UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1979

By D. D. Carlson and S. L. Green

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Cheyenne, Wyoming

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UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

COOPERATING AGENCIES

State Agencies

Wyoming Department of Agriculture
Wyoming Department of Economic Planning and Development
Wyoming Department of Environmental Quality
Wyoming Department of Game and Fish
Wyoming Highway Department
Wyoming State Engineer
Wyoming Water Resources Research Institute

Municipality

City of Cheyenne

Federal Agencies

Bureau of Land Management
Bureau of Reclamation
Corps of Engineers
Department of Energy
Environmental Protection Agency
Fish and Wildlife Service
National Park Service

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WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1979

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INTRODUCTION

The Water Resources Division of the U.S. Geological Survey is the Federal agency responsible for appraising the quantity, quality, and distribution of our surface-water and ground-water resources. The division conducts interpretive studies, supports hydrologic research, and maintains data-collection networks in every State; it also works through cooperative programs with State, local, and other Federal agencies agencies to help evaluate or solve regional and local water problems. Results of its investigations provide a basis for nearly all major public water-management decisions.

The U.S. Geological Survey, in cooperation with the State of Wyoming, the city of Cheyenne, and other Federal agencies, has five data-collection activities and 31 water-resource appraisal projects in Wyoming during fiscal year 1979 (October 1, 1978, through September 30, 1979).

The data-collection activities include: (1) Collection of records for streamflow and reservoir storage; (2) measurements of water levels in wells; (3) sampling and chemical analysis of water from streams and wells; (4) sampling and sediment analysis of surface water; and (5) collection of peak-flow information at partial-record sites. This report contains tables of monitoring sites for these five data-collection activities.

Water resource appraisal projects described in the report include the projects currently being conducted during fiscal year 1979 and projects completed in previous fiscal years, but for which final reports are in preparation.

The purpose of this report is to describe the water-resource work being done in Wyoming. The report is also intended to inform cooperating officials and the public about the accomplishments in the various investigations during the fiscal year 1979 (October 1, 1978, through September 30, 1979). It is one phase of an effort to coordinate the water-resources investigations of the U.S. Geological Survey with those of other organizations.

A BRIEF HISTORY OF THE WYOMING DISTRICT

On March 3, 1879, President Rutherford B. Hayes signed a bill establishing the U.S. Geological Survey. The Sundry Civil Appropriation Act of 1888 established an Irrigation Survey as a part of the U.S. Geological Survey "for the purpose of investigating the extent to which the arid region of the United States can be redeemed by irrigation ***." The Water Resources Division, of which the Wyoming District is a part, has its roots in the Irrigation Survey of 1888-1890. The following summary of the water-resources activities of the U.S. Geological Survey in Wyoming is included in this report in commemoration of the 100th anniversary of the U.S. Geological Survey.

There was no Wyoming District in 1888, when the Washington, D. C. office of the Survey paid the installation costs for the first gaging station in Wyoming, Laramie River at Woods Landing. It was constructed and operated by the Territorial Engineer, Elwood Mead. Between 1895 and 1901 the Survey paid operating expenses for additional stations operated by the State Engineer. A. J. Parshall became the first resident hydrographer for the Survey in Wyoming in 1901. For the next six years there was no cooperative work with the State, but 11 stations were operated with Survey and Reclamation Service funds. By 1912 the Survey's network consisted of 50 stations, including 21 in cooperation with the State Engineer. Parshall was appointed State Engineer; surprisingly, he refused to allow the Survey to use any part of its share of the funds to pay office expenses, so cooperation ended in 1912. The first official letter written by J. B. True as the new State Engineer in 1915 was to the Survey, urging resumption of the coop program. Fifty gaging stations were established or re-established; cooperation with the State Engineer has continued without further interruption.

Early Federal cooperators included the Indian Service (1908) and the Forest Service (1910). In 1938 the Bureau of Reclamation established 23 streamflow stations in the Green River Basin using Survey plans. The Bureau also did field work at Survey stations in the area; in return the Survey computed and published the records for all stations. During the postwar period, 1945-50, many new streamflow stations were established under the Interior Department's Missouri River Basin program. A flood-investigations program, started in 1959 in cooperation with the Wyoming Highway Department, has continued to the present.

Surface-water activities in Wyoming were directed from Washington until 1903, when the Denver District was established under M. C. Hinderlider. Between 1903 and 1961 Wyoming was part of the Colorado District, with local offices at various times in Kemmerer, Sheridan, and Casper. The Wyoming District, Surface Water Branch, was established in 1961, with L. A. Wiard as District Engineer.

The earliest known ground-water studies by the Survey in Wyoming were done between 1900 and 1917 by G. I. Adams in the Goshen Hole area (Water-Supply Paper 70); N. H. Darton in the Great Plains, Bighorn Mountains, Laramie Range, and Black Hills; and O. E. Meinzer in Lodgepole Valley. State cooperation has been continuous since 1940, when the Wyoming Planning and Water Conservation Board sponsored a study of the Egbert-Pine Bluffs area by T. W. Robinson. Cooperation with the State Engineer has continued since 1945. In 1959 all State cooperative ground-water work was consolidated under the State Engineer program. Ground-water work for other Federal agencies has included measurements of discharge and power consumption for REA in 1941, many investigations since 1946 for the Bureau of Reclamation under the Interior Department's Missouri River Basin Program, and a continuous series of studies of Yellowstone and Grand Teton National Parks for the National Park Service since the early 1960's.

Ground-water work in Wyoming was directed from Washington until 1945, when Wyoming became a part of the Colorado District under S. W. Lohman. The local geologist in charge was A. M. Morgan. In 1951 (?) the Wyoming District, Ground Water Branch, was established, with H. M. Babcock as District Geologist.

Surface-water quality work in Wyoming began with the establishment of an office in Worland in March 1945, with T. F. Hanly in charge. The program was directed by P. C. Benedict, Regional Engineer, in Lincoln, Nebraska. In 1948, the chemical quality or sediment stations were in operation at 16 sites in the Bighorn Basin and 5 sites in the North Platte basin, under the Department's Missouri River Basin program. By 1953, the program included 39 CQ stations and 42 sediment stations.

In February 1956 Worland became a District Office, Quality of Water Branch, with a field office in Riverton; the Riverton office was reassigned to the Surface Water Branch in October 1964. The first sediment station in the State coop program was established on Rock Creek near Atlantic City for the Wyoming Natural Resources Board in 1957. The State Engineer started a cooperative chemical-quality program to evaluate the effects of the Kendrick Project on the North Platte River in 1959. Since 1965 the Wyoming Department of Agriculture has been principal State Cooperator for chemical quality and the State Engineer for sediment data. In 1966 water-quality work in the Green River basin, previously done by the Utah District, was transferred to the Wyoming District.

The District sediment laboratory has remained in Worland since the office was opened, and today serves the Montana and North Dakota Districts as well. The chemical lab moved to Cheyenne in 1959 and was immediately downgraded because of the establishment of the WRD Central Laboratory in Salt Lake City. Since 1966, however, basic salinity analyses of samples collected for the State programs have been done by the State laboratory in Laramie for Direct Services credit in the program with the Wyoming Department of Agriculture.

The Branch districts were combined into a single WRD district in February 1967. The programs and staff of the District changed little until 1974. Within two years the staff doubled and the budget tripled, mostly in response to the pending boom in development of coal and other energy resources. The water-quality data program, in particular, increased several-fold. Significant new programs were started in cooperation with the Wyoming Department of Environmental Quality, the Bureau of Land Management, and the Environmental Protection Agency.

Today the District has approximately 70 employees, with field offices in Buffalo, Casper, Green River, Riverton, and Worland. Approximately half of the funding is for work for other agencies, and half is for participation in the Survey' energy programs and regional aquifer assessments. Reconnaissance and inventory studies have given way to problem-oriented, multidisciplinary studies and increased use of digital models. For the immediate future the impacts of coal and uranium mining, the effects of human activity on water quality, and the increased development of ground water for irrigation will occupy much of the Wyoming District's effort.

The District Chiefs who have directed the Wyoming District are listed below:

Surface Water Branch:	Leon A. Wiard	/61 - 2/67
Ground Water Branch:	Horace M. Babcock	/51(?) - /57(?)
	Ellis D. Gordon	2/58 - 2/67
Quality of Water Branch:	Thomas F. Hanly	2/56 - 2/67
Water Resources Division:	Leon A. Wiard	2/67 - 8/68
	Robert L. Cushman	8/68 - 6/73
	Sam W. West	12/73 - 12/78
	William W. Dudley, Jr.	4/79 - present

DISTRICT OFFICE ADDRESSES

Inquiries regarding projects described in this volume may be directed to the District Office or Subdistrict Office in which the work originated.

Wyoming District Office

U.S. Geological Survey
Water Resources Division
2120 Capitol Avenue
P.O. Box 1125
Cheyenne, WY 82001
(307) 778-2220 ext. 2153

Subdistrict Offices

215 N. Lincoln Street
Casper, WY 82601
(307) 265-5550

1214 Big Horn Avenue
Worland, WY 82401
(307) 347-2181

Field Headquarters

381 N. Main
P.O. Box S
Buffalo, WY 82834
(307) 684-9661

489 East 5th South
P.O. Box 1175
Green River, WY 82935
(307) 875-6700

509 S. Federal Blvd.
P.O. Box 431
Riverton, WY 82501
(307) 856-3771

Field Unit

2120 Capitol Ave.
P.O. Box 1125
Cheyenne, WY 82001
(307) 778-2220 ext. 2153

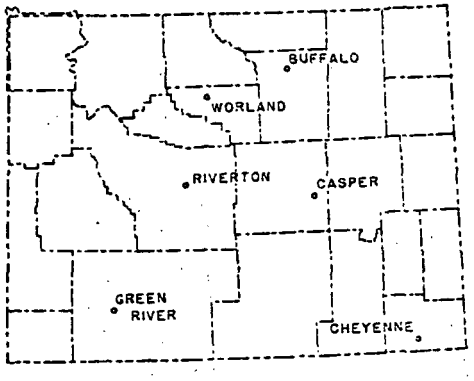


Figure 1.--Location of offices in Wyoming.

WYOMING DISTRICT ORGANIZATION CHART

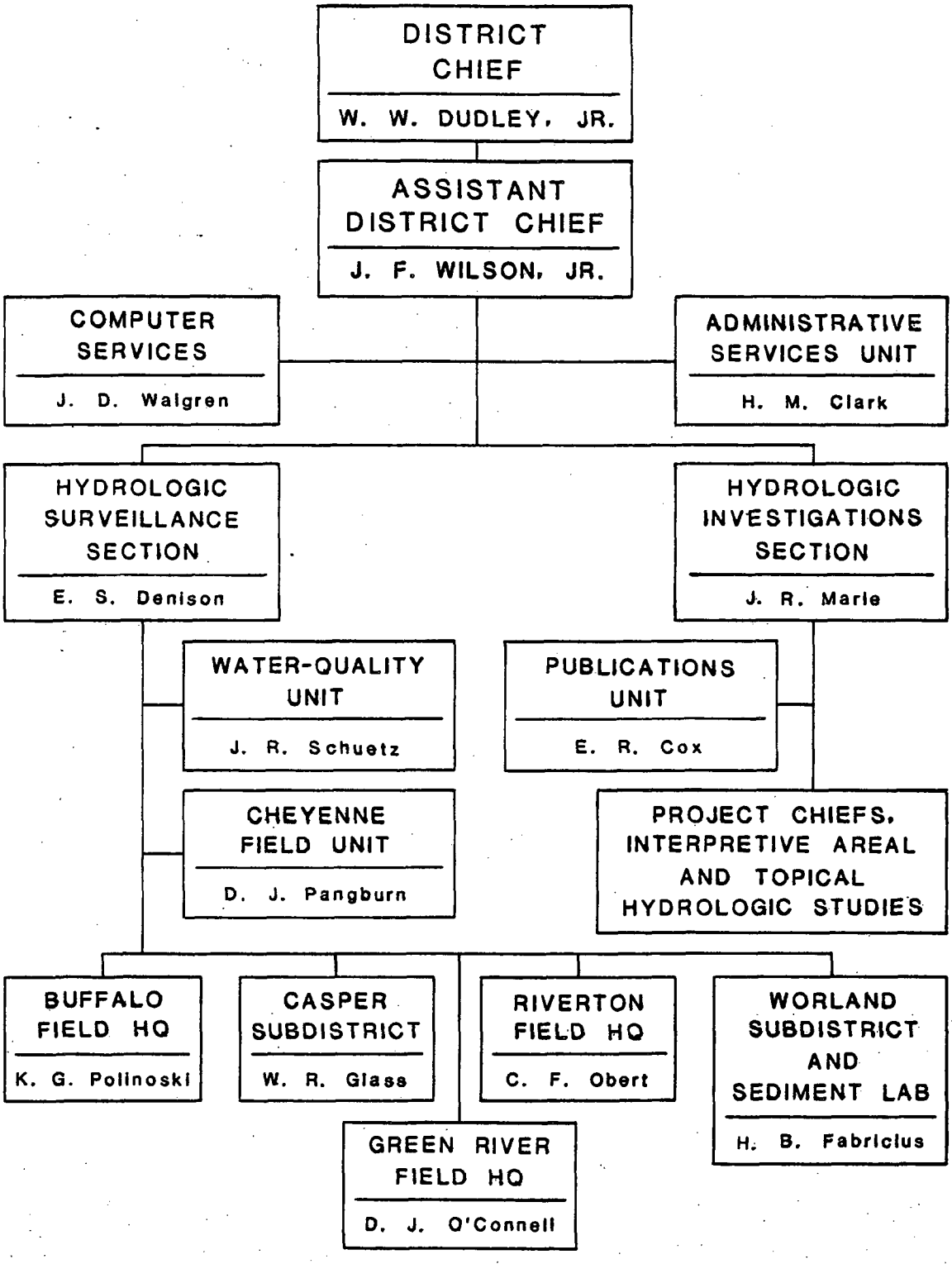


Figure 2.

WHERE TO OBTAIN GEOLOGICAL SURVEY PUBLICATIONS

Current releases are described in a monthly pamphlet, "New Publications of the Geological Survey," which may be obtained from

Branch of Distribution
U.S. Geological Survey
1200 South Eads Street
Arlington, VA 22202

Professional Papers, Bulletins, Water Supply Papers, Techniques of Water Resources Investigations, Earthquake Information Bulletin, and popular leaflets, pamphlets, and booklets may be purchased from the above address. Additional information is given in "A Guide to Obtaining Information from the U.S. Geological Survey, 1978," Geological Survey Circular 777, available without cost from the above address.

Open-file reports from Wyoming are available for inspection at the Wyoming District Office.

Flood-prone area maps may be obtained from the Wyoming District Office.

Map information is available from

Branch of Distribution
U.S. Geological Survey
Box 25286, Federal Center
Lakewood, CO 80225

Requests for miscellaneous water information and information on programs in other States may be referred to

Water Resources Division
U.S. Geological Survey, Mail Stop 440
12201 Sunrise Valley Drive
Reston, VA 22092

The Geological Survey National Center maintains a library with an extensive earth-sciences collection. Local libraries may obtain books, periodicals, and maps through interlibrary loan by writing to

U.S. Geological Survey Library
12201 Sunrise Valley Drive
Reston, VA 22092

DATA-COLLECTION SITES

Lists of the data-collection sites and the kinds of hydrologic data being collected at each are given as follows: Table 1, surface-water stations; table 2, ground-water stations; table 3, water-quality stations; table 4, sediment stations; and table 5, peak-flow partial-record stations.

Identification numbers have been assigned to conform with the standard downstream order for listing stations within each hydrologic region. The location of each data site is given in the tables. In table 2, ground-water stations are listed in numerical order by counties.

The headings of the columns in the five tables are slightly different to accomodate the type of sites in each list. In order to include the variety of information required by the many users of the lists, abbreviations and codes were used to conserve space in the tables. Explanations of the abbreviations and codes precede each table.

The locations of surface-water data sites are shown in figures 3-7. The locations of ground-water stations are shown in figures 8-11.

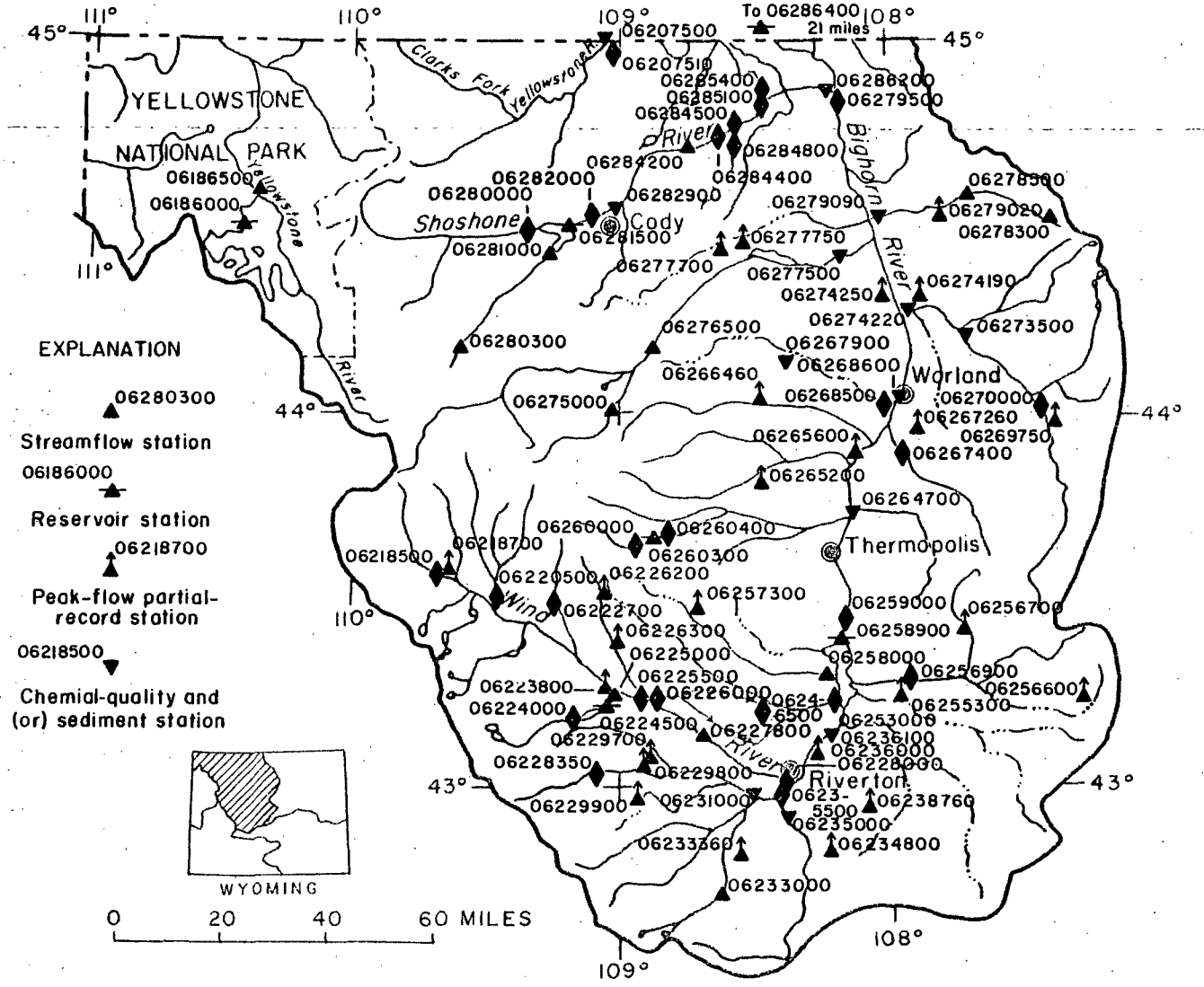


Figure 3.—Location of surface-water data sites in the Yellowstone River, Clarks Fork Yellowstone River, and Bighorn River basins.

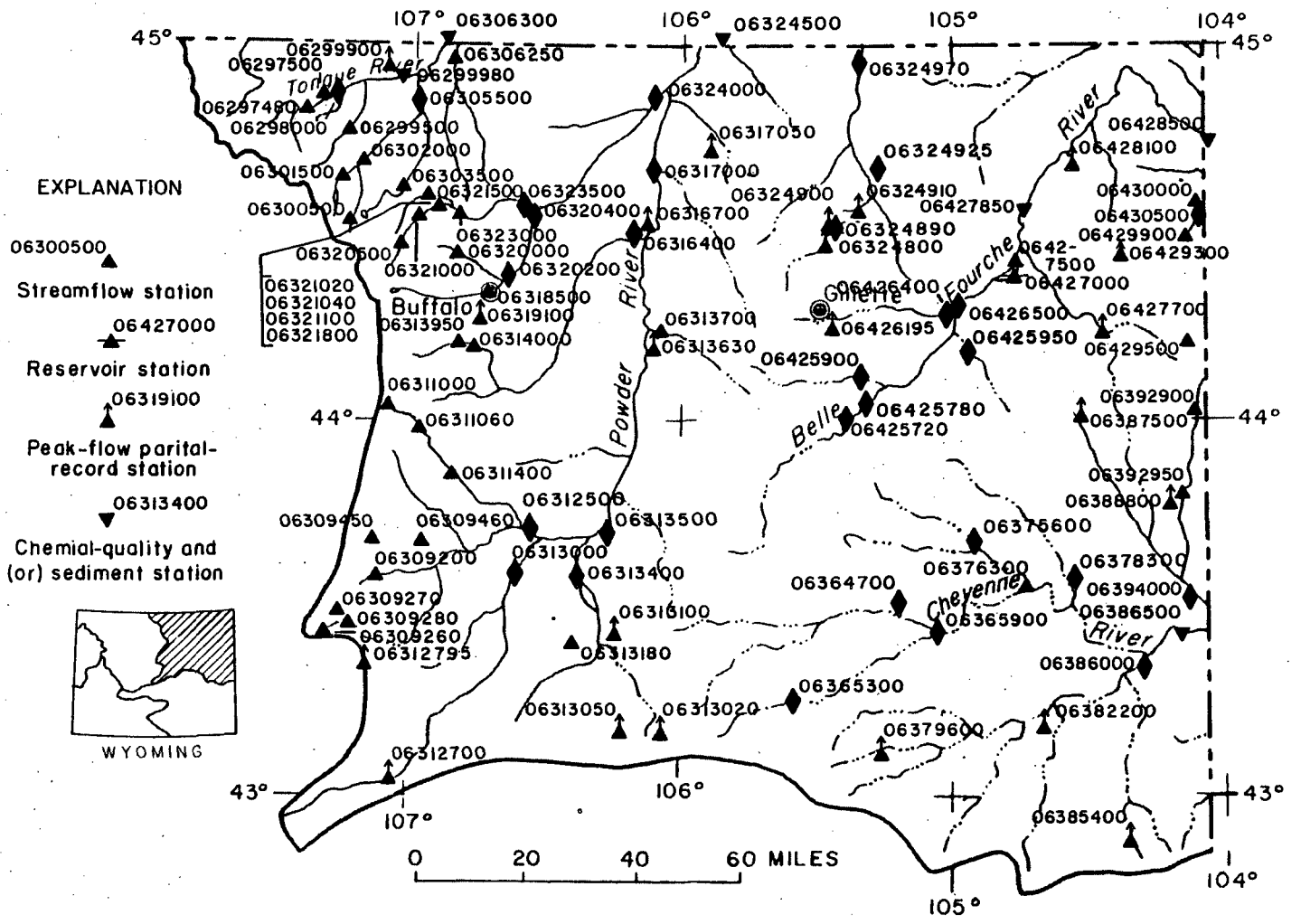


Figure 4.—Location of surface-water data sites in the Tongue River, Powder River, Belle Fourche River, and Cheyenne River basins.

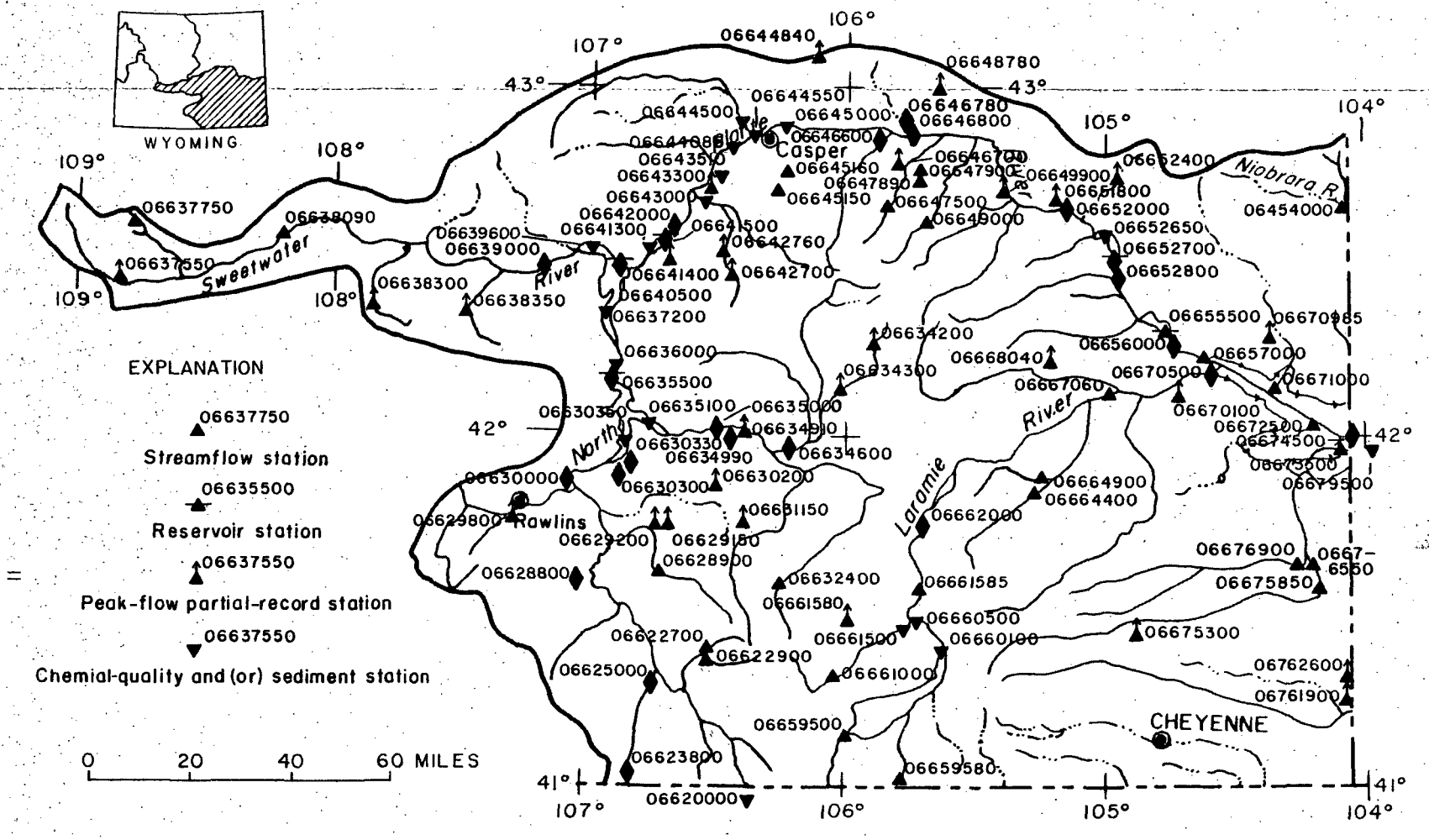


Figure 5.—Location of surface-water data sites in the Niobrara River and Platte River basins.

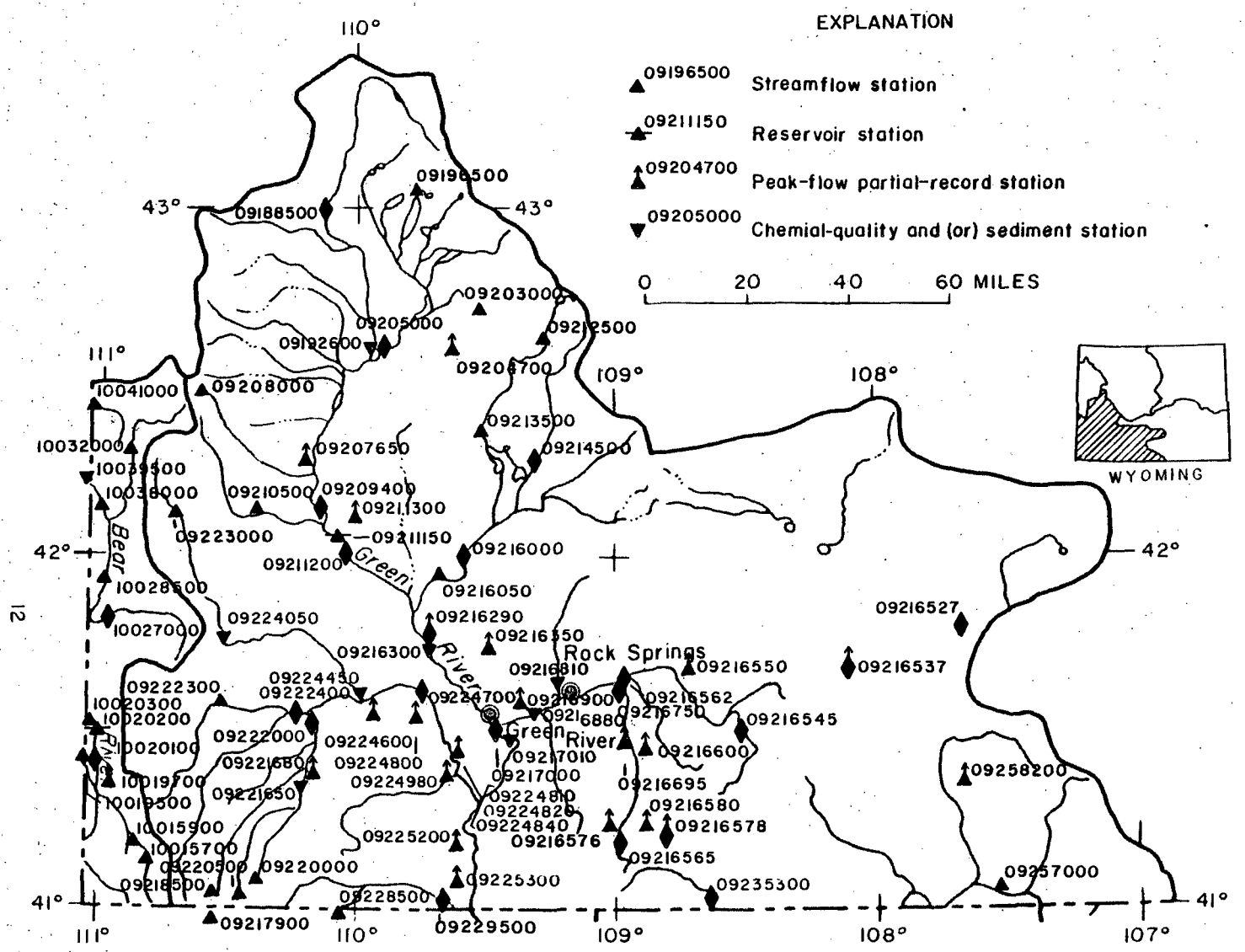


Figure 6.—Location of surface-water data sites in the Green River and Bear River basins.

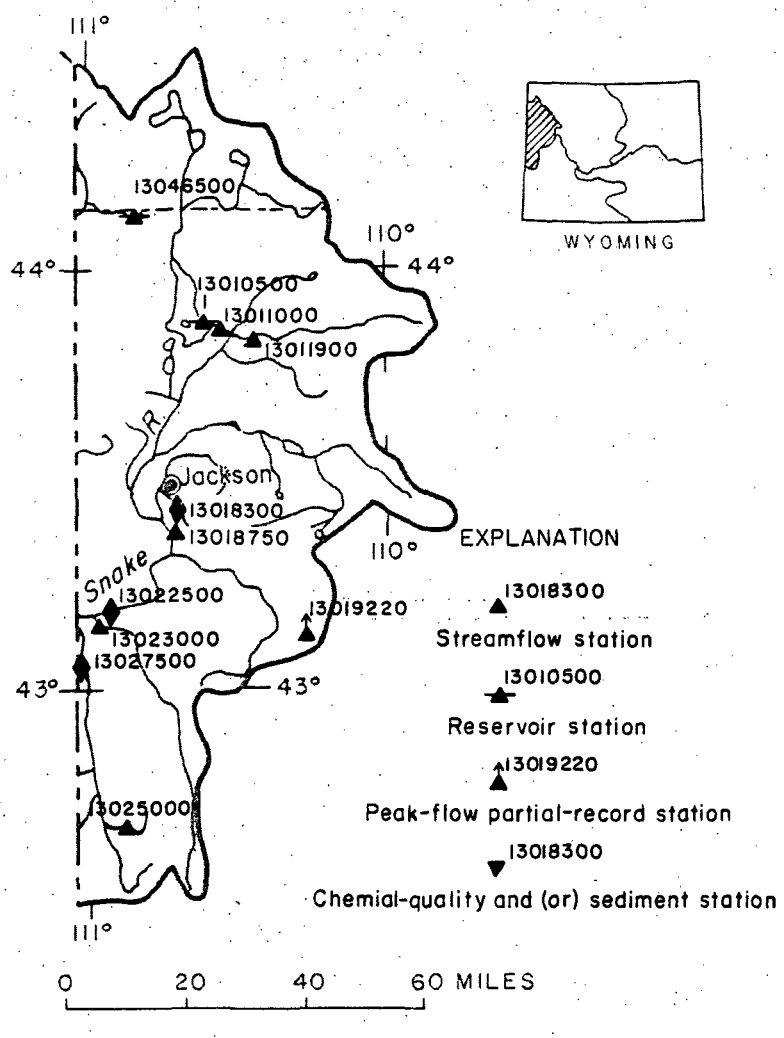


Figure 7.—Location of surface-water data sites in the Snake River basin.

Surface-water stations

Explanation of abbreviations and codes used in table 1.

Purpose: B, bench-mark or long-term-trend station
C, current-purpose station such as accounting, operation, forecasting, disposal, water quality, compact or legal, research or special study
H, hydrologic station
P, principal-stream station
R, regulated station

Period of Record: The dates given are the calendar years in which records began or ended. Breaks of less than a year are not shown.

