WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1983

Compiled By S. L. Green

U. S. Geological Survey

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UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

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Wyoming Highway Department
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Conversion factors

Inch-pound units used in this report may be converted to metric units by the following conversion factors:

Multiply	By	To obtain
foot (ft)	0.3048	meter
acre	4,047	square meter
acre-foot (acre-ft)	1,233	cubic meter
gallon per minute (gal/min)	0.06308	liter per second

Metric units used in this report may be converted to inch-pound units by the following conversion factors:

Multiply	By	To obtain
meter	3.281	foot
hectare (ha)	2.471	acre
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
cubic meter (m^3)	35.31	cubic foot
cubic hectometer (hm^3)	810.7	acre foot
cubic decimeter per second (dm^3/s)	15.85	gallon per minute

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ABSTRACT

This report contains lists and location maps of streamflow and reservoir stations, crest-stage partial-record stations, water-quality stations, sediment stations, and ground-water observation wells where data are currently being collected. Water-resources appraisal projects in Wyoming are described, including many that are related to development of energy resources. The general locations of the projects are shown on maps. The U.S. Geological Survey is striving to coordinate its water-resources investigations with those of other agencies. This report is one phase of that coordination effort, and serves as an annual progress report to cooperators and the public.

INTRODUCTION

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. Through its Water Resources Division, the Survey 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 to help evaluate or solve regional and local water problems. Results of its investigations provide a basis for many major public water-management decisions.

The Geological Survey, in cooperation with the State of Wyoming, the City of Buffalo, and other Federal agencies had five data-collection activities and 39 water-resources appraisal projects in Wyoming during fiscal year 1983 (October 1, 1982, through September 30, 1983).

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

Water-resources appraisal projects described in the report include the projects that were being conducted during fiscal year 1983 and projects completed in previous fiscal years, but for which final reports were in preparation at the end of fiscal year 1983.

The purpose of this report is to describe the water-resources investigations 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 1982 (October 1, 1981, through September 30, 1982) and planned work for fiscal year 1983. It is one phase of an effort to coordinate the water-resources investigations of the 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 ***."[1] The Water Resources Division of which the Wyoming District is a part, has its roots in the Irrigation Survey of 1888-1890.

There was no Wyoming District in 1888, when the Washington, D.C. office of the Geological 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 Geological Survey paid operating expenses for additional stations operated by the State Engineer. A. J. Parshall became the first resident hydrographer for the Geological Survey in Wyoming in 1901. For the next six years there was no cooperative work with the State, but 11 stations were operated with Geological Survey and Reclamation Service funds. By 1912 the Geological 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 Geological Survey to use any part of the State's 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 Geological 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 Geological Survey plans. The Bureau also did field work at Geological Survey stations in the area; in return the Geological 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 Colorado 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 Geological Survey in Wyoming were done between 1901 and 1917 by G. I. Adams in the Goshen Hole area; N. H. Darton and others in the Great Plains, Bighorn Mountains, Laramie Range,

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[1] U.S. Statutes at Large 1887-89, The Sundry Civil Appropriations Act of 1888: Washington, v. 25, chap. 1069, p. 526.

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. A number of ground-water studies in that part of Wyoming that lay in the Missouri River Basin was conducted by the staff of the Montana Ground Water District during 1945-53 with funds made available under the Missouri River Basin (MRB) program. From 1949 to 1953, most of this work was done from a Montana District field office at Riverton, Wyo. From 1954 through its termination in 1959, the MRB ground-water program in Wyoming was accomplished through the District office in Cheyenne. Ground-water work for other Federal agencies has also included measurements of discharge and power consumption for the Rural Electric Association (REA) in 1941, and a continuous series of studies of Yellowstone and Grand Teton National Parks for the National Park Service starting in the early 1960's and ending in 1982.

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 and sediment laboratory in Worland in March 1946, with T. F. Hanly in charge. The program was directed by P. C. Benedict, Regional Engineer, in Lincoln, Nebr. In 1948, chemical quality or sediment stations were in operation at 16 sites in the Bighorn Basin and 5 sites in the North Platte River basin under the Department's Missouri River Basin program. By 1953, the program included 39 chemical-quality stations and 42 sediment stations.

In February 1956 the office in Worland was designated as 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 cooperative 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 was established in Worland in 1946 when the office was opened. In September 1982 the Worland office was closed and the sediment-laboratory function was transferred to Iowa City, Iowa. In recent years the lab served the Montana, North Dakota, and Alaska Districts, as well as the Wyoming District. The chemical laboratory was moved from Worland to Cheyenne in 1969 and was immediately downgraded because of the establishment of the Water Resources Division Central Laboratory in Salt Lake City. (The Central Laboratory was later moved to Denver, Colorado.) 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 cooperative program with the Wyoming Department of Agriculture.

The Branch districts were combined into a single Water Resources Division 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.

The District staff had increased from approximately 40 employees in 1973 to approximately 75 by 1980. In 1981 and 1982, however; energy-related programs decreased significantly due to reductions in Federal funds. Today the District has approximately 50 employees, with field offices in Casper, Green River, Riverton, and Buffalo. (The field office in Buffalo was closed September 1983). Approximately two-thirds of the funding is for work in cooperation with other agencies, and one-third is for participation in the Survey's energy programs, regional aquifer-system assessments, and other Geological Survey national programs. Reconnaissance and inventory studies have given way to problem-oriented, multi-disciplinary studies and increased use of digital models. Major water-resources problems now being addressed by Wyoming District programs include the hydrology of energy-minerals areas, the hydrologic effects of energy development, the effects of human activities on water quality, and the availability of ground water to meet the rapidly increasing demands of agriculture and industry.

Water Resources programs have been directed by the following supervisors located in Wyoming:

Surface Water Branch: (Cheyenne)	Leon A. Wiard (District Engineer)	10/61 - 2/67
Ground Water Branch: (Cheyenne)	Horace M. Babcock (District Geologist)	10/51 - 1/58
	Ellis D. Gordon (District Geologist)	2/58 - 2/67
Quality of Water Branch: (Worland)	Thomas F. Hanly (District Chief)	2/56 - 2/67
Water Resources Division: (Cheyenne)	District Chiefs	
	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 - 8/82
	Richard M. Bloyd	2/83 - present

DISTRICT AND FIELD HEADQUARTERS OFFICE ADDRESSES

Inquiries regarding projects described in this report may be directed to the District Office or Field Headquarters in which the work originated.

Wyoming District Office

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2120 Capitol Avenue
P.O. Box 1125
Cheyenne, WY 82003
(307) 772-2153
FTS 328-2153

Field Headquarters

9 Spruce Street
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

215 N. Lincoln Street
Casper, WY 82601
(307) 261-5485
FTS 328-5485

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

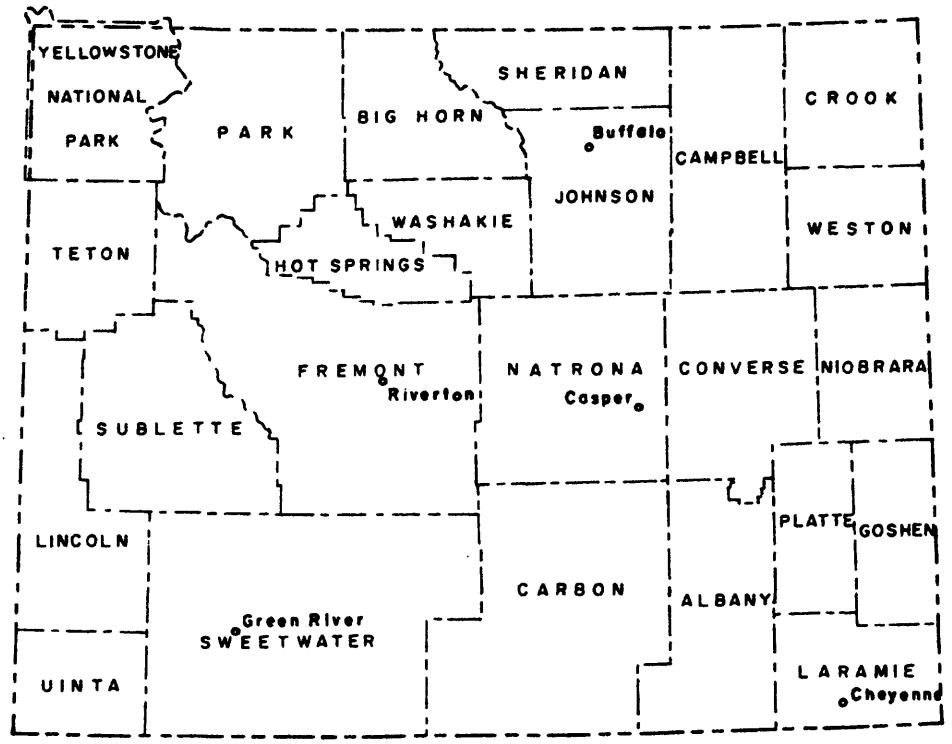

Figure 1.--Location of offices in Wyoming.

WYOMING DISTRICT ORGANIZATION CHART

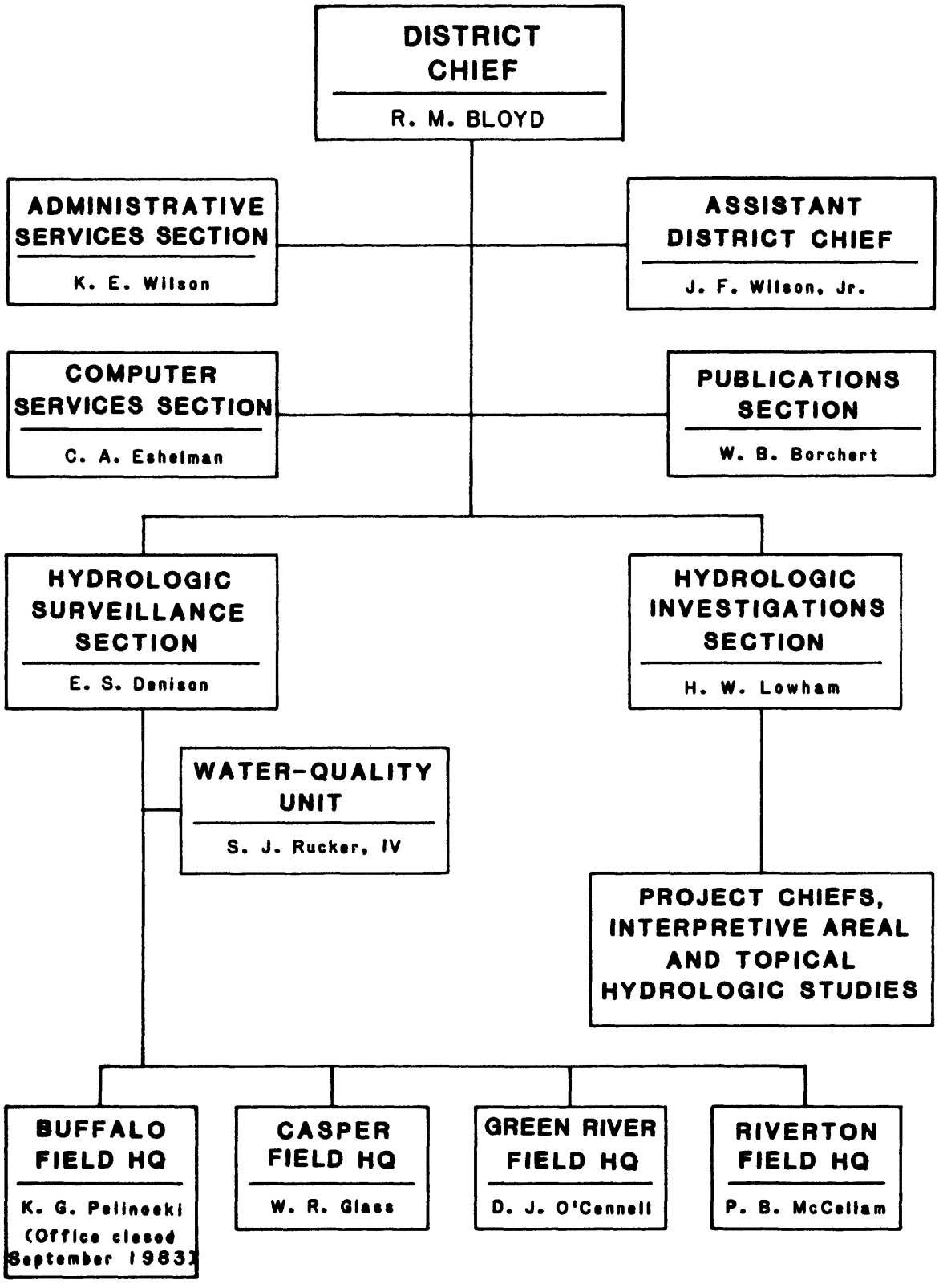

Figure 2.

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:

Mailing List Unit
U.S. Geological Survey
582 National Center
Reston, VA 22092

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Eastern Distribution Branch
Text Products Section
U.S. Geological Survey
604 South Pickett Street
Alexandria, VA 22304

Water-Resources Investigations reports published prior to May 1982 and annual Water Resources Data reports for Wyoming may be purchased from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Water-Resources Investigations reports and open-file reports from Wyoming are available for inspection at the Wyoming District Office. Water-Resources Investigations reports published after May 1982 and selected open-file reports may be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, CO 80225

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

Hydrologic-Investigations Atlases and geologic, topographic, and other maps may be purchased from:

Western Distribution Branch
U.S. Geological Survey
Box 25286, Federal Center
Denver, CO 80225

Additional information on Geological Survey products and sources where they may be obtained is given in "A Guide to Obtaining Information from the U.S. Geological Survey, 1982," Geological Survey Circular 777, available without cost from either the Eastern or Western Distribution Branches.

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

Water Resources Division
U.S. Geological Survey
440 National Center
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
950 National Center
Reston, VA 22092
Telephone: (703) 860-6671

DATA-COLLECTION SITES

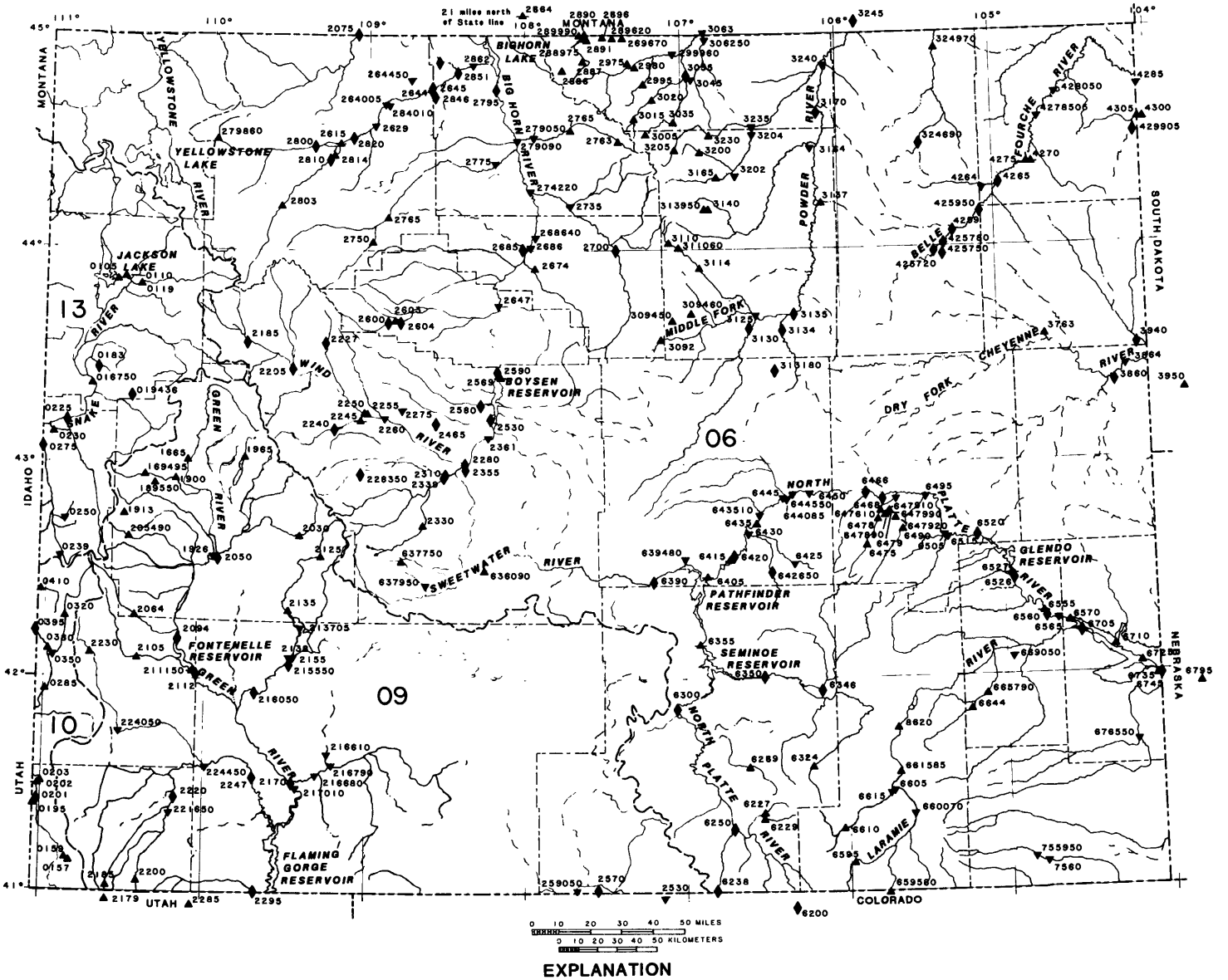
Lists of data-collection sites and the kinds of hydrologic data being collected at each are given as follows: Table 1, streamflow and reservoir stations; table 2, crest-stage partial-record stations; table 3, water-quality stations; table 4, sediment stations; and table 5, ground-water observation wells.

The station numbers for the stations listed in tables 1-4 conform with the standard downstream order for listing stations within each major river basin. The first two digits of the assigned eight-digit number, such as 06207500, identifies the major river basin in which the stream resides. The digits '06' refer to the Missouri River Basin. The remaining six digits identify the relative position of the station, with numbers increasing in the downstream direction. The section, township, and range location of each data station is given in the tables.

The well numbers listed in table 5, ground-water observation wells, are based on the U.S. Land Grant System. A detailed explanation of this system can be found on the page preceding table 5. The wells are listed in numerical order by counties.

Abbreviations and codes are used to conserve space in the tables. Explanations of the abbreviations and codes precede each table.

The locations of streamflow, reservoir, water quality and sediment stations are shown in figure 3. The locations of crest-stage partial-record stations and ground-water observation wells are shown in figure 4. The station numbers on the maps are abbreviated by not showing the two-digit basin number and the last two digits if zero.

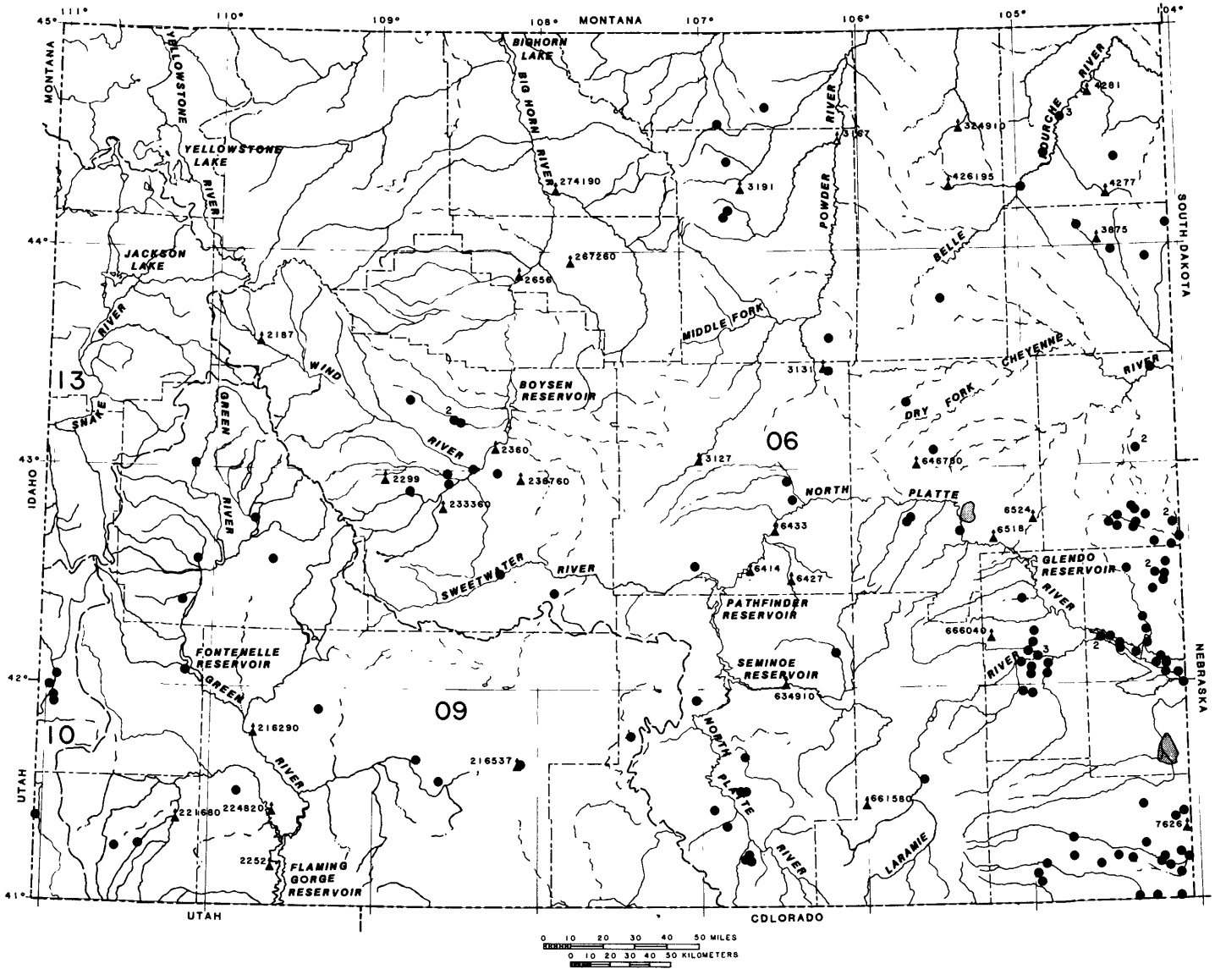


EXPLANATION

—— MAJOR DRAINAGE DIVIDE	10 BEAR RIVER BASIN	▼2530 WATER-QUALITY AND (OR) SEDIMENT STATION AND NUMBER	
06 MISSOURI RIVER BASIN	13 SNAKE RIVER BASIN	♦6238 STREAMFLOW AND WATER-QUALITY AND (OR) SEDIMENT STATION AND NUMBER	
09 GREEN RIVER BASIN	▲2265 STREAMFLOW STATION AND NUMBER	▲6355 RESERVOIR STATION AND NUMBER	

Station numbers are abbreviated by not showing two-digit basin number and last two digits if zero.

Figure 3.—Map showing locations of streamflow, reservoir, water-quality, and sediment stations, 1983 water year.



EXPLANATION

- MAJOR DRAINAGE DIVIDE
- 09 GREEN RIVER BASIN
- 13 SNAKE RIVER BASIN
- ●² GROUND-WATER OBSERVATION WELL--Number indicates how many wells are represented by the symbol if more than one.
- 06 MISSOURI RIVER BASIN
- 10 BEAR RIVER BASIN
- ▲2252 CREST-STAGE PARTIAL-RECORD STATION AND NUMBER
- AREA WHERE WELLS ARE TOO CLOSE TOGETHER TO SHOW INDIVIDUALLY

Station numbers are abbreviated by not showing two-digit basin number and last two digits if zero.

Figure 4.—Map showing locations of crest-stage partial-record stations and ground-water observation wells.

Table 1.--Streamflow and Reservoir 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. Periods of no record of less than a year are not shown.

Gage equipment:

- D digital recorder
- G graphic recorder
- M manometer gage
- S staff gage
- W well gage

Current record type:

- S seasonal operation (no winter records)
- Y full-year operation

Field office:

- B Buffalo
- C Casper
- CO Colorado District
- CP Cheyenne Project Personnel
- GR Green River
- ID Idaho District
- MT Montana District
- NE Nebraska District
- R Riverton
- S Wyoming State Engineer
- SD South Dakota District
- UT Utah District

Funding agency:

- BIA Bureau of Indian Affairs
- BLM Bureau of Land Management
- BRUC Bureau of Reclamation, Colorado Region
- BRUM Bureau of Reclamation, Upper Missouri Region
- BU City of Buffalo
- CE Corps of Engineers
- DEPD Wyoming Department of Economic Planning and Development
- MRB Geological Survey, Missouri River Basin Program
- NPS National Park Service
- USE Utah State Engineer
- USGS Geological Survey, Federal Program
- WDEQ Wyoming Department of Environmental Quality
- WSE Wyoming State Engineer
- WWDC Wyoming Water Development Commission

Remarks:

- AWG auxilary well gage
- HBM hydrologic benchmark station
- USBR furnished by Bureau of Reclamation

Table 1.--Streamflow and reservoir stations

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
YELLOWSTONE RIVER BASIN												
*06207500	Clarks Fork Yellowstone River near Belfry, Mont.	C	1,154	1921-	32	9S	22E	--	Y	MT	--	
*06218500	Wind River near Dubois	C	232	1945-	25	42N	108W	D,W	Y	R	WSE	
*#06220500	East Fork Wind River near Dubois	C	427	1950-57, 1975-	34	6N	6W	G,M	Y	R	MRB, BIA	
*06222700	Crow Creek near Tipperary	H	30.2	1962-	20	7N	4W	G,M	Y	R	MRB	
*06224000	Bull Lake Creek above Bull Lake	H	187	1941-53, 1966-	2	2N	4W	D,W	Y	R	MRB	
06224500	Bull Lake near Lenore	C	210	1938-	30	3N	2W	--	--	--	MRB, BRUM	USBR
06225000	Bull Lake Creek near Lenore	C	213	1918-	17	3N	2W	D,G,M	Y	R	BRUM	
06225500	Wind River near Crowheart	C,P	1,891	1945-	16	3N	2W	D,G,W	Y	R	BRUM	
*06228000	Wind River at Riverton	C,R	2,309	1906-08, 1911-	2	1S	4E	D,G,M	Y	R	CE	
*06228350	South Fork Little Wind River above Washakie Reservoir, near Fort Washakie	H	90.3	1976-	18	1S	2W	D,W	Y	R	BIA	
*06231000	Little Wind River above Araphaoe	C	660	1979-	23	1S	3E	D,M	Y	R	BIA	
06233000	Little Popo Agie River near Lander	C	125	1946-	27	32N	99W	G,W	S	S	WSE	
*06233900	Popo Agie River near Arapahoe	C	--	1979-	27	1S	3E	D,M	Y	R	BIA	
*06235500	Little Wind River near Riverton	C,R	1,904	1941-	11	1S	4E	D,W	Y	R	CE	
*06246500	Ocean Drain at Ocean Lake outlet, near Pavillion	C	--	1948-53, 1978-	31	3N	3E	D,W	Y	R	BRUM	
*#06253000	Fivemile Creek near Shoshoni	C	418	1941-42, 1948-	19	3N	6E	G,M	Y	R	BRUM	
*#06258000	Muddy Creek near Shoshoni	C	332	1949-68, 1972-	34	4N	5E	G,M	Y	R	BRUM	
06258900	Boysen Reservoir	C	7,700	1951-	16	5N	6E	--	--	--	MRB	USBR
*#06259000	Wind River below Boysen Reservoir	C,R	7,701	1951-	9	5N	6E	D,M	Y	R	BRUM	
*06260000	South Fork Owl Creek near Anchor	C,H	85.5	1932, 1939-43, 1959-	28	43N	100W	G,M	Y	R	BRUM	
06260300	Anchor Reservoir	C	131	1960-	26	43N	100W	--	--	--	MRB	USBR
*06260400	South Fork Owl Creek below Anchor Reservoir	C,R	131	1959-	25	43N	100W	G,W	Y	R	BRUM	
06267400	East Fork Nowater Creek near Colter	H	149	1971-	31	46N	92W	G,M	Y	R	WSE	
#06268500	Fifteenmile Creek near Worland	C	518	1951-72, 1978-	27	47N	93W	G,M	Y	R	WDEQ	

* Also water-quality station.
\# Also sediment station.

Table 1.--Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
YELLOWSTONE RIVER BASIN--Continued												
*06270000	Nowood River near Tensleep	P	803	1938-43, 1950-55, 1972-	27	47N	88W	D,G,M	Y	R	WSE	
06275000	Wood River at Sunshine	C,H	194	1945-	15	47N	101W	G,M	Y	R	WSE	
06276500	Greybull River at Meeteetse	C,P	681	1897, 1903, 1920-	4	48N	100W	D,G,M	S	S	WSE	
06278300	Shell Creek above Shell Reservoir	B,C,H	23.1	1956-	1	52N	88W	D,W	Y	R	WSE	
06278500	Shell Creek near Shell	C,H	145	1940-	17	53N	90W	G,W	S	S	WSE	
*#06279500	Bighorn River at Kane	C,R	15,765	1928-	9	55N	94W	G,M	Y	R	MRB	
06279850	Middle Creek at East Entrance, Yellowstone National Park	C	32.6	1981-	--	--	--	D,M	Y	R	NPS	
*06280000	North Fork Shoshone River near Wapiti	C,H	775	1921-26, 1979-	15	52N	104W	G,M	Y	R	MRB	
06280300	South Fork Shoshone River near Valley	B,H	297	1956-	24	49N	106W	D,W	Y	R	USGS	
*06281000	South Fork Shoshone River above Buffalo Bill Reservoir	P	585	1903, 1905-08, 1921-26, 1973-	33	52N	103W	G,M	Y	R	WSE	
06281400	Diamond Creek near mouth, near Cody	C	7.34	1981-	29	52N	102W	S	Y	R	MRB	
06281500	Buffalo Bill Reservoir	C	1,498	1909-	12	52N	103W	--	--	--	MRB	USBR
*06282000	Shoshone River below Buffalo Bill Reservoir	C,R	1,538	1921-	3	52N	102W	D,W	Y	R	BRUM	
*06284500	Bitter Creek near Garland	C	80.5	1950-53, 1957-60, 1968-	75	5N	97W	D,W	Y	R	MRB	
*06284800	Whistle Creek near Garland	C	101	1958-60, 1968-	30	55N	97W	G,M	Y	R	MRB	
*06285100	Shoshone River near Lovell	C,R	2,350	1966-	16	56N	96W	G,M	Y	R	MRB	
*06285400	Sage Creek at Sidon Canal, near Deaver	C	341	1958-60, 1968-	34	57N	97W	G,M	Y	R	MRB	
06286400	Bighorn Lake near St. Xavier, Mont.	C	19,626	1965-	18	6S	31E	--	--	--	MRB	USBR
06288600	Little Bighorn River below Dayton Gulch, near Burgess Junction	C	15.9	1983-	12	56N	91W	D,G,M	Y	B	WWDC	
06288700	Dry Fork Little Bighorn River below Lick Creek, near Burgess Junction	C	54.1	1983-	28	57N	89W	D,G,M	Y	B	WWDC	
06288975	Elkhorn Creek above Fuller Ranch Ditch, near Parkman	C	4.58	1983-	21	58N	89W	D,G,M	Y	B	WWDC	

* Also water-quality station.
\# Also sediment station.