Location: SE, section
TSP, township
RNGE, range

Gage Equipment: D, digital recorder
G, graphic recorder
M, manometer gage
O, observer record only
S, staff gage
T, pressure-transducer gage
W, well gage

Current Record Type: S, seasonal operation (no winter records)
Y, full-year operation

Field Office:
B, Buffalo
C, Casper
CF, Cheyenne Field Unit
CT, Contractor
GR, Green River
I, Idaho District
M, Montana District
N, Nebraska District
R, Riverton
S, Wyoming State Engineer
SD, South Dakota District
W, Worland
U, Utah District

Cooperator:
BLM, Bureau of Land Management
BRUC, Bureau of Reclamation, Upper Colorado Region
BRUM, Bureau of Reclamation, Upper Missouri Region
CE, Corps of Engineers
DEPD, Wyoming Department of Economic Planning and Development
MRB, Geological Survey, Missouri River Basin Program
USE, Utah State Engineer
USGS, Geological Survey, Federal Program
WDEQ, Wyoming Department of Environmental Quality
WGF, Wyoming Department of Game and Fish
WSE, Wyoming State Engineer

Remarks: USBR, U.S. Bureau of Reclamation

Table 1. Surface-water stations

STATION NUMBER	STATION NAME	PURPOSE	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	GAGE EQUIPMENT	CURRENT RECORD TYPE	FIELD OFFICE	COOPERATOR	REMARKS
YELLOWSTONE RIVER BASIN												
06186000	YELLOWSTONE LAKE AT BRIDGE BAY, YNP	P	1006	1921-	-	-	-	D	Y	M	-	
06186500	YELLOWSTONE R AT YELLOWSTONE LAKE OUTLET, YNP	P	1006	1922-25, 1926-	-	-	-	GW	Y	M	-	
*#06207510	BIG SAND COULEE AT WYOMING-MONTANA STATE LINE	CR	134	1973-	32	9S	22E	GM	S	W	BLM	
*06218500	WIND RIVER NEAR DUBOIS	C	232	1945-	25	42N	108W	DW	Y	R	WSE	
*#06220500	EAST FORK WIND RIVER NEAR DUBOIS	C	427	1950-57, 1975-	34	6N	6W	GM	Y	R	MRB	
*06222700	CROW CREEK NEAR TIPPERARY	H	30.2	1962-	20	7N	4W	GM	Y	R	MRB	
*06224000	BULL LAKE CREEK ABOVE BULL LAKE	H	187	1941-53, 1966-	2	2N	4W	DW	Y	R	MRB	
06224500	BULL LAKE NEAR LENORE	C	210	1938-	30	3N	2W	GM	Y	R	MRB, BRUM	
06225000	BULL LAKE CREEK NEAR LENORE	C	213	1918-	17	3N	2W	DGM	Y	R	BRUM	
#06225500	WIND RIVER NEAR CROWHEART	CP	1891	1945-	16	3N	2W	DGW	Y	R	BRUM	
#06226000	WYOMING CANAL NEAR LENORE	CH	-	1941-45, 1949-	17	3N	1W	DW	S	R	BRUM	APR THRU OCT
06227600	WIND RIVER NEAR KINNEAR	CR	2194	1974-	13	2N	1W	GM	S	R	WSE	
*06228000	WIND RIVER AT RIVERTON	CH	2309	1906-08, 1911-	2	1S	4E	DGM	Y	R	C E	
*06228350	SF LITTLE WIND R AB WASHAKIE RE NR FT WASHAKIE	H	90.3	1976-	18	1S	2W	DW	Y	R	MRB	
06233000	LITTLE POPO AGIE RIVER NEAR LANDER	C	125	1946-	27	32N	99W	GW	S	S	WSE	
*06235500	LITTLE WIND RIVER NEAR RIVERTON	CR	1904	1941-	11	1S	4E	DW	Y	R	C E	
*06246500	OCEAN DRAIN AT OCEAN LAKE OUTLET, NR PAVILLION	C		1948-53, 1978-				DW	Y	R	MRB	
*#06253000	FIVEMILE CREEK NEAR SHOSHONI	C	418	1941-42, 1948-	19	3N	6E	GM	Y	R	BRUM	
*#06256900	DRY CREEK NEAR BONNEVILLE	CH	52.6	1965-	8	38N	92W	GW	Y	R	BLM	
06258000	MUDDY CREEK NEAR SHOSHONI	C	332	1949-68, 1972-	34	4N	5E	GM	Y	R	BRUM	
06258900	BOYSEN RESERVOIR	C	7700	1951-	16	5N	6E	-	-	-	MRB	FURNISHED BY USBR
*06259000	WIND RIVER BELOW BOYSEN RESERVOIR	CR	7701	1951-	9	5N	6E	DM	Y	W	BRUM	
*#06260000	SOUTH FORK OWL CREEK NEAR ANCHOR	CH	85.5	1932, 1939-43, 1959-	28	43N	100W	GM	Y	W	MRB	
06260300	ANCHOR RESERVOIR	C	131	1960-	26	43N	100W	-	-	-	MRB	FURNISHED BY USBR
*06260400	SOUTH FORK OWL CREEK BELOW ANCHOR RESERVOIR	CR	131	1959-	25	43N	100W	GW	Y	W	MRB	
*#06267400	EAST FORK NOWATER CREEK NEAR CULTER	H	149	1971-	31	46N	92W	GM	Y	W	WSE	
*#06268500	FIFTEENMILE CREEK NEAR WORLAND	C	518	1951-72, 1978-	27	47N	93W	GM	Y	W	BLM	
*#06270000	NOWOOD RIVER NEAR TEN SLEEP	P	803	1938-43, 1950-55, 1972-	27	47N	88W	DGM	Y	W	WSE	
06275000	WOOD RIVER AT SUNSHINE	CH	194	1945-	15	47N	101W	GM	Y	W	WSE	
06276500	GREYBULL RIVER AT MEETEETSE	CP	681	1897, 1903, 1920-	4	48N	100W	DGM	S	S	WSE	
*06278000	DRY CREEK NEAR GREYBULL	C		1951-53, 1955-60, 1979-					Y	W	BLM	
06278300	SHELL CREEK ABOVE SHELL RESERVOIR	BCH	23.1	1956-	1	52N	88W	DW	Y	W	WSE	
06278500	SHELL CREEK NEAR SHELL	CH	145	1940-	17	53N	90W	GW	S	S	WSE	
*#06279500	BIGHORN RIVER AT KANE	CR	15765	1928-	9	55N	94W	GM	Y	W	MRB	
06280000	NORTH FORK SHOSHONE RIVER NEAR WAPITI	CH		1921-26, 1979-				GM	Y	W	WGF	
06280300	SOUTH FORK SHOSHONE RIVER NEAR VALLEY	BH	297	1956-	24	49N	106W	DW	Y	W	USGS	

* Also chemical quality station
\# Also sediment station

Table 1. Surface-water stations (continued)

STATION NUMBER	STATION NAME	PURPOSE	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	GAGE EQUIPMENT	CURRENT RECORD TYPE	FIELD OFFICE	COOPERATOR	REMARKS
YELLOWSTONE RIVER BASIN (Continued)												
06281000	SOUTH FORK SHOSHONE RIVER ABOVE BUFFALO BILL RES	P	585	1903, 1905-08, 1921-26, 1973-	33	52N	103W	GM	Y	W	WSE	
06281500	BUFFALO BILL RESERVOIR	C	1498	1909-	12	52N	103W	-	--	-	MRB	FURNISHED BY USBR
*06282000	SHOSHONE RIVER BELOW BUFFALO BILL RESERVOIR	CR	1538	1921-	3	52N	102W	DW	Y	W	BRUM	
06284200	SHOSHONE RIVER AT WILLWOOD	CR	1980	1974-	34	55N	99W	GM	Y	W	BRUM	
*06284400	SHOSHONE RIVER NEAR GARLAND	CR	2036	1958-	13	55N	98W	GM	Y	W	MRB	
*06284500	BITTER CREEK NEAR GARLAND	C	80.5	1950-53, 1957-60, 1968-	7	55N	97W	DW	Y	W	MRB	
*06284800	WHISTLE CREEK NEAR GARLAND	C	101	1958-60, 1968-	30	55N	97W	GM	Y	W	MRB	
*#06285100	SHOSHONE RIVER NEAR LOVELL	CR	2350	1966-	16	56N	96W	GM	Y	W	MRB	
*06285400	SAGE CREEK AT SIDON CANAL, NEAR DEAVER	C	341	1958-60, 1968-	34	57N	97W	GM	Y	W	MRB	
06286400	BIGHORN LAKE NEAR ST. XAVIER, MT	C	19626	1965-	18	6S	31E	-	-	-	MRB	FURNISHED BY USBR
06297480	TONGUE R AT TONGUE CANYON CAMPGROUND, NR DAYTON	C	202	1974-	10	56N	87W	GM	Y	B	USGS	
06297500	HIGHLINE DITCH NEAR DAYTON	C	-	1919-23, 1940-	11	56N	87W	GW	S	B	WSE	
*06298000	TONGUE RIVER NEAR DAYTON	RCH	204	1918-29, 1940-	11	56N	87W	DW	Y	B	WSE	
06299500	WOLF CREEK AT WOLF	CH	37.8	1945-	4	55N	86W	GW	S	S	WSE	
06300500	EAST FORK BIG GOOSE CREEK NEAR BIG HORN	CH	20.1	1953-	28	53N	86W	GM	S	S	WSE	
06301500	WEST FORK BIG GOOSE CREEK NEAR BIG HORN	C	24.4	1953-	30	54N	86W	GM	S	S	WSE	
06302000	BIG GOOSE CREEK NEAR SHERIDAN	C	120	1929-	35	55N	86W	GW	S	S	WSE	
06303500	LITTLE GOOSE CREEK IN CANYON, NEAR BIG HORN	CH	51.6	1941-	1	53N	85W	GW	S	S	WSE	
*#06305500	GOOSE CREEK BELOW SHERIDAN	C	392	1941-	15	56N	84W	DW	Y	B	WSE	
06306250	PRAIRIE DOG CREEK NEAR ACME	C	358	1970-	23	58N	83W	GW	Y	M	-	
06309200	MIDDLE FORK POWDER RIVER NEAR BARNUM	H	45.2	1961-	26	42N	86W	GM	Y	C	WSE	
06309260	BUFFALO CREEK AB N F BUFFALO CREEK, NEAR ARMINTO	C	8.80	1974-	20	40N	86W	GM	Y	C	USGS	
06309270	NORTH FORK BUFFALO CREEK NEAR ARMINTO	C	8.10	1974-	17	40N	86W	GW	Y	C	USGS	
06309280	BUFFALO CREEK BL N F BUFFALO CREEK, NEAR ARMINTO	C	18.6	1974-	21	40N	86W	GM	Y	C	USGS	
06309450	BEAVER CREEK BELOW BAYER CREEK, NEAR BARNUM	C	10.9	1974-	28	43N	85W	GW	Y	C	USGS	
06309460	BEAVER CREEK AB WHITE PANTHER DITCH, NEAR BARNUM	C	24.2	1974-	16	43N	84W	GM	Y	C	USGS	
06311000	NORTH FORK POWDER RIVER NEAR HAZELTON	RCH	24.5	1946-	21	47N	85W	GW	Y	B	WSE	
06311060	N FORK POWDER RIVER BL BULL CREEK, NR HAZELTON	C	32.3	1974-	25	47N	85W	GM	Y	B	USGS	
06311400	N FORK POWDER RIVER BL PASS CREEK, NR MAYOWORTH	CH	100	1974-	36	46N	84W	GM	Y	R	WSE	
*06312500	POWDER RIVER NEAR KAYCEE	C	980	1933-35, 1938-71, 1978-	13	43N	81W	GW	Y	C	WDEQ	
*06313000	SOUTH FORK POWDER RIVER NEAR KAYCEE	C	1150	1911, 1938-40, 1950-69, 1978-	9	42N	81W	GM	Y	C	WDEQ	
06313180	DUGOUT CREEK TRIBUTARY NEAR MIDWEST	H	.8	1974-	14	40N	80W	GW	Y	C	USGS	
*#06313400	SALT CREEK NEAR SUSSEX	C	769	1976-	8	42N	79W	GM	Y	C	USGS	
*#06313500	POWDER RIVER AT SUSSEX	CP	5090	1938-40, 1950-57, 1977-	13	43N	79W	DGM	Y	CT	USGS	
06313700	DEAD HORSE CREEK NEAR BUFFALO	H	151	1971-	15	49N	77W	GM	Y	A	WSE	
06313950	N F CRAZY WOMAN CREEK BL POLE CREEK, NR BUFFALO	CH	43.4	1973-	28	49N	83W	GM	Y	B	DEPD	
06314000	NORTH FORK CRAZY WOMAN CREEK NEAR BUFFALO	CH	44.9	1942-49, 1973-	27	49N	83W	GM	Y	A	DEPD	AUXILIARY WELL GAGE

* Also chemical quality station
\# Also sediment station

Table 1. Surface-water stations (continued)

STATION NUMBER	STATION NAME	PURPOSE	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	GAGE EQUIPMENT	CURRENT RECORD TYPE	FIELD OFFICE	COOPERATOR	REMARKS
YELLOWSTONE RIVER BASIN (Continued)												
*#06316400	CRAZY WOMAN CREEK AT UPPER STATION,NEAR ARVADA	CP	945	1963-70, 1977-	18	52N	77W	DGW	Y	CT	USGS	
*#06317000	POWDER RIVER AT ARVADA	CP	6050	1919-	21	54N	77W	GM	Y	B	WSE	
06318500	CLEAR CREEK NEAR BUFFALO	C	120	1894, 1896-99, 1917-27, 1938-	6	50N	82W	GW	Y	B	DEPD	
06320000	ROCK CREEK NEAR BUFFALO	CR	60.0	1941-	29	52N	83W	GW	S	S	WSE	
*#06320200	CLEAR CREEK BELOW ROCK CREEK, NEAR BUFFALO	C	322	1975-	30	51N	81W	GW	Y	B	USGS	
*#06320400	CLEAR CREEK AT UCROSS	C	409	1976-	19	53N	80W	GM	Y	B	USGS	
06320500	SOUTH PINEY CREEK AT WILLOW PARK	CR	33.6	1945-57, 1959-	24	52N	85W	GW	S	S	WSE	
06321000	SOUTH PINEY CREEK NEAR STORY	C	69.4	1951-71, 1974-	23	53N	84W	GM	Y	B	WSE	
06321020	MEAD-COFFEEN DITCH ABOVE FISH HATCHERY, NR STORY	C	-	1974-	13	53N	84W	DW	Y	B	USGS	
06321040	MEAD-COFFEEN DITCH BELOW FISH HATCHERY, NR STORY	C	-	1974-	13	53N	84W	DW	Y	B	USGS	
06321100	S PINEY CREEK BL MEAD-COFFEEN DITCH, NEAR STORY	C	69.5	1974-	13	53N	84W	GM	Y	B	USGS	
06321500	NORTH PINEY CREEK NEAR STORY	CH	36.8	1951-	12	53N	84W	DW	Y	B	DEPD	
06321800	SPRING CREEK NEAR STORY	C	-	1974-	13	53N	84W	DW	Y	B	USGS	
06323000	PINEY CREEK AT KEARNY	CR	118	1902-06, 1910-17, 1919-23, 1940-	26	53N	83W	GW	Y	S	WSE	
*06323500	PINEY CREEK AT UCROSS	CR	267	1917-23, 1950-	18	53N	80W	GW	Y	B	DEPD	
*#06324000	CLEAR CREEK NEAR ARVADA	C	1110	1915-19, 1928-29, 1939-	36	57N	77W	DW	Y	B	DEPD	
*#06324890	LITTLE POWDER R BELOW CORRAL C NEAR WESTON	CP	204	1977-	12	52N	72W	DGM	Y	CT	USGS	
*#06324925	LITTLE POWDER RIVER NEAR WESTON	CP	540	1977-	19	54N	70W	DGM	Y	CT	USGS	
*#06324970	LITTLE POWDER RIVER ABOVE DRY CREEK, NEAR WESTON	P	1235	1972-	13	57N	71W	GM	Y	C	WSE	
CHEYENNE RIVER BASIN												
*#06364700	ANTELOPE CREEK NEAR TECKLA	CP	959	1977-	35	41N	70W	DGM	Y	CT	USGS	
*#06365300	DRY FORK CHEYENNE RIVER NEAR BILL	C	128	1976-	31	38N	73W	GM	Y	C	BLM	
*#06365900	CHEYENNE RIVER NEAR DULL CENTER	C	1527	1976-	20	40N	68W	GM	Y	C	USGS	
*#06375600	LITTLE THUNDER CREEK NEAR HAMPSHIRE	CP	234	1977-	33	43N	67W	DGM	Y	CT	USGS	
06376300	BLACK THUNDER CREEK NEAR HAMPSHIRE	H	535	1972-	31	42N	65W	GM	Y	C	WSE	
*#06378300	LODGEPOLE CREEK NEAR HAMPSHIRE	CP	354	1977-	5	41N	64W	DGM	Y	CT	USGS	
*#06386000	LANCE CREEK NEAR RIVERVIEW	P	2070	1948-54, 1956-	14	39N	62W	GMW	Y	C	BLM	
06392900	BEAVER CREEK AT MALLO CAMP, NEAR FOUR CORNERS	C	10.3	1974-	4	47N	60W	GM	Y	SD	USGS	
06392950	STOCKADE BEAVER CREEK NEAR NEWCASTLE	C	107	1974-	19	45N	60W	GM	Y	SD	USGS	
*06394000	BEAVER CREEK NEAR NEWCASTLE	RP	1320	1943-	18	41N	60W	DGW	Y	C	USGS	
*#06425720	BELLE FOURCHE RIVER BEL RATTLESNAKE CR, NR PINEY	C	495	1975-	9	46N	71W	GM	Y	C	BLM	
*#06425780	BELLE FOURCHE RIVER ABOVE DRY CREEK, NEAR PINEY	C	594	1975-	25	47N	71W	GM	Y	C	BLM	
*#06425900	CABALLO CREEK AT MOUTH, NEAR PINEY	CR	260	1977-	4	47N	70W	DGM	Y	CT	USGS	
*#06425950	RAVEN CREEK NEAR MOORCROFT	CH	76	1977-	1	48N	69W	DGM	Y	CT	USGS	
*#06426400	DONKEY CREEK NEAR MOORCROFT	CR	246	1977-	30	50N	68W	DGM	Y	CT	USGS	
*#06426500	BELLE FOURCHE RIVER BELOW MOORCROFT	C	1670	1943-70 1975-	24	50N	68W	GM	Y	C	BLM	
06427000	KEYHOLE RESERVOIR NEAR MOORCROFT	C	2000	1952-	27	51N	66W	-	-	-	MRB	FURNISHED BY USBR
06427500	BELLE FOURCHE RIVER BELOW KEYHOLE RESERVOIR	CR	2000	1951-	21	51N	66W	GW	Y	C	BRUM	
06429500	COLD SPRINGS CREEK AT BUCKHORN	C	19.0	1974-	9	48N	60W	GM	Y	SD	USGS	

* Also chemical quality station
\# Also sediment station

Table 1. Surface-water stations (continued)

STATION NUMBER	STATION NAME	PURPOSE	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	GAGE EQUIPMENT	CURRENT RECORD TYPE	FIELD OFFICE	COOPERATOR	REMARKS
	CHEYENNE RIVER BASIN (Continued)											
06429905	SAND CREEK NEAR RANCH A, NEAR BEULAH	C	267	1976-	5	52N	60W	GW	Y	SD	USGS	
06430000	MURRAY DITCH AT WYOMING-SOUTH DAKOTA STATE LINE	C	-	1954-	7	7N	1E	GW	Y	SD	WSE	
#06430500	REDWATER CR AT WYOMING-SOUTH DAKOTA STATE LINE	CH	471	1929-31, 1936-37, 1954-	18	7N	1E	GW	Y	SD	WSE	
	NIOBRARA RIVER BASIN											
06454000	NIOBRARA RIVER AT WYOMING-NEBRASKA STATE LINE	BCH	450	1955-	15	31N	60W	DW	Y	N	-	
	PLATTE RIVER BASIN											
06622700	NORTH BRUSH CREEK NEAR SARATOGA	H	37.4	1960-	8	16N	81W	GW	Y	CF	WSE	
06622900	SOUTH BRUSH CREEK NEAR SARATOGA	C	22.8	1960-74, 1976-	20	16N	81W	GW	S	S	WSE	
*#06623800	ENCAMPMENT R AB HOG PARK CREEK, NEAR ENCAMPMENT	BH	72.7	1964-	10	12N	84W	GM	Y	CF	USGS	HYDRO BENCHMARK STA
*06625000	ENCAMPMENT RIVER AT MOUTH, NEAR ENCAMPMENT	CH	265	1940-	3	15N	83W	DW	Y	CF	WSE	
*#06628800	SAGE CREEK NEAR SARATOGA	C	263	1973-	32	19N	85W	GM	S	CF	BLM	
06628900	PASS CREEK NEAR ELK MOUNTAIN	CH	91.5	1957-	27	19N	82W	GM	Y	CF	WSE	
*06630000	N PLATTE RIVER AB SEMINOE RESERVOIR, NR SINCLAIR	CP	4175	1939-	13	22N	86W	GW	Y	CF	WSE	
*#06630300	BIG DITCH NEAR COYOTE SPRINGS	C	110	1975-	30	23N	83W	GM	Y	CF	BLM	
*#06630330	NORTH DITCH NEAR COYOTE SPRINGS	C	22.6	1976-	19	23N	83E	GM	Y	CF	BLM	
06632400	ROCK CREEK ABOVE KING CANYON CANAL, NR ARLINGTON	BCH	62.9	1965-	25	19N	79W	GM	Y	CF,S	WSE	
*#06634600	LITTLE MEDICINE BOW RIVER NEAR MEDICINE BOW	P	963	1973-	22	23N	78W	GW	Y	CF	WSE	
*#06634990	HANNA DRAW NEAR HANNA	C	21.6	1975-	34	24N	81W	GM	Y	CF	BLM	
*#06635000	MEDICINE BOW R AB SEMINOE RESERVOIR, NEAR HANNA	CP	2338	1939-	34	24N	81W	GW	Y	CF	WSE	
*06635500	SEMINOE RESERVOIR NEAR LEO	C	7230	1939-	8	25N	84W	-	-	-	MRB	FURNISHED BY USBR
06637750	ROCK CREEK ABOVE ROCK CREEK RESERVOIR	CH	9.2	1962-	27	30N	100W	DGW	Y	R	WSE	
06638090	SWEETWATER RIVER NEAR SWEETWATER STATION	P	849	1973-	12	29N	96W	GM	Y	R	WSE	
*#06639000	SWEETWATER RIVER NEAR ALCOVA	CP	2327	1913-24, 1938-	25	29N	87W	GW	S	S	WSE	
*06640500	PATHFINDER RESERVOIR NEAR ALCOVA	C	10711	1909-	24	29N	84W	-	-	-	MRB	FURNISHED BY USBR
*06641500	ALCOVA RESERVOIR AT ALCOVA	C	10766	1938-	24	30N	83W	-	-	-	MRB	FURNISHED BY USBR
*06642000	NORTH PLATTE RIVER AT ALCOVA	CH	10812	1904-05, 1954-	17	30N	82W	DW	Y	C	WSE	
06645150	SMITH CREEK ABOVE OTTER CREEK, NEAR CASPER	C	9.91	1974-	15	31N	78W	GM	Y	C	USGS	
06645160	SMITH CREEK AT OTTER CREEK, NEAR CASPER	C	10.9	1974-	14	31N	78W	DTW	Y	C	USGS	
*06646600	DEER CREEK BELOW MILLAR WASTEWAY, AT GLENROCK	CH	213	1961-	4	33N	75W	GW	Y	C,S	WSE	
*#06646780	SAND CREEK NEAR GLENROCK	CH	79.9	1977-	5	33N	74W	DGM	Y	CT	USGS	
*06646800	NORTH PLATTE RIVER NEAR GLENROCK	CH	13538	1959-	17	33N	74W	DW	Y	C,S	WSE	
06647500	BOX ELDER CREEK AT BOXELDER	H	63.0	1946-51, 1961-67, 1971-	32	31N	75W	GW	Y	C	WSE	
06647890	LITTLE BOX ELDER CREEK NEAR CASEYHURST	C	7.18	1974-	8	32N	74W	DW	Y	C	USGS	
06647900	L BOX ELDER C AT L BOX ELDER CAVE, NR CASEYHURST	C	8.47	1974-	9	32N	74W	GW	Y	C	USGS	
06649000	LAPRELE CREEK NEAR DOUGLAS	C	135	1919-	5	31N	73W	GW	S	S	WSE	
*#06652000	NORTH PLATTE RIVER AT ORIN	CH	14888	1895-99, 1917-18, 1924, 1958-	17	31N	69W	DW	Y	C	WSE	
*06652700	GLENDO RESERVOIR NEAR GLENDO	C	13545	1957-	24	29N	66W	-	-	-	MRB	FURNISHED BY USBR
*06652800	NORTH PLATTE RIVER BELOW GLENDO RESERVOIR	CH	13548	1957-	30	29N	67W	DW	Y	C,S	WSE	
06655500	GUERNSEY RESERVOIR NEAR GUERNSEY	C	16224	1928-	27	27N	66W	-	-	-	MRB	FURNISHED BY USBR
*06656000	NORTH PLATTE RIVER BELOW GUERNSEY RESERVOIR	CH	16237	1900-	27	27N	66W	DMW	Y	C,S	WSE	
06657000	NORTH PLATTE R BELOW WHALEN DIVERSION DAM	CH	16425	1909-	12	26N	65W	GM	Y	C,S	WSE	

* Also chemical quality station
\# Also sediment station

Table 1. Surface-water stations (continued)

STATION NUMBER	STATION NAME	PURPOSE	DRAINAGE AREA	PERIOD OF RECORD	LOCATION			GAGE EQUIPMENT	CURRENT RECORD TYPE	FIELD OFFICE	COOPERATOR	REMARKS
					SE	TSP	RNGE					
PLATTE RIVER BASIN (Continued)												
06659500	LARAMIE RIVER AND PIONEER CANAL NEAR WOODS	CR	434	1912-24, 1926-27, 1931-	36	14N	77W	GW	S	S	WSE	
06659580	SAND CREEK AT COLORADO-WYOMING STATE LINE	C	29.2	1968-	24	12N	75W	GW	S	S	WSE	
06661000	LITTLE LARAMIE RIVER NEAR FILMORE	CR	157	1902-03, 1911-26, 1932-	4	15N	77W	GW	S	S	WSE	
06661585	LARAMIE RIVER NEAR BOSLER	CR	1790	1972-	10	18N	74W	GW	Y	S	WSE	
*06662000	LARAMIE RIVER NEAR LOOKOUT	CR	2174	1912-17, 1921-27, 1932-	27	21N	74W	GW	S	S	WSE	
06664400	SYBILLE CREEK ABOVE MULE CREEK, NEAR WHEATLAND	CR	194	1974-	27	22N	70W	GW	S	S	WSE	
06664900	BLUEGRASS CREEK NEAR WHEATLAND	CR	139	1958-63, 1968-	22	22N	70W	GW	S	S	WSE	
06667060	LARAMIE RIVER ABOVE NORTH LARAMIE RIVER, NR UVA	CP	3131	1973-	19	25N	67W	GM	Y	C	DEPD	
*#06670500	LARAMIE RIVER NEAR FORT LARAMIE	CR	4564	1915-	28	26N	64W	GM	Y	C	WSE	
06671000	RAWHIDE CREEK NEAR LINGLE	C	522	1928-	20	25N	62W	GW	S	S	WSE	
06672500	CHERRY CREEK DRAIN NEAR TORRINGTON	C	356	1931-32, 1935-	23	24N	61W	GW	S	S	WSE	
06673500	KATZER DRAIN NEAR HENRY, NB	C	45.9	1928-	10	23N	60W	GW	S	S	WSE	
*#06674500	NORTH PLATTE R AT WYOMING-NEBRASKA STATE LINE	CR	22218	1929-	4	23N	58W	GW	Y	C	WSE	
06675850	HORSE CREEK NEAR JOHNSON RANCH, NEAR LAGRANGE	C		1978-	36	19N	61W	GM	Y	CF	USGS	
06676550	HORSE CREEK AT WYCROSS RANCH, NEAR LAGRANGE	C	680	1965-73, 1978-	28	20N	61W	GW	Y	CF	USGS	
06676900	BEAR CREEK AT LAGRANGE	C		1978-	6	19N	61W	GM	Y	CF	USGS	
GREEN RIVER BASIN												
*09188500	GREEN RIVER AT WARREN BRIDGE, NEAR DANIEL	C	468	1931-	8	35N	111W	GM	Y	GR	WSE	
09196500	PINE CREEK ABOVE FREMONT LAKE	BCH	75.8	1954-	5	35N	108W	DW	Y	GR	USGS	
09203000	EAST FORK RIVER NEAR BIG SANDY	C	79.2	1938-	7	31N	105W	DW	Y	GR	WSE	
*09205000	NEW FORK RIVER NEAR BIG PINEY	P	1230	1954-	22	30N	110W	DW	Y	GR	WSE	
09208000	LABARGE CREEK NR LABARGE MEADOWS RANGER STATION	BCH	6.3	1940-42, 1950-	8	29N	116W	GM	Y	GR	USGS	
*#09209400	GREEN RIVER NEAR LABARGE	CP	5910	1963-	33	26N	112W	DW	Y	GR	WSE	
09210500	FONTENELLE CR NR HERSCHLER RANCH, NR FONTENELLE	CH	152	1951-	2	24N	115W	GM	Y	GR	USGS	
09211150	FONTENELLE RESERVOIR NEAR FONTENELLE	C	4260	1964-	25	24N	112W	-	-	-	-	FURNISHED BY USBR
*09211200	GREEN RIVER BELOW FONTENELLE RESERVOIR	CR	4280	1963-	31	24N	111W	GM	Y	GR	BRUC	
09212500	BIG SANDY RIVER AT LECKIE RANCH, NEAR BIG SANDY	C	94.0	1910-11, 1939-	17	30N	104W	GM	S	GR	WSE	
#09213500	BIG SANDY RIVER NEAR FARSON	CR	322	1914-17, 1920-24, 1926-34, 1935-	17	27N	106W	GW	S	GR	WSE	
*#09214500	LITTLE SANDY CREEK ABOVE EDEN	C	134	1954-	11	26N	105W	GW	Y	GR	BLM	
*#09216000	BIG SANDY RIVER BELOW EDEN	CR	1610	1954-	31	24N	107W	DW	Y	GR	BRUC	
09216050	BIG SANDY RIVER AT GASSON BRIDGE, NEAR EDEN	CR	1720	1972-	29	23N	108W	GW	Y	GR	BRUC	
*#09216527	SEPARATION CREEK NEAR RINER	C	55.3	1975-	32	20N	90W	GW	Y	CF	BLM	
*#09216545	BITTER CREEK NEAR BITTER CREEK	C	308	1975-	36	18N	99W	GM	Y	GR	USGS	
*#09216562	BITTER CREEK AB SALT WELLS CREEK, NR SALT WELLS	C	836	1976-	2	19N	103W	GM	Y	GR	BLM	
*#09216565	SALT WELLS CREEK NEAR SOUTH BAXTER	C	34.7	1976-	15	14N	103W	GM	Y	GR	BLM	
*#09216750	SALT WELLS CREEK NEAR SALT WELLS	C	526	1976-	14	19N	103W	GM	Y	GR	BLM	
*#09217000	GREEN RIVER NEAR GREEN RIVER	CR	14000	1951-	26	18N	107W	GW	Y	GR	USGS	
09217900	BLACKS FORK NEAR ROBERTSON	H	130	1937-39, 1966-	27	3N	12E	GM	Y	GR	USE	

* Also chemical quality station
\# Also sediment station

Table 1. Surface-water stations (continued)

STATION NUMBER	STATION NAME	PURPOSE	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	GAGE EQUIPMENT	CURRENT RECORD TYPE	FIELD OFFICE	COOPERATOR	REMARKS
GREEN RIVER BASIN (Continued)												
09218500	BLACKS FORK NEAR MILLBURNE	C	152	1939-	11	12N	117W	GM	Y	GR	WSE	
09220000	EAST FORK OF SMITH FORK NEAR ROBERTSON	CH	53.0	1939-	5	12N	115W	GW	S	S	WSE	
09220500	WEST FORK OF SMITH FORK NEAR ROBERTSON	CH	37.2	1939-	15	12N	116W	GW	S	S	WSE	
*#09222000	BLACKS FORK NEAR LYMAN	CR	821	1937-57, 1962-	15	17N	113W	DW	Y	GR	BRUC	
*#09222300	LITTLE MUDDY CREEK NEAR GLENCOE	C	416	1976-	31	19N	116W	GM	Y	GR	BLM	
*#09222400	MUDDY CREEK NEAR HAMPTON	C	963	1975-	18	18N	113W	GM	Y	GR	BLM	
09223000	HAMS FORK BELOW POLE CREEK, NEAR FRONTIER	CH	128	1952-	35	25N	117W	GM	Y	GR	USGS	
*#09224700	BLACKS FORK NEAR LITTLE AMERICA	CR	3100	1962-	15	18N	109W	DW	Y	GR	USGS	
09228500	BURNT FORK NEAR BURNTFORK	CH	52.8	1943-	36	3N	16E	GM	S	S	WSE	
*09229500	HENRYS FORK NEAR MANILA, UT	CP	520	1928-	23	12N	109W	GW	Y	GR	USGS	
*#09235300	VERMILLION CREEK NEAR HIAWATHA, CO	C	196	1975-	15	12N	100W	GM	Y	GR	BLM	
#09257000	LITTLE SNAKE RIVER NEAR DIXON	CP	988	1910-23, 1938-	8	12N	90W	GM	S	CF	WSE	
BEAR RIVER BASIN												
10015700	SULPHUR CREEK ABOVE RESERVOIR, NEAR EVANSTON	CH	64.2	1957-	35	14N	119W	GW	Y	U	-	
10015900	SULPHUR CREEK BELOW RESERVOIR, NEAR EVANSTON	C	69.2	1958-	28	14N	119W	DW	Y	U	-	
10019500	CHAPMAN CANAL AT STATE LINE, NEAR EVANSTON	C	-	1942-	36	17N	121W	GW	Y	U	-	
*10020100	BEAR RIVER ABOVE RESERVOIR, NEAR WOODRUFF, UT	CR	752	1961-	29	17N	120W	GW	Y	U	-	
10020200	WOODRUFF NARROWS RESERVOIR NEAR WOODRUFF, UT	C	784	1965-	32	18N	120W	-	-	-	-	
10020300	BEAR RIVER BELOW RESERVOIR, NEAR WOODRUFF, UT	CH	784	1961-	32	18N	120W	DW	Y	U	-	
*#10027000	TWIN CREEK AT SAGE	C	246	1943-62, 1976-	7	21N	119W	GM	Y	GR	BLM	
10028500	BEAR RIVER BELOW PIXLEY DAM, NEAR COKEVILLE	CR	2032	1941-43, 1952-56, 1958-	25	23N	120W	GW	S	U	-	
10032000	SMITHS FORK NEAR BORDER	RCH	165	1942-	33	27N	118W	GW	Y	U	-	
10038000	BEAR RIVER BELOW SMITHS FORK, NEAR COKEVILLE	C	2447	1954-	28	25N	119W	GW	Y	U	-	
10041000	THOMAS FORK NEAR WYOMING-IDAHO STATE LINE	CH	113	1949-	19	28N	119W	DW	Y	U	-	
SNAKE RIVER BASIN												
13010500	JACKSON LAKE NEAR MORAN	C	807	1908-	18	45N	114W	-	-	I	-	FURNISHED BY USBR
13011000	SNAKE RIVER NEAR MORAN	RCR	807	1903-	18	45N	114W	DW	Y	I	-	
13011900	BUFFALO FORK ABOVE LAVA CREEK, NEAR MORAN	H	323	1965-	29	45N	113W	GM	Y	I	-	
*#13016300	CACHE CREEK NEAR JACKSON	RH	10.6	1962-	1	40N	116W	GW	Y	GR	USGS	HYDRO BENCHMARK STA
13018750	SNAKE RIVER BELOW FLAT CREEK NEAR JACKSON	CR	2627	1975-	3	39N	116W	DGM	Y	I	-	
*13022500	SNAKE RIVER ABOVE RESERVOIR, NEAR ALPINE	CR	3465	1917-18, 1937-39, 1953-	-	-	-	GW	Y	I	-	
13023000	GREYS RIVER ABOVE RESERVOIR, NEAR ALPINE	CP	448	1917-18, 1937-39, 1953-	34	37N	118W	GM	Y	I	-	
13025000	SWIFT CREEK NEAR AFTON	CH	27.4	1942-	29	32N	118W	GW	S	S	WSE	
*13027500	SALT RIVER ABOVE RESERVOIR, NEAR ETNA	CR	829	1953-	28	36N	119W	DW	Y	I	-	
13046500	GRASSY LAKE NEAR MORAN	C	10.4	1939-	18	48N	116W	-	-	-	-	FURNISHED BY USBR

* Also chemical quality station
\# Also sediment station

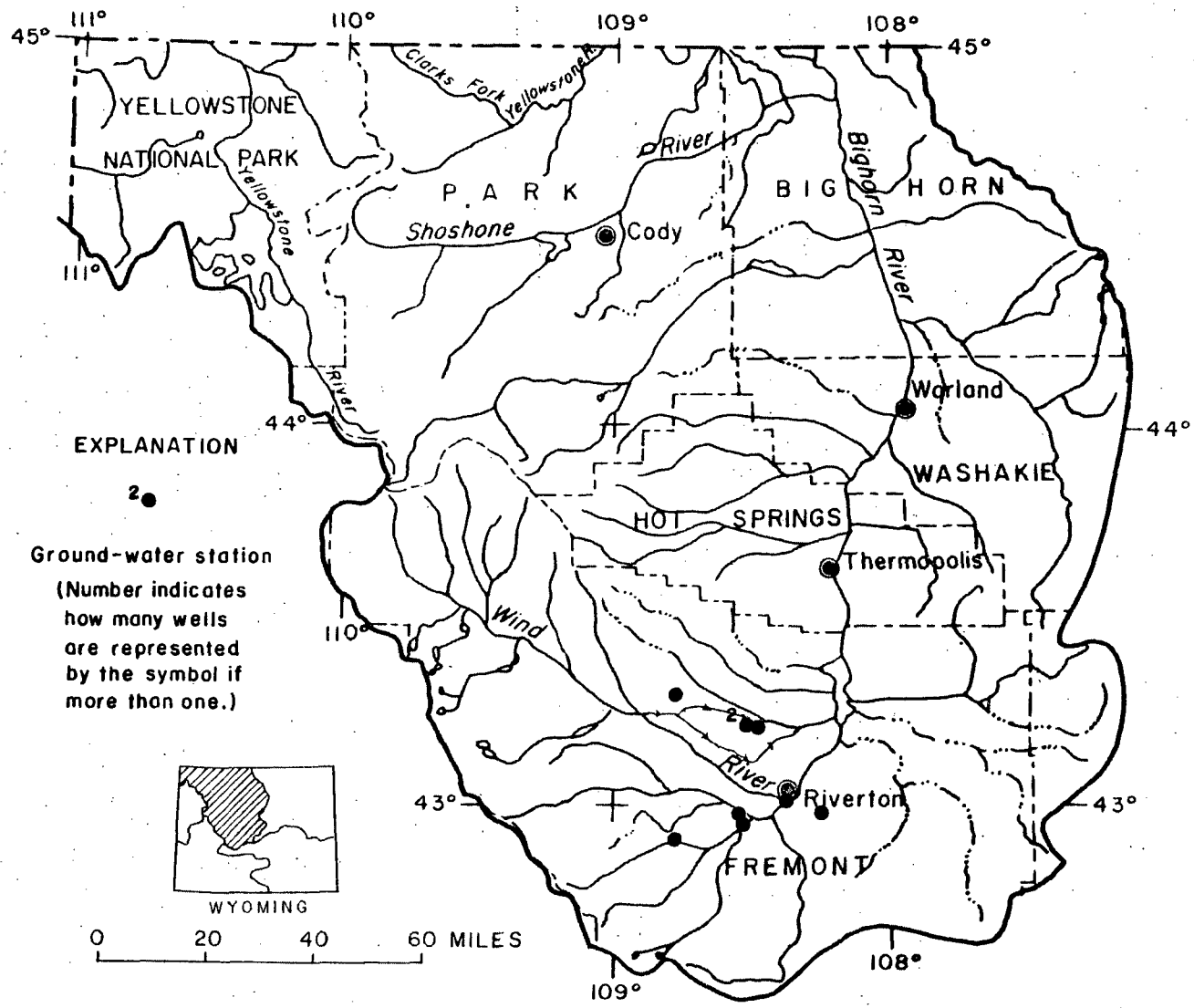


Figure 8.—Location of ground-water stations in the Yellowstone River, Clarks Fork Yellowstone River, and Bighorn River basins.