Table 1. Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
YELLOWSTONE RIVER BASIN--Continued												
06288990	West Fork Little Bighorn River near Parkman	C	38.2	1983-	17	58N	89W	D,G,M	Y	B	WWDC	
06289100	Red Canyon Creek near Parkman	C	3.2	1983-	27	58N	89W	D,G,M	Y	B	WWDC	
06289600	West Pass Creek near Parkman	C	15.4	1983-	21	58N	88W	G,W	Y	B	WWDC	
06289820	East Pass Creek near Dayton	C	21.7	1983-	24	58N	88W	G,W	Y	B	WWDC	
06289870	Twin Creek near Parkman	C	27	1983-	22	58N	87W	G,W	Y	B	WWDC	
06297500	Highline Ditch near Dayton	C	--	1919-23, 1940-	11	56N	87W	G,W	S	B	WSE	
06298000	Tongue River near Dayton	B,C,H	204	1918-29, 1940-	11	56N	87W	D,W	Y	B	WSE	
06299500	Wolf Creek at Wolf	C,H	37.8	1945-	4	55N	86W	G,W	S	S	WSE	
06300500	East Fork Big Goose Creek near Big Horn	C,H	20.1	1953-	28	53N	86W	G,M	S	S	WSE	
06301500	West Fork Big Goose Creek near Big Horn	C	24.4	1953-	30	54N	86W	G,M	S	S	WSE	
06302000	Big Goose Creek near Sheridan	C	120	1929-	35	55N	86W	G,W	S	S	WSE	
06303500	Little Goose Creek in canyon, near Big Horn	C,H	51.6	1941-	1	53N	85W	G,W	S	S	WSE	
*06305500	Goose Creek below Sheridan	C	392	1941-	15	56N	84W	D,W	Y	B	WSE	
06309200	Middle Fork Powder River near Barnum	H	45.2	1961-	26	42N	86W	G,M	Y	C	WSE	
06309450	Beaver Creek below Bayer Creek, near Barnum	C	10.9	1974-	28	43N	85W	G,W	Y	C	WSE	
06309460	Beaver Creek above White Panther Ditch, near Barnum	C	24.2	1974-	16	43N	84W	G,W	Y	C	WSE	
06311000	North Fork Powder River near Hazelton	B,C,H	24.5	1946-	21	47N	85W	G,W	Y	B	WSE	
06311060	North Fork Powder River below Bull Creek, near Hazelton	C	32.3	1974-	25	47N	85W	G,M	Y	B	WSE	
06311400	North Fork Powder River below Pass Creek, near Mayoworth	C,H	100	1974-	36	46N	84W	G,M	Y	B	WSE	
*#06313000	South Fork Powder River near Kaycee	C	1,150	1911, 1938-40, 1950-69, 1978-80, 1983-	9	42N	81W	D,G,M	Y	B	BLM	
#06313180	Dugout Creek tributary near Midwest	H	.8	1974-	14	40N	80W	G,W	Y	CP	USGS	
*#06313400	Salt Creek near Sussex	C	769	1976-81, 1983-	8	42N	79W	G,M	Y	C	BLM	
*#06313500	Powder River at Sussex	C,P	3090	1938-40, 1950-57, 1977-	13	43N	79W	D,G,M	Y	C	USGS	

* Also water-quality station.
\# Also sediment station.

Table 1.--Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
YELLOWSTONE RIVER BASIN--Continued												
06313700	Dead Horse Creek near Buffalo	H	151	1971-	15	49N	77W	G,M	Y	B	WSE	
06313950	North Fork Crazy Woman Creek below Pole Creek, near Buffalo	C,H	43.4	1973-	28	49N	83W	G,M	Y	B	DEPD	
06314000	North Fork Crazy Woman Creek near Buffalo	C,H	44.9	1942-49, 1973-	27	49N	83W	G,M	Y	B	DEPD	AWG
*#06317000	Powder River at Arvada	C,P	6,050	1919-	21	54N	77W	D,G,M	Y	B	WSE	
06318500	Clear Creek near Buffalo	C	120	1894, 1896-99, 1917-27, 1938-	6	50N	82W	G,W	Y	B	BU	
06320000	Rock Creek near Buffalo	C,R	60.0	1941-	29	52N	83W	G,W	S	S	WSE	
06320500	South Piney Creek at Willow Park	C,R	33.6	1945-57, 1959-	24	52N	85W	G,W	S	S	WSE	
06323000	Piney Creek at Kearny	C,R	118	1902-06, 1910-17, 1919-23, 1940-	26	53N	83W	G,W	Y	S	WSE	
*#06324500	Powder River at Moorhead, Mont.	--	8,080	1929-72, 1974-	8	9N	48W	G,W	Y	MT	--	
*#06324890	Little Powder River below Corral Creek, near Weston	C,P	204	1977-	12	52N	72W	D,G,M	Y	B	USGS	
06324970	Little Powder River above Dry Creek, near Weston	P	1,235	1972-	13	57N	71W	D,G,M	Y	B	WSE	
CHEYENNE RIVER BASIN												
06376300	Black Thunder Creek near Hampshire	H	535	1972-	31	42N	65W	D,G,M	Y	C	WSE	
*#06386000	Lance Creek near Riverview	P	2,070	1948-54, 1956-	14	39N	62W	G,M,W	Y	C	USGS	
*06394000	Beaver Creek near Newcastle	B,P	1,320	1943-	18	41N	60W	D,G,W	Y	C	USGS	
*#06425720	Belle Fourche River below Rattlesnake Creek, near Piney	C	495	1975-	9	46N	71W	G,M	Y	B	USGS	
*#06425750	Coal Creek near Piney	C	71.8	1980-	12	46N	71W	D,G,M	Y	B	USGS	
*#06425780	Belle Fourche River above Dry Creek, near Piney	C	594	1975-	25	47N	71W	G,M	Y	B	USGS	
*#06425900	Caballo Creek at mouth, near Piney	C,R	260	1977-	4	47N	70W	D,G,M	Y	B	USGS	
*#06425950	Raven Creek near Moorcroft	C,H	76	1977-	1	48N	69W	D,G,M	Y	B	USGS	

* Also water-quality station.
\# Also sediment station.

Table 1.--Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
CHEYENNE-RIVER-BASIN--Continued												
*#06426500	Belle Fourche River below Moorcroft	C	1,670	1943-70, 1975-	24	50N	68W	G,M	Y	B	USGS	
06427000	Keyhole Reservoir near Moorcroft	C	2,000	1952-	27	51N	66W	--	--	--	MRB	USBR
06427500	Belle Fourche River below Keyhole Reservoir	C,R	2,000	1951-	21	51N	66W	G,M	Y	C	BRUM	
*06429905	Sand Creek near Ranch A, near Beulah	C	267	1976-	5	52N	60W	G,M	Y	SD	USGS	
06430000	Murray Ditch at Wyoming-South Dakota State line	C	--	1954-	7	7N	1E	G,W	Y	SD	WSE	
06430500	Redwater Creek at Wyoming-South Dakota State line	C,H	471	1929-31, 1936-37, 1954-	18	7N	1E	G,W	Y	SD	WSE	
NIOBRARA RIVER BASIN												
06454000	Niobrara River at Wyoming-Nebraska State line	B,C,H	450	1955-	15	31N	60W	D,W	Y	NE	--	
PLATTE RIVER BASIN												
*06620000	North Platte River at Northgate, Colo.	H	1,431	1904, 1915-	11	11N	80W	D,W	Y	C	USGS	
06622700	North Brush Creek near Saratoga	H	37.4	1960-	8	16N	81W	G,W	Y	C	WSE	
06622900	South Brush Creek near Saratoga	C	22.8	1960-74, 1976-	20	16N	81W	G,W	S	S	WSE	
*#06623800	Encampment River above Hog Park Creek, near Encampment	B,H	72.7	1964-	10	12N	84W	G,M	Y	C	USGS	HBM
*06625000	Encampment River at mouth, near Encampment	C,H	265	1940-	3	15N	83W	D,W	Y	C	WSE	
06628900	Pass Creek near Elk Mountain	C,H	91.5	1957-	27	19N	82W	G,M	Y	C	WSE	
*06630000	North Platte River above Seminoe Reservoir, near Sinclair	C,P	4,175	1939-	13	22N	86W	G,W	Y	C	WSE	
06632400	Rock Creek above King Canyon Canal, near Arlington	B,C,H	62.9	1965-	25	19N	79W	G,M	Y	C,S	WSE	
*06634600	Little Medicine Bow River near Medicine Bow	P	963	1973-	22	23N	78W	G,W	Y	C	WSE	
*06635000	Medicine Bow River above Seminoe Reservoir, near Hanna	C,P	2,338	1939-	34	24N	81W	G,W	Y	C	WSE	
06635500	Seminoe Reservoir near Leo	C	7,230	1939-	8	25N	84W	--	--	--	MRB	USBR

* Also water-quality station.
\# Also sediment station.

Table 1. Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
PLATTE RIVER BASIN--Continued												
06637750	Rock Creek above Rock Creek Reservoir	C,H	9.2	1962-	27	30N	100W	D,G,W	Y	R	WSE	
06638090	Sweetwater River near Sweetwater Station	P	849	1973-	12	29N	96W	G,M	Y	R	WSE	
*06639000	Sweetwater River near Alcova	C,P	2,327	1913-24, 1938-	25	29N	87W	G,W	S	S	WSE	
06640500	Pathfinder Reservoir near Alcova	C	10,711	1909-	24	29N	84W	--	--	--	MRB	USBR
06641500	Alcova Reservoir at Alcova	C	10,766	1938-	24	30N	83W	--	--	--	MRB	USBR
*#06642000	North Platte River at Alcova	C,R	10,812	1904-05, 1934-	17	30N	82W	D,W	Y	C	WSE	
*#06642650	Stinking Creek above Lawn Creek, near Alcova	C	91.8	1983-	18	29N	80W	G,M	Y	C	BLM	
06643500	North Platte River near Goose Egg	C	15,398	1917-19 1924,47, 1950-60, 1983-	22	32N	81W	D,G,M	Y	C	BLM	
*06646600	Deer Creek below Millar Wasteway, at Glenrock	C,H	213	1961-	4	33N	75W	G,M	Y	C,S	WSE	
*06646800	North Platte River near Glenrock	C,R	13,538	1959-	17	33N	74W	D,W	Y	C,S	WSE	
06647500	Box Elder Creek at Boxelder	H	63.0	1946-51, 1961-67, 1971-	32	31N	75W	G,W	Y	C	WSE	
06647800	Box Elder Creek near Boxelder	C	136	1981-	24	32N	75W	G,M	Y	C	DEPD	
06647810	Box Elder Creek at Converse County Park, near Careyhurst	C	138	1981-	6	32N	74W	D,W	Y	C	DEPD	
06647890	Little Box Elder Creek near Careyhurst	C	7.18	1974-	8	32N	74W	D,W	Y	C	DEPD	
06647900	Little Box Elder Creek at Little Box Elder Cave, near Careyhurst	C	8.47	1974-	9	32N	74W	G,W	Y	C	DEPD	
06647910	Little Box Elder Spring near Careyhurst	C	--	1981-	3	32N	74W	D,W	Y	C	DEPD	
06647920	Cottonwood Creek near Careyhurst	C	2.33	1981-	4	32N	74W	D,W	Y	C	DEPD	
06649000	La Prele Creek near Douglas	C	135	1919-	5	31N	73W	G,W	S	S	WSE	
*06652000	North Platte River at Orin	C,R	14,888	1895-99, 1917-18, 1924, 1958-	17	31N	69W	D,W	Y	C	WSE	
06652700	Glendo Reservoir near Glendo	C	15,545	1957-	24	29N	68W	--	--	--	MRB	USBR
*06652800	North Platte River below Glendo Reservoir	C,R	15,548	1957-	30	29N	67W	D,W	Y	C,S	WSE	
06655500	Guernsey Reservoir near Guernsey	C	16,224	1928-	27	27N	66W	--	--	--	MRB	USBR
*06656000	North Platte River below Guernsey Reservoir	C,R	16,237	1900-	27	27N	66W	D,M,W	Y	C,S	WSE	

* Also water-quality station.
\# Also sediment station.

Table 1. Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
PLATTE RIVER BASIN--Continued												
06657000	North Platte River below Whalen Diversion Dam	C,R	16,425	1909-	12	26N	65W	G,M	Y	C,S	WSE	
06659500	Laramie River and Pioneer Canal near Woods	C,R	434	1912-24, 1926-27,	36	14N	77W	G,W	S	S	WSE	
06659580	Sand Creek at Colorado-Wyoming State line	C	29.2	1968-	24	12N	75W	G,W	S	S	WSE	
06661000	Little Laramie River near Filmore	C,H	157	1902-03, 1911-26, 1932-	4	15N	77W	G,W	S	S	WSE	
06661585	Laramie River near Bosler	C,R	1,790	1972-	10	18N	74W	G,W	Y	S	WSE	
06662000	Laramie River near Lookout	C,R	2,174	1912-17, 1921-27, 1932-	27	21N	74W	G,W	S	S	WSE	
06664400	Sybille Creek above Mule Creek, near Wheatland	C,H	194	1974-	27	22N	70W	G,W	S	S	WSE	
06665790	Sybille Creek above Canal No. 3, near Wheatland	C,R	--	1980-	4	22N	69W	G,W	S	S	WSE	
*06670500	Laramie River near Fort Laramie	C,R	4,564	1915-	28	26N	64W	G,M	Y	C	WSE	
06671000	Rawhide Creek near Lingle	C	522	1928-	20	25N	62W	G,W	S	S	WSE	
06672500	Cherry Creek Drain near Torrington	C	356	1931-32, 1935-	23	24N	61W	G,W	S	S	WSE	
06673500	Katzer Drain near Henry, Nebr.	C	45.9	1928-	10	23N	60W	G,W	S	S	WSE	
*06674500	North Platte River at Wyoming-Nebraska State line	C,R	22,218	1929-	4	23N	58W	G,W	Y	C	WSE	
06679500	North Platte River at Mitchell, Nebr.	C	24,300	1901-10, 1911, 1912-13, 1916-18, 1920-	33	33N	56W	D,G,W	Y	NE	--	
GREEN RIVER BASIN												
09188500	Green River at Warren Bridge, near Daniel	C	468	1931-	8	35N	111W	G,M	Y	GR	WSE	
09189495	North Horse Creek above Sherman Ranger Station	C	42.8	1983-	1	34N	114W	G,M	Y	GR	WWDC	
09189550	South Horse Creek near Merna	C	33.3	1983-	22	34N	113W	G,M	Y	GR	WWDC	
09190000	Horse Creek near Daniel	C	106	1931-54, 1983-	2	33N	111W	G,M	Y	GR	WWDC	

* Also water-quality station.
\# Also sediment station.