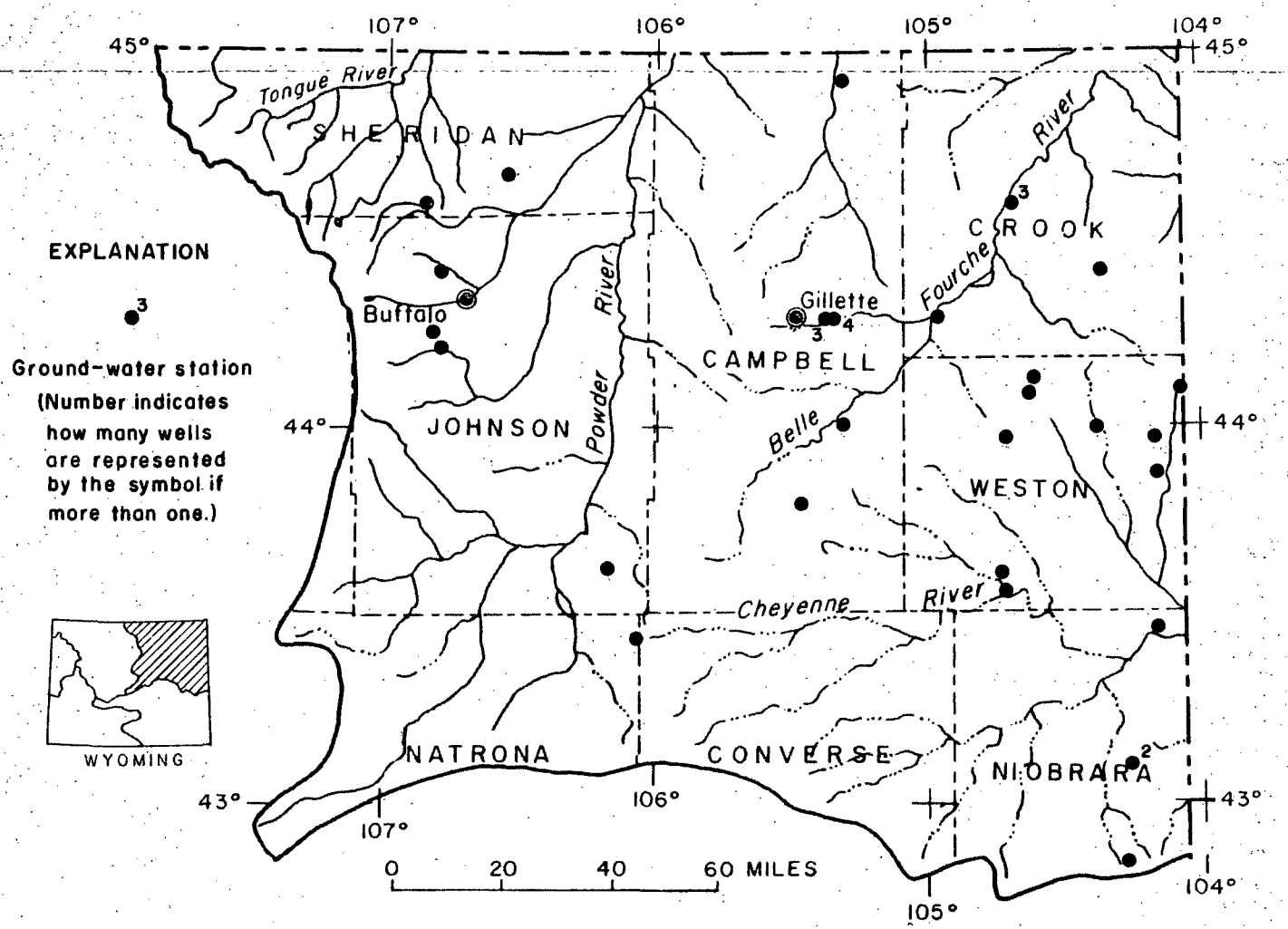


Figure 9.—Location of ground-water stations in the Tongue River, Powder River, Belle Fourche River, and Cheyenne River basins.

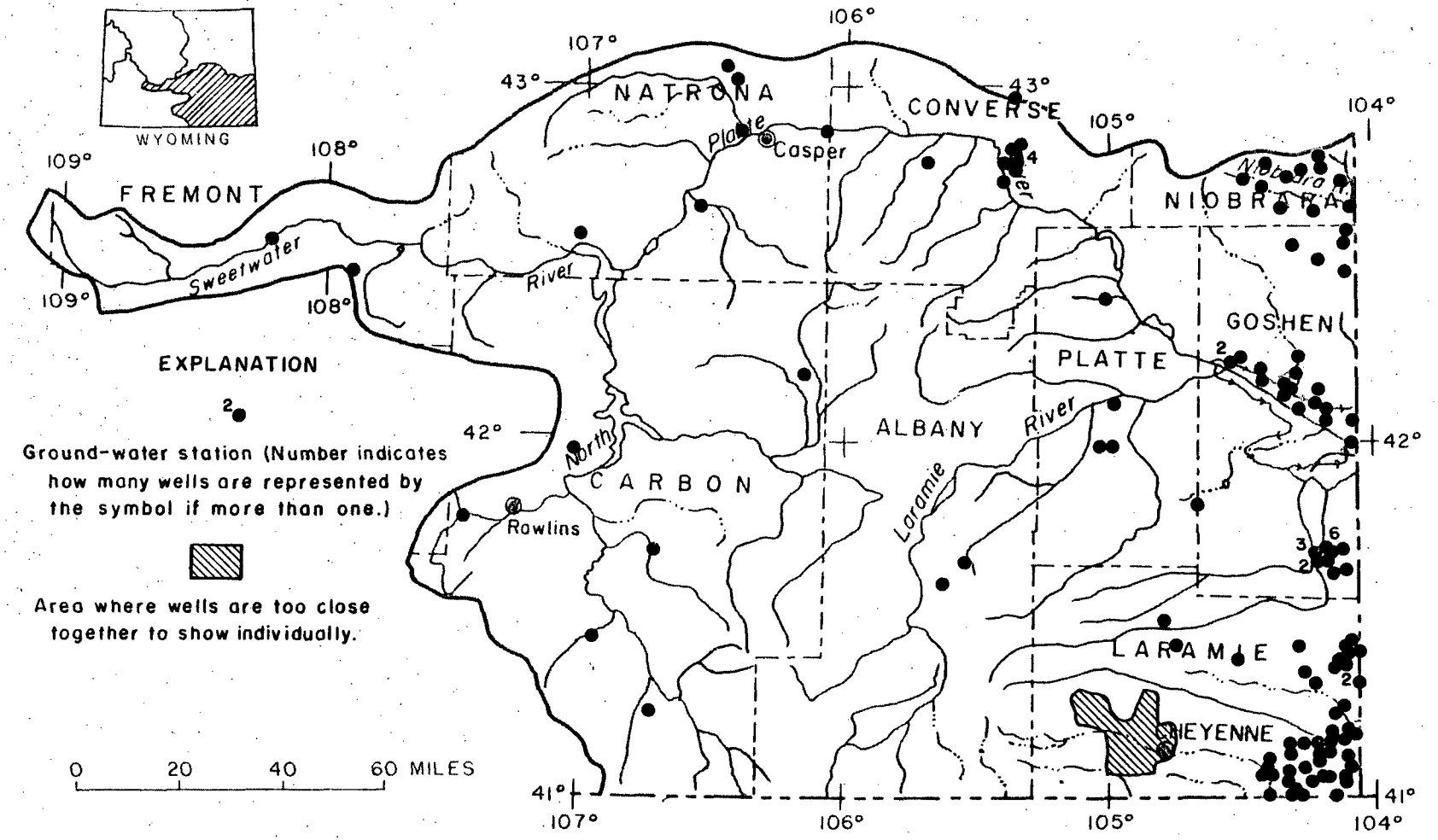


Figure 10.—Location of ground-water stations in the Niobrara River and Platte River basins.

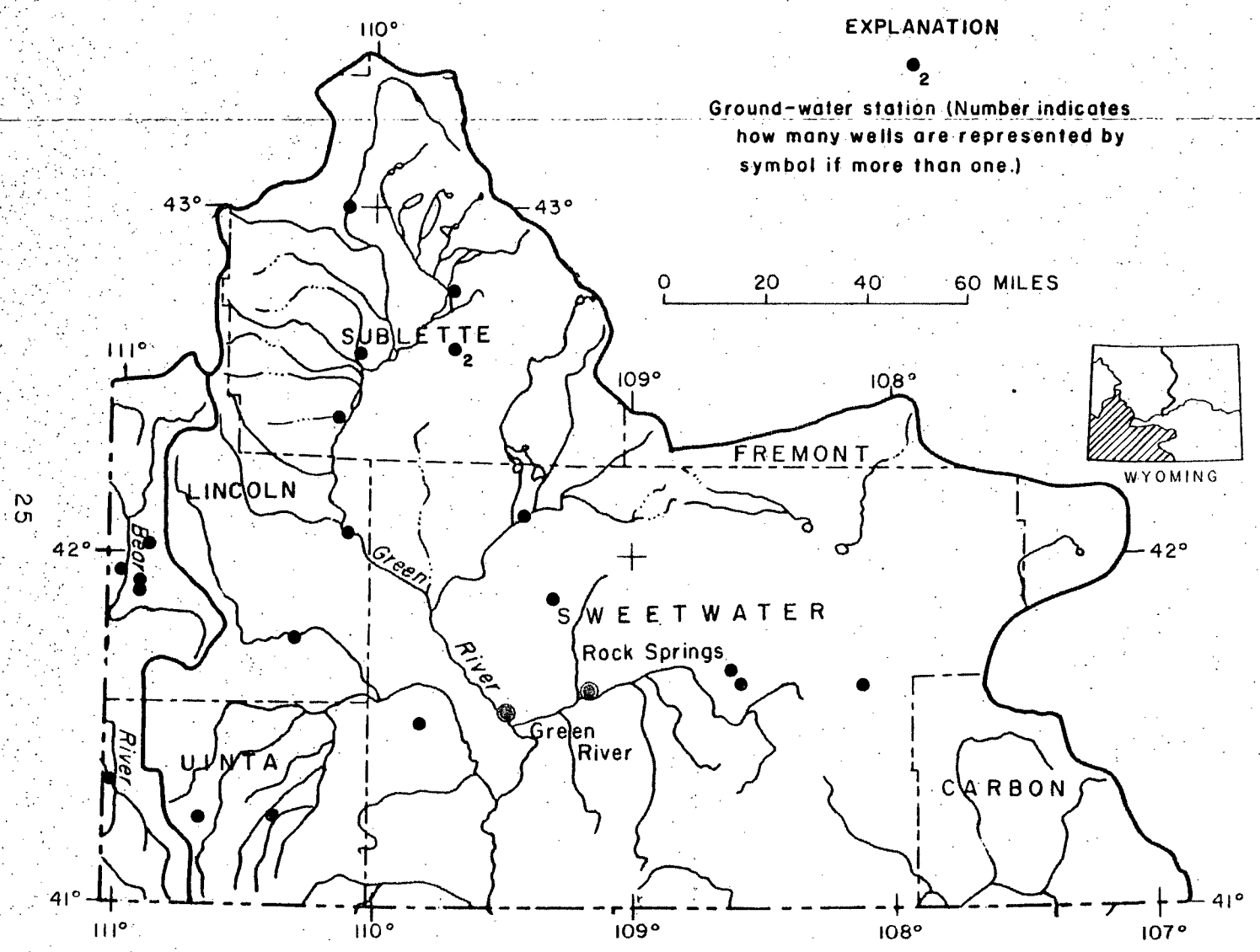


Figure 11.—Location of ground-water stations in the Green River and Bear River basins.

Ground-water stations

Explanation of abbreviations and codes used in table 2.

Well number: The well-numbering procedure used is based on the U.S. Land Grant System. The first segment of the number is the township (north); the second number segment is the range (west); the third number segment is the section, which is followed by a first letter designating the quarter section, a second letter, if shown, designating the quarter-quarter section, etc., (A-NE¼, B-NW¼, C-SW¼, D-SE¼). Well 30-108-05BCD2, for example, is in the SE¼ of the SW¼ of the NW¼ of sec. 5, T. 30 N., R. 108 W. The number 2 indicates it is the second well in the quarter-quarter-quarter section. Wells shown in Fremont County have an additional uppercase letter that begins the number. This letter designates the quadrant of the Wind River Meridian and Base Line System. The quadrants are lettered A, B, C, and D in a counter-clockwise direction beginning with A in the northeast quadrant.

Lat-Long-Seq No.: The first six digits are the latitude in degrees, minutes, and seconds. The next seven digits are the longitude in degrees, minutes, and seconds. The last two digits indicate the sequence number of when the well was inventoried in the event more than one well has the same latitude and longitude.

Explanation of abbreviations and codes used in table 2--continued

Geologic Unit:

111	ALVM	Alluvium	211	LNCE	Lance Formation
111	TRRC	Terrace deposits	211	MVRD	Mesaverde Formation or Group
121	NRPK	North Park Formation	211	STEL	Steele Shale
121	OGLL	Ogallala Formation	217	LKOT	Lakota Formation
122	ARKR	Arikaree Formation	221	SNDC	Sundance Formation
123	BRUL	Brule Formation	237	SPRF	Spearfish Formation
123	WRVR	White River Formation or Group	317	FRLL	Forelle Limestone Member of Goose Egg Formation
124	LNEY	Laney Shale Member of Green River Formation	317	MNKT	Minnekahta Limestone
124	WDRV	Wind River Formation	331	MDSN	Madison Limestone
124	WSTC	Wasatch Formation	337	PHSP	Pahasapa Limestone
125	FRUN	Fort Union Formation	374	FLTD	Flathead Quartzite or Sandstone
211	ALMD	Almond Formation			
211	FXHL	Fox Hills Sandstone			

The seven-character geologic unit code given above consists of two parts. The first three characters are numeric and identify the Era, System, and Series of the rock unit. The next four characters are in alpha mnemonic code for the name of the rock-stratigraphic unit.

Numeric Codes for Geologic Age Identification

	Code		Code
Cenozoic	100	Paleozoic--continued	
Quaternary	110	Pennsylvanian	320
Holocene	111	Upper	321
Pleistocene	112	Middle	324
Tertiary	120	Lower	327
Pliocene	121	Mississippian	330
Miocene	122	Upper	331
Oligocene	123	Lower	337
Eocene	124	Devonian	340
Paleocene	125	Upper	341
Mesozoic	200	Middle	344
Cretaceous	210	Lower	347
Upper	211	Silurian	350
Lower	217	Upper	351
Jurassic	220	Middle	354
Upper	221	Lower	357
Middle	224	Ordovician	360
Lower	227	Upper	361
Triassic	230	Middle	364
Upper	231	Lower	367
Middle	234	Cambrian	370
Lower	237	Upper	371
Paleozoic	300	Middle	374
Permian	310	Lower	377
Upper	311	Precambrian	400
Lower	317		

Explanation of abbreviations and codes used in table 2--continued

Cooperator: CHEY, City of Cheyenne
USGS, Geological Survey, Federal Program
WSE, Wyoming State Engineer

Field Office: B, Buffalo
C, Casper
CF, Cheyenne Field Unit
CH, Cheyenne Hydrologic Surveillance Section
GR, Green River
O, Observer
P, Project Personnel
R, Riverton
SD, South Dakota District

Frequency of Observation:
C, continuous (graphic or digital recorder)
M, monthly (12 visits per year)
Q, quarterly (4 visits per year)
SA, semiannual (2 visits per year)
A, annual (1 visit per year)
I, infrequent or as required

Period of Record: The dates given are the calendar years in which records began or ended. A record consists of one or more measurements during a calendar year.

Remarks: Recorder 77- indicates recorder continuous to present.

Table 2. Ground-water stations

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
ALBANY COUNTY	MISSOURI RIVER BASIN							
19-073-02CDD	413816105325601	317FHLL	WSE	CF	SA	65-68,70-	GIL SMITH	
19-074-36CCA	413424105390301	211STEL	WSE	CF	SA	66,70-	O. L. SCHMIDL	
CAMPBELL COUNTY	MISSOURI RIVER BASIN							
44-072-22CC 01	434611105295001	124WSTC	WSE	C	SA	66-	DURHAM MEAT CO.	
46-071-09ADA01	435904105231601	111ALVM	WSE	C	C	75-	USGS	RECORDER 77-
50-071-21BBB01	441816105243101	125FRUN	WSE	C	M	74-	USGS	
50-071-27AAC01	441749105221901	111ALVM	WSE	C	I	74-	USGS	
50-071-27BAA02	441728105224802	125FRUN	WSE	C	I	74-	USGS	
50-071-27BAD01	441716105224901	111ALVM	WSE	C	I	74-	USGS	
50-071-33BAC01	441628105240801	125FRUN	WSE	C	C	74-	USGS	RECORDER 74-
50-071-33BAC02	441628105240802	125FRUN	WSE	P	M	74-	USGS	
50-071-33BAC03	441628105240803	111ALVM	WSE	P	M	74-	USGS	
57-071-13CCB01	445545105210601	111ALVM	WSE	C	C	75-	USGS	RECORDER 77-
CARBON COUNTY	MISSOURI RIVER BASIN							
15-083-32DDD01	411307106442601	121NRPK	WSE	CF	SA	67-68,70-	HENRY FINCH	
17-085-23AAC01	412610106552401	121NRPK	WSE	CF	SA	77-	L. F. WALCK	
20-083-28BAB	414104106442701	121NRPK	WSE	CF	SA	50-	STATE OF WYOMING	
21-089-22ADA	414650107254501	125FRUN	WSE	CF	SA	63,65-	BLM	
23-085-19DBD	415652107014201	211MVRD	WSE	CF	SA	67-68,70-	MILLER ESTATE	
25-078-03CCC	420936106105001	111ALVM	WSE	CF	SA	68,70-		
CONVERSE COUNTY	MISSOURI RIVER BASIN							
32-071-02DAA01	424628105194201	125FRUN	WSE	C	SA	75-	ART SIMS	
32-071-04BDD01	424631105224301	125FRUN	WSE	C	SA	75-		
32-071-11BAB01	424558105204401	125FRUN	WSE	C	SA	75-		
32-071-31AAA	424229105242901	123WRVR	WSE	C	SA	50-56,59-	SALLIE EDWARDS	
32-074-03BCD	424620105424201	331MDSN	WSE	C	C	74-	WM BARBER	RECORDER 74-
33-071-24DAA01	424902105192301	125FRUN	WSE	C	SA	75-	RAYMOND BAKER	
33-071-26DAD01	424801105200901	125FRUN	WSE	C	SA	75-	ART SIMS	
33-071-34ACD01	424722105214301	125FRUN	WSE	C	SA	75-	D.W. FUNK	
33-071-34ACD02	424723105213602	125FRUN	WSE	C	SA	75-	ROY JARMON	
33-071-34ADC01	424723105213001	125FRUN	WSE	C	SA	75-	PHILLIPS PETROLEUM	
33-071-34BBC01	424734105222801	125FRUN	WSE	C	SA	75-	ROY JARMON	
35-071-23CC01	425910105211001		USGS	P	A	75-	PANHANDLE EASTERN	
40-068-20ACD01	432545105024301	111ALVM	WSE	C	I	75-	USGS	RECORDER 75-
40-068-20DBA01	432543105024401	111ALVM	WSE	C	I	75-	USGS	RECORDER 75-
CROOK COUNTY	MISSOURI RIVER BASIN							
50-068-36AD	441620104575001	211LNCE	WSE	C	SA	69-	STATE OF WYOMING	
51-063-23AAC	442340104225001	221SNDC	WSE	C	SA	68,75-	CITY OF SUNDANCE	
53-065-18BAC	443503104425101	317MNKT	WSE	C	SA	55,60,62-	NATIONAL PARK SERVICE	
53-065-18BBD01	443450104430001	237SPRF	WSE	C	SA	62-	NATIONAL PARK SERVICE	
53-065-18BBD02	443453104425602	337PHSP	WSE	C	SA	62-	NATIONAL PARK SERVICE	

Table 2. Ground-water stations (continued)

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
FREMONT COUNTY	MISSOURI RIVER BASIN							
29-093-36DB	422632107540501	122ARKR	WSE	R	C	74-	STATE OF WYOMING	RECORDER 74-
30-095-31AD	423127108132201	122ARKR	WSE	R	SA	65,73-		
A 1-4-33DD8	430051108240901	124WDRV	WSE	R	C	51,61-	TETON STUDS CORP.	RECORDER 66-
A 3-3-21ADA01	431326108311001	124WDRV	WSE	R	SA	49,65-	H. W. ROLAND	
A 3-3-21ADA02	431327108311102	124WDRV	WSE	R	SA	48-	H. W. ROLAND	
A 3-3-25BBB	431253108284401	124WDRV	WSE	R	SA	49-	USBR	
A 4-1-18DBC	431915108481501	124WDRV	WSE	R	SA	66-67,70-	USGS	
D 1-3-07DCD	425900108335401	124WDRV	WSE	R	SA	66-67,70-	USGS	
D 1-3-29CCC	425623108332401	124WDRV	WSE	R	SA	66-67,70-	USGS	
D 1-5-11BDD	425931108151301	111ALVM	WSE	R	SA	65-67,70-	USGS	
D 2-1-06DDD	425437108474101	111ALVM	WSE	R	SA	65-67,70-	I. W. SEAMANDS	
GOSHEN COUNTY	MISSOURI RIVER BASIN							
19-060-08AABB3	413809104060203	123BRUL	WSE	CH	SA	74-	JERRY CHAMBERLIN	
19-061-02CCD	413816104094901	111ALVM	WSE	CH	SA	43,49-69,72-	CITY OF LAGRANGE	
19-061-04ABC	413852104114901	111ALVM	WSE	CH	C	72-	FRANK SANDERS	RECORDER 73-
19-061-04CDD02	413813104115702	111ALVM	WSE	CH	SA	43,48-69,72-	HUGH STEMLER	
19-061-13BAA	413715104082701	123BRUL	WSE	CH	SA	72-	FLORA VANDENEL	
20-060-30CBB	414023104074501	123BRUL	WSE	CH	SA	72-	JOHN MEIER & SON, INC.	
20-061-21DDD	414051104112201	111ALVM	WSE	CH	SA	70-	CURTIS MEIER	
20-061-23CCC	414051104100701	111ALVM	WSE	CH	C	72-	USGS	RECORDER 73-
20-061-23DBB02	414104104091702	111ALVM	WSE	CH	SA	72-	CURTIS MEIER	
20-061-24CDD	414052104083001	123BRUL	WSE	CH	SA	76-	JOHN MEIER & SON, INC.	
20-061-25CBC02	414017104085702	111ALVM	WSE	CH	SA	72-	JOHN MEIER & SON, INC.	
20-061-25DCC	414002104081601	123BRUL	WSE	CH	SA	76-	CURTIS MEIER	
20-061-27DDA	414005104101701	111TRRC	WSE	CH	SA	43,49-70,72-	CURTIS TEMPLIN	
20-061-30BAC	414043104142301	123BRUL	WSE	CH	SA	72-	JAMES WARD	
20-061-31BCB	413944104144101	123BRUL	WSE	CH	SA	72-	LOVERCHECK LAND & CATTLE	
20-061-31DAD	413919104134101	123BRUL	WSE	CH	SA	72-	WARD HAY & CATTLE CO.	
20-061-33CCB	413917104122401	111ALVM	WSE	CH	SA	72-	FRANK SANDERS	
23-060-10AAC	415902104031601	111ALVM	WSE	CH	U	50-	FRENCH IRR. DIST.	
24-060-28CBD	420141104051501	111ALVM	WSE	CH	U	62-		
24-061-05CBB02	420449104133402	111ALVM	WSE	CH	U	51-	USGS	
24-061-11BBB	420426104100601	111TRRC	WSE	CH	U	62-	BILL RING	
24-061-23CCB	420204104100601	111ALVM	WSE	CH	U	62-	USGS	
24-062-11AAA	420429104155801	111ALVM	WSE	CH	U	62-	USGS	
25-061-28DBC	420626104114501	111TRRC	WSE	CH	U	43,48-52,54-	M. W. BERRY	
25-062-02BBB	421031104170001	111ALVM	WSE	CH	U	62-	USGS	
25-062-19AAB	420753104204701	111ALVM	WSE	CH	U	48-53,55-	LESTER STROUD	
25-062-27BDC02	420640104175402	111ALVM	WSE	CH	U	62-	USGS	
25-062-31ADC	420548104204801	111ALVM	WSE	CH	U	62-	USGS	
25-063-09CCB	420900104262201	111ALVM	WSE	CH	U	43,48-	EMERY BRIGHT	
26-062-14BBA	421357104165001	111ALVM	WSE	CH	U	48-	LESTER DUNTEN	
26-063-32DAC	421044104263201	111ALVM	USGS	CH	U	48-	JOSEPH SPELKNER	
26-064-23CDA	421233104303401	111ALVM	USGS	CH	U	62-	USGS	
26-064-28BBB	421216104332501	111ALVM	WSE	O	M	48-	NPS-FED NO. 2	
26-064-29ADA	421205104333001	111ALVM	WSE	O	M	42-43,46-	NPS	
29-061-08CDC	422946104131001	122ARKR	WSE	CH	SA	49-51,70,75-	GERALD STURMAN	
29-061-26ACC	422734104092501	122ARKR	WSE	CH	C	74-		RECORDER 75-
30-060-04DAA	423603104041001	122ARKR	WSE	CH	SA	72-	WM IMMESOETA	
30-060-29BBC	423255104062301	122ARKR	WSE	CH	SA	72-	OTTO YORK	
30-062-33DCA	423150104183401	122ARKR	WSE	CH	SA	74-	RONALD PODALAK	

Table 2. Ground-water stations (continued)

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
JOHNSON COUNTY	MISSOURI RIVER BASIN							
42-078-14DDB	433618106112901	211LNCE	WSE	C	SA	65-	W. B. LINCH	
49-083-05DCB	440912106512001	374FLTU	WSE	B	1	74-	MOBIL OIL	
49-083-27DBA02	441112106493502	331MDSN	WSE	B	C	74-	MOBIL OIL	RECORDER 74-
51-083-10ACB	442427106494001	124WSTC	WSE	B	SA	60-	NIELS NIELSON	
LARAMIE COUNTY	MISSOURI RIVER BASIN							
12-061-06CBB	410218104152201	111TRRC	WSE	CH	M	69-	KENNETH THOMPSON	
12-061-15DDD	410007104105301	123BRUL	WSE	CH	M	70-	USGS	
12-062-07BCA	410135104220301	111TRRC	WSE	CH	M	77-	MARVIN MCNALLY	
12-062-10BBC	410145104184101	111TRRC	WSE	CH	M	70-		
12-062-13BAA	410100104160301	111TRRC	WSE	CH	C	75-	STATE ENGINEER	RECORDER 75-
12-062-18DDB	410050104211701	111ALVM	WSE	CH	M	77-	FRANCIS BLAKE	
12-062-22ABB	410008104181101	111TRRC	WSE	CH	M	52,70-	FRANK DWINNELL	
12-063-15AAA02	410059104243202	123BRUL	WSE	CH	C	73-	USGS	RECORDER 72-
13-060-05CCB	410703104071201	123BRUL	WSE	CH	C	69-	ELMER GLANTZ	RECORDER 72-
13-060-20BBC	410458104071201	123BRUL	WSE	CH	M	46,70-	BERNARD MORTIZ	
13-060-31AAA	410322104071701	123BRUL	WSE	CH	M	40-	W. I. YOUNG	
13-061-04CBC	410710104125801	123BRUL	WSE	CH	M	53,59,65,70-	CLAUS PLAMBECK	
13-061-33CCC	410234104125601	123BRUL	WSE	CH	M	70-	TOM PORTER	
13-061-35CCC	410237104104101	111TRRC	WSE	CH	M	70-	A. M. IDE	
13-062-04DDD	410654104184301	123BRUL	WSE	CH	M	70-	USGS	
13-062-08CBD01	410646104204701	1210GLL	WSE	CH	M	77-	PAUL MURDOCH	
13-062-28BCC	410356104195001	111TRRC	WSE	CH	M	70-		
13-063-20CCD02	410419104274201	1210GLL	WSE	CH	M	77-	MARK FOSTER	
13-063-27DDC	410330104244501	123BRUL	WSE	CH	M	70-		
13-063-32DCC	410237104271801	123BRUL	WSE	CH	M	72-		
13-063-35CCC	410235104242801	123BRUL	WSE	CH	M	71-	USGS	
13-064-02DAC	410711104302601	1210GLL	WSE	CH	M	77-	DEXTER MCGREW	
13-064-23AAA	410510104301401	1210GLL	WSE	CH	M	77-	MARK FOSTER	
13-067-06BCB	410738104563501	1210GLL	CHEY	CH	A	67-	ART KING	
13-067-07DAD	410622104552801	1210GLL	CHEY	CH	A	63-64,67-	ART KING	
13-067-15BBA	410608104525201	1210GLL	CHEY	CH	A	41-43,49-50,64-65,67-68,71-	WARREN LIVESTOCK CO.	
13-067-16ABC	410557104534101	1210GLL	CHEY	CH	A	41-43,50,64-65,67-	WARREN LIVESTOCK CO.	
13-067-19CAA	410446104560501	1210GLL	CHEY	CH	A	41-42,50,64,67-	DUCK CREEK GRAZING ASSN.	
13-067-27BBA	410420104525601	1210GLL	CHEY	CH	A	41-42,50,63,65,67-	DUCK CREEK GRAZING ASSN.	
13-067-28BCD	410401104540801	1210GLL	CHEY	CH	A	63,67,69-	DUCK CREEK GRAZING ASSN.	
13-067-34BBA	410330104525801	1210GLL	CHEY	CH	A	63-	STATE OF WYOMING	
13-068-01BCD	410731104572901	1210GLL	CHEY	CH	A	63,67-	ART & JERRY KING	
13-068-03BBA	410747104594801	1210GLL	CHEY	CH	A	44-	CITY OF CHEYENNE	
13-068-04ADC	410729105001801	1210GLL	CHEY	CH	A	44-	CITY OF CHEYENNE	
13-068-04CBD	410717105010101	1210GLL	CHEY	CH	A	45-48,50-	CITY OF CHEYENNE	
13-068-04DCC	410707105002801	1210GLL	CHEY	CH	A	44-48,50-	CITY OF CHEYENNE	
13-068-09BAC	410640105004801	1210GLL	CHEY	CH	A	44,55,68-	ART KING	
13-068-11ACC	410642104581201	1210GLL	CHEY	CH	A	69-	ART KING	
13-068-12CCA	410622104573501	1210GLL	CHEY	CH	A	69-	CHEVRON OIL CO.	
13-068-12DCA	410623104565601	1210GLL	CHEY	CH	A	63-64,67-	ART & JERRY KING	
13-068-12DCC	410622104573201	1210GLL	CHEY	CH	A	70-	ART KING	
13-068-13CCC	410530104574001	1210GLL	CHEY	CH	C	42-50,69-	ART KING	RECORDER 72-
13-068-14BBB	410608104584901	1210GLL	CHEY	CH	A	45-50,69-	CITY OF CHEYENNE	
13-068-14CBD	410501104583901	1210GLL	CHEY	CH	A	45-	CITY OF CHEYENNE	
13-068-15CBD	410537104594701	1210GLL	CHEY	CH	A	63,68,70-	ART & JERRY KING	
13-068-16DBA	410542105002201	1210GLL	CHEY	CH	A	63,67,69-	ART & JERRY KING	

Table 2. Ground-water stations (continued)

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
LARAMIE COUNTY	MISSOURI RIVER BASIN (Continued)							
13-068-16DBD	410534105002401	1210GLL	CHEY	CH	A	49-	CITY OF CHEYENNE	
13-068-17CCB	410531105021601	1210GLL	CHEY	CH	A	65,67-69,71-	BELVOIR GRAZING ASSN.	
13-068-22BDC	410453104594401	1210GLL	CHEY	CH	A	41,42,50,64-	BELVOIR GRAZING ASSN.	
13-068-23BBC	410507104585201	1210GLL	CHEY	CH	A	67-	BELVOIR GRAZING ASSN.	
13-068-24AAD	410506104563701	1210GLL	CHEY	CH	A	64,67-	CITY OF CHEYENNE	
13-068-34ADD	410314104585801	1210GLL	CHEY	CH	A	61-69,71-	CITY OF CHEYENNE	
13-068-34DAC	410255104590401	1210GLL	CHEY	CH	A	41,63-	WARREN LIVESTOCK	
14-060-05BCB	410238104070801	123BRUL	WSE	CH	C	57-	C. C. GROSS	RECORDER 72-
14-060-10DBB	411131104041801	123BRUL	WSE	CH	C	73-	USGS	RECORDER 73-
14-060-19BDA03	411001104075001	111TRRC	WSE	CH	M	42,71-	DALE BOWERS	
14-061-18DDD01	411022104141201	123WRVR	WSE	CH	C	77-	LARAMIE CO. WELL #2	RECORDER 77-
14-061-22DCC	410900104110701	123BRUL	WSE	CH	C	75-	SHERIL BROWN	RECORDER 75-
14-061-23AAB	411019104094501	123BRUL	WSE	CH	M	71-	WALTER BROWN	
14-061-25CCB	410847104093101	123BRUL	WSE	CH	M	70-	JAY BROWN	
14-062-06AAC	411246104211301	1210GLL	WSE	CH	M	77-	ALEX PAVLICA	
14-062-20CCB	410940104205501	121ARKR	WSE	CH	M	59,64,70-	JOHN BASTIAN	
14-062-24BAB	411019104160201	123BRUL	WSE	CH	M	70-	MINNICK	
14-063-15AAA	411114104242501	122ARKR	WSE	CH	C	77-	LARAMIE CO. WELL #3	RECORDER 77-
14-063-18DDD	411025104275501	1210GLL	WSE	CH	M	77-	CLEO ROBERTSON	
14-064-01DCB	411214104293301	1210GLL	WSE	CH	C	77-	HOLLENBECK	RECORDER 77-
14-064-19BCC	411005104355001	1210GLL	WSE	CH	C	77-	LARAMIE CO. WELL #9	RECORDER 77-
14-064-28BCC	410909104333301	1210GLL	WSE	CH	M	77-	ROESELER #1	
14-066-08BDC01	411152104481201	1210GLL	WSE	CH	Q	76-	HUGH LOWHAM	
14-066-10ABA	411210104452001	1210GLL	WSE	CH	C	77-	LARAMIE CO. WELL #8	RECORDER 77-
14-066-18BBD	411110104492601	1210GLL	CHEY	CH	Q	75-	SAM WEST	
14-066-21DDD	410938104462001	1210GLL	WSE	CH	Q	76-		
14-067-06DAD	411231104553401	1210GLL	CHEY	CH	A	64-65,67-	JOHN BELL	
14-067-07CCB	411130104562701	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-067-07DCB	411131104555601	1210GLL	CHEY	CH	A	64-65,67-	CITY OF CHEYENNE	
14-067-18CBD	411050104562001	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-067-18DDC	411034104554001	1210GLL	CHEY	CH	C	56-	CITY OF CHEYENNE	RECORDER 72-
14-067-19BBD	411020104562701	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-067-31BBD	410834104562201	1210GLL	CHEY	CH	A	41-43,64,67-	MARK T. COX III	
14-067-31DDC	410755104554301	1210GLL	CHEY	CH	A	64-65,67-	ART KING	
14-068-10DCD	411124104591101	1210GLL	CHEY	CH	A	64-65,67-		
14-068-12DBC	411138104570501	1210GLL	CHEY	CH	A	65,67-	CITY OF CHEYENNE	
14-068-13ACB	411109104571001	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-13CCD	411032104573001	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-13DAD	411045104564201	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-14ADA	411107104574901	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-14CAD	411049104582301	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-14CBB	411050104584701	111ALVM	CHEY	CH	A	41-48,50-	CITY OF CHEYENNE	
14-068-14DCD	411035104580501	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-23DDC	410939104580101	1210GLL	CHEY	CH	A	40-47,49-	CITY OF CHEYENNE	
14-068-24BDD	411007104571801	1210GLL	CHEY	CH	A	56-	CITY OF CHEYENNE	
14-068-24DDD	410939104563601	1210GLL	CHEY	CH	A	50-53,55-62,64-	CITY OF CHEYENNE	
14-068-25ABB	410932104565801	1210GLL	CHEY	CH	A	41-42,50-51,64,70-	CITY OF CHEYENNE	
14-068-25DDA	410857104564401	1210GLL	CHEY	CH	A	41-	CITY OF CHEYENNE	
14-068-26BDD	410908104581801	1210GLL	CHEY	CH	A	42-43,45-47,68-69,71-	CITY OF CHEYENNE	
14-068-26CBC01	410901104585201	1210GLL	CHEY	CH	A	40-	CITY OF CHEYENNE	
14-068-27DCC	410848104592301	1210GLL	CHEY	CH	A	40,42-61,63-	CITY OF CHEYENNE	
14-068-28BCB02	410922105010402	1210GLL	CHEY	CH	A	64,68-	FRANCIS LIVESTOCK CO.	

Table 2. Ground-water stations (continued)

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
LARAMIE COUNTY	MISSOURI RIVER BASIN (Continued)							
14-068-28BDA	410921105004001	1210GLL	CHEY	CH	A	64-65,67-	FRANCIS LIVESTOCK CO.	
14-068-32DDC	410759105012201	1210GLL	CHEY	CH	A	48-	CITY OF CHEYENNE	
14-068-33ABC	410836105002801	1210GLL	CHEY	CH	A	47-	CITY OF CHEYENNE	
14-068-33DCC	410758105003501	1210GLL	CHEY	CH	A	45-48,50-	CITY OF CHEYENNE	
14-068-34AAB	410844104590601	1210GLL	CHEY	CH	A	40,42-	CITY OF CHEYENNE	
14-068-34DBD	410809104591901	1210GLL	CHEY	CH	A	43-48,50,69-	CITY OF CHEYENNE	
14-068-34DDD	410755104590001	1210GLL	CHEY	CH	A	44-48,50-	CITY OF CHEYENNE	
14-068-35CAC	410811104583501	1210GLL	CHEY	CH	A	45-	CITY OF CHEYENNE	
14-068-35CDD02	410757104582302	1210GLL	CHEY	CH	C	69-	CITY OF CHEYENNE	RECORDER 72-
14-068-36ACC	410825104571001	1210GLL	CHEY	CH	A	41-	CITY OF CHEYENNE	
14-068-36ADB	410833104565101	1210GLL	CHEY	CH	A	41-61,63-	CITY OF CHEYENNE	
14-068-36BCA	410832104573501	1210GLL	CHEY	CH	A	41-61,63-	CITY OF CHEYENNE	
15-060-18DBB	411557104074001	123BRUL	WSE	CH	M	71-	HENRY JESSEN	
15-061-03CCB	411727104113901	1210GLL	WSE	CH	M	77-	CHESTER BRUNS	
15-061-25CCC	411348104092301	123BRUL	WSE	CH	M	71-	USGS	
15-062-12DDD	411628104151401	1210GLL	WSE	CH	M	77-	EARL WOOLINGTON	
15-062-17BCC	411605104205201	1210GLL	WSE	CH	M	77-	MIKE PAVLICA	
15-062-20AAA	411531104194701	1210GLL	WSE	CH	C	77-	LARAMIE CO. WELL #4	RECORDER 77-
15-063-18DBD	411549104281001	1210GLL	WSE	CH	M	77-	ALICE PACE	
15-063-31BCC	411326104285801	1210GLL	WSE	CH	M	77-		
15-063-32BBC	411341104275201	1210GLL	WSE	CH	M	77-	MCDOWELL	
15-063-35CCD	411304104240801	1210GLL	WSE	CH	M	77-	ALEX PAVLICA	
15-066-10BAB	411725104454601	1210GLL	WSE	CH	C	77-	LARAMIE CO. WELL #7	RECORDER 77-
15-067-02DBA	411750104510901	1210GLL	WSE	CH	SA	61-	ERVIN M. MUELLER	
15-067-32DBA	411330104543701	1210GLL	CHEY	CH	A	42,50,53,64,67,69-	WARREN LIVESTOCK CO.	
15-069-06ACA	411808105094201	123BRUL	CHEY	CH	A	43-44,54-	CITY OF CHEYENNE	
15-069-09CAD	411655105073501	123BRUL	CHEY	CH	A	42-44,54-	CITY OF CHEYENNE	
15-069-16ACB	411621105072901	123BRUL	CHEY	CH	A	54-	CITY OF CHEYENNE	
15-069-21DCC	411452105072801	123BRUL	CHEY	CH	A	54-	CITY OF CHEYENNE	
15-069-27CDC	411406105063701	123BRUL	CHEY	CH	A	55-	CITY OF CHEYENNE	
15-069-28DBA	411425105071701	123BRUL	CHEY	CH	A	54-	CITY OF CHEYENNE	
15-069-33ABB	411359105072701	123BRUL	CHEY	CH	A	55-	CITY OF CHEYENNE	
15-069-34AAA	411355105055401	123BRUL	CHEY	CH	A	54-	CITY OF CHEYENNE	
16-060-07BBB	412227104081401	1210GLL	WSE	CH	C	75-	STATE ENGINEER	RECORDER 75-
16-060-10DBC	412155104040801	1210GLL	WSE	CH	M	76-	DON ANDERSON PETER #2	
16-060-27ABC	411941104041401	1210GLL	WSE	CH	M	72-	ANDERSON LIVESTOCK	
16-061-01CBA	412312104092001	1210GLL	WSE	CH	M	72-73,77-	ORVILLE LERURISH	
16-061-04DBB	412250104120901	1210GLL	WSE	CH	M	72-73,77-	LEONARD LUNDBERG	
16-061-08CCB	412147104135301	1210GLL	WSE	CH	M	77-	E. ZIMMERMAN	
16-061-14BBC	412126104102909	1210GLL	WSE	CH	M	64,74-	WARREN ANDERSON	
16-061-17AAA	411136104125301	1210GLL	WSE	CH	C	77-	LARAMIE CO. WELL #5	RECORDER 77-
16-061-30BBB	411952104150501	122ARKR	WSE	CH	SA	64-69,72-	FAYE MARQUISS	
16-062-14AAA	412134104162001	121DGLL	WSE	CH	M	72-	WARREN ANDERSON	
16-062-34CCC	411811104183501	122ARKR	WSE	CH	M	63-64,77-	KING CATTLE CO.	
16-063-26DDD02	411903104231902	122ARKR	WSE	CH	M	77-	ROBERT WISROTH	
16-064-03CCB	412238104322001	1210GLL	WSE	CH	M	53,64-70,72,74-	DAVID JOHNSON	
16-065-21DBC	412015104394301	1210GLL	WSE	CH	M	53,64-65,77-		
17-060-20ADA02	412542104053202	122ARKR	WSE	CH	M	72-	JOHN W. FREEBURG	
17-060-30DAD	412429104064101	1210GLL	WSE	CH	M	72-	RICHARD R. LARSON	
17-060-33CBB	412343104053101	1210GLL	WSE	CH	C	75-	STATE ENGINEER	RECORDER 75-
17-060-34CBB	412346104041801	1210GLL	WSE	CH	M	72-	ED P. ANDERSON	
17-061-26AAC	412456104084501	1210GLL	WSE	CH	M	77-	MIKE & BRUCE PETERSON	
17-062-20CCC	412507104133701	1210GLL	WSE	CH	C	77-	LARAMIE CO. WELL #6	RECORDER 77-

Table 2. Ground-water stations (Continued)

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
LARAMIE COUNTY	MISSOURI RIVER BASIN (Continued)							
17-062-26AAA	412505104160301	1210GLL	WSE	CH	M	53,64-70,72-	STOCKGROWERS BANK	
17-062-28BCC	412456104470901	1210GLL	WSE	CH	M	72-	GEORGE ROMSA	
17-062-31ACC02	412350104211002	122ARKR	WSE	CH	M	77-	LAZY JR LAND & LIVESTOCK	
17-063-26DBA02	412433104230802	122ARKR	WSE	CH	M	77-	LAZY JR LAND & LIVESTOCK	
18-066-31CCC	412853104493001	122ARKR	USGS	CH	SA	63-	HAROLD LEWIS	
LINCOLN COUNTY	GREEN RIVER BASIN							
21-114-26BCC 1	414619110193301	124LNEY	WSE	GR	SA	65-	STATE OF WYOMING	
24-112-08CBB	420430110191901	124LNEY	WSE	GR	SA	66-70,72-	NATIONAL PARK SERVICE	
LINCOLN COUNTY	BEAR RIVER BASIN							
22-119-05CDA	415442110571801	111TRRC	WSE	GR	SA	59,62-	DOYLE KNOUSE	
23-119-32BDA02	415552110571502	111TRRC	WSE	GR	SA	62-	THORNOCK BROS.	
23-120-13AAC	415849110590801	111ALVM	WSE	GR	SA	55-	DOYLE KNOUSE	
24-119-28ACA	420202110555501	111TRRC	WSE	GR	SA	62-	HERMAN TEICHERT	
NATRONA COUNTY	MISSOURI RIVER BASIN							
30-085-21BAB	423346107014201	122ARKR	WSE	C	SA	67-		
31-081-18AAB	423938106350301	111ALVM	WSE	C	SA	66-	J. H. RISSLER	
33-077-03BDC	425131106042801	111ALVM	WSE	C	SA	66-	JOHN PIERCE	
33-080-04ABB	425147106263701	111TRRC	WSE	C	SA	50,65-	USBR	
34-080-08CCC	425517106282501	111TRRC	WSE	C	SA	67-	USGS	
35-080-31DDD	425700106282801	111TRRC	WSE	C	SA	67-	USGS	
40-078-15AAB	432633106115201	211FXHL	WSE	C	SA	65-	TOWN OF EDGERTON	
NIOBRARA COUNTY	MISSOURI RIVER BASIN							
31-060-15DA	423940104031201	122ARKR	WSE	CH	SA	62-	USGS	
31-061-29BB	423816104131501	122ARKR	WSE	CH	SA	72-	ROBERT HOLMES	
31-062-18DC		122ARKR	WSE	CH	SA	73,75-	GORDAN KAAN	
32-060-29BC	424323104060301	122ARKR	WSE	CH	SA	56,72-	A. E. LARSON	
32-062-12CCD	424532104153001	122ARKR	WSE	CH	SA	72-	KEN FREEMAN	
32-062-20BDD	424410104195401	122ARKR	WSE	CH	SA	58,68,70-	KOEL LARSEN	
32-062-32BBB	424244104202001	122ARKR	WSE	C	C	70-	RICHARD PFISTER	RECORDER 70-
32-063-02CCC	424623104234601	122ARKR	WSE	CH	SA	52,59,68-	G. CHRISTIAN	
32-063-33BBB	424232104261001	122ARKR	WSE	CH	SA	57,60-	EARL QUIBLEY	
32-064-24DA 02	424355104290202	122ARKR	WSE	CH	SA	60-	IRA LAMB	
33-061-34BDC		122ARKR	WSE	CH	SA	75-	STATE OF WYOMING	
33-062-29DBA	424801104203101	122ARKR	WSE	CH	SA	67-74,76-	DALE FALLERTON	
36-062-28AB 01	430422104183201	331MDSN	WSE	C	C	74-	ENERGY TRANS. CO.	RECORDER 74-
36-062-28AB 02	430422104183202	217LKOT	WSE	C	C	74-	ENERGY TRANS. CO.	RECORDER 75-
40-061-21BAB	432611104114801	111ALVM	WSE	CH	SA	70-	USGS	
PLATTE COUNTY	MISSOURI RIVER BASIN							
21-065-16AAA	414755104391101	122ARKR	USGS	CH	SA	72-	HELLBAUM	
23-068-15DDD	415733104585601	122ARKR	WSE	CH	U	58-70,72,74-	USBR	
23-068-18DAD	415749105022501	122ARKR	WSE	CH	U	58-70,72-	USBR	
24-068-03DAD	420441104585801	122ARKR	WSE	CH	O	58-70,72-	USBR	
28-068-17CBC	422355105023601	122ARKR	WSE	CH	U	61-70,72-	W. H. JOHNSON	

Table 2. Ground-water stations (Continued)

WELL NUMBER	LAT-LONG-SEQ NO	GEO-LOGIC UNIT	COOPERATOR	FIELD OFFICE	FREQUENCY OF OBSERVATION	PERIOD OF RECORD	NAME OF OWNER	REMARKS
SHERIDAN COUNTY	MISSOURI RIVER BASIN							
53-083-07ADC	443450106534801	124WSTC	WSE	B	SA	60-	MR. PRATHER	
54-081-14BC02	443915106352201	124WSTC	WSE	B	SA	60-	ULM SCHOOL	
SUBLETTE COUNTY	GREEN RIVER BASIN							
28-112-19AC01	422348110114501	124WSTC	WSE	GR	SA	65-70,72-	BLM	
30-107-06DD01	423540109382001	124WSTC	WSE	GR	SA	64-66,68-	BLM	
30-108-05BCD02	423555109445702	124WSTC	WSE	GR	SA	73-		
30-111-17ACA01	423504110053001	124WSTC	WSE	GR	SA	65-	SUBLETTE COUNTY	
32-108-05BA	424624109450201	111ALVM	WSE	GR	SA	65-	JAMES BARGER	
35-111-08ADB	430118110071001	111ALVM	WSE	GR	SA	65-	USGS	
SWEETWATER COUNTY	GREEN RIVER BASIN							
18-110-21DBA01	413128109495801	111ALVM	WSE	GR	SA	64-	R. E. HOLDING	
19-095-05DD	413902108070601	124WSTC	WSE	GR	SA	72-	MR. JOLLEY	
19-099-06DCC	413850108362501	125FRUN	WSE	GR	SA	63-	ROCK SPGS GRAZING ASSOC.	
20-100-25DCD	414035108442001	211ALMD	WSE	GR	SA	63-	USGS	
22-105-07AAD	415402109203601	124LNEY	WSE	GR	SA	64-	SHEEP CO.	
25-106-27CCD	420615109265201	124LNEY	WSE	GR	SA	65-	TOWN OF FARSON	
UINTA COUNTY	GREEN RIVER BASIN							
15-115-20CBA	411549110243501	111TRRC	WSE	GR	SA	57-	SCHOOL DISTRICT	
15-118-24BCB	411607110404201	124WSTC	WSE	GR	SA	64-		
16-121-11ACC	412249111015801	111TRRC	WSE	GR	SA	55-	ELWIN SESSIONS	
WESTON COUNTY	MISSOURI RIVER BASIN							
42-066-14ADC01	433710104443501	211FXHL	USGS	P	SA	74-	TRUE OIL CO.	
42-066-36CD01	433415104435001	211LNCE	USGS	P	SA	76-	SLAGLE RANCH	
45-061-33AB	435030104110001	337PHSP	WSE	CH	A	75-	CORONADO CO.	
46-061-29BAC	435628104123401	337PHSP	WSE	C	SA	69-	FARELLA BROS.	
46-063-09DB	435840104253001	217LKOT	WSE	C	Q	69-	BLACK HILLS POWER AND LIG HT	
46-066-25DBB	435610104433001	331MDSN	WSE	CH	A	62,75-	TERRA RESOURCES	
47-060-04ADA	440500104034001	337PHSP	WSE	SD	M	72,75-	WESTON COUNTY	
48-065-35CBC	440645104365601	337PHSP	WSE	O	M	76-	TOWN OF UPTON	
48-065-35CC8	440530104381001	337PHSP		O	M	61-	UPTON #4	

Water-quality stations

Explanation of abbreviations and codes used in table 3.

Period of Record: The dates given are the calendar years in which records began or ended. Breaks of less than a year are not shown.

Location:
- SE, section
- TSP, township
- RNGE, range

Cooperator:
- BLM, Bureau of Land Management
- BRUC, Bureau of Reclamation, Upper Colorado Region
- BRUM, Bureau of Reclamation, Upper Missouri Region
- EPA, Environmental Protection Agency, Region 8
- MRB, Geological Survey, Missouri River Basin Program
- USGS, Geological Survey, Federal Program
- WDA, Wyoming Department of Agriculture
- WDEQ, Wyoming Department of Environmental Quality

Sampling Frequency:
- C, continuous (recorder)
- D, daily
- BW, biweekly
- M, monthly
- MW, monthly, except weekly during irrigation season
- MQ, monthly during summer, quarterly during winter
- Q, quarterly
- HL, high and low flow samples only
- SA, semiannual
- I, infrequent or as requested

Analysis Schedule:
1. salinity (major constituents)
2. specific conductance
3. daily temperature (observed)
4. bacteria or chemical oxygen demand
5. field determinations of: pH, specific conductance, dissolved oxygen, temperature, and (or) turbidity
6. total coliform, fecal coliform, and (or) fecal streptococcus
7. nutrient
8. trace metals
9. pesticides
10. radiochemical
11. biological
12. miscellaneous

Field Office:
- C, Casper
- CF, Cheyenne Field Unit
- CH, Cheyenne Hydrologic Surveillance Section
- CP, Cheyenne project personnel
- CT, Contractor
- GR, Green River
- R, Riverton
- W, Worland

Table 3. Water-quality stations

STATION NUMBER	STATION NAME	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	COOPERATOR	SAMPLING FREQUENCY	ANALYSIS SCHEDULE	FIELD OFFICE	REMARKS
YELLOWSTONE RIVER BASIN											
@06207500	CLARKS FORK YELLOWSTONE RIVER NEAR BELFRY, MT	1154	1965-	31	9S	22E	WDA	M	1	W	
#@06207510	BIG SAND COULEE AT WYOMING-MONTANA STATE LINE	134	1976-	32	9S	22E	BLM	Q	1,5,7,	W	
@06218500	WIND RIVER NEAR DUBOIS	232	1947-50,	25	42N	108W	WDA	M	1	K	
			1965-				WDEQ	M	5,6	R	
							WDA	HL	9	CH	
#@06220500	EAST FORK WIND RIVER NEAR DUBOIS	427	1975-	34	6N	6W	MRB	M	5	K	
@06222700	CROW CREEK NEAR TIPPERARY	30.2	1974-	20	7N	4W	MRB	M	5	R	
@06224000	BULL LAKE CREEK ABOVE BULL LAKE	187	1974-	2	2N	4W	MRB	M	5	R	
@06228000	WIND RIVER AT RIVERTON	2309	1947-50,	2	1S	4E	WDA	M	1	R	
			1953,								
			1965-								
@06228350	SF LITTLE WIND R AB WASHAKIE RE NR FT WASHAKIE		1976-	18	1S	2W	MRB	M	1,5	R	
06231000	LITTLE WIND RIVER ABOVE ARAPAHOE	660	1966-	22	1S	3E	WDA	M	1	R	
06235000	BEAVER CREEK NEAR ARAPAHOE	354	1967-	29	1S	4E	WDA	M	1	R	
@06235500	LITTLE WIND RIVER NEAR RIVERTON	1904	1965-	11	15N	4E	WDA	M	1	R	
06236100	WIND RIVER ABOVE BOYSEN RESERVOIR, NR SHOSHONI	4390	1974-	25	2N	5E	WDEQ	M	1,5,6	R	
							WDA	HL	9	CH	
@06246500	OCEAN DRAIN AT OCEAN LAKE OUTLET, NR PAVILLION		1978-				MRB	M	1,5	R	
#@06253000	FIVEMILE CREEK NEAR SHOSHONI	418	1949-51,	19	3N	6E	WDA	M	1	R	
			1953,								
			1965-								
#@06256900	DRY CREEK NEAR BONNEVILLE	52.6	1976-	8	38N	92W	BLM	M	1,5	R	
@06259000	WIND RIVER BELOW BOYSEN RESERVOIR	7701	1953-54,	9	5N	6E	WDA	D	2,3	W	
			1960-				WDA	M	1	W	
							WDFG	M	5,6	W	
							WDA	HL	9	CH	
							EPA	Q	10	W	
							EPA	HL	8	W	
@06260000	SOUTH FORK OWL CREEK NEAR ANCHOR	85.5	1974-	28	43N	100W	MRB	M	5	W	
							BLM	I	1,5,6	W	6 SAMPLES PER YR
@06260400	SOUTH FORK OWL CREEK BELOW ANCHOR RESERVOIR	131	1974-	25	43N	100W	MRB	M	5	W	
06264700	BIGHORN RIVER AT LUCERNE	-	1966-	32	44N	94W	WDA	M	1	W	
							WDFG	M	5,6	W	
#@06267400	EAST FORK NOWATER NEAR COLTER	149	1977-	31	46N	92W	BLM	Q	1,5,6	W	
							BLM	HL	7,8	W	
#06267900	MIDDLE FORK FIFTEENMILE CREEK NEAR WORLAND		1979-	2	47N	95W	BLM	Q	1,5,6	W	
#@06268500	FIFTEENMILE CREEK NEAR WORLAND	518	1962-72,	27	47N	93W	BLM	Q	1,5,6	W	
			1979-								
06268600	BIGHORN RIVER AT WORLAND	10810	1966-	25	47N	93W	WDA	M	1	W	
#@06270000	NOWOOD RIVER NEAR TEN SLEEP	803	1967-	27	47N	88W	WDA	M	1	W	
06273500	PAINT ROCK CREEK NEAR MOUTH, BELOW HYATTVILLE	376	1951-53,	19	49N	90W	WDA	M	1	W	
			1967-								
06274220	NOWOOD RIVER AT MANDERSON	2000	1965-	30	50N	92W	WDA	M	1	W	
06277500	GREYBULL RIVER NEAR BASIN	1115	1951-53,	8	51N	94W	WDA	M	1	W	
			1965-				WDA	HL	9	CH	
@06278000	DRY CREEK NEAR GREYBULL		1979-				BLM	Q	1,5,6	W	
06279090	SHELL CREEK NEAR GREYBULL	560	1951,	4	52N	93W	WDA	M	1	CH	
			1965-								
#@06279500	BIGHORN RIVER AT KANE	15765	1947-53,	9	55N	94W	WDA	M	1	CH	
			1955-57,				WDEQ	M	5,6	CH	
			1960-				WDA	HL	9	CH	
@06282000	SHOSHONE RIVER BELOW BUFFALO BILL RESERVOIR	1538	1947-49,	5	52N	102W	WDA	M	1	CH	
			1964-				WDA	HL	9	CH	
							MRB	C	3	W	
06282900	SHOSHONE RIVER ABOVE DRY CREEK, NEAR CODY	-	1974-	13	53N	101W	WDEQ	M	1,5,6	CH	
@06284400	SHOSHONE RIVER NEAR GARLAND	2056	1974-	13	55N	96W	BLM	M	5	W	
@06284500	BITTER CREEK NEAR GARLAND	80.5	1958-60,	7	55N	97W	MRB	D	2,3	CH	
			1969-				MRB	M	1,7	CH	

Also sediment station
@ Also streamflow station

Table 3. Water-quality stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	COOPERATOR	SAMPLING FREQUENCY	ANALYSIS SCHEDULE	FIELD OFFICE	REMARKS
YELLOWSTONE RIVER BASIN (Continued)											
@06284800	WHISTLE CREEK NEAR GARLAND	101	1959-60,	30	55N	97W	MRB	D	2,3	CH	
			1969-				MRB	M	1,7	CH	
#@06285100	SHOSHONE RIVER NEAR LOVELL	2350	1966-	16	56N	96W	MRB	D	2,3	CH	
							MRB	M	1,7	CH	
							WDEQ	M	5,6	CH	
@06285400	SAGE CREEK AT STOON CANAL, NEAR BEAVER	341	1958-60,	34	57N	97W	MRB	D	2,3	CH	
			1969-				MRB	M	1,7	CH	
06286200	SHOSHONE RIVER AT KANE	2989	1976-	6	56N	95W	WDA	ML	9	CH	
@06298000	TONGUE RIVER NEAR DAYTON	204	1966-	11	56N	87W	WDA	M	1	CH	
06299980	TONGUE RIVER AT MONARCH	-	1973-	20	57N	84W	EPA	M	1,4,5,6,7	CH	
							EPA	M	11	CH	ONE WINTER SMPL
							EPA	ML	8	CH	
06304500	LITTLE GOOSE CREEK NEAR SHERIDAN	159	1979-	27	56N	84W	WDEQ	M	1,5,6,7	CH	
#@06305500	GOOSE CREEK BELOW SHERIDAN	392	1959-60,	15	56N	84W	WDA	M	1	CH	
			1961-64,				WDEQ	M	5,6	CH	
			1967-				EPA	M	4,6,7	CH	
							EPA	ML	8	CH	
@06306300	TONGUE RIVER AT STATE LINE, NEAR DECKER, MT	1477	1965-	33	9S	40E	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
							EPA	M	6,7,11	CH	ONE WINTER SMPL
							EPA	ML	8	CH	
@06312500	POWDER RIVER NEAR KAYCEE	980	1968-	13	43N	81W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
@06313000	SOUTH FORK POWDER RIVER NEAR KAYCEE	1150	1968-	9	42N	81W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
#@06313400	SALT CREEK NEAR SUSSEX	769	1967-	8	42N	79W	WDA	M	1	CH	
							USGS	M	4,5,7	CH	
							USGS	Q	8	CH	
#@06313500	POWDER RIVER AT SUSSEX	3090	1949-53,	13	43N	79W	USGS	M	1,5,6,7	CT	
			1977-				USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06316400	CRAZY WOMAN CREEK AT UPPER STATION, NEAR ARVADA	945	1966-	18	52N	77W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06317000	POWDER RIVER AT ARVADA	6050	1946-53,	21	54N	77W	WDA	M	1	CH	
			1967-				WDEQ	Q	5,6	CH	
#@06320200	CLEAR CREEK BELOW ROCK CREEK, NEAR BUFFALO	322	1975-	30	51N	81W	USGS	M	1,4,5,7	CH	
							USGS	Q	8	CH	
#@06320400	CLEAR CREEK AT UCROSS	409	1975-	19	53N	80W	USGS	M	1,4,5,7	CH	
							USGS	Q	8	CH	
@06323500	PINEY CREEK AT UCROSS	267	1975-	18	53N	80W	EPA	M	1,5,6,7	CH	
							EPA	ML	8	CH	
#@06324000	CLEAR CREEK NEAR ARVADA	1110	1950-54,	36	57N	77W	WDA	M	1	CH	
			1966-				EPA	M	5,6,7	CH	
							EPA	ML	8	CH	
#@06324500	POWDER RIVER AT MOOREHEAD, MT	6088	1976-	8	9S	48E	WDA	ML	9	CH	
#@06324890	LITTLE POWDER R BELOW CORRAL C NEAR WESTON		1975-	12	52N	72W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06324925	LITTLE POWDER RIVER NEW WESTON		1976-	19	54N	70W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06324970	LITTLE POWDER RIVER ABOVE DRY CREEK, NR WESTON	1230	1975-	13	57N	71W	EPA	M	1,5,6,7	CH	
							EPA	ML	8	CH	

Also sediment station
@ Also streamflow station

Table 3. Water-quality stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	COOPERATOR	SAMPLING FREQUENCY	ANALYSIS SCHEDULE	FIELD OFFICE	REMARKS
CHEYENNE RIVER BASIN											
#@06364700	ANTELOPE CREEK NEAR TECKLA		1977-	35	41N	70W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06365300	DRY FORK CHEYENNE RIVER NEAR BILL	128	1976-	31	38N	73W	BLM	M	1,4,5,7,8	CH	SAMPLE WHEN FLOW
#@06365900	CHEYENNE RIVER NEAR DULL CENTER	1527	1975-	20	40N	68W	USGS	M	1,4,5,7	CH	
							USGS	Q	8	CH	
#@06375600	LITTLE THUNDER CREEK NEAR HAMPSHIRE		1977-	33	43N	67W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06378300	LODGEPOLE CREEK NEAR HAMPSHIRE		1977-	5	41N	64W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06386000	LANCE CREEK NEAR RIVERVIEW	2070	1975-	14	39N	62W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
06386500	CHEYENNE RIVER NEAR RIVERVIEW	5270	1975-	25	40N	61W	EPA	M	1,5,6,7	CH	
							EPA	Q	10	CH	
							EPA	HL	8	CH	
@06394000	BEAVER CREEK NEAR NEWCASTLE	1320	1949-53, 1967-	18	41N	60W	WDA	M	1	C	
#@06425720	BELLE FOURCHE RIVER BL RATTLESNAKE CR, NR PINEY	495	1975-	9	46N	71W	BLM	-	1,4,5,7,8	CH	SAMPLE WHEN FLOW
#@06425740	BELLE FOURCHE RIVER ABOVE DRY CREEK, NEAR PINEY	594	1975-	25	47N	71W	BLM	-	1,4,5,7,8	CH	SAMPLE WHEN FLOW
#@06425900	CABALLO CREEK AT MOUTH, NEAR PINEY		1977-	4	47N	70W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06425950	RAVEN CREEK NEAR MOORCROFT		1977-	1	48N	69W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06426400	DONKEY CREEK NEAR MOORCROFT		1977-	30	50N	68W	USGS	M	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	Q	8	CT	
							USGS	SA	10	CT	
#@06426500	BELLE FOURCHE RIVER BELOW MOORCROFT	1670	1975-	24	50N	68W	EPA	M	1,4,5,6,7	CH	
							EPA	M	11	CH	ONE WINTER SMPL
							BLM	M	1,4,5,7	CH	
							EPA	HL	8	CH	
							BLM	HL	8	CH	
06427850	BELLE FOURCHE RIVER AT DEVILS TOWER	-	1967-	7	53N	65W	WDA	M	1	CH	
@06428500	BELLE FOURCHE R AT WYO-SOUTH DAKOTA STATE LINE	5260	1965-	18	9N	1E	WDA	M	1	CH	
							WDFW	M	5,6	CH	
							EPA	M	6,7	CH	
							EPA	M	11	CH	ONE WINTER SMPL
							EPA	HL	8	CH	
PLATTE RIVER BASIN											
@06620000	NORTH PLATTE RIVER NEAR NORTHGATE, CO	1431	1965-	11	11N	80W	WDA	M	1	CH	
							WDFW	M	5,6	CH	
							WDA	HL	9	CH	
#@06623800	ENCAMPMENT RIVER AB HOG PARK CR, NR ENCAMPMENT	72.7	1967-	10	12N	84W	USGS	M	1,5,6,7	CF	
							USGS	HI	8,9	CF	
							USGS	A	10	CF	

Also sediment station
@ Also streamflow station

Table 3. Water-quality stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	COOPERATOR	SAMPLING FREQUENCY	ANALYSIS SCHEDULE	FIELD OFFICE	REMARKS
PLATTE RIVER BASIN (Continued)											
@06625000	ENCAMPMENT RIVER AT MOUTH, NEAR ENCAMPMENT	265	1965-	3	15N	83W	WDA	M	1	CH	
#@06628800	SAGE CREEK NEAR SARATOGA	263	1972-	32	19N	85W	BLM	M	1	CF	NO WINTER SAMPLE
@06630000	NORTH PLATTE RIVER AB SEMINOE RES, NR SINCLAIR	8138	1960-	13	22N	86W	WDA	M	1	CH	
							WQEQ	M	5,6	CH	
#@06630300	BIG DITCH NEAR COYOTE SPRINGS	110	1974-	30	23N	83W	BLM	M	1,5,7	CF	
							BLM	U	8	CF	
							BLM	A	10	CF	
#@06630330	NORTH DITCH NEAR COYOTE SPRINGS	22.6	1976-	19	23N	83W	BLM	M	1,5,7	CF	
							BLM	U	8	CF	
							BLM	A	10	CF	
06630350	SEMINOE RES IN N PLATTE R ARM NR SEMINOE BOAT C	-	1972-	35	24N	84W	MRR	MQ	5,7,11	CP	
							WDA	HL	9	CH	
#@06634600	LITTLE MEDICINE BOW RIVER NEAR MEDICINE BOW	966	1965-	21	23N	78W	WDA	M	1	CF	
							EPA	U	10	CF	
							EPA	HL	8	CF	
#@06634990	HANNA DRAW NEAR HANNA	21.6	1974-	34	24N	81W	BLM	M	1,5,7,	CF	
							BLM	U	8	CF	
							BLM	A	10	CF	
#@06635000	MEDICINE BOW RIVER ABOVE SEMINOE RES, NR HANNA	2358	1965-	34	24N	81W	WDA	M	1	CF	
							EPA	U	10	CF	
							EPA	HL	8	CF	
06635100	SEMINOE RE-MEDICINE BOW R ARM NR SEMINOE BOAT C	-	1972-	13	24N	83W	MRR	MQ	5,7,11	CP	
@06635500	SEMINOE RESERVOIR NEAR LEO	7230	1972-	8	25N	84W	MRR	MQ	5,7,11	CP	
06636000	NORTH PLATTE RIVER ABOVE PATHFINDER RESERVOIR	7241	1969-	34	26N	84W	MRR	M	5	CH	
06637200	PATHFINDER RE IN N PLATTE ARM NR SAND CR POINT	-	1972-	20	28N	84W	MRR	MQ	5,7,11	CP	
#@06639000	SWEETWATER RIVER NEAR ALCOVA	2327	1964-	25	29N	81W	WDA	M	1	CH	
							WQEQ	M	5,6	CH	
							EPA	U	10	CH	
							EPA	HL	8	CH	
06639600	PATHFINDER RE IN SWEETWATER R ARM NR BISHOP PT	-	1972-	20	29N	84W	MRR	MQ	5,7,11	CP	
06640500	PATHFINDER RESERVOIR NEAR ALCOVA	10711	1972-	24	29N	84W	MRR	MQ	5,7,11	CP	
06641300	ALCOVA RE AT MOUTH OF FREMONT CANYON, NR ALCOVA	-	1972-	3	29N	83W	MRR	MQ	5,7,11	CP	
06641500	ALCOVA RESERVOIR AT ALCOVA	10776	1972-	24	30N	83W	MRR	MQ	5,7,11	CP	
@06642000	NORTH PLATTE RIVER AT ALCOVA	10812	1965-	17	30N	82W	WDA	M	1	CH	
							WQEQ	M	5,6	CH	
06643000	BATES CREEK NEAR ALCOVA	343	1970-	1	31N	82W	MRR	M	5	CH	
06643510	NORTH PLATTE R AB POISON SPIDER C NR GOOSE EGG		1977-	3	32N	81W	EPA	BW	5,6,7	C	
							EPA	M	8	C	
							EPA	U	1,10	C	
							WQEQ	M	4	C	
06644085	NORTH PLATTE RIVER AT MILLS	-	1970-	7	33N	79W	MRR	MW	5	C	
06644500	CASPER CREEK AT CASPER	668	1970-	7	33N	79W	MRR	MW	5	C	
							MRR	A	1	C	
#06644550	NORTH PLATTE RIVER AT CASPER	-	1971-	4	33N	79W	MRR	MW	5	C	
06645000	NORTH PLATTE RIVER BELOW CASPER	12574	1950-52,	4	33N	78W	WDA	M	1	C	
			1957-59,				WQEQ	BW	4,5,6	C	
			1967-				EPA	BW	5,6	C	
							EPA	BW	7	C	
							EPA	M	8	C	
							EPA	U	10	C	
@06646600	DEER CREEK BELOW MILLAR WASTEWAY, AT GLENROCK	213	1967-	4	33N	75W	WDA	N	1	C	
#@06646780	SAND CREEK NEAR GLENROCK		1977-	5	33N	74W	USGS	N	1,5,6,7	CT	
							USGS	M	11	CT	
							USGS	U	6	CT	
							USGS	SA	10	CT	

Also sediment station
@ Also streamflow station

Table 3. Water-quality stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	COOPERATOR	SAMPLING FREQUENCY	ANALYSIS SCHEDULE	FIELD OFFICE	REMARKS
PLATTE RIVER BASIN (Continued)											
@06646800	NORTH PLATE RIVER NEAR GLENROCK	13538	1960-	17	33N	74W	WDA	M	1	C	
#@06652000	NORTH PLATTE RIVER AT ORIN	14888	1966-	17	31N	69W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
							EPA	Q	10	CH	
							EPA	HL	8	CH	
06652650	GLENDO RES OPPOSITE COTTONWOOD CR ARM NR GLENDO	-	1972-	12	29N	68W	MRR	MQ	5,7,11	CP	
							WDA	HL	9	CH	
06652700	GLENDO RESERVOIR NEAR GLENDO	15545	1972-	13	29N	68W	MRB	MQ	5,7,11	CP	
@06652800	NORTH PLATTE RIVER BELOW GLENDO RESERVOIR	15548	1966-	30	29N	67W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
@06656000	NORTH PLATTE RIVER BELOW GUERNSEY RESERVOIR	16237	1950-58, 1965-	27	27N	66W	WDA	M	1	CH	
06660100	LARAMIE RIVER AT HOWELL	-	1974-	30	17N	73W	WDEQ	M	1,5,6	CH	
06660500	LARAMIE RIVER AT TWO RIVERS	1224	1966-	5	17N	74W	WDA	M	1	CH	
06661500	LITTLE LARAMIE RIVER AT TWO RIVERS	376	1965-	6	17N	74W	WDA	M	1	CH	
@06662000	LARAMIE RIVER NEAR LOOKOUT	2174	1976-	27	21N	74W	WDA	HL	9	CH	
#@06670500	LARAMIE RIVER NEAR FORT LARAMIE	4495	1965-	25	26N	65W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
							WDA	HL	9	CH	
#@06674500	NORTH PLATTE R AT WYOMING-NEBRASKA STATE LINE	22218	1965-	4	23N	58W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
@06679500	NORTH PLATTE RIVER AT MITCHELL, NE	24300	1976-	33	33N	56W	WDA	HL	9	CH	
GREEN RIVER BASIN											
@09188500	GREEN RIVER AT WARREN BRIDGE, NEAR DANIEL	468	1962-64, 1967-73, 1974-	8	35N	111W	WDEQ	M	1,5,6	CH	
							USGS	M	11	CH	
09192600	GREEN RIVER NEAR BIG PINEY	-	1967-	21	30N	110W	WDA	M	1	GR	
@09205000	NEW FORK RIVER NEAR BIG PINEY	1230	1965-	22	30N	110W	WDA	M	1	GR	
#@09209400	GREEN RIVER NEAR LABARGE	3910	1963-	33	26N	112W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
							EPA	M	1,5,6,7	CH	
							WDA	HL	9	CH	
							EPA	HL	8	CH	
							EPA	M	11	CH	ONE WINTER SMPL
@09211200	GREEN RIVER BELOW FONTENELLE RESERVOIR	4280	1967-	31	24N	111W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
							EPQ	M	1,5,6,7	CH	
							EPQ	HL	8	CH	
							EPA	Q	11	CH	ONE WINTER SMPL
#@09214500	LITTLE SANDY CREEK ABOVE EDEN	134	1976-	11	26N	105W	BLM	M	1,5	CH	
							BLM	Q	7	CH	
							BLM	A	8	CH	
#@09216000	BIG SANDY RIVER BELOW EDEN	1610	1961-64, 1967-	31	24N	107W	WDA	M	1	CH	
							EPA	M	1,5,6,7	CH	
							EPA	HL	8	CH	
							WDA	HL	9	CH	
09216300	GREEN RIVER AT BIG ISLAND, NEAR GREEN RIVER	-	1966-	26	21N	109W	WDA	M	1	CH	
#@09216527	SEPARATION CREEK NEAR RINER	55.3	1975-	32	20N	90W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
#@09216545	BITTER CREEK NEAR BITTER CREEK	308	1975-	36	18N	99W	USGS	M	1,4,5,7	CH	
							USGS	Q	8	CH	
#@09216562	BITTER CREEK AB SALT WELLS CREEK, NR SALT WELLS	836	1975-	2	19N	103W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
#@09216565	SALT WELLS CREEK NEAR SOUTH BAXTER	-	1975-	15	14N	103W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	

Also sediment station
@ Also streamflow station

Table 3. Water-quality stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	COOPERATOR	SAMPLING FREQUENCY	ANALYSIS SCHEDULE	FIELD OFFICE	REMARKS
GREEN RIVER BASIN (Continued)											
#09216578	DRY CANYON CREEK NEAR SOUTH BAXTER	3.69	1976-	5	14N	102W	BLM	M	5	GR	
#@09216750	SALT WELLS CREEK NEAR SALT WELLS	526	1975-	14	19N	103W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
							BLM	U	2,3	GR	
09216810	KILLPECKER CREEK AT ROCK SPRINGS	-	1975-	26	19N	105W	EPA	M	1,5,6,7	CH	
							EPA	ML	8	CH	
09216880	BITTER CREEK BEL LITTLE BITTER CREEK, NR WANDA	-	1975-	7	18N	105W	EPA	M	1,5,6,7	CH	
							EPA	ML	8	CH	
#@09217000	GREEN RIVER NEAR GREEN RIVER	14000	1951-	26	18N	107W	USGS	D	2,3	CH	
							USGS	M	1	CH	
							WDEQ	M	5,6	CH	
							EPA	M	1,5,6,7	CH	
							EPA	ML	8	CH	
09217010	GREEN RIVER BELOW GREEN RIVER	-	1973-	36	18N	107W	WDEQ	M	1,5,6	CH	
							EPA	M	1,4,5,6,7	CH	
							EPA	ML	8	CH	
							WDA	ML	9	CH	
							EPA	M	11	CH	ONE WINTER SMPL
09221650	SMITHS FORK NEAR LYMAN	-	1974-	12	16N	114W	WDEQ	M	1,5,6	CH	
@09222000	BLACKS FORK NEAR LYMAN	821	1962-	15	17N	113W	BRUC	D	2,3	CH	
							BRUC	M	1,5,6	CH	
							WDEQ	M	5,6	CH	
#@09222300	LITTLE MUDDY CREEK NEAR GLENCOE	416	1975-	31	19N	116W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
#@09222400	MUDDY CREEK NEAR HAMPTON	963	1975-	18	18N	113W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
09224050	HAMS FORK NEAR DIAMONDVILLE	-	1975-	36	21N	116W	EPA	M	1,4,5,6,7	CH	
							EPA	ML	8	CH	
#09224450	HAMS FORK NEAR GRANGER	670	1965-	30	19N	111W	WDA	M	1	CH	
#@09224700	BLACKS FORK NEAR LITTLE AMERICA	3100	1951-	15	18N	109W	USGS	D	2,3	CH	
							USGS	M	1	CH	
							WDEQ	M	5,6	CH	
							WDA	ML	9	CH	
@09229500	HENRYS FORK NEAR MANILA, UT	520	1951-	25	12N	109W	USGS	D	2,3	GR	
							USGS	M	1	GR	
#@09235300	VERMILLION CREEK NEAR HIAWATHA, CO	196	1975-	15	12N	100W	BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
#@09257000	LITTLE SNAKE RIVER NEAR DIXON	988	1975-	8	12N	90W	WDA	M	1	CF	
BEAR RIVER BASIN											
@10020100	BEAR RIVER ABOVE RESERVOIR, NEAR WOODRUFF, UT	752	1968-	29	17N	120W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
#@10027000	TWIN CREEK AT SAGE	246	1967-69, 1975-	7	21N	119W	EPA	M	1,5,6,7	CH	
							EPA	ML	8	CH	
							BLM	M	1,4,5,7	CH	
							BLM	Q	8	CH	
@10039500	BEAR RIVER AT BORDER	2490	1965-	15	14S	46E	WDA	ML	9	CH	
							USGS	M	9	CH	
							USGS	D	2,3	CH	
SNAKE RIVER BASIN											
#@13018300	CACHE CREEK NEAR JACKSON	10.6	1965-	1	40N	116W	USGS	M	1,5,6,7	GR	
							USGS	ML	8,9	GR	
							USGS	A	10	GR	
#@13022500	SNAKE RIVER ABOVE RESERVOIR, NEAR ALPINE	3465	1965-	-	-	-	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
@13027500	SALT RIVER ABOVE RESERVOIR, NEAR ETNA	829	1965-	28	36N	119W	WDA	M	1	CH	
							WDEQ	M	5,6	CH	
							WDA	ML	9	CH	

Also sediment station
@ Also streamflow station

Sediment stations

Explanation of abbreviations and codes used in table 4.