Table 1. Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
GREEN RIVER BASIN--Continued												
09191300	South Cottonwood Creek near Big Piney	C	21.4	1983-	15	32N	115W	G,M	Y	GR	WWDC	
09196500	Pine Creek above Fremont Lake	B,C,H	75.8	1954-	5	35N	108W	D,W	Y	GR	USGS	
09203000	East Fork River near Big Sandy	C	79.2	1938-	7	31N	105W	D,W	Y	GR	WSE	
*09205000	New Fork River near Big Piney	P	1,230	1954-	22	30N	110W	D,W	Y	GR	WSE	
09205490	North Piney Creek above Apperson Creek, near Mason	C	29.6	1983-	24	31N	115W	G,M	Y	GR	WWDC	
09208400	La Barge Creek above Viola	C	122	1983-	36	27N	115W	G,M	Y	GR	WWDC	
*09209400	Green River near La Barge	C,P	3,910	1963-	33	26N	112W	D,W	Y	GR	WSE	
09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	C,H	152	1951-	2	24N	115W	G,M	Y	GR	USGS	
09211150	Fontenelle Reservoir near Fontenelle	C	4,280	1964-	25	24N	112W	--	--	--	--	USBR
*09211200	Green River below Fontenelle Reservoir	C,R	4,280	1963-	31	24N	111W	D,G,M	Y	GR	BRUC	
09212500	Big Sandy River at Leckie Ranch, near Big Sandy	C	94.0	1910-11, 1939-	17	30N	104W	G,M	S	GR	WSE	
09213500	Big Sandy River near Farson	C,R	322	1914-17, 1920-24, 1926-34, 1935-	17	27N	106W	D,W	S	GR	WSE	
*09215550	Big Sandy River below Farson	C,R	--	1981-	12	24N	107W	D,M	Y	GR	BRUC	
*09216050	Big Sandy River at Gasson Bridge, near Eden	C,R	1,720	1972-	29	23N	108W	D,W	Y	GR	BRUC	
*#09217000	Green River near Green River	C,R	14,000	1951-	26	18N	107W	G,W	Y	GR	USGS	
09217900	Blacks Fork near Robertson	H	130	1937-39, 1966-	27	3N	12E	G,M	Y	GR	USE	
09218500	Blacks Fork near Millburne	C	152	1939-	11	12N	117W	G,M	Y	GR	WSE	
09220000	East Fork of Smiths Fork near Robertson	C,H	53.0	1939-	5	12N	115W	G,W	S	S	WSE	
*09222000	Blacks Fork near Lyman	C,R	821	1937-57, 1962-	15	17N	113W	D,W	Y	GR	BRUC	
09223000	Hams Fork below Pole Creek, near Frontier	C,H	128	1952-	35	25N	117W	G,M	Y	GR	USGS	
*09224700	Blacks Fork near Little America	C,R	3,100	1962-	15	18N	109W	D,W	Y	GR	USGS	
09228500	Burnt Fork near Burntfork	C,H	52.8	1943-	36	3N	16E	G,M	S	S	WSE	
*09229500	Henrys Fork near Manila, Utah	C,P	520	1928-	23	12N	109W	D,W	Y	GR	USGS	
*09257000	Little Snake River near Dixon	C,P	988	1910-23, 1938-	8	12N	90W	G,M	S	CO	WSE	

* Also water-quality station.
\# Also sediment station.

Table 1. Streamflow and reservoir stations--Continued

Station number	Station name	Purpose	Drainage area (square miles)	Period of record	Location			Gage equipment	Current record type	Field office	Funding agency	Remarks
					Section	Township	Range					
BEAR RIVER BASIN												
10015700	Sulphur Creek above reservoir, near Evanston	C,H	64.2	1957-	35	14N	119W	G,W	Y	UT	--	
10015900	Sulphur Creek below reservoir, near Evanston	C	69.2	1958-	28	14N	119W	D,W	Y	UT	--	
10019500	Chapman Canal at State line, near Evanston	C	--	1942-	36	17N	121W	G,W	Y	UT	--	
*10020100	Bear River above reservoir, near Woodruff, Utah	C,R	752	1961-	29	17N	120W	G,W	Y	UT	--	
10020200	Woodruff Narrows Reservoir near Woodruff, Utah	C	784	1965-	32	18N	120W	--	--	--	--	
10020300	Bear River below reservoir, near Woodruff, Utah	C,R	784	1961-	32	18N	120W	D,W	Y	UT	--	
10028500	Bear River below Pixley Dam, near Cokeville	C,R	2,032	1941-43, 1952-56, 1958-	25	23N	120W	G,W	S	UT	--	
10032000	Smiths Fork near Border	B,C,H	165	1942-	33	27N	118W	G,W	Y	UT	--	
10038000	Bear River below Smiths Fork, near Cokeville	C	2,447	1954-	28	25N	119W	G,W	Y	UT	--	
*10039500	Bear River at Border	C	2,490	1937-	15	14S	43E	G,W	Y	UT	--	
10041000	Thomas Fork near Wyoming-Idaho State line	C,H	113	1949-	19	28N	119W	D,W	Y	UT	--	
SNAKE RIVER BASIN												
13010500	Jackson Lake near Moran	C	807	1908-	18	45N	114W	--	--	ID	--	USBR
13011000	Snake River near Moran	B,C,R	807	1903-	18	45N	114W	D,W	Y	ID	--	
13011900	Buffalo Fork above Lava Creek, near Moran	H	323	1965-	29	45N	113W	G,M	Y	ID	--	
*#13018300	Cache Creek near Jackson	B,H	10.6	1962-	1	40N	116W	G,W	Y	ID	USGS	HBM
13018750	Snake River below Flat Creek, near Jackson	C,R	2,627	1975-	3	39N	116W	D,G,M	Y	ID	USGS	
*#13019438	Little Granite Creek at mouth, near Bondurant	C	--	1982-	34	39N	114W	D,G,M	Y	ID	--	
*13022500	Snake River above reservoir, near Alpine	C,R	3,465	1917-18, 1937-39, 1953-	--	--	--	G,W	Y	ID	--	
13023000	Greys River above reservoir, near Alpine	C,P	448	1917-18, 1937-39, 1953-	34	37N	118W	G,M	Y	ID	--	
*13027500	Salt River above reservoir, near Etna	C,R	829	1953-	28	36N	119W	D,W	Y	ID	--	

* Also water-quality station.
\# Also sediment station.

Table 2.--Crest-Stage Partial-Record Stations

Explanation of abbreviations and codes used in table 2.

Period of record: The dates given are the calendar years in which records began or ended. Periods of no record 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
CH	Cheyenne
GR	Green River
R	Riverton

Funding agency:

WHD	Wyoming Highway Department

Table 2.--Crest-stage parital-record stations

Station number	Station name	Drainage area (square miles)	Period of record	Location			Gage equipment	Field office	Funding agency	Remarks
				Section	Township	Range				
YELLOWSTONE RIVER BASIN										
06218700	Wagon Gulch near Dubois	4.89	1961-	30	42N	107W	CSI	R	WHD	
06229900	Trout Creek near Fort Washakie	16.1	1961-68, 1970-	25	1S	2W	CSI	R	WHD	
06233360	Monument Draw at lower station, near Hudson	8.38	1965-73, 1973-	21	33N	98W	S-R CSI	R	WHD	
06236000	Kirby Draw near Riverton	129	1951-53, 1961-	3	1N	5E	CSI	R	WHD	
06238760	West Fork Dry Cheyenne Creek at upper station, near Riverton	.69	1965-73, 1973-	4	34N	94W	S-R CSI	R	WHD	
06265600	Tie Down Gulch near Worland	1.78	1961-	10	45N	94W	CSI	R	WHD	
06267260	North Prong East Fork Nowater Creek near Worland	3.77	1964-73, 1973-	18	46N	91W	S-R CSI	R	WHD	
06274190	Nowood River tributary No. 2 near Basin	1.51	1965-73, 1973-	28	50N	92W	S-R CSI	R	WHD	
06312700	South Fork Powder River near Powder River	262	1961-	3	35N	85W	CSI	C	WHD	
06313100	Coal Draw near Midwest	11.4	1961-	8	40N	78W	CSI	C	WHD	
06316700	Coal Draw near Buffalo	1.64	1965-73, 1973-	9	52N	77W	S-R CSI	B	WHD	
06319100	Bull Creek near Buffalo	10.8	1969-	29	50N	82W	CSI	B	WHD	
06324910	Cow Creek tributary near Weston	.72	1971-	26	53N	71W	CSI	B	WHD	
CHEYENNE RIVER BASIN										
06387500	Turner Creek near Osage	47.8	1959-	26	47N	64W	CSI	C	WHD	
06426195	Donkey Creek tributary above reservoir, near Gillette	.2	1970-	29	50N	71W	CSI	B	WHD	
06427700	Inyan Kara Creek near Upton	96.5	1959-	17	49N	63W	CSI	C	WHD	
06428100	Belle Fourche River tributary No. 2 near Hulett	10.2	1962-	3	54N	64W	CSI	C	WHD	
PLATTE RIVER BASIN										
06634910	Medicine Bow River tributary near Hanna	3.01	1965-73, 1973-	35	24N	81W	S-R CSI	C	WHD	
06641400	Bear Springs Creek near Alcova	9.33	1960-	30	30N	82W	CSI	C	WHD	
06642700	Lawn Creek near Alcova	11.5	1961-	8	29N	80W	CSI	C	WHD	
06643300	Coal Creek near Goose Egg	5.39	1960-	27	32N	81W	CSI	C	WHD	
06648780	Sage Creek tributary near Orpha	1.38	1965-73, 1973-	18	35N	73W	S-R CSI	C	WHD	
06651800	Sand Creek near Orin	27.8	1955-1961-	11	31N	70W	CSI	C	WHD	

Table 2.--Crest-stage partial-record stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Gage equipment	Field office	Funding agency	Remarks
				Section	Township	Range				
PLATTE RIVER BASIN--Continued										
06652400	Watkins Draw near Lost Springs	6.95	1960-70, 1970-72, 1972-	12	32N	68W	CSI S-R CSI	C	WHD	
06661580	Sevenmile Creek near Centennial	11.2	1962-	11	17N	77W	CSI	CH	WHD	
06668040	Rabbit Creek near Wheatland	1.3	1965-72, 1972-	22	26N	70W	S-R CSI	C	WHD	
06762600	Lodgepole Creek tributary No. 2 near Albin	5.69	1960-	28	16N	60W	CSI	CH	WHD	
GREEN RIVER BASIN										
09216290	East Otterson Wash near Green River	16.6	1969-	23	21N	109W	CSI	GR	WHD	
09216537	Delaney Draw near Red Desert	34.5	1961-	8	19N	95W	CSI	GR	WHD	
09221680	Mud Spring Hollow near Church Butte, near Lyman	8.83	1965-73, 1973-	7	16N	113W	S-R CSI	GR	WHD	
09224820	Blacks Fork tributary No. 3 near Green River	3.59	1965-	28	17N	108W	CSI	GR	WHD	
09225200	Squaw Hollow near Burntfork	6.57	1965-	29	14N	108W	CSI	GR	WHD	

Table 3.--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. Periods of no record of less than a year are not shown.

Funding agency:

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BRUC	Bureau of Reclamation, Upper Colorado Region
BRUM	Bureau of Reclamation, Upper Missouri Region
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:

A	annual
BM	bimonthly
C	continuous (recorder)
D	daily
HL	high and low flow samples only
I	infrequent or as requested
IS	every six weeks during irrigation season
M	every six weeks plus two events
MQ	monthly during summer, quarterly during winter
Q	quarterly
SA	semiannual
SSn	n = samples during spraying season
SWF	sample when there is flow
W	weekly during irrigation season

Analysis schedule:

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

Field office:

B	Buffalo
C	Casper
CH	Cheyenne Hydrologic Surveillance Section
CO	Colorado District
GR	Green River
ID	Idaho District
MT	Montana District
R	Riverton
S	Wyoming State Engineer
UT	Utah District

Table 3.--Water-quality stations

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
YELLOWSTONE RIVER BASIN											
@06207500	Clarks Fork Yellowstone River near Belfry, Mont.	1,154	1965-	31	9S	22E	WDA	M	1	MT	
							WDA	SS1	9		
@06218500	Wind River near Dubois	232	1947-50, 1965-	25	42N	108W	WDA	Q	1	R	
#@06220500	East Fork Wind River near Dubois	427	1975-	34	6N	6W	MRB	M	5	R	
@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	2,309	1947-50, 1953, 1965-	2	1S	4E	WDA	Q	1	R	
@06228350	South Fork Little Wind River above Washakie Reservoir, near Fort Washakie	90.3	1976-	18	1S	2W	BIA	M	1,5	R	
@06231000	Little Wind River above Arapahoe	660	1966-	23	1S	3E	WDA	M	1	R	
@06233900	Popo Agie River near Arapahoe	--	1979-	27	1S	3E	BIA	M	1	R	
							WDA	SS5	9		
@06235500	Little Wind River near Riverton	1,904	1965-	11	15N	4E	WDA	Q	1	R	
06236100	Wind River above Boysen Reservoir, near Shoshoni	4,390	1974-	25	2N	5E	WDEQ	M	4,5,7	R	
@06246500	Ocean Drain at Ocean Lake outlet, near Pavillion	--	1978-	31	3N	3E	BRUM	M	1,5	R	
#@06253000	Fivemile Creek near Shoshoni	418	1949-51, 1953, 1965-	19	3N	6E	WDA	M	1	R	
#@06258000	Muddy Creek near Shoshoni	332	1983-	34	4N	5E	BRUM	M	1	R	
#@06259000	Wind River below Boysen Reservoir	7,701	1953-54, 1960-	9	5N	6E	USGS	BM	1,5,6,7,8	R	
							WDEQ	BM	1,5,6,7	R	
@06260000	South Fork Owl Creek near Anchor	85.5	1974-	28	43N	100W	BRUM	M	5	R	
@06260400	South Fork Owl Creek below Anchor Reservoir	131	1974-	25	43N	100W	BRUM	M	5	R	
06264700	Bighorn River at Lucerne	--	1966-	32	44N	94W	WDEQ	M	5,6,7	R	
06268600	Bighorn River at Worland	10,810	1966-	25	47N	93W	WDA	M	1	R	
06268640	Slick Creek near Worland	--	1981-	7	47N	92W	WDA	Q	1	R	
@06270000	Nowood River near Ten Sleep	803	1967-	27	47N	88W	WDA	Q	1	R	
							WDA	SS3	9		
06273500	Paint Rock Creek near mouth, below Hyattville	376	1951-53, 1967-	19	49N	90W	WDA	Q	1	R	
							WDA	SS3	9		
06274220	Nowood River at Manderson	2,000	1965-	30	50N	92W	WDA	MQ	1	R	
06277500	Greybull River near Basin	1,115	1951-53, 1965-	8	51N	94W	WDA	MQ	1	R	
							WDA	SS3	9		

Also sediment station.
@ Also streamflow station.