Period of Record: The dates given are the calendar years in which records began or ended. Breaks of less than a year are not shown.

Location:
SE, section
TSP, township
RNGE, range

Sampling Equipment:
H, hydrographer sample
O, observer sample
P, pumping sampler
S, single-stage samplers

Suspended Sediment Sampling Frequency:
1, samples collected by observer once daily during operation except during periods of rapidly changing flow when additional samples are collected.
2, sampled by hydrographer at least once a month all year, with additional samples collected during periods of rapidly changing flow.
3, sampled by hydrographer at least once a month during open-water period and at least twice during extended periods of ice cover.
4, sampled by hydrographer at least once a month Apr.-Sept.
5, samples collected by Bureau of Reclamation weekly during irrigation season.
6, pumping sampler serviced monthly or more often during periods of high runoff.
7, single-stage sampler serviced at least monthly. Samples collected by hydrographer if there is flow at time of visit.
8, infrequent sampling, sample when visiting station operated by WSE personnel.
9, sampled quarterly.

Bed Material Sampling Frequency:
3, sample the surficial bed material in the cross section at least three times per year (high, medium, and low flow).
4, manual in-situ measurement and analysis of streambed material (pebble count), at a frequency of once per year (or longer), at the discretion of the District sediment specialist.

Suspended Sediment Analysis:
1, suspended-sediment concentration.
2, 0.062mm sieve analysis.
3, particle-size distribution.
4, all of the above.

Explanation of abbreviations and codes used in table 4.--Continued

Laboratory: W, Worland

Cooperator:
- BLM, Bureau of Land Management
- BRUM, Bureau of Reclamation, Upper Missouri Region
- MRB, Geological Survey, Missouri River Basin Program
- USGS, Geological Survey, Federal Program
- WSE, Wyoming State Engineer

Field Office:
- B, Buffalo
- C, Casper
- CF, Cheyenne Field Unit
- CH, Cheyenne Hydrologic Surveillance Section
- CT, Contractor
- GR, Green River
- R, Riverton
- W, Worland

Table 4. Sediment stations

STATION NUMBER	STATION NAME	DRAINAGE AREA MI²	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	SAMPLING EQUIPMENT	SUSPENDED SAMPLING FREQ	BED MATERIAL SAMPLING FREQ	LABORATORY	COOPERATOR	FIELD OFFICE	SUSPENDED ANALYSIS TYPE	REMARKS
YELLOWSTONE RIVER BASIN														
*@06207510	BIG SAND COULEE AT WYOMING-MONTANA STATE LINE	154	1973-	32	9S	22E	D	1	3	W	BLM	W	1,3	
*@06220500	EAST FORK WIND RIVER NEAR DUBOIS	827	1975-	34	6N	6W	H	3	4	W	MRB	R	1,3	
@06225500	WIND RIVER NEAR CROWHEART	1891	1971-	16	3N	2W	H	3	4	W	WSE	R	4	
@06226000	WYOMING CANAL NEAR LENORE		1975-	17	3N	1W	H	5	-	W	BRUM	W	4	SAMPLED BY USBR
06227500	WYOMING CANAL BELOW PILOT DIVERSION, NR MORTON		1975-	20	3N	1E	H	5	-	W	BRUM	W	4	SAMPLED BY USBR
*@06253000	FIVEMILE CREEK NEAR SHOSHONI	81A	1948-75, 1978-	14	3N	6E	H	3	-	W	MRB	R	1	
*@06256900	DRY CREEK NEAR RUNNEVILLE	52.6	1965-	8	5AN	92W	H	1	3	W	BLM	R	1,3	
*@06267400	EAST FORK NOWATER CREEK NEAR CULTER	140	1977-	31	46N	92W	H	6	-	W	BLM	W	1,2	
*06267900	MIDDLE FORK FIFTEENMILE CREEK NEAR WORLAND		1978-				H	9	-	W	BLM	W	1,2	
*@06268500	FIFTEENMILE CREEK NEAR WORLAND	518	1949-72, 1979-	27	47N	93W	P	6	-	W	BLM	W	1,2	
*@06270000	NOWOOD RIVER NEAR TEN SLEEP	803	1971-	27	47N	A8W	H	3	-	W	WSE	W	4	
*@06279500	BIGHORN RIVER AT KANE	15765	1946-64, 1969-	9	55N	94W	H	9	-	W	MRB	W	1,3	
*@06285100	SHOSHONE RIVER NEAR LOVELL	2350	1971-	16	56N	96W	H	3	-	W	WSE	W	4	
*@06305500	GOOSE CREEK BELOW SHERIDAN	392	1971-	15	56N	84W	H	3	-	W	WSE	R	4	
*@06313400	SALT CREEK NEAR SUSSEX	769	1976-	8	42N	79W	H	3	3	W	USGS	C	1,3	
*@06313500	POWDER RIVER AT SUSSEX	3090	1949-53, 1976-	13	43N	79W	H	3	3	W	USGS	CT	1,3	
*@06316400	CRAZY WOMAN CREEK AT UPPER STATION, NEAR ARVADA	945	1977-	18	52N	77W	H	3	3	W	USGS	CT	1,3	
*@06317000	POWDER RIVER AT ARVADA	6050	1946-57, 1967-79	21	54N	77W	D	1	3	W	BLM	B	1,3	
*@06320200	CLEAR CREEK BELOW ROCK CREEK, NEAR BUFFALO	322	1976-	30	51N	A1W	H	3	3	W	USGS	A	1,3	
*@06320400	CLEAR CREEK AT UCROSS	409	1976-	19	53N	A0W	H	3	3	W	USGS	A	1,3	
*@06324000	CLEAR CREEK NEAR ARVADA	1110	1950-53, 1975-	36	57N	77W	H	3	3	W	BLM	B	1,3	
*@06324890	LITTLE POWDER R BELOW CORRAL CREEK, NEAR WESTON	204	1977-	12	52N	72W	H	3	3	W	USGS	CT	1,3	
*@06324925	LITTLE POWDER RIVER NEAR WESTON	540	1977-	19	50N	70W	H	3	3	W	USGS	CT	1,3	
*@06324970	LITTLE POWDER RIVER ABOVE DRY CREEK, NEAR WESTON	1230	1975-	13	57N	71W	H	3	3	W	WSE	C	1,3	
CHEYENNE RIVER BASIN														
*@06364700	ANTELOPE CREEK NEAR TECKLA	959	1977-	35	41N	70W	H	7	3	W	USGS	CT	1,3	
*@06365300	DRY FORK CHEYENNE RIVER NEAR BILL	128	1976-	31	38N	73W	H	3	3	W	BLM	C	1,3	
*@06365900	CHEYENNE RIVER NEAR DILL CENTER	1527	1976-	20	40N	68W	H	3	3	W	USGS	C	1,3	
*@06375600	LITTLE THUNDER CREEK NEAR HAMPSHIRE	250	1977-	33	43N	67W	H	7	3	W	USGS	CT	1,3	
*@06378300	LODGEPOLE CREEK NEAR HAMPSHIRE	354	1977-	5	41N	64W	H	7	3	W	USGS	CT	1,3	
*@06386000	LANCE CREEK NEAR RIVERVIEW	2070	1976-	14	39N	62W	H	3	3	W	BLM	C	1,3	
*@06425720	BELLE FOURCHE RIVER BEL RATTLESNAKE CR, NR PINEY	495	1975-	9	46N	71W	P	6	3	W	BLM	C	1,3	
*@06425780	BELLE FOURCHE RIVER ABOVE DRY CREEK, NEAR PINEY	598	1975-	25	47N	71W	P	6	3	W	BLM	C	1,3	
*@06425900	CABALLO CREEK AT MOUTH, NEAR PINEY	260	1977-	4	47N	70W	H	7	3	W	USGS	CT	1,3	
*@06425950	RAVEN CREEK NEAR MOORCROFT	74	1977-	1	48N	69W	H	7	3	W	USGS	CT	1,3	
*@06426400	DONKEY CREEK NEAR MOORCROFT	246	1977-	30	50N	68W	H	7	3	W	USGS	CT	1,3	
*@06426500	BELLE FOURCHE RIVER BELOW MOORCROFT	1470	1976-	24	50N	68W	H	3	3	W	BLM	C	1,3	
@06430500	REDWATER CK AT WYOMING-SOUTH DAKOTA STATE LINE	871	1971-	18	7N	1E	H	3	4	W	WSE	SD	1,3	
PLATTE RIVER BASIN														
*@06623800	ENCAMPMENT RIVER AB HOG PARK CK, NEAR ENCAMPMENT	12.7	1964-	10	12N	84W	H	3	-	W	USGS	CF	1,3	
*@06628800	SAGE CREEK NEAR SARATOGA	263	1972-	32	19N	85W	H	4	3	W	BLM	CF	1,3	
*@06630300	BIG DITCH NEAR COYOTE SPRINGS	110	1974-	30	23N	83W	H	3	3	W	BLM	CF	1,3	

* Also chemical-quality station
@ Also streamflow station

Table 4. Sediment stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA MI²	PERIOD OF RECORD	LOCATION SE	LOCATION TSP	LOCATION RNGE	SAMPLING EQUIPMENT	SUSPENDED SAMPLING FREQ	BED MATERIAL SAMPLING FREQ	LABORATORY	COOPERATOR	FIELD OFFICE	SUSPENDED ANALYSIS TYPE	REMARKS
PLATTE RIVER BASIN (Continued)														
*@06630330	NORTH DITCH NEAR COYOTE SPRINGS	22.6	1976-	19	23N	83W	H	3	3	W	BLM	CF	1,3	
*@06634600	LITTLE MEDICINE BOW RIVER NEAR MEDICINE BOW	963	1971-	22	23N	78W	H	3	3	W	WSE	CF	4	
*@06634990	HANNA DRAW NEAR HANNA	21.6	1974-	34	24N	81W	H	3	3	W	BLM	CF	1,3	
*@06635000	MEDICINE BOW R AB SEMINOE RESERVOIR, NEAR HANNA	2338	1971-	34	24N	81W	H	3	3	W	WSE	CF	4	
*@06639000	SWEETWATER RIVER NEAR ALCOVA	2327	1974-	25	29N	87W	H	3	-	W	WSE	C	1,3	
*06644550	NORTH PLATTE RIVER AT CASPER	-	1971-	4	33N	79W	H	3	3	W	WSE	C	1,3	
*@06646780	SAND CREEK NEAR GLENROCK	79.9	1977-	5	33N	74W	H	8	3	W	USGS	CT	1,3	
*@06652000	NORTH PLATTE RIVER AT ORIN	14888	1971-	17	31N	69W	H	3	3	W	WSE	C	1,3	
							D	1	4	W	WSE	CH	1,3	SEASONAL
*@06656000	NORTH PLATTE RIVER BELOW GUERNSEY RESERVOIR	16237	1979-	27	27N	66W	D	1	4	W	WSE	CH	1,3	SEASONAL
@06657000	NORTH PLATTE RIVER BELOW WHALEN DIVERSION DAM	16425	1979-	12	26N	65W	D	1	4	W	WSE	CH	1,3	SEASONAL
*@06670500	LARAMIE RIVER NEAR FORT LARAMIE	4495	1971-	25	26N	65W	H	3	3	W	WSE	C	1,3	
*@06674500	NORTH PLATTE RIVER AT WYOMING-NEBRASKA ST LINE	22218	1971-	4	23N	58W	H	3	3	W	WSE	C	1,3	
GREEN RIVER BASIN														
*@09209400	GREEN RIVER NEAR LABARGE	3910	1974-	33	26N	112W	H	3	3	W	WSE	GR	1,3	
@09213500	BIG SANDY RIVER NEAR FARSON	322	1971-	17	27N	106W	H	3	3	W	WSE	GR	1,3	
*@09214500	LITTLE SANDY CREEK ABOVE EDEN	134	1975-	11	26N	105W	H	3	3	W	BLM	GR	1,3	
*@09216000	BIG SANDY RIVER BELOW EDEN	1610	1971-	31	24N	107W	H	3	3	W	WSE	GR	1,3	
*@09216527	SEPARATION CREEK NEAR RINER	55.3	1975-	32	20N	90W	P	6	3	W	BLM	CF	1,3	
*@09216545	BITTER CREEK NEAR BITTER CREEK	308	1976-	36	18N	99W	S	7	3	W	USGS	GR	1,3	
*@09216562	BITTER CREEK ABOVE SALT WELLS CR, NR SALT WELLS	836	1976-	2	19N	103W	H	3	3	W	BLM	GR	1,3	
*@09216565	SALT WELLS CREEK NEAR SOUTH BAXTER	34.7	1975-	15	14N	103W	P	6	3	W	BLM	GR	1,3	
*@09216578	DRY CANYON NEAR SOUTH BAXTER	3.69	1976-	5	14N	102W	HS	7	3	W	BLM	GR	1,3	
*@09216750	SALT WELLS CREEK NEAR SALT WELLS	526	1976-	14	19N	103W	H	3	3	W	BLM	GR	1,3	
*@09217000	GREEN RIVER NEAR GREEN RIVER	14000	1951-	26	18N	107W	D	1	-	W	USGS	GR	1,3	
*@09222000	BLACKS FORK NEAR LYMAN	821	1971-	15	17N	113W	H	3	3	W	USGS	GR	1,3	
*@09222300	LITTLE MUDDY CREEK NEAR GLENCOE	416	1976-	31	19N	116W	H	3	3	W	BLM	GR	1,3	
*@09222400	MUDDY CREEK NEAR HAMPTON	963	1976-	18	18N	113W	H	3	3	W	BLM	GR	1,3	
*09224450	HAMS FORK NEAR GRANGER	670	1971-	30	19N	111W	H	3	3	W	WSE	CH	1,3	
*@09224700	BLACKS FORK NEAR LITTLE AMERICA	3100	1967-	15	18N	109W	H	3	3	W	WSE	GR	4	
*@09235300	VERMILLION CREEK NEAR MIDWAY, CO	196	1976-	15	12N	100W	H	3	3	W	BLM	GR	1,3	
*@09257000	LITTLE SNAKE RIVER NEAR DIXON	988	1971-	8	12N	90W	H	4	3	W	WSE	CF	1,3	
BEAR RIVER BASIN														
*@10027000	TWIN CREEK AT SAGE	246	1976-	7	21N	119W	H	3	3	W	BLM	GR	1,3	
*@10039500	BEAR RIVER AT BORDER	2890	1969, 1979-	15	14S	40E	H	3	-	W	USGS	CH	1,2	
SNAKE RIVER BASIN														
*@13018300	CACHE CREEK NEAR JACKSON	10.6	1968-	1	40N	116W	H	3	3	W	USGS	GR	1,3	

* Also chemical-quality station
@ Also streamflow station

Peak-flow partial-record stations

Explanation of abbreviations and codes used in table 5.

Location: SE, section
TSP, township
RNGE, range

Period of Record: The dates given are the calendar years in which records began or ended. Breaks of less than a year are not shown.

Gage Equipment: CSI, crest-stage indicator
S-R, stage-rainfall recorder

Field Office: B, Buffalo
C, Casper
CF, Cheyenne Field Unit
GR, Green River
R, Riverton
W, Worland

Cooperator: BLM, Bureau of Land Management
WHD, Wyoming Highway Department

Table 5. Peak-flow partial-record stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA MI²	LOCATION SE	TSP	RNGE	PERIOD OF RECORD	GAGE EQUIPMENT	FIELD OFFICE	COOPERATOR	REMARKS
CHEYENNE RIVER BASIN										
06379600	BOX CREEK NEAR BILL	112	9	36N	70W	1956-58, 1959, 1961-	CSI	C	WHD	
06382200	PRITCHARD DRAW NEAR LANCE CREEK	5.1	8	37N	65W	1964-72, 1972-	S-R CSI	C	WHD	
06385400	COTTONWOOD CREEK AT HAT CREEK	14.5	12	34N	63W	1972-	CSI	C	WHD	
06387500	TURNER CREEK NEAR OSAGE	47.8	26	47N	64W	1959-	CSI	C	WHD	
06388800	BLACKTAIL CREEK TRIBUTARY NEAR NEWCASTLE	.25	16	44N	61W	1960-	CSI	C	WHD	
06426195	DONKEY CREEK TRIB ABOVE RESERVOIR, NEAR GILLETTE	.2	29	50N	71W	1970-	CSI	C	WHD	
06427700	INYAN KARA CREEK NEAR UPTON	96.5	17	49N	63W	1959-	CSI	C	WHD	
06428100	BELLE FOURCHE RIVER TRIBUTARY NO 2 NEAR HULETT	10.2	3	54N	64W	1962-	CSI	C	WHD	
06429300	OGDEN CREEK NEAR SUNDANCE	8.42	30	52N	62W	1962-65, 1965-72, 1972-	CSI S-R CSI	C	WHD	
PLATTE RIVER BASIN										
06629150	COAL BANK DRAW TRIBUTARY NEAR WALCOTT	3.65	3	20N	83W	1962-	CSI	CF	WHD	
06629200	COAL BANK DRAW TRIBUTARY NO 2 NEAR WALCOTT	2.41	4	20N	83W	1962-	CSI	CF	WHD	
06629800	COAL CREEK NEAR RAWLINS	7.32	30	21N	87W	1959-	CSI	CF	WHD	
06630200	BIG DITCH TRIBUTARY NEAR HANNA	7.42	21	22N	81W	1959-70, 1970-72, 1972-	CSI S-R CSI	CF	WHD	
06631150	THIRD SAND CREEK NEAR MEDICINE BOW	10.8	29	21N	79W	1965-73, 1973-	S-R CSI	CF	WHD	
06634200	SHEEP CREEK NEAR MARSHALL	61.0	30	27N	75W	1961-	CSI	CF	WHD	
06634300	SHEEP CREEK NEAR MEDICINE BOW	174	19	25N	76W	1961-	CSI	CF	WHD	
06634910	MEDICINE BOW RIVER TRIBUTARY NEAR HANNA	3.01	35	24N	81W	1965-73, 1973-	S-R CSI	CF	WHD	
06637550	SWEETWATER RIVER NEAR SOUTH PASS CITY	177	28	28N	101W	1958-73, 1974-	CSI	R	WHD	
06638300	WEST FORK CROOKS CREEK NEAR JEFFREY CITY	11.6	31	28N	92W	1961-	CSI	R	WHD	
06638350	COAL CREEK NEAR MUDDY GAP	6.08	4	27N	89W	1961-	CSI	R	WHD	
06641400	BEAR SPRINGS CREEK NEAR ALCOVA	9.33	30	30N	82W	1960-	CSI	C	WHD	
06642700	LAWN CREEK NEAR ALCOVA	11.5	8	29N	80W	1961-	CSI	C	WHD	
06642760	STINKING CREEK NEAR ALCOVA	117	30	30N	80W	1961-	CSI	C	WHD	
06643300	COAL CREEK NEAR GOOSE EGG	5.39	27	32N	81W	1960-	CSI	C	WHD	
06644840	MCKENZIE DRAW TRIBUTARY NEAR CASPER	2.02	12	36N	78W	1965-73, 1973-	S-R CSI	C	WHD	
06646700	EAST FORK DRY CREEK TRIBUTARY NEAR GLENROCK	2.60	26	33N	75W	1961-	CSI	C	WHD	
06648780	SAGE CREEK TRIBUTARY NEAR ORPHA	1.38	18	35N	73W	1965-73, 1973-	S-R CSI	C	WHD	
06649900	NORTH PLATTE RIVER TRIBUTARY NEAR DOUGLAS	8.53	5	31N	71W	1961-	CSI	C	WHD	
06651800	SAND CREEK NEAR ORIN	27.8	11	31N	70W	1955, 1961-	CSI	C	WHD	
06652400	WATSON DRAW NEAR LOST SPRINGS	6.95	12	32N	68W	1960-70, 1970-72, 1972-	CSI S-R CSI	C	WHD	
06661580	SEVENMILE CREEK NEAR CENTENNIAL	11.2	11	17N	77W	1962-	CSI	CF	WHD	
06668040	RABBIT CREEK NEAR WHEATLAND	1.3	22	26N	70W	1965-72, 1972-	S-R CSI	C	WHD	
06670100	LARAMIE RIVER TRIBUTARY NEAR GUERNSEY	1.97	7	25N	65W	1971-	CSI	C	WHD	
06670985	DRY RAWHIDE CREEK NEAR LINGLE	20	21	27N	62W	1969-	CSI	C	WHD	
06675300	HORSE CREEK TRIBUTARY NEAR LITTLE BEAR	8.16	10	17N	67W	1961-	CSI	CF	WHD	
06761900	LODGEPOLE CREEK TRIBUTARY NEAR PINE BLUFFS	.44	21	15N	60W	1960-	CSI	CF	WHD	
06762600	LODGEPOLE CREEK TRIBUTARY NO 2 NEAR ALBIN	5.69	28	16N	60W	1960-	CSI	CF	WHD	

Table 5. Peak-flow partial-record stations

STATION NUMBER	STATION NAME	DRAINAGE AREA MI²	LOCATION SE	LOCATION TSP	LOCATION RNGE	PERIOD OF RECORD	GAGE EQUIPMENT	FIELD OFFICE	COOPERATOR	REMARKS
YELLOWSTONE RIVER BASIN										
06218700	WAGON GULCH NEAR DUBOIS	4.89	30	42N	107W	1961-	CSI	R	WHD	
06223800	WIND RIVER TRIBUTARY NO 2 NEAR CROWHEART	3.16	18	3N	2W	1961-	CSI	R	WHD	
06226200	LITTLE DRY CREEK NEAR CROWHEART	10.5	35	7N	3W	1961-	CSI	R	WHD	
06226300	DRY CREEK NEAR CROWHEART	97.9	19	5N	2W	1959, 1961-	CSI	R	WHD	
06229700	NORKOK MEADOWS CREEK NEAR FORT WASHAKIE	15.8	8	1N	1W	1965-	CSI	R	WHD	
06229800	SAND DRAW NEAR FORT WASHAKIE	.99	18	1N	1W	1961-	CSI	R	WHD	
06229900	TROUT CREEK NEAR FORT WASHAKIE	16.1	15	56N	94W	1961-68, 1970-	CSI	R	WHD	
06233360	MONUMENT DRAW AT LOWER STATION, NEAR HUDSON	8.38	21	33N	98W	1965-73, 1973-	S-R CSI	R	WHD	
06234800	BOBCAT DRAW NEAR SAND DRAW	2.89	21	33N	95W	1969, 1971-	CSI	R	WHD	
06236000	KIRBY DRAW NEAR RIVERTON	129	3	1N	5E	1951-55, 1961-	CSI	R	WHD	
06238760	N F DRY CHEYENNE C AT UPPER STATION, NR RIVERTON	.69	4	34N	94W	1965-73, 1973-	S-R CSI	R	WHD	
06255300	POISON CREEK TRIBUTARY NEAR SHOSHONI	.39	33	38N	93W	1959-	CSI	R	WHD	
06256600	RED CREEK NEAR ARMINTO	7.15	19	38N	87W	1963-	CSI	C	WHD	
06256700	SOUTH BRIDGER CREEK NEAR LYSITE	10.0	9	40N	91W	1960-	CSI	R	WHD	
06257300	SHOTGUN CREEK TRIBUTARY NEAR PAVILLION	2.57	27	6N	1E	1961-	CSI	R	WHD	
06265200	SAND DRAW NEAR THERMOPOLIS	6.33	2	44N	97W	1960-	CSI	W	WHD	
06265600	TIE DOWN GULCH NEAR WORLAND	1.78	10	45N	94W	1961-	CSI	W	WHD	
06266460	MURPHY DRAW NEAR GRASS CREEK	2.32	28	47N	97W	1965-73, 1973-	S-R CSI	W	WHD	
06267260	NORTH PRONG EAST FORK NOWATER CREEK NEAR WORLAND	3.77	18	46N	91W	1964-73, 1973-	S-R CSI	W	WHD	
06269750	NOWOOD RIVER TRIBUTARY NEAR TEN SLEEP	.42	11	46N	88W	1960-	CSI	W	WHD	
06274190	NOWOOD RIVER TRIBUTARY NO 2 NEAR BASIN	1.51	28	50N	92W	1965-73, 1973-	S-R CSI	W	WHD	
06274250	ELK CREEK NEAR BASIN	96.9	16	50N	93W	1959-	CSI	W	WHD	
06277700	TWENTYFOUR MILE CREEK NEAR EMBLEM	12.8	23	52N	98W	1960-	CSI	W	WHD	
06277750	DRY CREEK TRIBUTARY NEAR EMBLEM	.65	19	52N	97W	1960-68, 1970-	CSI	W	WHD	
06279020	RED GULCH NEAR SHELL	47.8	32	53N	91W	1967, 1970-	CSI	W	WHD	
06299900	SLATER CREEK NEAR MONARCH	18.0	18	57N	84W	1967-	CSI	B	WHD	
06312700	SOUTH FORK POWDER RIVER NEAR POWDER RIVER	262	3	35N	85W	1961-	CSI	C	WHD	
06312795	SANCHEZ CREEK ABOVE RESERVOIR, NEAR ARMINTO	5.53	20	39N	86W	1970-	CSI	C	WHD	
06313020	BOBCAT CREEK NEAR EDGERTON	8.29	10	37N	77W	1965-73, 1973-	S-R CSI	C	WHD	
06313050	EAST TEAPOT CREEK NEAR EDGERTON	5.44	16	37N	78W	1965-72, 1973-	S-R CSI	C	WHD	
06313100	COAL DRAW NEAR MIDWEST	11.4	8	40N	78W	1961-	CSI	C	WHD	
06313630	VAN HOUTEN DRAW NEAR BUFFALO	10.8	33	49N	77W	1971-	CSI	A	WHD	
06316700	POWDER RIVER TRIBUTARY NEAR BUFFALO	1.64	9	52N	77W	1965-73, 1973-	S-R CSI	B	WHD	
06317050	RUCKER DRAW NEAR SPOTTED HORSE	3.98	28	55N	75W	1961-	CSI	B	WHD	
06319100	BULL CREEK NEAR BUFFALO	10.8	29	50N	82W	1969-	CSI	B	WHD	
06324800	LITTLE POWDER RIVER TRIBUTARY NEAR GILLETTE	.81	36	52N	72W	1960-	CSI	C	WHD	
06324900	CEDAR DRAW NEAR GILLETTE	3.45	6	52N	71W	1959-	CSI	C	WHD	
06324910	COW CREEK TRIBUTARY NEAR WESTON	.72	26	53N	71W	1971-	CSI	C	WHD	

Table 5. Peak-flow partial-record stations (continued)

STATION NUMBER	STATION NAME	DRAINAGE AREA MI²	LOCATION SE	LOCATION TSP	LOCATION RNGE	PERIOD OF RECORD	GAGE EQUIPMENT	FIELD OFFICE	COOPERATOR	REMARKS
GREEN RIVER BASIN										
*#09204700	SAND SPRINGS DRAW TRIBUTARY NEAR BUILDER	2.77	8	30N	107W	1961-	CSI	GR	WHD	
*#09207650	DRY BASIN CREEK NEAR BIG PINEY	47.2	12	28N	112W	1971-	CSI	GR	WHD	
*#09211300	FOURMILE GULCH TRIBUTARY NEAR FONTENELLE	14.2	15	24N	111W	1971-	CSI	GR	WHD	
*#09216290	EAST OTTERSON WASH NEAR GREEN RIVER	16.6	23	21N	109W	1969-	CSI	GR	WHD	
*#09216350	SKUNK CANYON CREEK NEAR GREEN RIVER	15.7	8	20N	107W	1965, 1971-	CSI	GR	WHD	
#09216537	DELANEY DRAW NEAR RED DESERT	34.5	8	19N	95W	1961-	CSI	GR	WHD	
*#09216550	DEADMAN WASH NEAR POINT OF ROCKS	152	25	20N	101W	1961-	CSI	GR	WHD	
*#09216576	GAP CREEK BL BEANS SPRING CR, NEAR SOUTH BAXTER	35.9	7	14N	103W	1976-	CSI	GR	WHD	
*#09216578	DRY CANYON NEAR SOUTH BAXTER	3.64	5	14N	102W	1976-	S-R	GR	BLM	
*#09216580	BIG FLAT DRAW NEAR ROCK SPRINGS	19.5	4	15N	102W	1973-	CSI	GR	WHD	
*#09216600	CUTTHROAT DRAW NEAR ROCK SPRINGS	7.88	17	17N	102W	1959-70, 1970-72, 1972-	CSI S-R CSI	GR	WHD	
*#09216695	NO NAME CREEK NEAR ROCK SPRINGS	18.2	1	17N	103W	1973-	CSI	GR	WHD	
*09216900	BITTER CREEK TRIBUTARY NEAR GREEN RIVER	1.65	16	18N	106W	1959-	CSI	GR	WHD	
*#09221680	MUD SPRING HOLLOW NEAR CHURCH BUTTE, NEAR LYMAN	8.83	7	16N	113W	1965-73, 1973-	S-R CSI	GR	WHD	
*09224600	BLACKS FORK TRIBUTARY NEAR GRANGER	5.03	15	16N	111W	1959-	CSI	GR	WHD	
*#09224800	MEADOW SPRINGS WASH TRIBUTARY NEAR GREEN RIVER	5.26	18	18N	109W	1962-65, 1968-	CSI CSI	GR	WHD	
*#09224810	BLACKS FORK TRIBUTARY NO 2 NEAR GREEN RIVER	12.0	8	17N	108W	1965-	CSI	GR	WHD	
*#09224820	BLACKS FORK TRIBUTARY NO 3 NEAR GREEN RIVER	3.54	28	17N	108W	1965-	CSI	GR	WHD	
*#09224840	BLACKS FORK TRIBUTARY NO 4 NEAR GREEN RIVER	1.26	33	17N	108W	1965-	CSI	GR	WHD	
*#09224980	SUMMERS DRY CREEK NEAR GREEN RIVER	427	13	16N	109W	1965-	CSI	GR	WHD	
*#09225200	SQUAW HOLLOW NEAR BURNTFORK	6.57	29	14N	108W	1965-	CSI	GR	WHD	
*#09225300	GREEN RIVER TRIBUTARY NO 2 NEAR BURNTFORK	13.0	31	13N	108W	1959, 1961-	CSI	GR	WHD	
*#09258200	DRY COW CREEK NEAR BAGGS	49.7	19	16N	91W	1970-	CSI	CF	WHD	
BEAR RIVER BASIN										
10019700	WHITNEY CANYON CREEK NEAR EVANSTON	8.93	27	17N	120W	1965-	CSI	GR	WHD	
SNAKE RIVER BASIN										
13019220	SOUR MOOSE CREEK NEAR BONDURANT	2.77	26	37N	112W	1964-	CSI	GR	WHD	

* Also chemical quality station
\# Also sediment station

WATER-RESOURCES PROJECTS

The numerous water-resources projects being conducted in Wyoming are described in the following pages. The descriptions reflect project status as of October 1978. The project number is given following each title. All project leaders in the Wyoming district are located in the Cheyenne office.

The cooperating agencies during the fiscal year 1979 are shown for each project. The section "Progress and Significant Results" covers the period for fiscal year 1978. The area of each study is shown as either a shaded area or a large black dot on the index map near the title of each project.

Water-Resources Projects Conducted by the Wyoming District

PROJECT TITLE: Surface-Water Stations (WY 00-001)

COOPERATING AGENCY: Bureau of Land Management, Bureau of Reclamation, City of Cheyenne, Corps of Engineer, Utah State Engineer, Wyoming Department of Economic Planning and Development, Wyoming Department of Environmental Quality, Wyoming Game and Fish, and Wyoming State Engineer.

PROJECT LEADER: Ernest S. Denison.

FIELD LOCATION: Statewide.

PROBLEM: Surface-water information is needed for purposes of surveillance, planning, design, hazard warning, operation, and management in related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water resources development. To provide this information, an appropriate data base is necessary.

OBJECTIVE: (1) To collect surface-water data sufficient to satisfy needs for current-purpose uses such as (a) assessment of water resources, (b) operation of reservoirs or industries, (c) forecasting of stage or discharge, (d) pollution controls and disposal of wastes, (e) discharge data to accompany water-quality measurements, (f) compact and legal requirements, and (g) research or special studies. (2) To collect data necessary for analytical studies to define for any location the statistical properties of, and trends in, the occurrence of water in streams, lakes, and estuaries for use in planning and design.

APPROACH: Standard methods of data collection will be used as described in the series, "Techniques of Water Resource Investigations of the United States Geological Survey," and partial-record gaging will be used where it serves the required purpose instead of complete-record gaging.

PROGRESS AND SIGNIFICANT RESULTS: Data collection was done on schedule and computation of the 1978 water year records was started. During the 1978 water year, six gaging stations were established and four were discontinued. Several indirect measurements of flow were made to define rating curves. In addition, fifteen indirect determinations of peak flow were made for the May 1978 flood. A number of gaging stations were damaged by the high flow in May. The coal-lease monitoring project, WY-039, operated eleven additional streamflow stations in northeastern Wyoming.