Table 3.--Water-quality stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Funding agency	Remarks
				Section	Township	Range					
YELLOWSTONE RIVER BASIN--Continued											
06279050	Shell Creek at Porter Gulch, near Greybull	--	1983-	33	53N	92W	WDA	SS3	9	R	
06279090	Shell Creek near Greybull	560	1951, 1965-	4	52N	93W	WDA	Q	1	R	
#@06279500	Bighorn River at Kane	15,765	1947-53, 1955-57, 1960-	9	55N	94W	MRB	M	5	R	
							WDA	M	1		
							WDEQ	M	7		
@06280000	North Fork Shoshone River near Wapiti	775	1979-	15	52N	104W	MRB	C	3	R	
							WDA	M	1		
@06281000	South Fork Shoshone River above Buffalo Bill Reservoir	585	1981-	33	52N	103W	MRB	C	3	R	
							WDA	Q	1		
@06282000	Shoshone River below Buffalo Bill Reservoir	1,538	1947-49, 1964-	3	52N	102W	WDA	M	1	R	
06282900	Shoshone River above Dry Creek, near Cody	--	1974-	13	53N	101W	WDEQ	M	5,6,7	R	
06284400	Shoshone River near Garland	--	1983-	13	55N	98W	WDA	SS3	9	R	
06284450	Bitter Creek below sewage lagoon, near Powell	--	1981-	36	56N	99W	WDEQ	M	5,6,7	R	
@06284500	Bitter Creek near Garland	80.5	1958-60, 1969-	7	55N	97W	MRB	D	2,3	R	
							MRB	Q	1,5		
@06284800	Whistle Creek near Garland	101	1959-60, 1969-	30	55N	97W	MRB	D	2,3	R	
							MRB	Q	1,5		
@06285100	Shoshone River near Lovell	2,350	1966-	16	56N	96W	MRB	D	2,3	R	
							MRB	Q	1,5		
@06285400	Sage Creek at Sidon Canal, near Deaver	341	1958-60, 1969-	34	57N	97W	MRB	D	2,3	R	
							MRB	Q	1,5		
06286200	Shoshone River at Kane	2,989	1976-	6	56N	95W	WDEQ	M	5,6,7	R	
06299980	Tongue River at Monarch	--	1973-80, 1983-	20	57N	84W	WDEQ	M	5,6,7	B	
06304500	Little Goose Creek near Sheridan	159	1979-	27	56N	84W	WDEQ	M	5,6	B	
							WDA	SS3	9		
@06305500	Goose Creek below Sheridan	392	1959-60, 1961-64, 1967-	15	56N	84W	WDA	M	1	B	
							WDEQ	M	5,6,7		
06306250	Prairie Dog Creek near Acme	358	1983-	23	58N	83W	WDA	SS3	9	B	
06306300	Tongue River at State line, near Decker, Mont.	1,477	1965-	33	9S	40E	WDA	M	1	MT	
							WDEQ	M	5,6		
							WDA	SS3	9	B	
06312500	Powder River near Kaycee	980	1968-	13	43N	81W	WDA	Q	1	C	
#@06313000	South Fork Powder River near Kaycee	1,150	1968-81, 1983-	9	42N	81W	BLM	M	1	C	

Also sediment station.
@ Also streamflow station.

Table 3.--Water-quality stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
YELLOWSTONE RIVER BASIN--Continued											
#@06313400	Salt Creek near Sussex	769	1967-81, 1983-	8	42N	79W	WDEQ	M	1	C	
#@06313500	Powder River at Sussex	3,090	1949-53, 1977-	13	43N	79W	USGS	Q	1,5,7	C	
							USGS	I	8		
							USGS	A	10		
06316400	Crazy Woman Creek at upper station, near Arvada	945	1966-81, 1983-	18	52N	77W	WDA	SS3	9	B	
#@06317000	Powder River at Arvada	6,050	1946-53, 1967-	21	54N	77W	WDA	Q	1	B	
06320200	Clear Creek below Rock Creek, near Buffalo	322	1975-	30	51N	81W	WDEQ	M	5,6,7	B	
							WDA	SS3	9		
06320400	Clear Creek at Ucross	409	1975-81, 1983-	19	53N	80W	WDA	SS3	9	B	
06323500	Piney Creek at Ucross	267	1975-80, 1983-	18	53N	80W	WDA	SS3	9	B	
#06324000	Clear Creek near Arvada	1,110	1950-54, 1966-	36	57N	77W	WDA	Q	1	B	
							WDA	SS3	9		
#@06324500	Powder River at Moorhead, Mont.	8,088	1976-	8	9S	48E	WDEQ	M	1	MT	
#@06324890	Little Powder River below Corral Creek, near Weston	204	1975-	12	52N	72W	USGS	Q	1,5,7	B	
							USGS	I	8		
							USGS	A	10		
CHEYENNE RIVER BASIN											
#@06386000	Lance Creek near Riverview	2,070	1975-	14	39N	62W	USGS	M	1,5,7	C	
							USGS	Q	8,10		
06386400	Cheyenne River near Riverview	5,270	1975-	25	40N	61W	WDA	SS3	9	C	
@06394000	Beaver Creek near Newcastle	1,320	1949-53, 1967-	18	41N	60W	WDA	M	1	C	
#@06425720	Belle Fourche River below Rattlesnake Creek, near Piney	495	1975-	9	46N	71W	USGS	SWF	1,4,5,7,8	B	
#@06425750	Coal Creek near Piney	71.8	1980-	12	46N	71W	USGS	SWF	1,4,5,7,8	B	
#@06425780	Belle Fourche River above Dry Creek, near Piney	594	1975-	25	47N	71W	USGS	SWF	1,4,5,7,8	B	
#@06425900	Caballo Creek at mouth, near Piney	260	1977-	4	47N	70W	USGS	Q	1,5,6,7	B	
							USGS	I	8		
							USGS	A	10		

Also sediment station.
@ Also streamflow station.

Table 3.--Water-quality stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
CHEYENNE RIVER BASIN--Continued											
#@06425950	Raven Creek near Moorcroft	76	1977-	1	48N	69W	USGS	Q	1,5,6,7	B	
							USGS	I	8		
							USGS	A	10		
06426400	Donkey Creek near Moorcroft	--	1977-	30	50N	68W	WDEQ	M	5	C	
#@06426500	Belle Fourche River below Moorcroft	1,670	1975-	24	50N	68W	WDEQ	M	5,6,7	C	
							WDA	SS3	9		
							USGS	Q	1,8,10		
06427850	Belle Fourche River at Devils Tower	--	1967-	7	53N	65W	WDA	M	1	C	
							WDA	SS4	9		
06428050	Belle Fourche River below Hulett	--	1981-	6	54N	64W	WDEQ	M	5,6,7	C	
							WDA	SS3	9		
06428500	Belle Fourche River at Wyoming-South Dakota State line	3,280	1965-	18	9N	1E	WDA	Q	1	C	
@06429905	Sand Creek near Ranch A, near Beulah	267	1982-	5	52N	60W	WDEQ	Q	5,6,7	C	
PLATTE RIVER BASIN											
@06620000	North Platte River near Northgate, Colo.	1,431	1965-	11	11N	80W	WDA	M	1	C	
							WDA	SS2	9		
#@06623800	Encampment River above Hog Park Creek, near Encampment	72.7	1967-	10	12N	84W	USGS	Q	1,5,6,7	C	
							USGS	HL	8		
							USGS	A	10		
@06625000	Encampment River at mouth, near Encampment	265	1965-	3	15N	83W	WDA	M	1	C	
							WDA	SS3	9		
							WDEQ	M	5,6,7		
@06630000	North Platte River above Seminoe Reservoir, near Sinclair	8,134	1960-	13	22N	86W	WDA	M	1	C	
							WDEQ	M	5,6,7		
@06634600	Little Medicine Bow River near Medicine Bow	966	1965-	21	23N	78W	WDA	Q	1	C	
							WDEQ	Q	10		
@06635000	Medicine Bow River above Seminoe Reservoir, near Hanna	2,338	1965-	34	24N	81W	WDA	Q	1	C	
							WDEQ	Q	10		
@06639000	Sweetwater River near Alcova	2,327	1964-	25	29N	87W	WDA	Q	1	C	
							WDEQ	Q	10		
06639480	Horse Creek at Highway 220, near Alcova	--	1983-	15	30N	85W	WDA	SS3	9	C	
#@06642000	North Platte River at Alcova	10,812	1965-	17	30N	82W	USGS	BM	1,5,6,7,8	C	
							WDEQ	BM	1,5,6,7		
06642500	Bates Creek near Freeman	129	1981-	29	30N	79W	WDA	Q	1	C	

Also sediment station.
@ Also streamflow station.

Table 3.--Water-quality stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
PLATTE RIVER BASIN--Continued											
#@06642650	Stinking Creek above Lawn Creek, near Alcova	91.8	1983-	18	29N	80W	BLM	M	1	C	
06643000	Bates Creek near Alcova	393	1970-	1	31N	82W	WDA	M	1	C	
#06643510	North Platte River above Poison Spider Creek, near Goose Egg	--	1977-80, 1983-	3	32N	81W	BLM WDEQ	M Q	1 6	C	
06644085	North Platte River at Mills	--	1970-	7	33N	79W	WDEQ	M	6	C	
06644500	Casper Creek at Casper	668	1970-	7	33N	79W	WDEQ	M	6	C	
06644550	North Platte River at Casper	--	1971-	4	33N	79W	MRB WDA WDEQ	W SS3 M	5 9 6	C	
06645000	North Platte River below Casper	12,574	1950-52, 1957-59, 1967-	4	33N	78W	WDA WDEQ	M M	1 5,6,7	C	
@06646600	Deer Creek below Millar Wasteway, at Glenrock	213	1967-	4	33N	75W	WDA	Q	1	C	
@06646800	North Platte River near Glenrock	13,538	1960-	17	33N	74W	WDA	Q	1	C,S	
06647990	Box Elder Creek below Interstate 25, near Careyhurst	--	1981-	13	33N	74W	WDA	Q	1	C	
06649500	La Prele Creek near Orpha	--	1981-	15	33N	72W	WDA	Q	1	C	
06650500	Wagonhound Creek near La Bonte	--	1981-	16	31N	71W	WDA	Q	1	C	
06651500	La Bonte Creek near La Bonte	--	1981-	15	31N	71W	WDA	Q	1	C	
@06652000	North Platte River at Orin	14,888	1966-	17	31N	69W	WDA WDA WDEQ	M SS4 M	1 9 5,6,7	C	
@06652800	North Platte River below Glendo Reservoir	15,548	1966-	30	29N	67W	WDA WDA	M SS4	1 9	C	
@06656000	North Platte River below Guernsey Reservoir	16,237	1950-58, 1965-	27	27N	66W	WDA	Q	1	C	
06656500	North Platte River near Guernsey	--	1981-	5	26N	65W	WDEQ	M	5,6,7	C	
06660070	Laramie River above Howell	--	1980-	9	16N	73W	WDEQ	M	5,6,7	CH	
06660500	Laramie River at Two Rivers	1,224	1966-	5	17N	74W	WDA WDA	Q SS3	1 9	CH	
06661500	Little Laramie River at Two Rivers	376	1965-	6	17N	74W	WDA WDA	Q SS3	1 9	CH	
06669050	Wheatland Creek below Wheatland	--	1983-	1	24N	68W	WDEQ	M	5,6,7	CH	
@06670500	Laramie River near Fort Laramie	4,495	1965-	25	26N	65W	WDA	M	1	C	
@06674500	North Platte River at Wyoming-Nebraska State line	22,218	1965-	4	23N	58W	WDA WDEQ	M M	1 5,6	C	

Also sediment station.
@ Also streamflow station.

Table 3.--Water-quality stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
PLATTE RIVER BASIN--Continued											
06676550	Horse Creek at WyCross Ranch, near La Grange	561	1981-	28	20N	61W	WDEQ	M	5,6,7	C	
06755950	Crow Creek at F. E. Warren AFB	--	1983-	36	14N	67W	WDA	SS5	9	CH	
06756000	Crow Creek near Cheyenne	--	1983-	3	13N	66W	WDA	SS5	9	CH	
GREEN RIVER BASIN											
09192600	Green River near Big Piney	1,260	1967-	21	30N	110W	WDA	Q	1	GR	
@09205000	New Fork River near Big Piney	1,230	1965-	22	30N	110W	WDA	Q	1	GR	
@09209400	Green River near La Barge	3,910	1963-	33	26N	112W	WDA	M	1	GR	
							WDA	SS3	9		
@09211200	Green River below Fontenelle Reservoir	4,280	1967-	31	24N	111W	WDA	M	1	GR	
09213705	Big Sandy River below Big Sandy Reservoir	--	1981-	12	26N	106W	WDA	Q	1	GR	
09213800	Big Sandy River at Farson	--	1981-	33	25N	106W	WDA	Q	1	GR	
09215500	Little Sandy Creek at Farson	--	1981-	34	25N	106W	WDA	Q	1	GR	
@09215550	Big Sandy River below Farson	--	1981-	12	24N	107W	BRUC	C	3	GR	
							WDA	M	1		
							WDA	SS3	9		
@09216050	Big Sandy River at Gasson Bridge, near Eden	1,720	1975-	29	23N	108W	WDA	M	1	GR	
							WDA	SS3	9		
							BRUC	C	3		
09216790	Bitter Creek above Killpecker Creek, at Rock Springs	--	1983-	26	19N	105W	WDA	SS3	9	GR	
09216810	Killpecker Creek at Rock Springs	--	1975-80, 1982-	26	19N	105W	WDEQ	M	6	GR	
							WDA	SS3	9		
09216880	Bitter Creek below Little Bitter Creek, near Kanda	--	1975-	7	18N	105W	WDEQ	M	7	GR	
#@09217000	Green River near Green River	14,000	1951-	26	18N	107W	USGS	D	2,3	GR	
							USGS	SA	1,7		
							USGS	Q	8		
							USGS	BM	1,5,6,7		
09217010	Green River below Green River	--	1973-	36	18N	107W	WDEQ	M	1,4,5,6,7	GR	
09221650	Smiths Fork near Lyman	--	1974-	12	16N	114W	WDA	SS3	9	GR	
@09222000	Blacks Fork near Lyman	821	1962-	15	17N	113W	BRUC	D	2,3		
							BRUC	M	1		
							WDA	SS3	9		
09224050	Hams Fork near Diamondville	--	1975-	36	21N	116W	WDEQ	M	5,6,7	GR	
							WDA	SS3	9		
09224450	Hams Fork near Granger	670	1965-	30	19N	111W	WDA	M	1	GR	

Also sediment station.
@ Also streamflow station.