PLANS FOR FISCAL YEAR 1979: Operation of the present stream-gaging network will continue. Two new continuous-record stations will be established; Dry Creek near Greybull, and North Fork Shoshone River near Wapiti. A report on the floods of May 1978 in Wyoming and Montana will be published with the Montana District and the National Weather Service. Work on the annual data report for publication will continue.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Boner, F.C., 1978, Water-resources investigations of the U.S. Geological Survey in Wyoming, Fiscal Year 1978: U.S. Geological Survey Open-File Report 78-239, 106 p.

Muench, R.L., 1977, Footbridge for measuring streamflow: U.S. Geological Survey WRD Bulletin, Apr.-Sept. 1977, p. 94-96.

Parrett, Charles, Carlson, D.D., Craig, Gordon S. Jr., Hull, J.A., 1978, Data for Floods of May 1978 in Northeastern Wyoming and Southeastern Montana: U.S. Geological Survey Open-File Report 78-985, 16 p.

U.S. Geological Survey, 1977, Water-resources data for Wyoming, Water Year 1976, Vol. 1. Missouri River Basin: U.S. Geological Survey Water-Data Report WY-76-1, 631 p.

U.S. Geological Survey, 1978, Water-resources data for Wyoming, Water Year 1976, Vol. 2. Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-76-2, 436 p.

PROJECT TITLE: Ground-Water Stations (WY 00-002)

COOPERATING AGENCY: Wyoming State Engineer and City of Cheyenne.

PROJECT LEADER: Jess O. Ragsdale.

FIELD LOCATION: Statewide.

PROBLEM: (1) Long-term water-level records are needed to evaluate the effects of climatic variations on the recharge to and discharge from the ground-water systems to provide a data base from which to (a) measure the effects of development, (b) to assist in the prediction of future supplies, and (c) to provide data for management of the resource. (2) Short-term water-level records are also needed for (a) assessment of ground-water resources, (b) areal investigations, and (c) water-use investigations.

OBJECTIVE: (1) To collect water-level data sufficient to provide a minimum long-term data base so that the general response of the hydrologic system to climatic variations and induced stresses is known, and, so that potential problems can be defined early enough to allow planning and management. (2) To provide a data base against which short-term records acquired in areal studies can be analyzed. This analysis must provide (a) an assessment of the ground-water resource, (b) allow prediction of future conditions, (c) detect and define pollution and supply problems, and (d) provide the data base necessary for ground-water management.

APPROACH: The most advantageous locations for long-term observations will be determined and this network will be refined as records become available and detailed areal studies of the ground-water system more closely define the aquifers, their properties, and the stresses to which they are subjected.

PROGRESS AND SIGNIFICANT RESULTS: During the 1978 water year, a total of about 1,200 water-level measurements were made in about 290 wells. Early in 1978, mass water-level measurements were made in areas of heavy pumpage in southeastern Wyoming. The compilation of water levels measured in calendar year 1977 was completed and net changes between 1976 and 1977 were computed. The 1977 data, together with water-level hydrographs for the period 1968-77, were published in the U.S. Geological Survey Open-File Report 78-605.

PLANS FOR FISCAL YEAR 1979: The observation-well network will be evaluated for geographic and hydrologic coverage. Changes in the network will be made as opportunities occur. As interpretive ground-water projects are completed, project wells will be selected for addition to the network, particularly in southeastern Wyoming. Water levels will be measured at all wells at frequencies similar to those of 1978. Where a need is indicated, some wells will be tested to check that they are open to the aquifer. An open-file report containing the 1978 data and hydrographs for 1969-78 will be prepared.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Boner, F.C., 1978, Water-resources investigations of the U.S. Geological Survey in Wyoming, Fiscal Year 1978: U.S. Geological Survey Open-File Report 78-239, 106 p.

Stevens, M.D., 1978, Ground-water levels in Wyoming, 1977: U.S. Geological Survey Open-File Report 78-605, 203 p.

U.S. Geological Survey, 1977, Water levels in the United States, 1971-74, northwestern states: U.S. Geological Survey Water-Supply Paper 2161, p. 141-153.

U.S. Geological Survey, 1977, Water-resources data for Wyoming, Water Year 1976, Vol. 1. Missouri River Basin: U.S. Geological Survey Water-Data Report WY-76-1, 631 p.

U.S. Geological Survey, 1978, Water-resources data for Wyoming, Water Year 1976, Vol. 2. Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-76-2, 436 p.

PROJECT TITLE: Water-Quality Stations (WY 00-003)

COOPERATING AGENCY: Bureau of Land Management, Bureau of Reclamation, Environmental Protection Agency, Wyoming Department of Agriculture, and Wyoming Department of Environmental Quality.

PROJECT LEADER: Joel R. Schuetz.

FIELD LOCATION: Statewide.

PROBLEM: Water resource planning and water-quality assessment require a nationwide base level of relatively standardized information. For intelligent planning and realistic assessment of the water resource, the chemical and physical quality of the rivers and streams must be defined and monitored.

OBJECTIVE: To provide a national bank of water-quality data for broad federal planning and action programs and to provide data for State and Federal management of interstate waters.

APPROACH: Operate a network of water-quality stations to provide data on average chemical concentrations, loads, and trends as required by planning and management agencies.

PROGRESS AND SIGNIFICANT RESULTS: During the year, data collection was continued on schedule. Work continued throughout the year on preparation of the annual data reports. Salinity sampling on eight stations operated in the Bighorn Basin was discontinued at the end of the water year. The NASQAN (National Stream-Quality Accounting Network) station on the Snake River near Alpine was discontinued and a NASQAN sampling station was started on Bear River near Border. Analysis for dicambra and picloram was added at twenty stations to supplement the herbicide study (Project 77-043).

PLANS FOR FISCAL YEAR 1979: Most data-collection activities will continue with only minor changes during the year. An evaluation of all programs will continue and it is hoped that the data from some of the long-term trend stations can be statistically analyzed during the year. This analysis would be used in planning and re-evaluating changes in the water-quality program.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Boner, F.C., 1978, Water-resources investigations of the U.S. Geological Survey in Wyoming, Fiscal Year 1978: U.S. Geological Survey Open-File Report 78-239, 106 p.

U.S. Geological Survey, 1977, Water-resources data for Wyoming, Water Year 1976, Vol. 1. Missouri River Basin: U.S. Geological Survey Water-Data Report WY-76-1, 631 p.

U.S. Geological Survey, 1978, Water-resources data for Wyoming, Water Year 1976, Vol. 2. Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-76-2, 436 p.

PROJECT TITLE: Sediment Stations (WY 00-004).

COOPERATING AGENCY: Bureau of Land Management, Bureau of Reclamation, and Wyoming State Engineer.

PROJECT LEADER: Harold B. Fabricius.

LOCATION: Statewide.

PROBLEM: Water resource planning and water-quality assessment require a nationwide base level of relatively standardized information. Sediment concentrations and discharges in rivers and streams must be defined and monitored.

OBJECTIVE: The major objectives are (1) to provide a national bank of sediment data for use in broad Federal and State planning and action programs, (2) to provide data for Federal and State management of interstate waters, and (3) to provide data for interpretation in areal studies.

APPROACH: A network of sediment stations will be established and operated to provide data on areal and temporal averages and trends of sediment concentration, sediment discharges, and particle size distribution of sediment being transported by rivers and streams.

PROGRESS AND SIGNIFICANT RESULTS: The collection and processing for publication of sediment data continued on schedule for 119 stations, 5 of which were sampled daily by local observers. Concentration data were collected at all stations and bed material at 109 stations. Three sites had pumping samplers and 26 sites had single-stage samplers. One daily station was discontinued. Miscellaneous sampling programs for BLM in the Bighorn Basin and a USGS oil shale project in the Green River Basin were completed. The Worland laboratory processed 28,766 bottles of samples while performing 17,743 concentration analyses, 891 sieve analyses (-.062 mm), 343 suspended-size analyses, and 278 other size analyses. About half of this laboratory work was for the Montana and North Dakota Districts. Analysis of data for 20 sites was started; preliminary results indicate fairly good correlation between sediment discharge and water discharge at all 20 sites.

PLANS FOR FISCAL YEAR 1979: Field and laboratory workloads will be smaller in fiscal year 1979. The Wyoming network will consist of about 62 stations, including 5 sampled daily by observers and 3-5 with automatic samplers. The station, Powder River at Arvada, may be changed from daily to monthly. A total of 43 stations will be operated under contract for coal-lease monitoring in Wyoming, Montana, and North Dakota. Lab work for Wyoming and Montana will decrease because of discontinued stations. The Wyoming District will assist QW Branch by collecting special sediment material to be used in preparation of standard samples for a nationwide quality-control check of sediment laboratories.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Boner, F.C., 1978, Water-resources investigations of the U.S. Geological Survey in Wyoming, Fiscal Year 1978: U.S. Geological Survey Open-File Report 78-239, 106 p.

U.S. Geological Survey, 1977, Water-resources data for Wyoming, Water Year 1976, Vol. 1. Missouri River Basin: U.S. Geological Survey Water-Data Report WY-76-1, 631 p.

U.S. Geological Survey, 1978, Water-resources data for Wyoming, Water Year 1976, Vol. 2. Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report. WY-76-2, 436 p.

PROJECT TITLE: Flood investigations in Wyoming (WY 59-010).

COOPERATING AGENCY: Wyoming Highway Department.

PROJECT LEADER: Gordon S. Craig, Jr.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: July 1958 to June 1983.

PROBLEM: The optimal design of highway drainage structures requires a knowledge of the magnitude and frequency of peak discharges expected at a given site. This knowledge may be derived either from data collected at the desired location or from regional analysis of peak-flow characteristics. The paucity of peak-flow data for small drainage basins in Wyoming, particularly for ephemeral streams, restricts the use of the regionalization techniques presently available. A network of peak-flow partial-record sites is needed to supplement the existing network of continuous-record streamflow stations.

OBJECTIVE: The main objective is to obtain sufficient basic hydrologic data to define the magnitude and frequency of floods on a regional basis for the entire state and to publish the interpretative analyses in easily usable form. On request from the cooperator, flood-flow characteristics of streams at specific sites will be determined by studying such factors as: History of past floods; distribution of flow across the flood-plain and main channel; and mean velocities in the main channel and overflow areas.

APPROACH: Available flood data will be analyzed, and sites for crest stage gages will be selected where they will best supplement the existing network of continuous-record stream-gaging stations. Stage-discharge relations will be defined for each crest-stage site by recording water stage and by making current-meter measurements, indirect measurements of peak flow, or by using the "step-backwater method." Basin characteristics that are pertinent in flood-frequency analysis will be determined. Frequency characteristics will be related to basin characteristics by regression analysis. Peak-flow measurements will be made at miscellaneous sites where unusual floods occur.

PROGRESS AND SIGNIFICANT RESULTS: The crest-stage gage network continued in operation without major change. The annual peak data files were updated to include all 1977 water-year data and some 1978 peak flows resulting from the floods of May 1978. Indirect discharge measurements were made on flood peaks at four crest-stage sites and two miscellaneous sites. A method was developed for estimating inflow peaks at culverts where highway embankments create extensive storage ponding. A description of the method was published in the Water Resources Division Bulletin January-June, 1978.

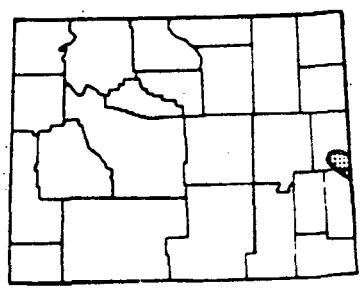
PLANS FOR FISCAL YEAR 1979: Efforts to relocate the crest-stage gages on ephemeral streams, especially in northeaster Wyoming, will continue. Special hydraulic and hydrologic studies at bridges and culverts will be made when requested by the Wyoming Highway Department. Miscellaneous measurements will be made where outstanding floods occur.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Craig, G.S., Jr., 1978, Estimating inflow peaks at culverts where ponding has occurred: U.S. Geological Survey WRD Bulletin, Jan.-June, 1978, p. 60-64.

Parrett, Charles, Carlson, D.D., Craig, Gordon S. Jr., Hull, J.A., 1978, Data for Floods of May 1978 in Northeastern Wyoming and Southeastern Montana: U.S. Geological Survey Open-File Report 78-985, 16 p.

PROJECT TITLE: Hydrologic evaluation of the Arikaree Formation near Lusk, Wyoming (WY 74-024).



COOPERATING AGENCY: Wyoming Department of Planning and Development.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: East-central Wyoming.

PERIOD OF PROJECT: July 1973 to September 1979.

PROBLEM: The Arikaree Formation contains a large amount of water suitable in quality for domestic, industrial, and agricultural uses. Many irrigation wells have been developed near Lusk, Wyoming; yields greater than 500 gal/min are not uncommon. The number of irrigation wells in the Arikaree increases each year. Development of nearby energy resources will increase the need to use ground water for industrial purposes. State water planners have no guidelines for regulation of ground-water development in the area. A study is needed that will describe the ground-water system in detail and provide information on the cause-and-effect of ground-water development.

OBJECTIVE: The objectives are (1) to define the ground-water system in more detail than was done in previous studies; (2) to determine the cause-and-effect relationship of current ground-water development; and (3) to provide a means of predicting cause-and-effect relationship of future ground-water development.

APPROACH: Inflow and outflow of all water will be inventoried and a water budget prepared. This will require inventories of all large-capacity wells, records of stream diversions for irrigation, pumpage, and acreage irrigated. Hydraulic properties will be determined primarily from aquifer tests. Surface geology and the configuration of the base of the Arikaree will be shown on maps. The water-level surface will be contoured and a saturated thickness map prepared. A digital model will be prepared to simulate hydrologic conditions in the Arikaree. The model will be used to determine the cause-and-effect relationship of ground-water development in the aquifer.

PROGRESS AND SIGNIFICANT RESULTS: Pumpage was updated through 1976. The digital model was revised with the new pumpage and proposed development in 1977 and 1978. The model was used to predict the effect of the new stress. Results calculated with the model are used by the Wyoming State Engineer as a guide to administer ground-water development in the area.

PLANS FOR FISCAL YEAR 1979: The relatively small amount of annual activity will consist of updating well inventory and pumpage information, and incorporating the new data into the digital model of the ground-water system.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

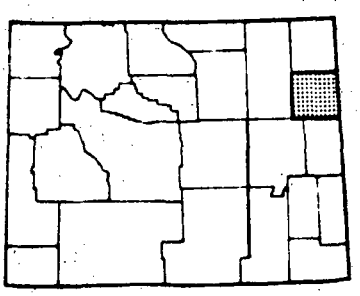
Crist, M.A., 1977, Hydrologic evaluation of the Arikaree Formation near Lusk, Niobrara and Goshen Counties, Wyoming: U.S. Geological Survey Water-Resources Investigations 77-111, 23 p., 3 pl.

PROJECT TITLE: Water resources of Weston County, Wyoming (WY 74-026).

COOPERATING AGENCY: Wyoming State Engineer.

PROJECT LEADER: Marlin E. Lowry.

FIELD LOCATION: Northeastern Wyoming.



PERIOD OF PROJECT: March 1974 to June 1976 (incomplete).

PROBLEM: The demand for ground water will probably increase rapidly in Weston County because of its proximity to the coal deposits in the Powder River Basin and the fact that potential aquifers are at relatively shallow depths, compared to depths in the areas where coal will be mined. Industrial, municipal, and much of the agricultural supplies in the county are obtained from ground water. There are no major perennial streams in the area. The ground-water resources of the county have not been adequately evaluated for orderly development of these resources.

OBJECTIVE: The objectives are to determine (1) the distribution (areally and vertically) and thickness of each of the principal aquifers or aquifer systems; (2) the movement of water in each of the principal aquifers or aquifer systems; (3) the hydraulic characteristics for each principal aquifer or aquifer system; (4) the water-bearing properties of subordinate aquifers; (5) the volume of ground water in storage; (6) the quality of water in each aquifer; (7) the quantity of runoff from small watersheds; (8) the quality of runoff at gaged sites; (9) the effect of ground-water withdrawal on water levels; and (10) to evaluate the potential for artificial recharge.

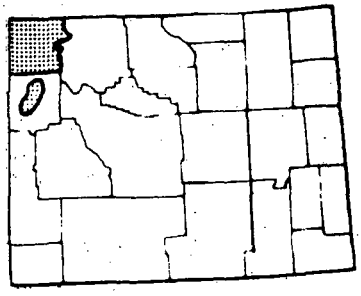
APPROACH: A well inventory will be made and periodic water-level measurements taken. Water samples will be collected and analyzed. Pumping tests will be made to determine aquifer characteristics. Rock samples will be collected and analyzed for water-bearing characteristics. Cross sections of major drainages will be augered. Ground water use will be inventoried. Existing data will be tabulated, and a geologic map and cross sections will be compiled. Structure-contour and isopach maps of the principal aquifers will be prepared. The volume of ground water in storage (by aquifer) will be calculated and shown on maps. Potentiometric and depth-to-water maps for principal aquifers will be constructed. Well-field histories will be analyzed. The potential for artifical recharge will be evaluated. Runoff characteristics for small basins will be described using channel geometry techniques.

PROGRESS AND SIGNIFICANT RESULTS: No work was done in fiscal year 1978. Final report is nearly completed.

PLANS FOR FISCAL YEAR 1979: Complete the final report and publish it in the WRI series.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Monitoring wastewater effluent in Yellowstone and Grand Teton National Parks, Wyoming (WY 74-027).



COOPERATING AGENCY: National Park Service.

PROJECT LEADER: Edward R. Cox.

FIELD LOCATION: Northwestern Wyoming.

PERIOD OF PROJECT: June 1974 to September 1981.

PROBLEM: The National Park Service is constructing new or rehabilitating existing evaporation-percolation ponds at several sewage wastewater treatment and disposal sites in Yellowstone and Grand Teton National Parks. The sites (four in Yellowstone and two in Grand Teton) are near streams or lakes. The National Park Service needs to determine the effects of the wastewater effluent on the ecosystem of the parks. In order to do this, they need to know the amount, direction, and velocity of movement of the effluent that percolates from the ponds. Additional sites may be added to the study.

OBJECTIVE: The objectives are to determine (1) the position of the water table and its relation to the ponds and nearby surface-water bodies; (2) the slope of the water table and thus the direction of movement of the effluent; (3) the ground-water velocities and thus the time-of-travel of effluent from pond to surface-water body; (4) the vertical zone of movement of the effluent; and (5) the baseline water quality in the shallow aquifers in the vicinity of the percolation ponds and in surface-water bodies.

APPROACH: Wells will be installed in unconsolidated material near the sewage ponds. About 30 wells in Yellowstone and about 9 wells in Grand Teton will be needed for the project. Aquifer tests will be made by pumping from selected wells. Tracer tests will be made in a few selected wells. Water samples will be collected from the wells and analyzed for chemical and bacteriological quality of the water. Water levels in the wells will be measured periodically. A program of monitoring water quality will be established following preliminary sampling and calculations of ground-water velocity determined from the hydraulic and tracer tests.

PROGRESS AND SIGNIFICANT RESULTS: Water levels were measured approximately monthly during autumn, spring, and summer in about 40 wells at the four study sites in Yellowstone. About 30 water samples were collected from wells, effluents, and nearby streams and analyzed for dissolved carbon, nitrogen, phosphorus, and other constituents. In addition, about 50 samples were collected from wells and effluents and analyzed for chloride and sulfate. A report containing data collected during the 15-month period ending September 1976 and describing wastewater movement near the sites was released to the open file and transmitted to the National Park Service. A similar report containing data collected and interpretations of wastewater movement for fiscal year 1977 was prepared and is in review.

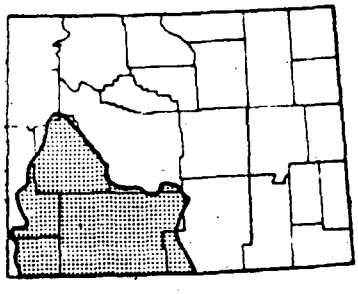
PLANS FOR FISCAL YEAR 1979: Measuring of wells and sampling of wells, effluents, and streams at the four study sites in Yellowstone will continue. A report describing data collected and interpretations made for fiscal year 1978 will be prepared for open-file release.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Cox, E. R., 1978, Preliminary study of wastewater movement in Yellowstone National Park, Wyoming, July 1975 through September 1976: U.S. Geological Survey Open-File Report 78-227, 54 p.

Cox, E.R., 1978, Iron in water near wastewater lagoons in Yellowstone National Park, Wyoming: in Journal of Research of the U.S. Geological Survey, v. 6, no. 3, May-June, 1978, p. 319-324.

PROJECT TITLE: Water and its relation to economic development in the Green River and Great Divide basins in Wyoming (WY 75-030).



COOPERATING AGENCY: Bureau of Land Management.

PROJECT LEADER: Hugh W. Lowham.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: November 1974 to September 1979.

PROBLEM: Development of extensive coal, oil, gas, trona, and oil-shale resources in the project area will require a projected increase in water consumption of 480,000 acre-ft per year by 1990. Development of energy resources in other parts of the State also will require large amounts of water; transbasin diversion of Green River water to other areas could total an additional 270,000 acre-ft per year. Water planners and managers need much more information about available ground and surface water, present quality of the waters, and the impacts on water supply and quality caused by development of energy resources.

OBJECTIVE: The study will be designed to gather information, and to make available to interested industrial, agricultural, and governmental people, interpretive reports that describe (1) the distribution and quality of surface water in space and time; (2) the relationships between surface water and ground water; (3) the distribution, quantity, and quality of ground water; and (4) the hydrology-related aspects of the environment. Efforts of the study will be directed toward (1) describing the water resources and hydrologic relationships that presently exist; (2) developing predictive methods that may be used to describe future conditions, including reactions to increased water development; and (3) establishing monitoring programs for detecting possible changes in water parameters.

APPROACH: Existing water data will be compiled and evaluated. A literature search for present hydrologic knowledge of the area will be conducted. A planning report will be prepared during the first year of the project, outlining the specific techniques to be used in subsequent phases. Regarding water quality, particular attention will be given to trace metals, biological parameters, and trend analyses. Channel-geometry techniques, LANDSAT imagery, and detailed statistical analyses will be applied to surface-water studies. Aquifer tests and bore hole and surface geophysical surveys will be used in ground-water studies. Digital models will be developed for chemical-quality and surface-water systems.

PROGRESS AND SIGNIFICANT RESULTS: An intensive sampling program was conducted during the fall and spring, using a helicopter and eight hydrologists. Water-quality samples and field measurements were collected at several hundred surface- and ground-water sites. A preliminary analysis indicated abnormally high concentrations of lead, cadmium, and selenium in waters near Baggs, Wyoming. The computer is being used to analyze the water-quality data that have been collected during the past few years. Up-to-date data lists were retrieved. Computer-drawn maps, trilinear diagrams, and histograms are being made. Explanation of WRD activities in the study area and results to date were presented to State and Federal agencies at a special meeting in March 1978. A second meeting was held in July at Rock Springs, Wyoming, to brief BLM, FS, and coal-company hydrologists on channel-geometry techniques and the regional salinity model. Analysis of stream temperatures was completed--a regional model was developed that allows estimation of stream temperatures at unmeasured sites.

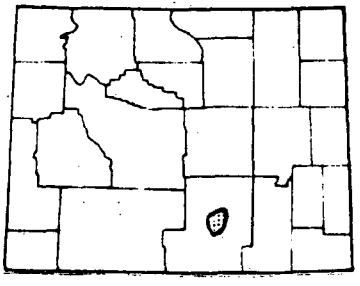
PLANS FOR FISCAL YEAR 1979: Emphasis will be placed on completing interpretive reports. First priorities are the reports shown as in progress.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Lowham, H.W., 1978, An analysis of stream temperatures, Green River Basin, Wyoming: U.S. Geological Survey Water-Resources Investigation 78-13, 41 p.

Engelke, M.J., 1978, Considering the Caudata: Wyoming Wildlife, v. 42, no. 9, p. 14-15.

PROJECT TITLE: Impacts of economic development and water use on water resources in the Hanna Basin in Wyoming (WY 75-031).



COOPERATING AGENCY: Bureau of Land Management.

PROJECT LEADER: Pamela B. Freudenthal.

FIELD LOCATION: South-central Wyoming.

PERIOD OF PROJECT: July 1974 to September 1979.

PROBLEM: The Hanna Basin has over 22,000 acres of land leased for coal mining. Mining, some of which will be in water-saturated coal beds, will apply stresses on the hydrologic environment through dewatering and due to new demands for water supplies. Federal and State agencies are concerned about the availability of water and the impact of coal mining on the water resources.

OBJECTIVE: The objectives of the project are to describe the present characteristics of the hydrologic environment, to monitor changes in it, and to evaluate the effects of those changes. At the surface, the objectives are to determine streamflow and water-quality characteristics of streams. In the subsurface, the objectives are to define aquifer characteristics and quality of water.

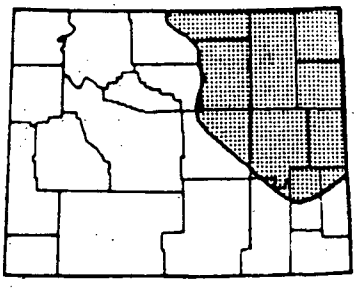
APPROACH: A network of wells in and around the mines, finished below, in, and above the zones to be mined will be extablished; aquifer tests will be done and quality of water and water levels will be monitored. Gages on the major drainages will be maintained to monitor streamflow, and quality-of-water samples will be collected for salinity and trace-element analyses.

PROGRESS AND SIGNIFICANT RESULTS: Water levels were measured periodically in about 70 wells, about 50 water quality samples were collected and analyzed, about 45 wells were cleaned by bailing, and recovery tests were done after bailing those 45 wells. Four wells in the area were cased. A report was prepared for releasing water quality data (in review process).

PLANS FOR FISCAL YEAR 1979: Emphasis will be placed on finishing the water-quality data report. A water-level and well-data report is planned and also an interpretive report of water quality, potentiometric surfaces, and aquifer analyses. Water levels will continue to be measured periodically.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Water resources of the Powder River structural basin in Wyoming in relation to energy development (WY 75-032).



COOPERATING AGENCY: Bureau of Land Management and Department of Energy.

PROJECT LEADER: Marlin E. Lowry.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: November 1974 to September 1979.

PROBLEM: The problems are those related to large water requirements for development of energy resources in the water-short Powder River Basin and the impacts resulting from such development. An average annual requirement for energy development of 250,000 acre-ft of water per year is projected by 1990. Part of the initial demand could be supplied by surface water and (or) ground water from aquifers of upper Cretaceous or Tertiary age. The impacts of mining, reclamation, transbasin diversions, off-channel and other reservoirs on the shallow aquifers, stream systems, and quality of water is not known.

OBJECTIVE: The objectives of the first phase will be to determine the adequacy of existing data to describe water availability and assess possible impact of the pending development, and to identify specific subjects that should be studied by the district. The findings of the first phase will be used to identify major thrusts for the second phase, which will constitute the district's program in the basin during the succeeding four years. A data-collection system will be designed, based on findings of the first phase, to meet data needs for thrusts and obtain benchmark information.

APPROACH: The existing data and data-collection program will be evaluated and a data-collection program, which is coordinated with other governmental and industrial programs, will be implemented. Various study techniques including those for determination of aquifer properties, streamflow analysis, channel geometry, isotope study, biological assay, water budgets, modeling, and geophysics will be explored and those that have merit will be pursued in the second phase of the study.

PROGRESS AND SIGNIFICANT RESULTS: Field work has been essentially completed and, in addition to the two published reports listed, results of parts of the investigation have been described at nine meetings of professional societies. Ground-water studies have produced evidence that the concept of recharge in the topographic high areas of the basin with discharge in topographic lows may be an oversimplification and not valid in predicting impacts of development. Studies of infiltration in small basins indicate it may be possible to assign infiltration values to some of the soils, or soil groups, in the basin. This would greatly enhance the transfer value of this phase of the investigation. During the study, the scope of the ground-water quality investigations was expanded to include the impacts of in-situ coal gasification. This phase of the investigation was done in cooperation with Lawrence Livermore Laboratories.

PLANS FOR FISCAL YEAR 1979: Complete writing of reports describing results of investigations.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

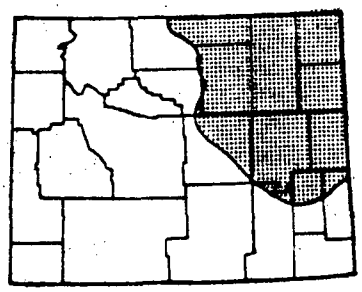
Feder, G.L., Lee, R.W., Busby, J.F., and Saindon, L.G., 1977, Geochemistry of ground waters in the Powder River coal region, in Geochemical survey of the western energy regions, Fourth Annual progress report: U.S. Geological Survey Open-File Report 77-872, p. 173-179.

Rankl, J.G., and Barker, D.S., 1977, Rainfall and runoff data from small basins in Wyoming: Wyoming State Engineer, Wyoming Water Planning Program Report No. 17, 195 p.

Busby, J.F., and others, 1978, A comparative hydrogeochemical investigation of two western coal regions (abs.): Amer. Assoc. for the Advancement of Science annual meeting, Washington, D. C., Feb. 1978, 1 p.

Busby, J.F., 1978, A geochemical investigation of ground water in the Powder River Basin, Wyoming (abs.): Amer. Geophysical Union meeting, Miami, Fla., April 1978, 1 p.

PROJECT TITLE: Hydrology of Paleozoic rocks in the Powder River basin and adjacent areas, northeastern Wyoming (WY 75-033).[1/]



COOPERATING AGENCY: None.

PROJECT LEADER: William J. Head.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: November 1974 to September 1979.

PROBLEM: Development of energy resources, especially enormous coal deposits, in the Powder River Basin will require a projected increase of 250,000 acre-ft of water per year by 1990. Ground water is more readily available, and will be the principal source of water in the early years of development until large-scale multipurpose water projects are completed. Paleozoic-age carbonate rocks, largely undeveloped, could yield large quantities of water. Development of large water supplies from the Paleozoic rocks depends on the presence of secondary permeability and on the aquifer response to pumping from nearby wells developed in the same aquifer.

OBJECTIVE: The project is designed to derive a conceptual model of the aquifer system to better predict the quantity and quality of water available from the Paleozoic rocks and to predict some of the effects of its development. Principal objectives will be to determine (1) the distribution, thickness, and physical properties of the aquifer system; (2) the processes that developed the present distribution of aquifer parameters in order to extend point data to other parts of the aquifer system; (3) the potentiometric surface and chemical quality of the water in the aquifer system; and (4) the effects of increased development of water from the aquifer system.

APPROACH: All available data for the aquifer system will be collected and compiled, including data for water wells, oil and gas tests that penetrated the aquifer, and tests, cores, and chemical analyses of water. Borehole and surface geophysical surveys will be made to evaluate and correlate the physical characteristics of the aquifer to the water-yielding properties. Natural tracers will be used to determine both the rate and direction of flow. Temperature differences with depth will be obtained to evaluate vertical movement of water. A streamflow analysis will be made to evaluate recharge and underground flow regime. Digital simulation models will be designed to aid in interpreting the aquifer systems and to predict the response to future stresses.

[1/] This project is subsidiary to project CR 76-192, described on page 102.

PROGRESS AND SIGNIFICANT RESULTS: Geochemical and ground-water modeling efforts were transferred to the regional-level study. Geochemical data have been compiled and reports prepared. Support was provided for maintenance and hydrologic and geophysical testing of the USGS Madison test wells. Fifteen gaging stations were operated throughout the year in the outcrop areas (Project WY 00-001). Vertical seismic-profile work was completed. Trade seismic data were interpreted and a contract for new seismic data was let. New gravity data were taken in the Powder River Basin by NOAA (National Oceanic and Atmospheric Administration). A gravity study was made in Test Hole No. 3 near Billings, Montana, to examine local structure. Several borehole gravity measurements were made in Test Hole No. 1 near Hulett, Wyoming, showing high-quality density and porosity information. Apparent Water Resistivity (Rwa) results for the Madison were mapped and interpreted. The temperatures and temperature-gradient studies were completed. Several geophysical reports were prepared.

PLANS FOR FISCAL YEAR 1979: Support will continue for the USGS Madison test wells. The fifteen gaging stations will continue to be operated. A final regional Bouguer map will be constructed. Borehole gravity will be taken in Test Holes No. 2 near Broadus, Montana, and No. 3 near Billings, Montana, and interpreted. New seismic data will be taken at the Madison test-hole sites and the data will be geologically interpreted. Finally reports on the geophysical efforts will be made.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Head, W.J., Kilty, K.T., and Knottek, R.K., 1978, Maps showing formation temperatures and configurations of the tops of the Minnelusa Formation and Madison Limestone, Powder River Basin, Wyoming, Montana, and adjacent areas: U.S. Geological Survey Open-File Report 78-905, 12 p.

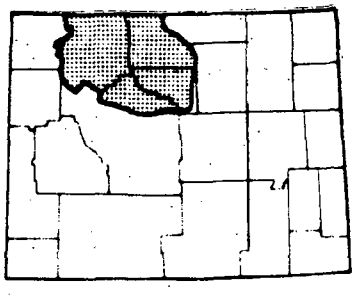
Brown, D.L., Blankennagel, R.K., Busby, J.F., and Lee, R.W., 1977, Preliminary data for Madison Limestone Test Well No. 2, SE¼SE¼ sec.18, T.1 N., R.54 E., Custer County, Montana: U.S. Geological Survey Open-File Report 77-863, 135 p., 4 pl. (1978).

PROJECT TITLE: Evaluation of Paleozoic and alluvial aquifers in the Bighorn Basin, Wyoming (WY 75-034).

COOPERATING AGENCY: Wyoming State Engineer.

PROJECT LEADER: Maurice E. Cooley.

FIELD LOCATION: North-central Wyoming.



PERIOD OF PROJECT: December 1974 to September 1977 (incomplete).

PROBLEM: In the Bighorn Basin there is a need for development of additional ground-water supplies for irrigation and industrial use. Lack of water for late-season irrigation is a problem now. The best potential sources include (1) the Artesian aquifer systems in the deeply buried Paleozoic rocks in the eastern part of the basin, and (2) the shallow water-table aquifers in the generally thin, flood-plain alluvium along tributaries to the Bighorn River throughout the basin. Additional information is needed about the amount and quality of water that could be developed from the Paleozoic and alluvial aquifers without causing significant decreases in the amount of water in storage, artesian pressures, or streamflow.

OBJECTIVE: For the Paleozoic (artesian) aquifers the objectives are to: (1) Evaluate effects of past withdrawals on storage, artesian pressures, and water quality; (2) delineate areas most favorable structurally for continued development of the aquifer system; and (3) provide additional water-quality data of wells, springs, and streams for comparisons with past and future data at the same sites. For the alluvial aquifers the objectives are to: (1) Delineate areas most favorable for ground-water development, particularly the Nowood River (Ten Sleep and Painted Rock Creeks), Greybull River, and Owl Creek; and (2) evaluate the suitability of ground water for irrigation, domestic, and industrial use.

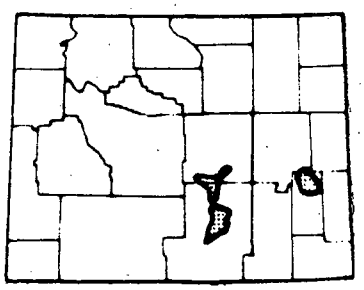
APPROACH: For the Paleozoic aquifers the planned approach is to: (1) Make mass measurements of artesian pressures in wells; (2) prepare a pressure map for the two artesian aquifers (Ten Sleep and Bighorn/Madison); (3) use aerial photographs and satellite imagery to determine folding and fracturing; (4) make conductivity measurements of streams; and (5) collect samples of water from streams and wells. For the alluvial aquifers the planned approach is to: (1) Determine lithologic characteristics of the alluvium and prepare a geomorphic map; (2) use electrical resistivity and test drilling to prepare selected profiles; (3) make conductivity measurements of streams; (4) use color photography to determine wet areas and for geomorphologic information; (5) delineate on maps the areas most favorable for ground-water development; and (6) analyze water samples from streams and wells.

PROGRESS AND SIGNIFICANT RESULTS: During the year, four reports giving results of this project were completed. The report on alluvial deposits of the Greybull River valley was reviewed and submitted for approval. The other three reports are nearly ready for review.

PLANS FOR FISCAL YEAR 1979: Plans are to finish processing the remaining reports through review and approval, and publish them in the Water-Resources Investigation/Open-File series.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Algal-growth potential of principal North Platte River reservoirs in Wyoming (WY 76-035).



COOPERATING AGENCY: None.

PROJECT LEADER: Samuel J. Rucker, IV.

FIELD LOCATION: Central Wyoming.

PERIOD OF PROJECT: July 1975 to September 1979.

PROBLEM: Eutrophic conditions may be developing in one or more of the four major reservoirs on the North Platte River (Seminoe, Pathfinder, Alcova, and Glendo). Oxygen depletion could have an adverse effect on recreational use of the reservoirs and on fish habitat. Development of mineral resources, particularly coal mining, is taking place at locations adjacent to one of the reservoirs. There is no information about the present state of algal growth with which to evaluate the seriousness of the problem, to evaluate changes caused by mining activities, or to predict future trends.

OBJECTIVE: The objectives of the study are to (1) determine the extent of algal growth in the four major reservoirs; (2) evaluate trends in algal-growth potential, including effects of effluent from coal mining activities adjacent to the reservoirs; and (3) determine the feasibility of developing a model for predicting algal growth (modeling would be a follow-up project).