Table 3.--Water-quality stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
GREEN RIVER BASIN--Continued											
@09224700	Blacks Fork near Little America	3,100	1951-	15	18N	109W	USGS	D	2,3	GR	
							USGS	M	1		
09229500	Henrys Fork near Manila, Utah	520	1951-	23	12N	109W	WDA	M	1	GR	
							WDA	SS3	9		
09253000	Little Snake River near Slater, Colo.	285	1978-	15	12N	87W	WDA	I	1	CO	
@09257000	Little Snake River near Dixon	988	1975-	8	12N	90W	WDA	IS	1	CO	
							WDA	SS3	9		
09259050	Little Snake River below Baggs	--	1981-	7	12N	92W	WDA	Q	1	CO	
							WDA	SS3	9		
							WDEQ	M	5,6,7		
BEAR RIVER BASIN											
@10020100	Bear River above reservoir, near Woodruff, Utah	752	1968-	29	17N	120W	WDA	M	1	UT	
							WDEQ	M	5,6,7		
10035000	Smiths Fork near Cokeville	--	1983-	4	24N	119W	WDA	SS3	9	UT	
@10039500	Bear River at Border	2,490	1965-	15	14S	46E	WDA	BM	1	UT	
							WDEQ	M	4		
							USGS	BM	5,6,7		
							USGS	M	1		
							USGS	Q	8		
SNAKE RIVER BASIN											
#@13018300	Cache Creek near Jackson	10.6	1965-	1	40N	116W	USGS	--	--	ID	
#@13019438	Little Granite Creek at mouth, near Bondurant	--	1982-	34	39N	114W	USGS	--	--	ID	
@13022500	Snake River above reservoir, near Alpine	3,465	1965-	--	--	--	WDA	M	1	ID	
13023900	Salt River near Smoot	--	1981-	33	30N	118W	WDA	M	1	ID	
13025000	Swift Creek near Afton	27.4	1981-	29	32N	118W	WDA	M	1	ID	
@13027500	Salt River above reservoir, near Etna	829	1965-	28	36N	119W	WDA	M	1	ID	
							WDA	SS3	9		

Also sediment station.
@ Also streamflow station.

Table 4.--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. Periods of no record of less than a year are not shown.

Funding agency:

BLM	Bureau of Land Management
BRUM	Bureau of Reclamation, Upper Missouri River Basin
MRB	Geological Survey, Missouri River Basin Program
USGS	Geological Survey, Federal Program
WDEQ	Wyoming Department of Environmental Quality

Sampling frequency:

BM	bimonthly
D	daily (observer)
HL	high and low flow samples only
HML	high, medium and low flow samples only
I	infrequent, whenever enough sediment in suspension to do analysis
M	every six weeks plus two events.
MS	monthly seasonally.
P	PS69 sediment pump sampler
Q	quarterly

Analysis schedule:

1	suspended-sediment concentration.
2	particle-size distribution.
3	0.062mm sieve analysis.
4	bed material particle-size distribution.

Field office:

B	Buffalo	GR	Green River
C	Casper	ID	Idaho
CP	Cheyenne Project Personnel	R	Riverton

Remarks:

USBR SAMPLES furnished by Bureau of Reclamation.

Table 4.--Sediment stations

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
YELLOWSTONE RIVER BASIN											
*@06220500	East Fork Wind River near Dubois	427	1975-	34	6N	6W	MRB	M	1	R	
							MRB	I	2		
06226000	Wyoming Canal near Lenore	--	1975-	17	3N	1W	BRUM	--	--	R	USBR SAMPLES
06227500	Wyoming Canal below Pilot Diversion, near Morton	--	1975-	20	3N	1E	BRUM	--	--	R	USBR SAMPLES
*@06253000	Fivemile Creek near Shoshoni	418	1948-75, 1978-	19	3N	6E	BRUM	M	1	R	
*@06258000	Muddy Creek near Shoshoni	332	1983-	34	4N	5E	BRUM	M	1	R	
*@06259000	Wind River below Boysen Reservoir	7,701	1979-	9	5N	6E	USGS	BM	1,3	R	
@06268500	Fifteenmile Creek near Worland	518	1949-72, 1979-	27	47N	93W	WDEQ	P	1	R	
							WDEQ	HL	2		
*@06279500	Bighorn River at Kane	15,765	1946-64, 1969-	9	55N	94W	MRB	M	1	R	
							MRB	I	2		
06284005	Willwood Canal near Willwood	--	1979-	9	54N	100W	BRUM	MS	1	R	
							BRUM	I	2,3		
06284010	Shoshone River below Willwood Dam	1,833	1979-	9	54N	100W	BRUM	M	1	R	
							BRUM	I	2,3		
*@06313000	South Fork Powder River near Kaycee	1,150	1983-	9	42N	81W	BLM	P	1	C	
							BLM	I	2		
							BLM	HL	4		
@06313180	Dugout Creek tributary near Midwest	.8	1983-	14	40N	80W	USGS	P	1,2	CP	
*@06313400	Salt Creek near Sussex	769	1976-81, 1982-	8	42N	79W	BLM	M	1	C	
							BLM	I	2		
							BLM	HL	4		
*@06313500	Powder River at Sussex	3,090	1949-53, 1976-	13	43N	79W	BLM	D	1	C	
							BLM	I	2		
							BLM	HL	4		
*@06317000	Powder River at Arvada	6,050	1983-	21	54N	77W	BLM	D	1	B	
							BLM	I	2		
							BLM	HL	4		
*06324000	Clear Creek near Arvada	1,110	1950-53, 1975-	36	57N	77W	USGS	Q	1	B	
							USGS	I	2		
							USGS	HML	4		
*@06324890	Little Powder River below Corral Creek, near Weston	204	1977-	12	52N	72W	USGS	M	1	B	
							USGS	I	2		
							USGS	HML	4		

* Also water-quality station.
@ Also streamflow station.

Table 4.--Sediment stations--Continued

Station number	Station name	Drainage area (square miles)	Period of record	Location			Funding agency	Sampling frequency	Analysis schedule	Field office	Remarks
				Section	Township	Range					
CHEYENNE RIVER BASIN											
*@06386000	Lance Creek near Riverview	2,070	1976-	14	39N	62W	USGS	M	1	C	
							USGS	I	2		
							USGS	HML	4		
*@06425720	Belle Fourche River below Rattlesnake Creek, near Piney	495	1975-	9	46N	71W	USGS	P	1	B	
							USGS	HML	4		
*@06425750	Coal Creek near Piney	71.8	1980-	12	46N	71W	USGS	P	1	B	
							USGS	HML	4		
*@06425780	Belle Fourche River above Dry Creek, near Piney	594	1975-	25	47N	71W	USGS	P	1	B	
							USGS	HML	4		
*@06425900	Caballo Creek at mouth, near Piney	260	1977-	4	47N	70W	USGS	M	1	B	
							USGS	I	2		
							USGS	HML	4		
*@06425950	Raven Creek near Moorcroft	76	1977-	1	48N	69W	USGS	M	1	B	
							USGS	HML	4		
*@06426500	Belle Fourche River below Moorcroft	1,670	1976-	24	50N	68W	USGS	M	1	B	
							USGS	HML	4		
PLATTE RIVER BASIN											
*@06623800	Encampment River above Hog Park Creek, near Encampment	72.7	1964-	10	12N	84W	USGS	Q	1,2	C	
*@06642000	North Platte River at Alcova	10,812	1979-	17	30N	82W	USGS	BM	1,3	C	
*@06642650	Stinking Creek above Lawn Creek, near Alcova	91.8	1983-	18	29N	80W	BLM	P	1	C	
							BLM	HL	4		
*06643510	North Platte River above Poison Spider Creek, near Goose Egg	--	1983-	3	32N	81W	BLM	P	1	C	
							BLM	HL	4		
GREEN RIVER BASIN											
*@09217000	Green River near Green River	14,000	1951-	26	18N	107W	USGS	D	1	GR	
							USGS	I	2		
							USGS	BM	3		
							USGS	HML	4		
SNAKE RIVER BASIN											
*@13018300	Cache Creek near Jackson	10.6	1968-	1	40N	116W	USGS	--	--	ID	
*@13019438	Little Granite Creek at mouth, near Bondurant	--	1982-	34	39N	114W	USGS	--	--	ID	

* Also water-quality station.
@ Also streamflow station.

Table 5.--Ground-Water Observation Wells

Explanation of abbreviations and codes used in table 5.

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.

Geologic unit:

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

Explanation of abbreviations and codes used in table 5--Continued

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 5--Continued

Funding agency:

DEPD	Wyoming Department of Economic Planning and Development
USGS	Geological Survey, Federal Program
WSE	Wyoming State Engineer

Field office:

B	Buffalo	O	Observer
C	Casper	P	Project Personnel
CF	Cheyenne Field Unit	R	Riverton
CH	Cheyenne Hydrologic Surveillance Section	S	Wyoming State Engineer
		SD	South Dakota District
GR	Green River	UT	Utah 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)

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 1980- indicates a recorder was installed during the year shown and is continuous to present.

Table 5.--Ground-water observation wells

Well number	Lat-long-seq no.	Geo-logic unit	Funding agency	Field office	Frequency of observation	Period of record	Name of owner	Remarks
ALBANY COUNTY	MISSOURI RIVER BASIN							
19-074-36CCA	413419105391301	211STEL	WSE	CF	SA	1968, 1970-	O. L. Schmidl	
CAMPBELL COUNTY	MISSOURI RIVER BASIN							
44-072-22CC 01	434611105295001	124WSTC	USGS	C	SA	1966-	Durham Meat Company	
CARBON COUNTY	MISSOURI RIVER BASIN							
14-083-03CAB01	411234106424601	121NRPK	WSE	P	C	1980-	Robert Helmer	Recorder 1980-
15-083-32DDD01	411307106442601	121NRPK	WSE	C	SA	1967-68, 1970-	Henry Finch	
15-083-34BAB01	411353106425701	121NRPK	WSE	P	C	1980-	Robert Helmer	Recorder 1980-
16-084-09CBC01	412202106511401	121NRPK	WSE	P	C	1980-	G. A. Berger	Recorder 1980-
17-085-23AAC01	412610106552401	122ARKR	WSE	C	SA	1977-	L. E. Walck	
18-083-16DBD01	413145106440501	121NRPK	WSE	P	C	1980-	Saratoga Land & Cattle Co.	Recorder 1980-
18-083-17CAC01	413148106453701	121NRPK	WSE	P	C	1980-	Burton Tuttle	Recorder 1980-
20-083-28BAB	414104106442701	121NRPK	USGS	C	SA	1950-	State of Wyoming	
21-089-22ADA	414650107254501	125FRUN	WSE	C	SA	1963, 1965-	Bureau of Land Management	
23-085-19DBD	415652107014201	211MVRD	WSE	C	SA	1967-68, 1970-	Miller Estate	
25-078-03CCC	420936106105001	111ALVM	WSE	C	SA	1968, 1970-		
CONVERSE COUNTY	MISSOURI RIVER BASIN							
32-071-02DAA01	424628105194201	125FRUN	WSE	C	SA	1975-	Art Sims	
32-071-04BDD01	424631105224601	125FRUN	WSE	C	SA	1975-		
32-071-11BAB01	424558105204401	125FRUN	WSE	C	SA	1975-		
32-071-31AAA	424229105242901	123WRVR	USGS	C	SA	1950-56, 1959-	Sallie Edwards	
32-074-03BCD	424620105424201	331MDSN	WSE	C	C	1974-	Wm Barber	Recorder 1974-
32-074-08DBC01	424520105440501	331MDSN	WSE	C	C	1980-	Wm Barber	Recorder 1981-
33-071-24DAA01	424902105192301	125FRUN	WSE	C	SA	1975-	Raymond Baker	
33-071-26DAD01	424801105200901	125FRUN	WSE	C	SA	1975-	Art Sims	
33-071-34ACD01	424722105214301	125FRUN	WSE	C	SA	1975-	D. W. Funk	
33-071-34ACD02	424723105213602	125FRUN	WSE	C	SA	1975-	Roy Jarman	
33-071-34ADC01	424723105213001	125FRUN	WSE	C	SA	1975-	Phillips Petroleum	
33-071-34BBC01	424734105222801	125FRUN	WSE	C	SA	1975-	Roy Jarman	
36-073-24BA	430502105334101	124WSTC	WSE	P	C	1981-	Mrs. Whiting	Recorder 1981-
38-074-03AAA	431809105430901	124WSTC	WSE	P	C	1981-	Roy Baker	Recorder 1981-
CROOK COUNTY	MISSOURI RIVER BASIN							
50-068-36AD	441620104575001	211LNCE	WSE	C	SA	1969-	State of Wyoming	

Table 5.--Ground-water observation wells--Continued

Well number	Lat-long-seq no.	Geo-logic unit	Funding agency	Field office	Frequency of observation	Period of record	Name of owner	Remarks
CROOK COUNTY--Continued		MISSOURI RIVER BASIN						
51-063-23AAC	442340104225001	221SNDC	WSE	C	SA	1968, 1975-	City of Sundance	
51-066-06DCD	442540104493501	331MDSN	WSE	S	C	1981-	City of Gillette	Recorder 1981-
53-065-18BAC	443503104425101	317MNKT	USGS	C	SA	1955, 1960, 1962-	National Park Service	
53-065-18BBD01	443450104430001	237SPRF	WSE	C	SA	1962-	National Park Service	
53-065-18BBD02	443453104425602	337PHSP	WSE	C	SA	1962-	National Park Service	
FREMONT COUNTY		MISSOURI RIVER BASIN						
29-093-36DB	422632107540501	122ARKR	WSE	R	C	1974-	State of Wyoming	Recorder 1974-
30-095-31AD	423127108132201	122ARKR	WSE	R	SA	1965, 1973-		
A 1-4-33DDB	430051108240901	124WDRV	WSE	R	C	1951, 1961-	Teton Studs Corp.	Recorder 1966-
A 3-3-21ADA01	431326108311001	124WDRV	WSE	R	SA	1949, 1965-	H. W. Roland	
A 3-3-21ADA02	431327108311102	124WDRV	WSE	R	SA	1948-	H. W. Roland	
A 3-3-25BBB	431253108284401	124WDRV	WSE	R	SA	1949-	Bureau of Reclamation	
A 4-1-18DBC	431915108481501	124WDRV	WSE	R	SA	1966-67, 1970-	Geological Survey	
D 1-3-07DCD	425900108335401	124WDRV	WSE	R	SA	1966-67, 1970-	Geological Survey	
D 1-3-29CCC	425623108332401	124WDRV	WSE	R	SA	1966-67, 1970-	Geological Survey	
D 1-5-11BDD	425931108151301	111ALVM	WSE	R	SA	1965-67, 1970-	Geological Survey	
D 2-1-06DDD	425437108474101	111ALVM	WSE	R	SA	1965-67, 1970-	I. W. Seamands	
GOSHEN COUNTY		MISSOURI RIVER BASIN						
19-061-02CCD	413816104094901	111ALVM	WSE	S	SA	1943, 1949-69, 1972-	City of La Grange	
19-061-03DCD	413817104103201	111ALVM	WSE	S	M	1978-	Charles Lyman	
19-061-04ABC	413852104115801	111ALVM	WSE	S	C	1972-	Frank Sanders	Recorder 1973-
19-061-04CDD02	413813104115702	111ALVM	WSE	S	M	1943, 1948-69, 1972-	Hugh Stemler	
19-061-10AAB01	413810104102301	123BRUL	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
19-061-13BAA	413715104082701	123BRUL	WSE	S	M	1972-	Flora Vandehei	
20-060-30BBB	414049104074501	123BRUL	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
20-061-03DAD01	414348104101301	123WRVR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
20-061-14CDB	414151104094101	123BRUL	WSE	S	M	1978-	Dan Phinney	
20-061-15ADA02	414218104101502	123BRUL	WSE	S	M	1978-	Horse Creek Conserv. Dist.	
20-061-15DCD02	414149104103002	123BRUL	WSE	S	M	1978-	Horse Creek Conserv. Dist.	
20-061-20DCC	414050104130301	111ALVM	WSE	S	M	1978-	John Meier & Son, Inc.	
20-061-21DDD	414050104112301	111ALVM	WSE	S	M	1970-	Curtis Meier	
20-061-22AAA03	414139104101503	123BRUL	WSE	S	M	1978-	Horse Creek Conserv. Dist.	
20-061-22ACC	414118104104201	123BRUL	WSE	S	M	1978-	John Meier & Son, Inc.	
20-061-23BBC02	414133104100402	123BRUL	WSE	S	M	1978-	John Meier & Son, Inc.	
20-061-23BDB02	414128104094502	123BRUL	WSE	S	C	1978-	John Meier & Son, Inc.	Recorder 1978-
20-061-23CCC	414051104100701	111ALVM	WSE	S	C	1972-	John Meier & Son, Inc.	Recorder 1973-