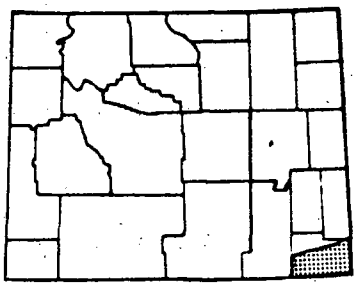
APPROACH: The first three years will be devoted exclusively to data collection, with analysis of data and preparation of a report scheduled for the fourth year. Vertical-profile water samples will be collected monthly (May-October) from a boat at sites above the dams and in the principal arms of each reservoir. Sampling will also be done twice each winter. Field parameters will include dissolved oxygen and temperature. Lab parameters will include nitrogen, ammonia (NH_4); nitrite + nitrate (NO_2+NO_3); phosphorus (P); residue, and algal-growth potential (AGP). A set of phytoplankton samples will be collected each year in early spring and in late summer for identification of genera. Graphical and statistical techniques, such as regression, will be used.

PROGRESS AND SIGNIFICANT RESULTS: The storage in Seminoe Reservoir was reduced to approximately one-fourth of the reservoir capacity during the winter period of 1977-78, exposing a large area of the bottom. Five samples of bottom material were obtained and analyzed for nitrogen and phosphorous. The nutrient levels were between 580 and 750 milligrams per kilogram for two samples in the Medicine Bow River arm. By mid-August, storage in the reservoir had increased to near the original level. The dissolved-solids concentration was lower than in previous years. Algal growth does not seem to be affected.

PLANS FOR FISCAL YEAR 1979: It is possible that one more sampling run will be made on the reservoirs. The main effort for fiscal year 1979 will be to complete the data analysis and the final report.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Quantitative study of the Tertiary aquifers in southern Laramie County, Wyoming (WY 77-038).



COOPERATING AGENCY: Wyoming State Engineer and Wyoming Department of Economic Planning and Development.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: October 1976 to December 1978.

PROBLEM: Ground-water development for irrigation in Laramie County has increased significantly the past 3 years. Part of the development is upgradient of two areas that have been designated as Control Areas by the Wyoming State Board of Control. Development is regulated within the Control Areas, but generally is not restricted outside these areas. State water administrators need more information about the development and its effect on water levels and stream discharge, and a way to predict the result of decisions to regulate future development. A model of the ground-water system in the shallow aquifers is needed.

OBJECTIVE: The objectives are (1) to determine the extent of ground-water development for irrigation, industry, and municipal use, and describe the effect of this development on water levels and stream discharge in the study area; and (2) to provide a means of predicting the effects of alternative ground-water management decisions.

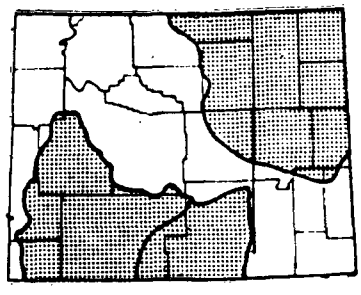
APPROACH: Data will be collected and compiled to make a quantitative analysis of the hydrologic system in the Tertiary aquifers within the study area. A digital model with coarse grid will be prepared utilizing available information. The model would be used to test and verify concepts of recharge and ground-water movement in southern Laramie County. The grid density will be increased in areas of development where more information is available locally. The detailed model would be used to predict the effects of pumping.

PROGRESS AND SIGNIFICANT RESULTS: The inventory of large-capacity wells was completed and historical and current pumpage were estimated from irrigated acreage maps prepared by the Wyoming State Engineer's office. A digital model has been developed for the ground-water systems in post-Cretaceous aquifers in an area of about 3500 square miles in Laramie County, Wyoming and adjacent parts of Colorado and Nebraska. The model is to be used by state water administrators as a guide for management of future ground-water development.

PLANS FOR FISCAL YEAR 1979: The final report will be completed and submitted to the Director for approval and published as a Water-Resources Investigation/Open-File Report.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Water-resources monitoring in the Powder River, south-central, and southwestern coal regions in Wyoming (WY 77-039).



COOPERATING AGENCY: None.

PROJECT LEADER: Stanley A. Druse.

FIELD LOCATION: Northeastern, south-central, and southwestern Wyoming.

PERIOD OF PROJECT: January 1977 to September 1980.

PROBLEM: Coal mining and associated developments of the scale and duration anticipated in major coal producing regions of the West may have adverse effects on the water resources of these regions. Mine dewatering, changes in land-use patterns, disposal of wastes, stream-channel realignment, and withdrawals of water for industrial and domestic use may significantly alter existing surface- and ground-water systems on a regional basis, limit available supplies, interfere with traditional water uses, and cause deterioration of the remaining water resources.

OBJECTIVE: The objective of the program is to determine the characteristics of the regional water-resources system and to detect and document changes in the system or its components that may be associated with coal mining.

APPROACH: The existing water-resources monitoring program will be evaluated for its regional surveillance value and additional data sites will be added or existing sites upgraded as needed. Data that continuously or periodically describe ground-water levels and quality, and streamflows and their quality will be evaluated so that changes may be detected and documented.

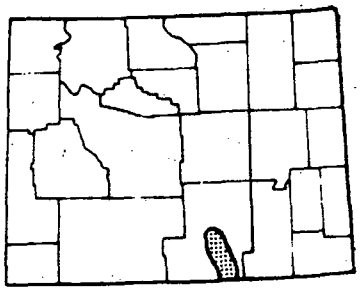
PROGRESS AND SIGNIFICANT RESULTS: (1) In the Powder River Coal Region, operation of the eleven surface water stations was fully implemented by the contractor, Morrison-Maierle, Inc., Helena, Montana. Field and office evaluations of contractor performance were made several times through the year. The contractor performance has been satisfactory in all phases of data collection and processing. Peak discharges, up to 100-year events, occurred at several contract gages, providing opportunity for fairly complete rating definition. Discharge measurement coverage by the contractor, during the floods, was good; however, several streams could not be measured by current meter because of a lack of highwater measuring structure. The Wyoming District surveyed and computed six indirect determinations of discharge and four step-backwater determinations to aid in rating development. The floods necessitated major rehabilitation at several sites; the work was accomplished by the contractor following the necessary additions to contract specifications. Cableway A-frame specifications were prepared for three stations, and construction of the A-frames was awarded by competitive bids. A low-flow reconnaissance of discharge and chemical quality was completed by the contractor to supplement the coal-hydrology data base and provide gain-and-loss information for the Northern Great Plains project. The contract for cleaning and sampling observation wells, Drane Drilling, Broadus, Montana, was successfully completed.

(2) South-central and southwestern Coal Regions: The contract termination date for cleaning and sampling observation wells was extended to provide for additional work in the regions. Work was completed June 30; data obtained are to be used by ground-water projects in the areas.

PLANS FOR FISCAL YEAR 1979: Contractor operation of the eleven stream-gaging stations will be monitored for quality assurance. Field data received will be reviewed and processed. Chemical-quality data collection is proposed for four additional sites, pending adequate funding. Specifications will be prepared for construction and installation of three cableways and rehabilitation of a fourth. Present plans are to contract the cableway construction. Indirect determinations of peak flow will be run as needed. A status report, scheduled for fiscal year 1978, will be completed. A proposed report documenting the validity of step-backwater rating development procedures may be started.

REPORTS PUPLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Effects of herbicide usage on water quality of selected streams in Wyoming (WY 77-043).



COOPERATING AGENCY: Wyoming Department of Agriculture.

PROJECT LEADER: Joel. R. Schuetz.

FIELD LOCATION: South-central Wyoming.

PERIOD OF PROJECT: June 1977 to September 1980.

PROBLEM: Local weed and pest control districts will be spraying the banks of selected streams (and islands in larger rivers) throughout Wyoming with Tordon (4-amino-3, 5, 6-trichloropicolinic acid), Banvel (2-methoxy-3, 6-dichlorobenzoic acid), and 2,4-D. The Wyoming Department of Agriculture needs to know whether or not any of these herbicides appear in the water or bed material downstream from the spraying activity. This problem could be compounded by the extremely low flow expected in reaches of some rivers.

OBJECTIVE: The objectives are to determine the effects of herbicide spraying on water quality and on bed materials in the study reach.

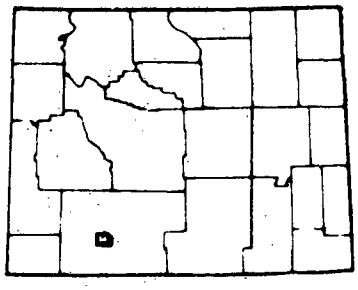
APPROACH: Sets of water- and bed-material samples will be collected upstream and downstream from the spray area before, during, and after the herbicide is applied. Application will last for about 8 weeks, during which sample sets will be collected twice a week immediately downstream. Samples will be analyzed in the Denver Central Laboratory. Results will be examined and the effects on water quality determined.

PROGRESS AND SIGNIFICANT RESULTS: The second sampling run on the North Platte River was made in November 1977. Based on preliminary data for the North Platte River, the scope of the project was increased to include the entire state and the end date extended to 1980, as new spraying areas were planned by local weed and pest control Districts. Training in sampling procedures was given to state and county personnel in Thermopolis in March and Buffalo in June. Following spraying, samples were collected and sent to the WRD Central Lab in June and September for 10 sites in northeastern Wyoming and 2 sites in south-central Wyoming. To supplement this project, sampling for dicambra and picloran was added to the 20 pesticide stations in the basic water-quality network (Project WY 00-003).

PLANS FOR FISCAL YEAR 1979: Spraying and subsequent sampling is expected to continue at the same level as 1978. New streams in other parts of Wyoming probably will be selected by state and local agencies for the spraying program. A report on results to date may be started.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: A preliminary hydrologic investigation of an in-situ oil-shale retorting site near Rock Springs, Wyoming (WY 78-045).



COOPERATING AGENCY: Environmental Protection Agency.

PROJECT LEADER: Everett A. Zimmerman.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1979.

PROBLEM: An in-situ oil-shale retorting experiment was conducted in 1969 by the Department of Energy in the Tipton Shale Member of the Green River Formation at Site 4 near Rock Springs, Wyoming. Prior to combustion, a 20-foot thick section of the oil shale, having extremely low porosity and permeability, was extensively fractured, using electrolinking, hydraulic, and chemical-explosive methods. The Environmental Protection Agency and Department of Energy are concerned about possible effects of the in-situ retorting of oil shale on nearby aquifers and need hydrologic and water-quality data for the site.

OBJECTIVES: The objectives of this study are to collect and publish hydrologic and water-quality data from within and adjacent to the combustion zone during dewatering.

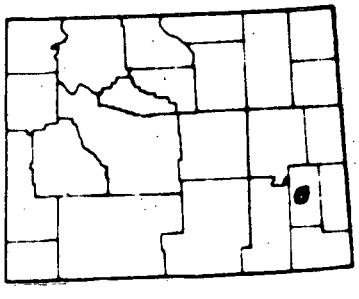
APPROACH: The Department of Energy will drill into and dewater the burned area at Site 4. DOE will also drill three observation wells in unburned areas adjacent to and on three sides of the burned area. The well sites will be selected using data provided by DOE from core holes drilled before and after the burn and from an infrared surface-temperature survey made after the burn. Water-level and pumpage data and water samples will be collected from all 4 wells during dewatering. The samples will be split and sent to USGS and DOE laboratories for chemical analysis. The data will be published in an open-file report.

PROGRESS AND SIGNIFICANT RESULTS: Planning of the project and assembling a library of pertinent data was done in fiscal year 1978. Execution of plans for drilling and sampling were postponed by Department of Energy until at least January 1979 because of suspected communication between the study site and an active burn at another site.

PLANS FOR FISCAL YEAR 1979: Plans have been made to (1) locate observation wells, (2) collect water-level and pumping data during dewatering, (3) collect water samples for chemical analysis, (4) tabulate data, and (5) publish and transmit data to Environmental Protection Agency and Department of Energy.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Digital model of the Arikaree aquifer in Muleshoe Flat, southeastern Wyoming (WY 78-046).



COOPERATING AGENCY: Bureau of Land Management.

PROJECT LEADER: Dwight T. Hoxie.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1978.

PROBLEM: A total of 75 high-yield wells are proposed to be installed in Muleshoe Flat for irrigation purposes. The Bureau of Land Management needs an evaluation of the effects of these withdrawals in order to make a final decision on whether or not to permit the development.

OBJECTIVE: The objective is to predict the effects of the proposed irrigation pumpage from 75 high-yield wells on ground-water levels within the study area and on stream-flow in the Laramie River and Sybille Creek, which border the area.

APPROACH: Plans are to (1) conduct a hydrogeologic reconnaissance of the Arikaree aquifer, including (a) compilation of surface geologic map, (b) map a configuration of base of aquifer, (c) measurement of water levels and compilation of water-table map, and d) make seepage runs on principal streams; (2) develop and calibrate a digital two-dimensional flow model; and (3) simulate the proposed pumpage under transient conditions to predict effects on water levels and streamflow.

PROGRESS AND SIGNIFICANT RESULTS: The hydrologic effects of proposed irrigation of 8,320 acres of land with ground water in Muleshoe Flat, a 34 square-mile area in west-central Platte County, Wyoming, were assessed. Results generated by a digital ground-water flow model indicated that at the end of a 40-year period ground-water level declines of more than 50 feet can be expected in an area of 12.5 square miles and of more than 200 feet can be expected in an area of 7 square miles. In addition, streamflow depletions of 4,300 acre-feet per year and 4,700 acre-feet per year can be expected in the Laramie River and Sybille Creek, respectively. A program of hydrologic field-data collection should be undertaken prior to initiation of the proposed irrigation development in order to improve these assessments. The final report was prepared, colleague review completed, and the report submitted for approval.

PLANS FOR FISCAL YEAR 1979: The final report will be published in the U.S. Geological Survey Water-Resources Investigation series.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

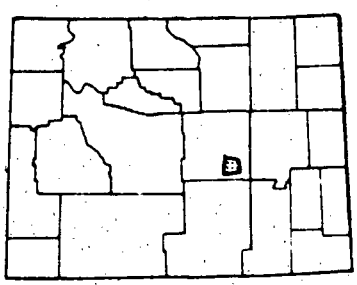
PROJECT TITLE: Digital model of the alluvial aquifer in Bates Hole, central Wyoming (WY 78-047).

COOPERATING AGENCY: Wyoming State Engineer.

PROJECT LEADER: Kent C. Glover.

FIELD LOCATION: Central Wyoming.

PERIOD OF PROJECT: October 1977 to September 1979.



PROBLEM: A total of 10 high-yield irrigation wells are proposed for installation in Bates Hole. Existing surface-water diversions virtually depleted the flow of Bates Creek during the irrigation season. The Wyoming State Engineer needs an evaluation of the effects of these withdrawals on streamflow in order to make a final decision on whether or not to permit the development.

OBJECTIVE: The objectives of this study are to define the relationship between Bates Creek and its associated alluvial aquifer and to predict the effects of the proposed pumpage on streamflow and water levels within the area.

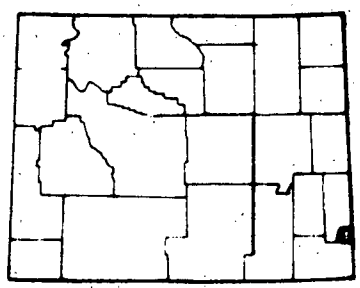
APPROACH: The approach to be taken in this study is (1) to conduct a hydrogeologic reconnaissance at the alluvial aquifer, including a) collection of lithologic and water-table data at approximately 30 wells, this will require drilling 20 observation wells, b) installation of three stream gages, c) compilation of surface geology map, map of base of the aquifer, and water-table maps for irrigation and non-irrigation seasons, d) aquifer tests of stream depletion, e) seepage runs on Bates Creek, and f) monitor pumpage and diversions; (2) to develop a digital two-dimensional ground-water flow model for the area; and (3) to simulate the proposed pumpage to predict the effects on streamflow and water levels.

PROGRESS AND SIGNIFICANT RESULTS: Water levels in approximately 25 wells, including several newly drilled wells, have been monitored monthly. Stream and irrigation discharge has also been measured. A seepage run along Bates Creek was made in March 1978 prior to spring runoff and irrigation. Two wells were driven in Bates Creek to observe the head difference between stream and aquifer. A set of wells were augered on both sides of Bates Creek to observe the potentiometric surface near the creek. A pumpage inventory and irrigated acreage inventory for 1978 has been completed. Maps showing surface geology, base of the alluvium and steady-state potentiometric surface have been prepared. Hydraulic conductivity was estimated from drilling samples and driller logs of previous U.S. Geological Survey studies. Development of a ground-water digital model has begun for the steady-state period of December 1977 through March 1978.

PLANS FOR FISCAL YEAR 1979: Water levels and stream discharge will continue to be measured. A seepage run is planned for October 1978 to observe changes in the stream-aquifer relationship during an irrigation season. Development of a digital model will continue for the steady-state period of December 1977 through March 1978 and the transient-flow period beginning April 1978. Prediction of water levels and stream discharge in response to planned ground-water pumpage will be made using the developed model.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Digital model of the hydrologic system in the La Grange area, southeastern Wyoming (WY 78-048).



COOPERATING AGENCY: Wyoming State Engineer.

PROJECT LEADER: William B. Borchert.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1979.

PROBLEM: Surface water and ground water are used for irrigation in the La Grange area. Surface water stored in a water district reservoir is supplemented by ground water pumped from district wells adjacent to the reservoir and by springs at the reservoir. The reservoir is down gradient of 27 irrigation wells in a 7 mi^2 area where water-level declines have occurred in the last 3 years. Because of concern about possible additional water-level declines, the Wyoming State Engineer needs to know the effect of current stresses on the system, as well as a means of predicting future stresses, for water administration.

OBJECTIVE: The objectives are to determine the interrelationship between water in the reservoir and water in the aquifer or aquifers adjacent to the reservoir, to determine the effects of ground-water pumpage on water levels throughout the area, and to determine the effects of ground-water pumpage on the flow of the springs at the reservoir. The ground-water flow system and the surface- and ground-water relationships will be simulated using a digital model with possible future stresses imposed on the model.

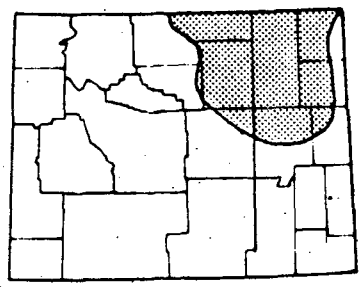
APPROACH: Observation wells will be drilled in and near the reservoir and where needed in other parts of the area. Water-level measurements will be made as needed. Preparation of a hydrologic budget will include surface-water inflow and outflow data for two creeks, a pumpage inventory, and estimates of ground-water inflow and outflow, evapotranspiration, and recharge from precipitation. Seepage runs on the creeks and measurements of surface-water diversions will be made. The reservoir will be simulated by a pond model used in conjunction with an appropriate digital model that simulates the ground-water flow system.

PROGRESS AND SIGNIFICANT RESULTS: Sixty-one holes were drilled, including eight holes penetrating the Brule Formation for which electric logs were made, and 45 holes were cased for observation wells. To determine the interconnection of aquifers, some observation wells, in groups of two or three, were completed in different aquifers. The electric logs and hydrographs for observation wells open to different aquifers under pumping stress indicate the vertical extent of the aquifer system. A water-level recorder was installed on a well between the pumping wells at the reservoir and the irrigation wells upgradient. The hydrograph and pumping schedules help to indicate the areal extent of water-level decline due to the two pumping areas. Stream-gaging stations were installed on Horse Creek and Bear Creek where they enter the study area. Mass water-level measurements were made in the spring and in the fall. A pumpage inventory and monthly electric-power readings were made. Piezometers penetrating the streambed of Horse Creek were installed. A seepage run was made on Horse Creek and Bear Creek in September.

PLANS FOR FISCAL YEAR 1979: An aquifer test will be made of a well at the reservoir. Using differential leveling, land surface altitudes will be determined for selected observation wells and irrigation wells. Interpretation of data will continue; the data necessary for a ground-water flow model will be compiled. Parameter estimation and adjustment will be accomplished using a water-table map prepared in 1957 as a basis for comparison. The model will be operated in a transient mode using short-term and long-term stresses. The responses of the model will be compared with known responses of the flow system.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Northern Great Plains Regional Aquifer-System Analysis, Wyoming (WY 78-049).[1/]



COOPERATING AGENCY: None.

PROJECT LEADER: Dwight T. Hoxie.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1981.

1/ This project is subsidiary to project CR 78-230, described on page 107.

PROBLEM: Rapid development of energy resources in the Northern Great Plains will put stresses on heretofore little used aquifers for water requirements and waste disposal. Previous studies have concentrated on counties or river and structural basins. There is now a need for a regional study of potential aquifers. More knowledge is needed so water development and management alternatives can be evaluated. To provide this knowledge, the Wyoming district will concentrate on aquifers above the Madison and below the Pierre Shale (Cretaceous). The study area is essentially the same as the regional Madison study. Four districts in the Northern Great Plains will participate with coordination by a Central Region staff.

OBJECTIVE: The overall objectives of the project are to provide a quantitative evaluation of the principal hydrologic systems, the quantity and quality of the water in the principal aquifers, the amounts of water available to wells under existing technology, and the effects of withdrawing the water.

The ultimate objective is to provide water managers with technical means of administering and regulating the development of water resources in the project area with emphasis on ground water.

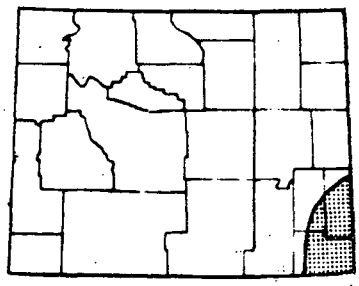
APPROACH: The areal extent of potential aquifers will be defined from previous studies, existing geohydrologic data will be compiled and evaluated, and a program will be developed to selectively collect additional data. The physical parameters of aquifers will be determined by machine processing of digitized geophysical logs. Recharge and discharge from streamflow records, seepage runs, well pumpage, evapotranspiration, and infiltration estimations will be determined. Digital models of the systems will be developed as a predictive means to evaluate alternatives for development of the aquifers and management of the systems. Water quality will be described and geochemical trends and anomalies defined. A data-collection network will be developed for future monitoring of systems.

PROGRESS AND SIGNIFICANT RESULTS: Project staffing was completed. A pilot study to determine evapotranspiration rates within the Powder River Basin of Wyoming and Montana was initiated. The first of two seepage runs and water-quality sampling of perennial streams within the Powder River Basin was completed. The drilling of a deep hydrologic test well in the northern Powder River Basin of Wyoming was begun.

PLANS FOR FISCAL YEAR 1979: Field data collected for the pilot evapotranspiration study in the Powder River Basin will be analyzed and a report prepared. Structural fence diagrams for the Powder River Basin of Wyoming will be prepared. The second of two seepage runs on perennial streams in the Powder River Basin will be completed and the data from both runs will be analyzed. Data for construction of a digital flow model of the Dakota aquifer over the project area will be assembled. Existing geochemical data will be acquired and used.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: High Plains Regional Aquifer-System Analysis, Wyoming (WY 78-050).[1/]



COOPERATING AGENCY: None.

PROJECT LEADER: Charles F. Avery.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1982.

PROBLEM: The Ogallala Formation and associated rocks are the principal aquifers underlying the High Plains. The economic future of the High Plains and surrounding area is heavily dependent upon the capacity of the aquifer to sustain withdrawals. Comprehensive knowledge of the aquifer system is needed so that water-management alternatives can be evaluated and the economic life of the aquifer projected. To provide that knowledge, the USGS will do a 5-year study; eight districts, including Wyoming, will participate, with coordination by Central Region staff.

OBJECTIVE: The overall (Regional) objectives are to (1) describe the quantity and quality of the water resource and the operation of the hydrologic system; (2) develop a regional water-resources data storage and retrieval system; (3) develop data-collection networks for future monitoring; (4) develop digital models of the aquifer system; and (5) evaluate ground-water management alternatives using the models. The objectives for Wyoming will be to provide hydrogeologic data for the post-Cretaceous formations in southeastern Wyoming to the Regional project staff in support of the overall objectives.

APPROACH: The areal extent of aquifer(s) will be defined based on previous studies. Geophysical logs will be examined to help determine aquifer thickness. About 25 test holes will be drilled. Ground-water occurrence and movement, aquifer properties, and recharge will be determined from existing data or from aquifer tests on new wells. Ground-water discharge will be estimated from pumpage and irrigated acreage inventories, and from streamflow measurements. Approximately 50 water samples will be collected and analyzed. Periodic mass water-level measurements will be made. All existing and new data will be compiled and entered into the Regional computer system. Work will be done with the Regional project team to apply Wyoming data to the Regional ground-water model.

[1/] This project is subsidiary to project CR 78-229, described on page 104.

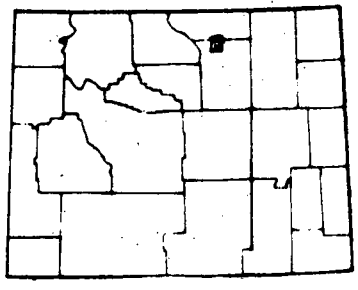
PROGRESS AND SIGNIFICANT RESULTS: The project chief was assigned in September 1978. Some time was spent becoming familiar with available literature concerning ground water within the study area. Mass water-level measurements were made in the LaGrange area. Sixty-five test holes were drilled; 49 of those were cased as observation wells.

PLANS FOR FISCAL YEAR 1979: Ground-water quality data will be compiled and stored in WATSTORE (National Water Data Storage and Retrieval System). The areal extent of the High Plains aquifer system and the potentiometric surface of the aquifer system during 1978 will be delineated on maps. The drilling program will start as soon as site priorities are established.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Weeks, J.B., 1978, Plan of study for the High Plains regional aquifer system analysis in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming: U.S. Geological Survey Water-Resources Investigations 78-70, 28 p.

PROJECT TITLE: Rate of nutrient release from decomposing plankton and periphyton in Lake De Smet and its outflow, north-central Wyoming (WY 78-051).



COOPERATING AGENCY: None.

PROJECT LEADER: David J. Wangsness.

FIELD LOCATION: North-central Wyoming.

PERIOD OF PROJECT: September 1978 to September 1979.

PROBLEM: There is a lack of understanding about the amount and rate of nutrient (phosphorus and nitrogen) release during algal cell decomposition in lakes and streams. This kind of information would be useful to water managers. The Lake De Smet system is well suited to this study. Originally an abandoned coal pit, the lake receives most of its inflow by diversions from Piney and Clear Creeks. Lake capacity has been increased by dams and dikes. Outflow for irrigation is controlled.

OBJECTIVE: The objective is to determine the amounts of nutrients released during algal cell decomposition and the rate of nutrient release from blue-green algae and diatoms in stream periphyton and lake plankton.

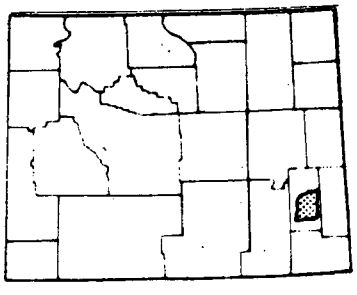
APPROACH: Uniform samples of plankton and periphyton biomass will be collected and placed in duplicate sample bottles. Algal cells will be killed with a photosynthetic inhibitor and the samples incubated in the lake and stream. Every 3 hours for 36 hours, and every 6 hours for the second 36-hour period a sample will be filtered and analyzed for dissolved forms of nitrogen and phosphorus to the microgram per liter level. Additional samples will be analyzed for total nutrients, average sample biomass, specie identification and cell counts. Decomposition rates and total nutrient released will be determined.

PROGRESS AND SIGNIFICANT RESULTS: Dissolved-nutrient data were collected during two 72-hour study periods from Lake De Smet and the outlet from Lake De Smet. Twenty samples were collected during each study period. Algal biomass samples were also collected and pH and temperature measurements were made at the time of sample collection.

PLANS FOR FISCAL YEAR 1979: Data will be analyzed and interpreted and a report published which will discuss the rate of nutrient release from algal cells upon cell decomposition.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Hydrologic conditions in the Wheatland Flats area, Platte County, Wyoming, Part II (WY 79-052).



COOPERATING AGENCY: Wyoming State Engineer and Department of Economic Planning and Development.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: April 1979 to March 1981.

PROBLEM: Water is diverted from the Laramie River to irrigate approximately 40,000 acres of land in the Wheatland Flats area. Ground water is the source for an additional 2,000 acres. Adequate supplies of surface water are available only in years when stream runoff is above normal. Additional water is provided by wells. The increase in irrigation wells from about 85 in 1960 to about 225 in 1978 has resulted in substantially more pumpage of ground water. Consequently some of the shallow wells are no longer productive. Information is needed to determine the effect of ground-water development upon water levels and streamflow.

OBJECTIVE: The objectives are (1) to determine the extent of present ground-water development for irrigation, industry, and municipal use and describe the effect of this development upon water levels in the separate aquifers; (2) to determine the effect of imported surface water upon water levels and the effect of imported water and ground-water development upon stream discharge in the area; and (3) to provide a means of predicting the effect of water management decisions.

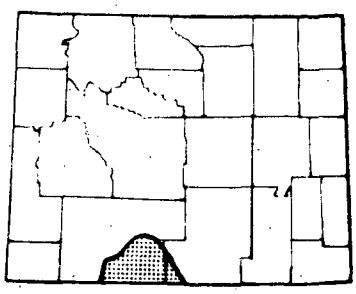
APPROACH: Well-inventory, pumpage, and surface-water use data will be updated. Additional data will be collected to include the adjacent area around Wheatland Flats where irrigation wells have been constructed. An observation-well network will be established and mass water-level measurements will be made in the spring prior to start of irrigation. Seepage runs will be made on all the streams to estimate stream-aquifer relationship. Preparation of a water budget will aid in the development of a digital model of the hydrologic system, which will be tied in with two existing models for adjacent areas.

PLANS FOR FISCAL YEAR 1979: The inventory of large-capacity wells will be completed, mass water-level measurements made, and an observation-well network established. Seepage runs will be made on all the streams, and compilation will start of the data to be used for development of a digital model of the hydrologic system.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

Water-Resources Projects Conducted by other Districts

PROJECT TITLE: Yampa River Basin assessment, northwestern Colorado and south-central Wyoming (CO 75-075).



COOPERATING AGENCY: Routt County Department of Environmental Health.

PROJECT LEADER: Timothy Doak Steele. (Lakewood, Colorado)

FIELD LOCATION: South-central Wyoming and northwestern Colorado.

PERIOD OF PROJECT: April 1975 to December 1977.

PROBLEM: Energy resources in the Yampa River basin in Colorado and Wyoming are being developed. Coal is the dominant energy resource being developed, with annual production in northwestern Colorado expected to increase from 6.0 million tons in 1976 to more than 20 million tons by 1990. A substantial part of this mined coal will be converted in the basin to electric power or possibly synthetic gases. Other energy resources in the basin include oil and gas, oil shale, uranium, and geothermal springs.

Decisions affecting policy of energy-resource development need to consider the environmental and economic impact of this development. Energy-resource development leads to increased discharge of residuals to water, air, and land. Residuals are the noneconomic byproducts of energy-development activities. Discharged residuals will modify environmental quality, and attempts to modify or reduce residual discharges will affect both the quantity and quality of the basin's water resources. The availability of water may be a limiting factor to future development of the energy resources in the basin.

OBJECTIVES: The project is designed to assess the availability and quality of the basin's water resources and evaluate the potential environmental and selected socioeconomic impacts of various coal-resource development plans proposed by mining and power companies. The possible constraints on water availability and current uses as a consequence of existing water rights and compact arrangements will be considered. The basin-assessment program is designed to provide Federal, State, and local decision makers with basic environmental information for formulating and evaluating policies for the development of the basin's energy and water resources.

APPROACH: Ambient hydrologic conditions in the Yampa River basin will be evaluated through interpretation of historic data and collection of additional data where deficiencies have been identified. Other basin-assessment evaluations include analyses of surface- and groundwater availability, multireservoir modeling of proposed surface-water development alternatives, remote-sensing applications, travel time and wasteload assimilative capacity analyses, socioeconomic impacts, review of water rights, and investigation of institutional constraints and basin compacts which may limit the availability of water for energy-resource development. Existing hydrologic models as well as coal-mining and coal-conversion models will be used to simulate the impact of various coal-development plans on the water-resource systems.

PROGRESS AND SIGNIFICANT RESULTS: Two reports describing the phase I and phase II project work activities have been published. All study work elements outlined in these work-plan reports were carried out, and most have been completed. Several reports documenting results of special topic areas, including contractual studies, are completed or are in process. Summary reports highlighting results for each project phase are in preparation.

PLANS FOR FISCAL YEAR 1979: Complete all reports.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Andrews, E.D., 1978, Present and potential sediment yields in the Yampa River Basin, Colorado and Wyoming: U.S. Geological Survey Water-Resources Investigations 78-105, 48 p.

Bauer, D.P., Rathbun, R.E., and Lowham, H.W., 1978a, Traveltime, unit-concentration, longitudinal-dispersion, and reaeration characteristics of upstream reaches of two mountain streams (ABS.): American Water Resources Association, 14th annual meeting, Disney World Village, Fla, Nov. 6-10, 1978.

_____, 1978b, Traveltime, unit-concentration, logintudinal-dispersion, and reaeration characteristics of upstream reaches of the Yampa and Little Snake Rivers, Colorado and Wyoming: U.S. Geological Survey Water-Resources Investigations 78-122 (in press).

Heimes, F.J., 1978, Potential geohydrologic and land-use applications of LANDSAT images and aerial photographs in the Yampa River Basin, Colorado and Wyoming (ABS.): American Geophysical Union Transcript, v. 59, no. 4, p. 273-274.

Heimes, F.J., Moore, G.K., and Steele, T.D., 1978, Preliminary applications of LANDSAT images and aerial photography for determining land-use, geologic, and hydrologic characteristics in the Yampa River Basin, Colorado and Wyoming: U.S. Geological Survey Water-Resources Investigations 78-96, 33 p.

Steele, T.D., 1978, Assessment techniques for modelling water quality in a river basin impacted by coal resource development, in modelling the water quality of the hydrological cycle symposium, Baden, Austria, September 1978, Proceedings: IAHS-AISH Publication no. 125, p. 322-332.

_____, 1978, The potential impacts of energy development on water resources in the Yampa River Basin--A discussion, in Spofford, W.O., Jr., Ed., resources for future and U.S. Fish and Wildlife Service: Forum on the impact of energy development on the water, fish, and wildlife in the Upper Colorado River Basin, Albuquerque, N. Mex., Oct. 15-16, 1976 Proceedings (in press).

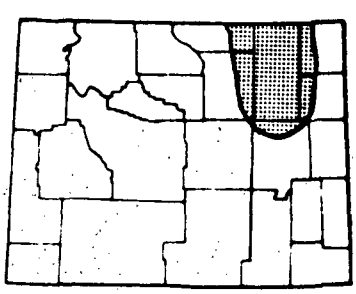
_____, 1978, An overview of river-basin assessment techniques in an energy-impacted region--Yampa River Basin, Colorado and Wyoming: American Water Resources Association, 13th annual meeting, special symposium on river-quality assessments, Tuscon, Arizona, November 2-3, 1977 (in press).

Steele, T.D., Bauer, D.P., Wentz, D.A., and Warner, J.W., 1978, The Yampa River Basin, Colorado and Wyoming--a preview to expanded resource development and its impact of regional water resources: U.S. Geological Survey Water-Resources Investigations 78-126 (in press).

Steele, T.D., Wentz, D.A., and Warner, J.W., 1978, Hydrologic reconnaissance of the Yampa River during low flow, Dinosaur National Monument, northwestern Colorado: U.S. Geological Survey Open-File Report 78-226, 10 p.

Warner, J.W., Dale, R.H., and Steele, T.D., 1978, Potential effects of coal-resource development on the ground-water resources of the Yampa River Basin, Colorado and Wyoming (ABS.): American Geophysical Union Transcript, v. 59, no. 4, p. 278.

PROJECT TITLE: Effects of mining and related activities on the shallow ground-water system (MT 75-048).



COOPERATING AGENCY: None.

PROJECT LEADER: Steven E. Slagle. (Billings, Montana)

FIELD LOCATION: Eastern Montana and northeastern Wyoming.

PERIOD OF PROJECT: July 1974 to June 1979.

PROBLEM: Strip mining and the related aspects of coal development can be expected to cause ground-water levels and ground-water quality to change. The public, industry, and government need to know the extent of change in order to take and enforce mitigating measures. Water availability and water quality need to be known in order for other agencies to evaluate alternative sources of water.

OBJECTIVE: The major objectives are (1) to define and understand the regional and local flow systems in aquifers above the Pierre Shale; (2) to develop a semi-quantitative conceptual model as a basis for predictive models, (3) to develop predictive models to assess the effects of mining on water levels and the yield of wells and springs; (4) to develop "first estimate" water-quality models to predict rate and direction of movement of poor quality water from spoil banks and other sources; (5) to utilize all of the models to evaluate and revise the data-collection program; and (6) to assure that the data-collection and interpretation (modeling) programs meet the needs of other federal and state agencies.

APPROACH: The accumulated geologic and hydrologic information will be combined to develop conceptual models of the hydrologic system on both large and small scales. Additional data needed for more complete understanding of the hydrologic system will be colelcted. Digital models will be developed, first to test and modify the concepts and evaluate the data-collection network, then to predict the effects of mining and related activities on ground-water levels and the discharge of springs. Using the hydraulic models, development of water-quality models will be attempted to determine or predict leachate migration and the movement of other poor-quality water.