Table 5.--Ground-water observation wells--Continued

Well number	Lat-long-seq no.	Geo-logic unit	Funding agency	Field office	Frequency of observation	Period of record	Name of owner	Remarks
GOSHEN COUNTY--Continued MISSOURI RIVER BASIN								
20-061-24CDD	414052104083001	123BRUL	WSE	S	M	1976-	John Meier & Son, Inc.	
20-061-25CBC02	414017104085702	111ALVM	WSE	S	M	1972-	John Meier & Son, Inc.	
20-061-25DCC	414002104081601	123BRUL	WSE	S	M	1976-	Curtis Meier	
20-061-27DDA	414005104101701	111TRRC	WSE	S	M	1943, 1949-70, 1972-	Curtis Templin	
20-061-31DAD	413919104134101	123BRUL	WSE	S	M	1972-	Ward Hay & Cattle Company	
20-061-34DCC	413907104103801	123BRUL	WSE	S	M	1978-	Curtis Templin	
20-061-35AAB	413953104091001	123BRUL	WSE	S	M	1970-76, 1978-	John Meier & Son, Inc.	
20-061-35CCC	413910104100701	123BRUL	WSE	S	M	1978-	John Meier & Son, Inc.	
23-060-10AAC	415902104031601	111ALVM	WSE	CH	Q	1950-	French Irrigation District	
24-060-28CBD	420141104051501	111ALVM	WSE	CH	Q	1962-		
24-061-05CBB02	420449104133402	111ALVM	WSE	CH	Q	1951-	Geological Survey	
24-061-11BBB	420427104100601	111TRRC	WSE	CH	Q	1962-	Bill Ring	
24-061-23CCB	420204104100601	111ALVM	WSE	CH	Q	1962-	Geological Survey	
25-061-28DBC	420626104114501	111TRRC	WSE	CH	Q	1943, 1948-52, 1954-	M. W. Berry	
25-062-02BBB	421031104170001	111ALVM	WSE	CH	Q	1962-	Geological Survey	
25-062-19AAB	420753104204701	111ALVM	WSE	CH	Q	1948-53, 1955-	Lester Stroud	
25-062-27BDC02	420640104175401	111ALVM	WSE	CH	Q	1962-	Geological Survey	
25-062-31ADC	420548104204801	111ALVM	WSE	CH	Q	1962-	Geological Survey	
25-063-09CCB	420900104262201	111ALVM	WSE	CH	Q	1943, 1948-	Emery Bright	
26-062-14BBA	421357104165001	111ALVM	WSE	CH	Q	1948-	Lester Dunten	
26-063-32DAC	421044104263201	111ALVM	WSE	CH	Q	1948-	Joseph Speckner	
26-064-23CDA	421233104303401	111ALVM	WSE	CH	Q	1962-	Geological Survey	
26-064-28BBB	421216104332301	111ALVM	USGS	O	M	1948-	National Park Service	
26-064-29ADA	421205104333001	111ALVM	WSE	O	M	1942-43, 1946-	National Park Service	
28-061-06ABA	422512104135501	122ARKR	WSE	S	C	1979-	State of Wyoming	Recorder 1979-
29-061-08CDC	422946104131001	122ARKR	WSE	CH	SA	1949-51, 1970, 1975-	Gerald Sturman	
29-061-17AAD	422928104121401	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
29-061-23ABB	422849104090801	122ARKR	WSE	S	C	1979-	State of Wyoming	Recorder 1979-
29-061-26CBB01	422730104094801	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
30-060-04DAA	423632104070201	122ARKR	WSE	CH	SA	1972-	Wm Immesoeta	
30-060-29BBC	423232104090001	122ARKR	WSE	CH	SA	1972-	Otto York	
30-062-33DCA	421730104183001	122ARKR	WSE	CH	SA	1974-	Ronald Podalak	
JOHNSON COUNTY MISSOURI RIVER BASIN								
42-078-14DDB	433618106112901	211LNCE	WSE	C	SA	1965-	W. B. Linch	
48-083-05DCC	440912106512001	374FLTD	WSE	B	C	1974-	Mobil Oil	Recorder 1979-
49-083-27DBA02	441112106493502	331MDSN	WSE	B	C	1974-	Mobil Oil	Recorder 1974-
51-083-10ACB	442427106494001	124WSTC	WSE	B	SA	1960-	Helen Rauch	

Table 5.--Ground-water observation wells--Continued

Well number	Lat-long-seq no.	Geo-logic unit	Funding agency	Field office	Frequency of observation	Period of record	Name of owner	Remarks
LARAMIE COUNTY	MISSOURI RIVER BASIN							
12-060-07DDD	410059104072401	123BRUL	WSE	S	C	1977-	State of Wyoming	Recorder 1977-
12-062-13BAA	410100104160301	111TRRC	WSE	S	C	1975-	State of Wyoming	Recorder 1975-
12-063-15AAA02	410111104223102	123BRUL	WSE	S	C	1973-	Geological Survey	Recorder 1972-
13-060-05CCB	410703104071201	123BRUL	WSE	S	C	1969-	Elmer Glantz	Recorder 1972-
13-068-13CCC	410530104574001	1210GLL	WSE	CH	C	1942-50, 1969-	City of Cheyenne	Recorder 1972-
14-060-05BCB	411238104070801	123BRUL	WSE	S	C	1957-	C. C. Gross	Recorder 1972-
14-060-10DBB	411131104041801	123BRUL	WSE	S	C	1973-	Geological Survey	Recorder 1973-
14-061-18DDD01	411022104141201	123WRVR	WSE	S	C	1977-	Laramie Co. Well #2	Recorder 1977-
14-061-22DCC	410900104110701	123BRUL	WSE	S	C	1975-	Sheril Brown	Recorder 1975-
14-063-15AAA	411114104242501	122ARKR	WSE	S	C	1977-	Laramie Co. Well #3	Recorder 1977-
14-064-01DCB	411214104293301	1210GLL	WSE	S	C	1977-	Hollenbeck	Recorder 1977-
14-064-19BCC	411005104355001	1210GLL	WSE	S	C	1977-	Laramie Co. Well #9	Recorder 1977-
14-066-10ABA	411210104452001	1210GLL	WSE	S	C	1977-	Laramie Co. Well #8	Recorder 1977-
14-067-18DDC	411034104554001	1210GLL	WSE	CH	C	1956-	City of Cheyenne	Recorder 1972-
14-068-35CDD02	410757104582302	1210GLL	WSE	CH	C	1969-	Art King	Recorder 1972-
15-062-20AAA	411531104194701	1210GLL	WSE	S	C	1977-	Laramie Co. Well #4	Recorder 1977-
15-066-10BAB	411725104454601	1210GLL	WSE	S	C	1977-	Laramie Co. Well #7	Recorder 1977-
16-060-07BBB	412227104081401	1210GLL	WSE	S	C	1975-	State of Wyoming	Recorder 1975-
16-061-17AAA	411136104125301	1210GLL	WSE	S	C	1977-	Laramie Co. Well #5	Recorder 1977-
17-060-33CBB	412343104053101	1210GLL	WSE	S	C	1975-	State of Wyoming	Recorder 1975-
17-062-17CCC	412605104203001	1210GLL	WSE	S	M	1982-	State of Wyoming	Recorder 1982-
LINCOLN COUNTY	GREEN RIVER BASIN							
24-112-08CBB	420434110092001	124LNEY	WSE	GR	SA	1966-70, 1972-	National Park Service	
LINCOLN COUNTY	BEAR RIVER BASIN							
22-119-05CDA	415442110571801	111TRRC	WSE	UT	SA	1959, 1962-	Doyle Knouse	
23-119-32BDA02	415557110571502	111TRRC	WSE	UT	SA	1962-	Thornock Bros.	
23-120-13AAC	415849110590801	111ALVM	WSE	UT	SA	1955-	Doyle Knouse	
24-119-28ACA	420202110560201	111TRRC	WSE	UT	SA	1962-	Herman Teichert	
NATRONA COUNTY	MISSOURI RIVER BASIN							
30-085-21BAB	423346107014201	122ARKR	USGS	C	SA	1967-		
33-080-04ABB	425147106263701	111TRRC	WSE	C	SA	1950, 1965-	Bureau of Reclamation	
35-080-31DDD01	425700106282801	111TRRC	WSE	C	SA	1967-	Geological Survey	
40-078-15AAB	432633106115201	211FXHL	USGS	C	SA	1965-	Town of Edgerton	

Table 5.--Ground-water observation wells--Continued

Well number	Lat-long-seq no.	Geo-logic unit	Funding agency	Field office	Frequency of observation	Period of record	Name of owner	Remarks
NIOBRARA COUNTY	MISSOURI RIVER BASIN							
31-060-15DA	423940104031201	122ARKR	WSE	CH	SA	1962-	Geological Survey	
31-061-29BB	423816104125801	122ARKR	WSE	CH	SA	1972-	Robert Holmes	
31-062-18DC	424024104060401	122ARKR	WSE	CH	SA	1973, 1975-	Gordon Kaan	
32-060-29BC	424325104060401	122ARKR	WSE	CH	SA	1956, 1972-	A. E. Larson	
32-062-05BAA	424709104194101	122ARKR	WSE	S	C	1979-	State of Wyoming	Recorder 1979-
32-062-12CCD	424531104153101	122ARKR	WSE	CH	SA	1972-	Ken Freeman	
32-062-20BDD	424342104191801	122ARKR	WSE	CH	SA	1958, 1968, 1970-	Koel Larsen	
32-062-32BBB	424244104202001	122ARKR	USGS	C	C	1970-	Richard Pfister	Recorder 1970-
32-063-02CCC	423100104233001	122ARKR	WSE	CH	SA	1952, 1959, 1968-	G. Christian	
32-063-08DAA	424544104260601	122ARKR	WSE	S	C	1979-	State of Wyoming	Recorder 1979-
32-063-33BBB	424232104261001	122ARKR	WSE	CH	SA	1957, 1960-	Earl Quibley	
32-064-24DA 02	424352104294501	122ARKR	WSE	CH	SA	1960-	Ira Lamb	
33-062-29DBA	424801104203101	122ARKR	WSE	CH	SA	1967-74, 1976-	Dale Fallerton	
36-062-28AB 01	430422104183201	331MDSN	USGS	C	C	1974-	Energy Trans. Co.	Recorder 1974-
36-062-28AB 02	430422104183202	217LKOT	WSE	C	C	1974-	Energy Trans. Co.	Recorder 1975-
40-061-16CCD	432610104115401	111ALVM	WSE	C	SA	1970-	Geological Survey	
PLATTE COUNTY	MISSOURI RIVER BASIN							
21-065-16AAA	414755104391101	122ARKR	WSE	CH	SA	1972-	Hellbaum	
23-068-15DDD	415733104585601	122ARKR	WSE	CH	Q	1958-70, 1972, 1974-	Bureau of Reclamation	
23-068-18DAD	415753105022601	122ARKR	WSE	CH	Q	1958-70, 1972-	Bureau of Reclamation	
24-067-21AAB	420237104532101	111ALVM	WSE DEPD	S	C	1979-	Ed Preuit	Recorder 1979-
24-068-03DAD	420446104590001	122ARKR	WSE	CH	Q	1958-70, 1972-	Bureau of Reclamation	
24-068-22AAB	420246104590301	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1981-
25-067-19DDA01	420718104553901	122ARKR	WSE DEPD	P	C	1979-	Ed Wilhelm	Recorder 1979-
25-067-34CCD	420524104530201	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
25-068-12DDA	420859104565001	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
25-068-15BBD	420840105000401	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
25-068-24AAD	420748104565051	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
25-068-31AAA	420613105024401	122ARKR	WSE DEPD	P	C	1979-	Ernie Douglas	Recorder 1979-
26-068-12CBD01	421443104574601	122ARKR	WSE	S	C	1980-	State of Wyoming	Recorder 1980-
26-068-36BBB01	421128104575801	122ARKR	WSE	S	C	1981-	State of Wyoming	Recorder 1981-
28-068-17CBC	422355105023401	122ARKR	WSE	CH	Q	1961-70, 1972-	W. H. Johnson	

Table 5.--Ground-water observation wells--Continued

Well number	Lat-long-seq no.	Geo-logic unit	Funding agency	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	1960-	Mr. Prather	
54-081-14BC02	443915106352201	124WSTC	WSE	B	SA	1960-	Ulm School	
SUBLETTE COUNTY	GREEN RIVER BASIN							
28-112-19AC01	422348110114501	124WSTC	WSE	GR	SA	1965-70, 1972-	Bureau of Land Management	
30-107-06DD01	423536109382001	124WSTC	WSE	GR	SA	1964-66, 1968-	Bureau of Land Management	
30-111-17ACA01	423504110053001	124WSTC	WSE	GR	SA	1965-	Sublette County	
32-108-05BA	424633109450001	111ALVM	WSE	GR	SA	1965-	James Barger	
35-111-08ADB	430118110071001	111ALVM	USGS	GR	SA	1965-	Geological Survey	
SWEETWATER COUNTY	GREEN RIVER BASIN							
18-110-21DBA01	413128109495801	111ALVM	WSE	GR	SA	1964-	R. E. Holding	
19-095-05DD	413902108070601	124WSTC	WSE	GR	SA	1972-	Mr. Jolley	
19-099-06DCC	413535108364401	125FRUN	WSE	GR	SA	1963-	Rock Springs Grazing Assoc.	
20-101-25DDD01	414035108442001	211ALMD	WSE	GR	SA	1963-	Geological Survey	
22-105-07AAD	415416109203601	124LNEY	WSE	GR	SA	1964-	Sheep Company	
UINTA COUNTY	GREEN RIVER BASIN							
15-115-20CBA	411600110243301	111TRRC	WSE	GR	SA	1957-	School District	
15-118-24BCB	411522110333201	124WSTC	WSE	GR	SA	1964-		
UINTA COUNTY	BEAR RIVER BASIN							
16-121-11ACC	412248111020301	111TRRC	WSE	UT	SA	1955-	Elwin Sessions	
WESTON COUNTY	MISSOURI RIVER BASIN							
46-061-29BDA	435628104123401	337PHSP	WSE	C	SA	1969-	R. J. Rumney	
46-063-09DB	435840104253001	217LKOT	WSE	C	Q	1969-	Black Hills P & L	
47-060-04ADA	440500104034001	337PHSP	WSE	SD	M	1972, 1975-	Weston County	
48-065-35CCB	440530104381001	337PHSP	WSE	O	M	1961-	Upton #4	

WATER-RESOURCES PROJECTS

The numerous water-resources projects being conducted in Wyoming are described on the following pages. The descriptions reflect project status as of October 1982. The project number is given following each title.