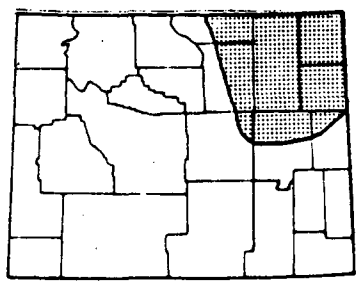
PROGRESS AND SIGNIFICANT RESULTS: A geologic map of the northern Powder River Basin was published and a report on the geochemistry of water in the Fort Union Formation of the Northern Powder River basin was submitted for review. Collection and compilation of water-quality and well data for hydrologic-data reports was completed. Collection and analysis of data from low-flow investigations was continued as was the collection of hydrogeologic data for refinement of isopach, basal configuration, sand percent, and sand thickness maps. Construction of the hydrologic model continued. Channel geometry studies were initiated to determine mean-annual flow in ungaged streams.

PLANS FOR FISCAL YEAR 1979: Hydrologic-data reports of water quality and well data will be completed. Hydrogeologic maps will be refined for publication as an I-Series report. The report on low-flow studies will be completed. Construction and verification of the hydrologic model will be completed. Channel geometry studies and stream water-quality studies will continue.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: -

Lewis, B.D., and Roberts, R.S., Geology and water-yielding characteristics of rocks of the northern Powder River Basin, southeastern Montana: U.S. Geological Survey Miscellaneous Investigations Map I-847-D.

PROJECT TITLE: Availability of ground water from aquifers in the Cretaceous and Tertiary systems in the Fort Union Coal Region (ND 75-071).



COOPERATING AGENCY: None.

PROJECT LEADER: Mack G. Croft.
(Bismark, North Dakota)

FIELD LOCATION: Northeastern Wyoming, southeastern Montana, and western North Dakota and South Dakota (Northern Great Plains).

PERIOD OF PROJECT: July 1974 to June 1977.

PROBLEM: Proposed coal developments in the Fort Union Coal Region of the Northern Plains will be attended by substantial increases in water usage. In much of the region, the only practical source of water for domestic, stock, municipal, and small-scale industrial requirements is ground water from relatively shallow aquifers in rocks of Cretaceous and Tertiary age. However, knowledge of these aquifers is fragmental and limited to scattered localities. A systematic and regional appraisal is required for planning, development, and management purposes.

OBJECTIVE: The major objectives are (1) to determine the location, extent, and nature of the major aquifers and confining beds in the Cretaceous and Tertiary systems in the Fort Union Coal Region; (2) to evaluate the occurence, movement, and availability of ground water, including sources of recharge and discharge; and (3) to determine the chemical quality of the ground water.

APPROACH: The investigation will be concerned mainly with the compilation, analysis, and interpretations of existing pertinent data from available sources in the states of North Dakota, South Dakota, Wyoming, and Montana. Major aquifers in the Cretaceous and Tertiary systems will be identified, described, and correlated mainly through the use of geophysical and lithologic logs. Three regional hydrogeologic sections will be prepared that will illustrate the structural and stratigraphic relationships of the major aquifers. A structural map will be prepared, using the top of the Pierre Shale which, for much of the region, also will represent the lower limit of potable ground water. The final report will be prepared in the professional paper or Water-Resources Investigation Series.

PROGRESS AND SIGNIFICANT RESULTS: The project is mainly a compilation of existing published and unpublished data from reports in the Fort Union Coal Region. Water-level and transmissivity maps of the Fox Hills and Tullock (lower Ludlow) aquifer have been compiled. Also a geologic map of the Fort Union Coal Region and cross sections have been made. All field work and data compilation completed. Report has received considerable review and has been updated.

PLANS FOR FISCAL YEAR 1979: Processing of report will be finished and Director's approval obtained for publication.

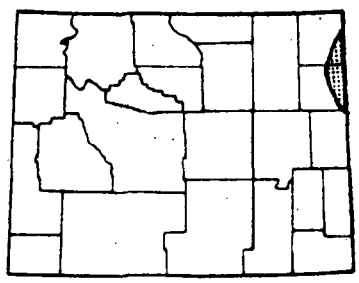
REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

PROJECT TITLE: Hydrology of the aquifer(s) in the Madison Group (SD 76-043).[1/]

COOPERATING AGENCY: None.

PROJECT LEADER: Lewis W. Howells.
(Huron, South Dakota)

FIELD LOCATION: Northeastern Wyoming and western South Dakota.



PERIOD OF PROJECT: July 1975 to June 1980.

[1/] This project is subsidiary to project CR 76-192, described on page 102.

PROBLEM: New withdrawals of water from the aquifer(s) in the Madison Group for existing and proposed mining and industrial facilities could greatly exceed 100,000 acre-ft per year within five years. Some concerned persons, including public officials, fear that the aquifer is incapable of supporting a sustained yield of that magnitude and that severe damage may result to other water users in the region.

The problem, therefore, is to delineate the magnitude and distribution (both in space and time) of the water resources in the Madison, and to determine the response of the aquifer to proposed withdrawals of water.

OBJECTIVE: The objectives of the study are (1) to delineate the water resource(s) contained in or integrally related to the Madison Group in South Dakota; (2) to determine the hydrologic regimen of the aquifer(s), with special emphasis on the surface- and ground-water relationship in areas of outcrop, of the aquifer(s) in the Madison Group and to those in underlying limestone rocks of Paleozoic age and of the overlying Minnelusa Formation; and (3) to predict the probable results of removal of large amounts of water from the Madison.

APPROACH: Records, data, and other information available from public and private sources will be collected, evaluated, and interpreted, including analysis of drill-stem test data by a professional analyst. A data-collection network will be established and operated to meet the objectives of the project. Test drilling, dye tracer tests, aquifer tests, geophysical studies, and other tests and studies will be conducted as needed and feasible. Information will be interpreted and reports prepared that include structure, isopach, potentiometric, and geochemical maps, and predictions of probable effects of various patterns and magnitude of water resources development. Predictions will be refined from new information available from the data-collection network.

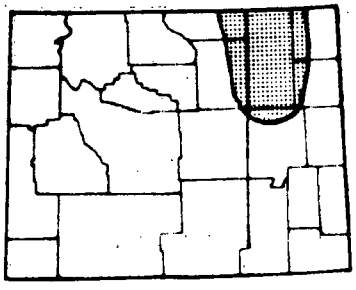
PROGRESS AND SIGNIFICANT RESULTS: The canvass of wells in the western half of South Dakota is complete. The gaging stations on streams in the Black Hills have been installed. Plotting of data for stratigraphic maps is nearly complete. Conversion of well records to System 2000 is about half completed.

PLANS FOR FISCAL YEAR 1979: The compilation and evaluation of data will continue. Gaging stations will be operated and the water-level monitoring program will continue. Ground-water samples will be collected and analyzed from any new wells that are drilled. Coding and conversion of records to ADP will be completed.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

Water-Resources Projects Conducted by Central Region Staff

PROJECT TITLE: Geochemical survey of waters of the western coal regions (CR 74-095).



COOPERATING AGENCY: None.

PROJECT LEADER: Gerald L. Feder.
(Lakewood, Colorado)

FIELD LOCATION: Northeastern Wyoming, southeastern Montana, western North Dakota, and parts of Arizona, Colorado, New Mexico, and Utah.

PERIOD OF PROJECT: July 1973 to September 1979.

PROBLEM: The anticipated large scale exploitation of coal or other energy-producing natural materials in the western United States is expected to result in marked changes in the geochemical environment including the quality of waters in the region, and especially the trace-element content of waters. Such changes will result predominantly from effects of strip mining and power production. These changes can be best monitored only if realistic estimates of the predevelopment water quality are known.

OBJECTIVE: It is the goal of this project to efficiently provide data on the "natural" or pre-development geochemistry of the waters of the area, with particular emphasis on trace elements that may have a relationship to health and disease in humans or animals. If time and interest permit, attention may also be given to quantifying changes already produced by existing developments in the area. In addition, the relationships between soils, plants, rocks, and waters, within the study area, will be quantified.

APPROACH: During the 1974-75 field season, a hydrogeochemical sampling program will be carried out in the major coal basins in the Rocky Mountain and Northern Great Plains Coal Provinces. Rigorous statistical techniques will be used throughout the study. The data collected will include major chemical constituents, trace elements, and gross alpha and beta activity. If high alpha or beta activities are obtained, additional analysis will be made for specific radiochemical elements. All chemical analyses will be done in Water Resources Division laboratories.

PROGRESS AND SIGNIFICANT RESULTS: Work was performed as a member of the ground-water Quantity and Quality Committee of the International Poplar River Water Quality Board of the International Joint Commission. The final report with co-investigators was completed. The general geochemical environment was found to be similar to the previously studied Northern Great Plains coal regions.

PLANS FOR FISCAL YEAR 1979: Additional sampling and data analysis in other western coal regions will be done. A study will be made with the help of R. L. Bassett to determine if boron isotopes can be used to trace water movement.

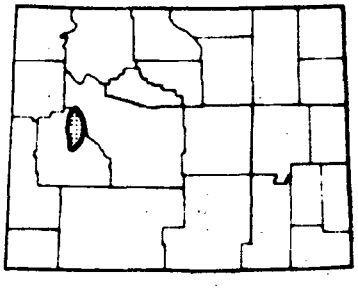
REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Busby, J.F., Feder, G.L., Lee, R.W., Saindon, L.G. 1978, A comparative geochemical investigation of western coal regions (abs); Abstracts of papers of the 144th National Meeting 12-17 February 1978 AAAS, p. 179.

Feder, G.L., 1978, Possible effects of power production activity on ground-water quality in the Northern Great Plains Coal Province (abs): EOS, Transactions, American Geophysical Union, v. 59, no. 4, p. 278.

Averett, R.C., Feder, G.L., Grisak, G.W., Lennox, D.H., Miller, M.R., Schneider, A.T., Stan, S., Taylor, O.J., 1978, Effects of Saskatchewan Power Corporation power plant on quantity and quality of ground-water in the Poplar River Basin, Saskatchewan-Montana: Report to the International Poplar River Water Quality Board by the ground water Quantity and Quality Committee, 80 p.

PROJECT TITLE: Bedload transport research (CR 74-187).



COOPERATING AGENCY: None.

PROJECT LEADER: William W. Emmett. (Lakewood, Colorado)

FIELD LOCATION: West-central Wyoming.

PERIOD OF PROJECT: July 1973 to September 1980.

PROBLEM: Of all processes operating in river channels, especially those of practical concern to engineers and others interested in river channel behavior, perhaps the least knowledge is available about the hydraulics and mechanics of bedload transport. Before continuing advances in river channel behavior can be made, some understanding of the behavior of bedload sediment must be made.

OBJECTIVE: The objectives are (1) to define spatial and temporal variations in bedload transport rate for a single stage of flow; (2) to define change in average magnitude of transport rate over a range in hydraulics of flow; (3) to define change in average magnitude of transport rate over a range in channel geometry; and (4) to analyze the data to evaluate the applicability of available bedload equations, suggest new coefficients for the existing equations, or propose new relations for predicting rates of bedload transport.

APPROACH: The conveyor-belt bedload-transport facility on the East Fork River near Pinedale, Wyoming will be used as a control to evaluate variability factors in bedload transport and to field calibrate the Helley-Smith bedload sampler. The calibrated Helley-Smith sampler will be used in the systematic collection of bedload samples, along with the concurrent measurements of streamflow hydraulics from a variety of sand- and gravel-bed streams. Within the laws of general physics, empirical relations of bedload transport will be stochastically developed and the physical significance of the developed relations will be interpreted.

PROGRESS AND SIGNIFICANT RESULTS: Field calibration of the sediment-trapping characteristics of the Helley-Smith bedload sampler has been completed and the report submitted for Director's approval. Data analysis and interpretation of information gathered at the conveyor-belt bedload-trap facility and at additional sites through the use of the Helley-Smith bedload sampler will continue. Analysis is underway to facilitate the transfer of information from site-specific field areas to areal application and application to watershed and channel flow/sediment modeling concepts.

PLANS FOR FISCAL YEAR 1979: The Helley-Smith bedload sampler will be used to enlarge the data base necessary to evaluate a range in hydraulic and sediment parameters significant to the bedload-transport process. A tracer study will be initiated at the conveyor-belt research facility utilizing fluorescent particles to evaluate the (1) residence time of sediment, (2) average speed of particles, (3) depth of bed material involved in transport, (4) influence of bedforms on transport characteristics, (5) dispersion of bed material, and (6) other related aspects of sediment transport.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Emmett, W.W., 1978, Overland flow: in Hillslope Hydrology (M.J. Kirkby, ed.), John Wiley and Sons, 389 p. (pp. 145-176).

Emmett, W.W., Burrows, R.L., and Parks, Bruce, 1978, Sediment transport in the Tanana River in the vicinity of Fairbanks, Alaska, 1977: U.S. Geological Survey Open-File Report 78-290, 28 p.

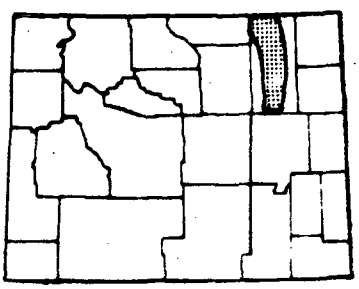
Leopold, L.B., and Emmett, W.W., 1977, 1976 bedload measurements, East Fork River, Wyoming: Proc., National Academy of Sciences, v. 74, no. 7, pp. 2644-2648.

Emmett, W.W., and Leopold, L.B., 1977, A comparison of observed sediment-transport rates with rates computed using existing formulas in Geomorphology in Arid Regions (D.O. Doehring, ed.), Proc. 8th Annual Geomorphology Symposium, State University of New York, Binghamton, NY, September 23-24, 1977, pp. 187-188.

Druffel, Leroy, Emmett, W.W., Schneider, V.R., and Skinner, J.V., 1976, Laboratory hydraulic calibration of the Helley-Smith bedload sampler: U.S. Geological Survey Open-File Report 76-752, 63 p.

Mahoney, H.A., Andrews, E.D., Emmett, W.W., Leopold, L.B., Meade, R.H., Myrick, R.M., and Nordin, C.F., 1976, Data for calibrating unsteady-flow sediment-transport models, East Fork River, Wyoming, 1975: U.S. Geological Survey Open-File Report 76-22, 293 p.

PROJECT TITLE: Reconnaissance techniques for evaluation of rehabilitation potential of energy resource lands (CR 75-104).



COOPERATING AGENCY: Bureau of Land Management.

PROJECT LEADER: Lynn M. Shown. (Lakewood, Colorado)

FIELD LOCATION: White Tail Butte EMRIA site, northeastern Wyoming.

PERIOD OF PROJECT: July 1974 to September 1979.

PROBLEM: Hydrologic information with respect to rehabilitation potential is needed by local, state and federal governments, private landowners, energy companies, and others prior to decisions on the leasing, mining plans, and mining of publicly-owned coal and oil shale. The information is needed over the next 1 to 5 years, so reconnaissance techniques must be used to obtain much of the necessary data. The two facets of the problem are: (1) To define the baseline conditions as they exist prior to mining, mostly in areas having sparse hydrologic data; and (2) to assess the potential for rehabilitation of the land-water system after mining.

OBJECTIVES: The purpose of this project will be to refine and apply reconnaissance techniques that will provide mappable and other easily assimilated information to be used as baseline data and in evaluating the rehabilitation potential of lands where energy resource mining and other land-use changes are proposed and in development, verification, and application of hydrologic process and regression models. Data to be collected and interpreted include: Mean annual runoff, 2-, 5-, and 10-year peak flows, sediment yields, soil-vegetation-water relations, slope and exposure effects on vegetation and hydrology, reconstruction of topography after assumed mining, channel and hillslope erosion, and channel condition.

APPROACH: The techniques to be used to characterize watersheds of various sizes are (1) soil-moisture storage associated with vegetation types; (2) estimates of annual runoff by subtracting soil-moisture storage from annual precipitation; (3) the relation of percent bare soil to runoff and sediment yields; (4) index of erodibility by water dispersion; (5) estimates of annual runoff and peak discharges using channel measurements; (6) estimates of sediment yield using climate, drainage basin characteristics, and reservoir sediment surveys; (7) erosion monitoring by resurveying monumented transects; and (8) hillslope, channel, and geologic cross-section analysis with respect to reconstruction of the topography of potential mine areas. Soils, vegetation and runoff and erosion of nearby mine spoils in various states of rehabilitation will be investigated.

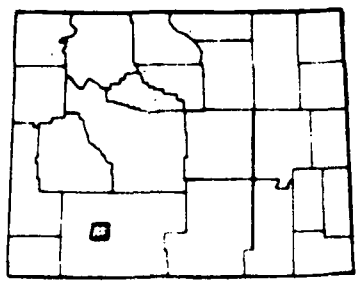
PROGRESS AND SIGNIFICANT RESULTS: Information on vegetation, vegetation-soil-water relations, and sediment yields was prepared for draft Interagency reports on four EMRIA study areas. Rehabilitation potential is relatively high for the Beulah Trench area, North Dakota; is moderate to high for the White Tail Butte, Wyoming area; moderate for the Hanging Woman Creek, Montana area; and relatively low for the Kimbeto Wash, New Mexico area. Soil-moisture investigations were begun on six of the model basins and vegetation investigations were begun on two of the basins. Preparations were begun on a presentation to be given on reconnaissance methods at an AGU Symposium on surface-mineable lands. Poor results were obtained in a test of Flaxman's sediment-yield equation, using a set of 20 small basins in northeast Wyoming and southeast Montana for which annual sediment yields had been determined by spudding stock ponds. A regression equation, which utilized independent variables similar to those in Flaxman's equation and stock pond sediment-yield data as the dependent variable explained 68 percent of the variation in annual sediment yields with a standard error of 26 percent. Data collection was continued at two of the runoff plots in the Piceance basin, but discontinued at three others because of prototype oil-shale development construction activities. Several new channel cross sections were installed and resurveyed three times to monitor prospective channel-geometry changes caused by oil-shale development dewatering.

PLANS FOR FISCAL YEAR 1979: Open-file reports and maps on vegetation, soil moisture, and sediment yields will be prepared for the Coal Creek, Oklahoma basin, which is to be modeled. Testing of an equation for predicting annual sediment yields from small basins in the Powder River basin will be completed. Vegetation, soil-moisture, and sediment-yield information will be collected for two basins to be modeled in Montana and Colorado. Project personnel will participate more actively in the development of precipitation-runoff-sediment yield models of small basins. The channel cross sections and hillslope transects in the Piceance basin will be resurveyed.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Frickel, D. G., 1978, Hydrologic and geomorphic data from the Piceance basin, Colorado, 1972-77: U.S. Geological Survey Open-File Report 78-825, 169 p.

PROJECT TITLE: Sorption of residual organic substances in retort waters by spent oil-shale residues (CR 75-181).



COOPERATING AGENCY: Department of Energy, Laramie Energy Research Center.

PROJECT LEADER: Jerry A. Leenheer (Lakewood, Colorado)

FIELD LOCATION: Southwestern Wyoming (Rock Springs LERC oil-shale retorting site).

PERIOD OF PROJECT: 1975 to September 1980.

PROBLEM: In-situ oil-shale retorting produces 1 to 5 barrels of wastewater per barrel of oil. This wastewater is the result of free water contained in the oil shale, the dehydration and dehydroxylation of oil shale minerals at the high temperatures of the retorting process, and the partial combustion of the kerogen which produces retort water. The water-oil mixture is an emulsion which is physically separated after pumping from the in-situ retort, and the wastewater is a brown solution containing 500 to 1,000 milligrams per liter dissolved organic carbon.

Because the wastewater must be handled at land surface during oil production, there is some potential for wastewater contact with the soils present at the retort site. Because of concern about the nutrient and toxilogical aspects of the constituents dissolved in the wastewaters, it is important to understand and measure the chemical and physical interactions between the soil and the wastewater.

The wastewater may be disposed at land surface by using various waste treatment processes, or it may be disposed in the subsurface via injection wells. Because of the concern about the toxilogical aspects of these waste organic solutes, the waste-treatment process selected for use is partially contingent upon the rate of transport of these organic solutes in surface and ground waters after their disposal. Organic solute transport is governed by the rate of water movement, and by solute sorption upon soils, sediments, and aquifer material.

OBJECTIVE: The objective of the proposed research is to determine the chemical and physical effects of soil upon the wastewater composition and wastewater upon soil composition, and to determine the type and magnitude of the organic solute sorption processes which occur upon soil and sediment sorbents associated with the disposal of in-situ-produced wastewater.

APPROACH: This investigation will be conducted using the wastewaters, natural waters, soils, and sediments associated with the experimental in-situ oil-shale retorting site of the Laramie Energy Research Center, Department of Energy, located near Rock Springs, Wyoming. All waters, soils, and sediments will be supplied by personnel of the Laramie Energy Research Center.

The proposed investigation will directly study only the chemical and physical aspects of soil-wastewater interactions. Also, the sorptive properties of unconsolidated soils and sediment sampled at land surface will be characterized by running adsorption isotherms by the batch process of both fractionated and unfractionated wastewater using dissolved organic carbon to quantify the organic solute concentration. The fractionation procedure (Leenheer and Huffman, 1976) typifies the sorptive interactions of the organic solutes into six characteristic fractions.

PROGRESS AND SIGNIFICANT RESULTS: Interactions between soil and retort waste water were evaluated, and waste water was found to extract both the sesquioxide and organic coatings from soil particles. Soil sorbs organic base solute fractions perferentially to organic acid fractions from retort water, which is the reverse order for processed shale as the sorbent. A first-order soil survey was conducted at an in-situ oil-shale retorting site near Rock Springs, Wyoming to aid in evaluating soil-retort water interactions. A significant finding in retort-water chemistry was the discovery of high concentrations of thiocyanate, which is especially toxic to plants.

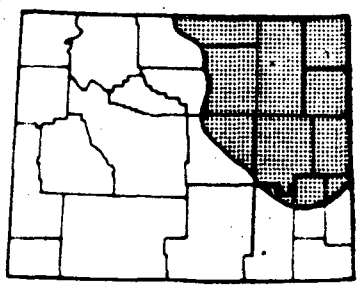
PLANS FOR FISCAL YEAR 1979: The main effort will center on soil-retort water interactions. Soil columns will be constructed in the laboratory and retort water will be applied. A similar study will apply retort water to soil at a field site, and leachate samples will be collected at various depths in the soil profile. Changes in organic, inorganic, and trace-metal solute composition will be evaluated. The main effort in water chemistry will center on the determination of the organic bases in retort water by liquid chromatography. This class of compounds presents the greatest environmental hazard because of mutagenic and carcinogenic properties.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Leenheer, J.A. and Huffman, E.W.D., Jr., 1976, Classification of organic solutes in water by using macroreticular resins: Journal Research U.S. Geological Survey, v. 4, no. 6, p. 737-751.

Stuber, H.A., and Leenheer, J.A., 1978, Fractionation of organic solutes in oil shale retort waters for studies on processed shale: Preprints, American Chemical Society, Division of Fuel Chemistry, v. 23, no. 2, p. 165-174.

PROJECT TITLE: Hydrology of the Madison Limestone and associated rocks in parts of Montana, North Dakota, South Dakota, and Wyoming (CR 76-192).



COOPERATING AGENCY: None.

PROJECT LEADER: Elliot M. Cushing. (Lakewood, Colorado)

FIELD LOCATION: Northeastern Wyoming, southeastern Montana, southwestern North Dakota, and northwestern South Dakota.

PERIOD OF PROJECT: December 1975 to September 1980.

PROBLEM: Major development of coal within the area will place a heavy demand on the area's limited water resources. The surface water is poorly distributed in time and space. It is fully appropriated in part of the area, and in the rest of the area its use will require storage reservoirs and distribution systems. Preliminary studies indicate that the Madison Limestone and associated rocks might provide a significant percentage of the total water requirements for coal development. However, the effects of large sustained withdrawals of water from these rocks on the hydrologic system are not known.

OBJECTIVE: The quantity of water that may be available from the Madison will be evaluated, the chemical and physical properties of the water defined. The effects of existing developments on potentiometric head, storage, recharge and discharge, spring flow and streamflow, and pattern of groundwater flow will be determined. Possible hydrologic effects of proposed withdrawals of water for large-scale developments at selected rates and locations will be predicted. Better locations for wells will be determined and also the type of construction and development of deep wells to obtain optimum yields. A network of observation wells and streamflow gages will be designed to monitor effects of additional developments on the hydrologic system.

APPROACH: Available geologic and hydrologic data, prior studies, and oil company information will be compiled and evaluated. Borehole and surface geophysical information and other pertinent data will be purchased from oil companies. Structure and stratigraphy will be defined, and aquifer boundaries and geologic parameters that control permeability will be determined. These parameters will be translated into hydrologic terms. A test-drilling program will be designed and the aquifer will be drilled and tested. The preliminary digital simulation model of the system will be refined, and a monitoring network will be designed. Predictions will be made about the possible effects of various patterns of water-supply development on potentiometric surface, recharge, discharge, springs, streamflow, and water quality. The monitoring network will be operated and the predictions will be refined.

PROGRESS AND SIGNIFICANT RESULTS: Tectonic and structure analysis of Madison Group and associated rocks was continued and preliminary structure and lithofacies maps were prepared. The geochemical and subsurface geophysical studies were continued. Water-temperature and Rwa maps for Red River Formation, Madison Limestone, and Minnelusa Formation were completed. Drilling of Madison Limestone test well 3 was begun and at the end of the fiscal year the top of the Madison was reached at a depth of 4,300 feet. A preliminary test indicated that the shut-in head of the Madison at the test site is more than 1,000 feet above the land surface.

PLANS FOR FISCAL YEAR 1979: Drilling, coring, and preliminary testing of Madison Limestone test well 3 was completed. Selected zones in at least one of the three Madison test wells may be acidized to determine the effect of acid treatment on the yields of water from these zones. The geological and geochemical studies will be completed and reports relating to these studies will be prepared. A large-scale digital model of the geohydrologic section from the top of the Madison to the top of the Precambrian will be developed, and an attempt will be made to verify it with existing water-level data. The model will be refined as input data from the Northern Great Plains RASA (Regional Aquifer System Analysis) become available, and the model will be used as a predictive tool for various alternatives of ground-water development.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

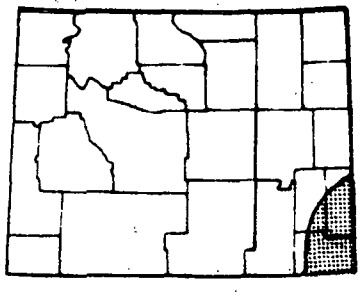
Brown, D. L., Blankennagel, R. K., Busby, J. F., and Lee, R. W., 1977, Preliminary data for Madison Limestone test well 2, SE¼SE¼ sec.18, T.1 N., R.54 E., Custer County, Montana: U.S. Geological Survey Open-File Report 77-863, 135 p.

Cushing, E. M., and Brown, D. L., 1978, The Madison Aquifer Study: Duplicated by authors as a preprint, American Society of Civil Engineers National Convention, Pittsburgh, Pennsylvania, April 27-28, 1978, 11 p.

Brown, D. L., 1978, Wrench-style deformational patterns associated with a meridional stress axis recognized in Paleozoic rocks in parts of Montana, South Dakota, and Wyoming: Montana Geological Society, 24th Annual Conference, 1978, Williston Basin Symposium, p. 17-31.

Peterson, J. A., 1978, Subsurface geology and porosity distribution, Madison Limestone and underlying formations, Powder River Basin, northeastern Wyoming and southeastern Montana, and adjacent areas: U.S. Geological Survey Open-File Report 78-783, 9 p., 21 figs.

PROJECT TITLE: High Plains regional aquifer-system analysis (CR 78-229).



COOPERATING AGENCY: None.

PROJECT LEADER: John B. Weeks. (Lakewood, Colorado)

FIELD LOCATION: Southeastern Wyoming, south-central South Dakota, Nebraska, eastern Colorado, western Kansas, western Oklahoma, western Texas, and eastern New Mexico.

PERIOD OF PROJECT: Fiscal years 1978 through 1982.

PROBLEM: The High Plains is a discontinuous upland area of about 150,000 mi2 extending from southern South Dakota to western Texas and eastern New Mexico. The Ogallala Formation is the principal aquifer underlying the High Plains, which includes about 23 percent of the irrigated land in the United States. The aquifer contains on the order of 2 billion acre-ft of water in storage; but, water is being withdrawn for irrigation in excess of the rate of natural replenishment. The economic future of the High Plains and the surrounding region in eight states (Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming) is heavily dependent upon the capacity of the aquifer to sustain withdrawals.

Several water-management options have been proposed, including those (1) to extend the life of the aquifer by artificial recharge, more efficient soil and water-management practices, and limiting annual withdrawal; (2) to supplement the water in the region by weather modification and water importation; and (3) to allow unrestricted water use. Local, regional, and National interests are vitally concerned about the future of the ground-water supply and its impact on the economy of the region. A comprehensive knowledge of the hydrologic system of the High Plains is required so that water-management alternatives can be evaluated and the economic life of the aquifer can be projected.

OBJECTIVE: The objectives of the study of the High Plains aquifer system are (1) to describe the water resource and the operation of the hydrologic system; (2) to develop a regional water-resources (and related) data storage and retrieval system; (3) to design and develop a digital computer model (or models) of the High Plains aquifer system; and (4) to evaluate selected ground-water management alternatives to demonstrate the applicability of the model (or models) and provide a hydrologic basis for the economic evaluation of management alternatives.

APPROACH: The objectives of the study will be accomplished through (1) the assembly, compilation, and analysis of existing data; (2) the collection and analysis of data designed to provide information on parameters for which data are lacking; and (3) the development of computer models. Data collection networks will be initiated in those areas where existing networks are inadequate to quantitatively describe the hydrology of the High Plains. The data compiled and collected will become part of a computerized data-management system which will provide a hydrologic (and related) data file for the entire High Plains region.

The purpose of the computerized data file is twofold. First, the data file will provide all input data necessary for the development of a regional model of ground-water flow in the High Plains aquifer system. Second, the data file will provide all users with hydrologic and related data on a scale suitable for local interpretation and modeling. The data-management file will be maintained on the U.S. Geological Survey computer at National Headquarters (possibly within System 2000) to provide maximum accessibility to the file. It is intended that the data file will be periodically updated and maintained for water-resource management purposes beyond the life of this High Plains aquifer study.

Information for several of the hydrologic parameters needed for modeling is not available in adequate detail to provide regional and (or) historical variations in the value of the parameter. This is particularly true of recharge, pumpage, and specific yield data. For these and other parameters where data are sparse or nonexistent, special investigations will be planned and executed to develop the necessary data or estimation techniques to regionalize the data.

Water-level, pumpage, and recharge records are the primary data sets for which historical data must be developed. It is anticipated that water-level records are generally adequate to describe the historical water-level changes in the Ogallala aquifer. However, it is expected that adequate data are not available to describe historical pumpage or recharge for the aquifer. Existing data collection networks for both water levels and pumpage will be reviewed, revised, and expanded as necessary to provide an accurate and extensive data base for the future. Particular emphasis will be placed on developing a monitoring network for determining annual pumpage and consumptive use.

Data on the regional variation of specific yield are not available and will have to be developed during this study. It is anticipated that several methods for estimating specific yield will be funded and studied by this project. The methods will include both field and computer model studies.

The primary product of this project is a computer model of the High Plains aquifer system capable of predicting the future state of the aquifer system given knowledge of the future stress. It is intended that this model will become a ground-water management tool to aid regional, state, and local planners in assessing the impact of management alternatives on the hydrologic and economic future of the aquifer system. The model (or models) will be developed and tested during this study and used to evaluate selected ground-water management alternatives to demonstrate the applicability of the model.

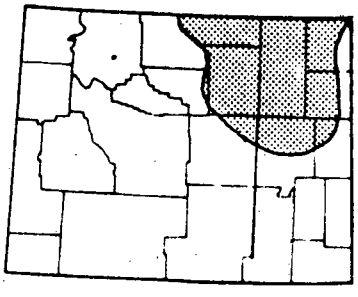
PROGRESS AND SIGNIFICANT RESULTS: A plan of study was developed and published. Project offices were established and staffed in each of the eight states in the study area. The objectives of the study were established and responsibilities defined for each of the project offices. Review, compilation, and analysis of existing geologic, hydrologic, and water-quality data were started. Design of a computerized data-base management system for storage and retrieval of regional data was initiated.

PLANS FOR FISCAL YEAR 1979: The compilation and analysis of existing data will continue and additional data needs will be defined. Development of the data-base management system will be completed and existing data stored. Regional hydrologic maps will be prepared.

REPORTS PUBLISHED DURING FISCAL YEAR 1978:

Weeks, J.B., 1978, Plan of study for the High Plains Regional Aquifer-System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming: U.S. Geological Survey Water-Resources Investigations 78-70, 32 p.

PROJECT TITLE: Northern Great Plains regional aquifer assessment (CR 78-230)



COOPERATING AGENCY: None.

PROJECT LEADER: George A. Dinwiddie. (Lakewood, Colorado)

FIELD LOCATION: Northeastern Wyoming, eastern Montana, western North Dakota, and northwestern South Dakota.

PERIOD OF PROJECT: Fiscal years 1978 through 1980.

OBJECTIVE: Objectives of the program to assess the availability of water in the Northern Great Plains are those recommended by the National Water Commission in 1973 in its final report sponsored by the United States Congress, with priorities given to those with falling water tables and deteriorating water quality, are to determine: (1) Aquifer boundaries, thickness, saturation, and transmissivity; (2) the suitability of overlying land and wells for artificial recharge programs; (3) depth of water, quality and temperature of water; (4) the storage capacity at various ground-water levels; (5) the source of pollutants found in the aquifer; (6) natural discharge from the aquifer, principal withdrawals, sources and amounts of recharge, anticipated yields, and the effect of pumping on surface supplies; (7) the extent of past ground-water mining and the estimated economic life of the aquifer under various assumptions as to rates of withdrawal; and (8) the susceptibility of the aquifer to operation and management on a "sustained yield" basis.

APPROACH: The first 9 months of the study is designated for collection of existing geologic, hydrologic, and geochemical data. Report outlines will also be prepared the first year, after data compilation is underway.

Drilling, geophysical logging, and testing in test holes is scheduled for late fiscal year 1978, all of fiscal year 1979, and early fiscal year 1980. This phase of the study is delayed to allow adequate time to select drilling sites and to prepare contracts for bid. The large expenditures for drilling, logging, and testing are distributed over all 3 fiscal years of the project in order to effectively utilize the funds budgeted for each fiscal year. Testing includes hydraulic testing in zones isolated by packers, and coring for lab tests; including hydraulic and elastic measurements. Water-quality sampling and analysis from each aquifer penetrated by the test holes is also part of testing.

Preliminary design of simulation models is scheduled to begin the second half of fiscal year 1978, in order to design the framework of the models, to ascertain needed data for models, and to conduct preliminary simulation of hydrologic systems.

Additional data collection beginning in late fiscal year 1978 includes well and spring inventory, aquifer testing, and gain-and-loss studies. Well and spring inventory are needed in the remote parts of the area to provide data on the potentiometric surface, water quality, water use and discharge, and to identify wells suitable for further testing. Aquifer testing of existing wells will continue for a large part of the project duration in order to obtain data needed for modeling and analytical calculations. Gain-and-loss studies in selected streams are needed in order to identify areas of natural recharge by streams, and discharge to streams for exposed aquifers. Repetitive measurements through a 21-month period permit calculation of rates of recharge and discharge.

Preparation of geologic, hydrologic, and geochemical maps begins in late fiscal year 1978 and continues to the middle of fiscal year 1980. Resulting maps will be published in technical reports and provide input data for hydrologic models, geochemical models, and water-management analyses. Geologic maps include structure-contour maps, tectonic maps, and lithofacies maps. Hydrologic maps include saturated thickness, potentiometric surface, transmissivity, and storage. Geochemical maps include water type as related to flow systems, pollution, and special studies, as needed.

A series of professional papers is proposed to describe results of each project. Chapters of each professional paper would cover the geology, configuration, tectonics, hydrology, and geochemistry of each project. A combined report on modeling of the Madison and Northern Great Plains projects is planned in order to describe multilayered system analysis. The modeling report would describe hydrologic and geochemical modeling, including analysis of water-management alternatives.

A preliminary coarse-mesh simulation model will be prepared beginning in fiscal year 1979. The model is proposed to include the following areas: Williston Basin; Power River Basin; Hogeland Basin and north-central Montana; and Bull Mountains Basin. The model will integrate all data and simulate the flow systems, including water quality as related to the flow systems. Carefully prepared and calibrated models will be prepared during fiscal year 1979 and fiscal year 1980. The models form the basis for later water-management studies.

Water-management alternatives will be appraised late in fiscal year 1979 and during most of fiscal year 1980. The effects of normal use, drouth, and coal mining on the aquifers, water quality, and land surface will be simulated. Schemes to improve water use will be designed and tested using the simulation models and techniques of systems analysis.

PROGRESS AND SIGNIFICANT RESULTS: A plan of study was written and is in review. An exploratory hole in the Powder River Basin was drilled, tested and sampled. Several staff members were acquired in District and Project offices. Preparation of the data base was started, and special studies were initiated.

PLANS FOR FISCAL YEAR 1979: Existing data will be assembled and a plan for further data collection made. Staffing in District and Project offices will be completed. Basic data will be entered into the computer data file. Studies of the regional geologic framework, geochemistry, and potentiometric surfaces will continue.

REPORTS PUBLISHED DURING FISCAL YEAR 1978: None.

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-0-681-063/40