The funding agencies during the fiscal year 1983 are shown for each project. The section "Progress and Significant Results" covers the period for fiscal year 1982. The area of each study, unless noted as statewide, 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).

FUNDING AGENCIES: Wyoming State Engineer, Wyoming Department of Economic Planning and Development, Wyoming Department of Environmental Quality, Wyoming Water Development Commission, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, City of Buffalo, Corps of Engineers, National Park Service, and Geological Survey.

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: The objectives are to: (1) 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; and (2) 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 resources 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 FOR FISCAL YEAR 1982: Hydrologic data collection was performed on schedule. Computation of the 1981 water-year records was completed. During the year, 16 gaging stations were installed and 31 were discontinued. Cooperation on 12 of the new stations is with a new agency, the Wyoming Water Development Commission. The contract for collection and processing of data for 13 gaging stations was cancelled, effective September 30, 1981; six of the stations were discontinued and seven were continued under the Coal Hydrology Program. The Worland Sub-district Office was officially closed on September 4, 1982, and all field responsibilities were transferred to the Riverton field office. Numerous requests for tables of daily flows and statistical summaries of flow data were received and filled.

PLANS FOR FISCAL YEAR 1983: Limited Federal funding will result in the discontinuation of five gaging stations at the beginning of the year. If funds are obtained from other agencies, four of these stations will be reactivated.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

Glass, W. R., Circulation system for winter operation of gage wells: Water Resources Division Bulletin, Sept. 1982 - April 1983, p. 51-53.

Green, S. L., 1983, Water-resources investigations of the U.S. Geological Survey in Wyoming, fiscal years 1981 and 1982: U.S. Geological Survey Open-File Report 83-254, 122 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 1, Missouri River Basin: U.S. Geological Survey Water-Data Report WY-81-1, 575 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 2, Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-81-2, 219 p.

PROJECT TITLE: Ground-water stations (WY 00-002).

FUNDING AGENCIES: Wyoming State Engineer, Wyoming Department of Economic Planning and Development, and Geological Survey.

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: The objectives are to: (1) 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 potential problems can be defined early enough to allow planning and management; and (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 FOR FISCAL YEAR 1982: About 1,000 water-level measurements were made from a total of 197 wells, of which 69 have continuous recorders. About 133 observation wells, hand-measured monthly in Laramie County, were discontinued in December 1981. A report, "Ground-water levels in Wyoming, 1971 through part of 1980," was completed and published as Open-File Report 82-859.

PLANS FOR FISCAL YEAR 1983: Collection and processing of water-level information at sites and frequencies similar to those in 1982 will be continued. A computer program for plotting hydrographs directly from Ground Water Site Inventory (GWSI) and daily values files will be developed. Historical data will be entered into GWSI. A report containing hydrographs for selected wells will be prepared.

REPORTS PUBLISHED DURING FISCAL YEARS 1982 AND 1983:

Ragsdale, Jess O., 1982, Ground-water levels in Wyoming, 1971 through part of 1980: U.S. Geological Survey Open-File Report 82-859, 200 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 1, Missouri River Basin: U.S. Geological Survey Water-Data Report WY-81-1, 575 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 2, Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-81-2, 219 p.

PROJECT TITLE: Water-quality stations (WY 00-003).

FUNDING AGENCIES: Wyoming Department of Agriculture, Wyoming Department of Environmental Quality, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, Department of Energy, and Geological Survey.

PROJECT LEADER: Samuel J. Rucker, IV.

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: The objectives are 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: A network of water-quality stations will be operated to provide data on average chemical concentrations, loads, and trends as required by planning and management agencies.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: The water-quality network decreased from 190 stations in fiscal year 1981 to 125 stations in fiscal year 1982. Decreases were mainly in the Bureau of Land Management energy program and the Geological Survey Coal Hydrology program. Contractor operation of energy-related stations ceased on September 30, 1981. Programs for State and other Federal agencies were unchanged or had minor changes, although sampling frequencies were decreased in some cases due to funding decreases. A compilation of data regarding streams with high alkalinity was done for the Environmental Protection Agency. Special sampling activities were done in cooperation with the Department of Energy at the Hoe Creek coal-gasification site and the White Mountain in-situ oil-shale retorting site. All water-quality data for the 1981 annual data report series was compiled and prepared for publication.

PLANS FOR FISCAL YEAR 1983: Operation of the network will be continued, with the following changes: (1) Three stations will be discontinued; (2) specific-conductance monitors will be installed at two stations; (3) the Environmental Protection Agency energy program will be discontinued (mostly trace metals, nutrients and coliform at stations for which salinity sampling is sponsored by other agencies); and (4) manpower permitting, there may be re-establishment of a limited program in cooperation with the Bureau of Land Management. Sampling for herbicides, previously done in project WY 77-043, will be done in this project starting in fiscal year 1983.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 1, Missouri River Basin: U.S. Geological Survey Water-Data Report WY-81-1, 575 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 2, Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-81-2, 219 p.

REPORT COMPLETED DURING FISCAL YEAR 1983:

Rucker, S. J., IV, and DeLong, L. L., 1983, Evaluation of selected surface-water-quality stations in Wyoming: U.S. Geological Survey Water-Resources Investigations Report 82-4003 (in press).

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

FUNDING AGENCIES: Wyoming Department of Environmental Quality, Bureau of Land Management, Bureau of Reclamation, and Geological Survey.

PROJECT LEADER: Ernest S. Denison

FIELD 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 to: (1) Provide a national bank of sediment data for use in broad Federal and State planning and action programs, (2) provide data for Federal and State management of interstate waters, and (3) 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 FOR FISCAL YEAR 1982: Sediment data collection and processing continued on schedule at four stations with pumping samplers, one station with a daily observer, and 47 stations where the sampling frequency ranged from weekly to quarterly. The sediment laboratory in Worland officially closed on September 4, 1982. Prior to its closure, the Worland laboratory analyzed sediment samples for the Wyoming, Montana, North Dakota, and Alaska Districts.

PLANS FOR FISCAL YEAR 1983: Fieldwork will continue during fiscal year 1983 on a reduced scale. The network will be reduced from 52 to 32 stations. Four of these remaining stations will have automatic pumping samplers, one will be sampled daily by an observer, and 27 will be sampled at frequencies ranging from weekly during the irrigation season to quarterly.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 1, Missouri River Basin: U.S. Geological Survey Water-Data Report WY-81-1, 575 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 2, Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-81-2, 219 p.

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

FUNDING AGENCIES: Wyoming Highway Department and Geological Survey.

PROJECT LEADER: Stanley A. Druse.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: July 1958 to September 1984.

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 FOR 1982: An evaluation of the crest-stage gage network resulted in a reduction from 98 active sites to 34 active sites. Two indirect measurements were made at crest-stage gage sites. At one site the 1982 peak flow was more than twice the magnitude of the previous highest peak. A supplementary study was started; about 35 gage sites have been field-checked in an attempt to relate old floods with time, or to extend recorded flood peaks back in time, by considering flood-plain deposition, terrace formation, shrub growth and flood-debris decay. This phase of the study (paleohydrology) has not produced conclusive results to date, but has added a considerable amount of valuable geomorphological data and historical information (within the last 100 years) to the station files.

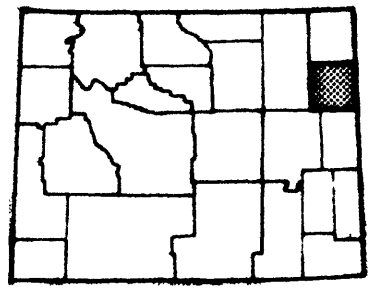
PLANS FOR FISCAL YEAR 1983: Operation of the crest-stage gage network will be continued but the number of gage sites will be reduced further. A minimum figure has not yet been determined. The study of historical floods will be completed. A major effort will be made to assemble all information, analyses, and results of the project over its 25-year span and begin preparation of a comprehensive final report. The report will be completed and the project ended in fiscal year 1984, according to present plans.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 1, Missouri River Basin: U.S. Geological Survey Water-Data Report WY-81-1, 575 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1981, Volume 2, Green River, Bear River, and Snake River Basins: U.S. Geological Survey Water-Data Report WY-81-2, 219 p.

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



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

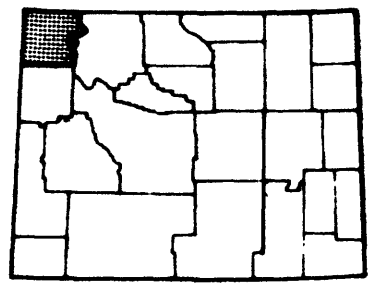
PROJECT LEADER: Marlin E. Lowry.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: March 1974 to June 1976 (complete except report).

STATUS: Colleague review of the final report has been completed. The State Engineer also reviewed the report which is being prepared for approval.

PROJECT TITLE: Monitoring wastewater effluent in Yellowstone National Park, Wyoming (WY 74-027).



FUNDING AGENCY: National Park Service.

PROJECT LEADER: Edward R. Cox.

FIELD LOCATION: Northwestern Wyoming.

PERIOD OF PROJECT: June 1974 to September 1982 (complete except report).

PROBLEM: The National Park Service is constructing new or rehabilitating existing evaporation-percolation ponds at several sewage wastewater treatment and disposal sites in Yellowstone National Park. The sites are near streams or lakes. The National Park Service needs to determine the effects of the wastewater effluent on nearby lakes and streams. In order to do this, they need to know the amount and direction of movement of the effluents that percolate from the ponds.

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 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 the surface-water bodies.

APPROACH: Forty-six wells were installed in unconsolidated material near the sewage ponds. Several wells have been destroyed, including four that were in the area of a new lagoon constructed in 1976. Tracer tests using Rhodomine WT dye were made in a few selected wells. Water samples are collected from the wells and analyzed for chemical quality of the water. Water levels in the wells are measured periodically. A program of monitoring water quality has been established following preliminary data collection depending on funds available for the project.

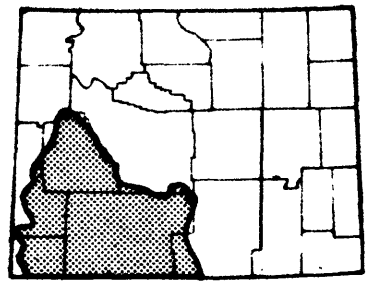
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Treated wastewater effluents percolating from evaporation-percolation lagoons at Fishing Bridge, Old Faithful, and Madison Junction have had no discernible effects on the quality of water in nearby streams and lakes.

Ground-water mounds build up under the lagoons as percolation of effluents occurs. The percolating effluents mix with ground water and form plumes of water that contain chemical constituents from the effluents. These plumes move down the hydraulic gradient toward ground-water-discharge areas. Conservative constituents such as chloride, sulfate, and nitrate increased above background levels in water in wells near and down gradient from the lagoons; whereas, those constituents in water in wells farther from the lagoons were only slightly above background levels.

Conservative constituents in water have not increased in a reach of the Yellowstone River defined by sampling sites upstream and downstream from the Fishing Bridge lagoons, nor have they increased in a reach of the Madison River defined by sampling sites upstream and downstream from the Madison Junction lagoons. Conservative constituents do increase in a reach of Iron Spring Creek defined by sampling sites upstream and downstream from the Old Faithful lagoons; however, most, if not all, of the increase is due to highly mineralized thermal water discharging in the reach. Conservative constituents from the Grant Village effluent have not been noted in water in nearby Yellowstone Lake.

PLANS FOR FISCAL YEAR 1983: The final report will be completed.

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



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Hugh W. Lowham.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: November 1974 to September 1980 (complete except report).

STATUS: Seven reports were in progress at the start of the fiscal year 1982. Three were published during the year: (1) Hydrology of Salt Wells Creek; (2) Streamflow and channels, Green River Basin; and (3) Sediment runoff, Big Sandy River. The report on water quality of springs and streams was approved by the Director. The report on ground-water data was reviewed and edited for publication in fiscal year 1983. The report on sediment-streamflow relationships was revised for additional review. The report on a biological survey of streams was dropped with permission of the Regional Hydrologist.

REPORTS PUBLISHED DURING FISCAL YEAR 1982:

Kircher, J. E., 1982, Sediment transport and source areas of sediment and runoff, Big Sandy River basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 81-72, 51 p.

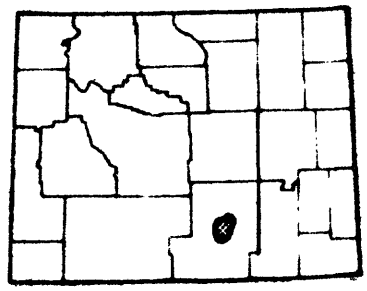
Lowham, H. W., 1982, Streamflows and channels of the Green River basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 81-71, 73 p.

Lowham, H. W., DeLong, L. L., Collier, K. R., and Zimmerman, E. A., 1982, Hydrology of Salt Wells Creek--A plains stream in southwestern Wyoming: U.S. Geological Survey Water-Resources Investigations Report 81-62, 52 p.

REPORT COMPLETED DURING FISCAL YEAR 1983:

DeLong, L. L., 1983, Water quality of streams and springs, Green River Basin--Wyoming: U.S. Geological Survey Water-Resources Investigations Report 82-4008 (in press).

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



FUNDING AGENCY: Geological Survey.

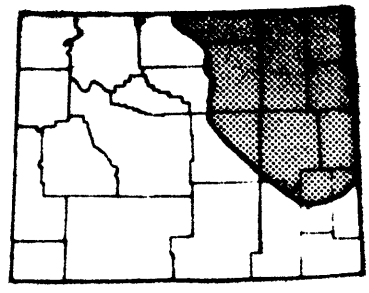
PROJECT LEADER: Pamela B. Daddow.

FIELD LOCATION: South-central Wyoming.

PERIOD OF PROJECT: July 1974 to September 1980 (incomplete).

STATUS: Water levels in the area around the coal surface mines have declined in some wells, risen in some, and have not changed in others. Ground-water level measurements in 65 wells in the Hanna and Ferris formations of the Hanna Basin, Wyo., have been prepared for entering into the Ground Water Site Inventory (GWSI) National Water Storage and Retrieval System (WATSTORE) computer file. Tables of well records and of ground-water-level data will be retrieved for the report from GWSI, selected hydrographs will be retrieved and plotted from GWSI, and the brief text will be written and the report published in 1983.

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



FUNDING AGENCIES: Department of Energy and Geological Survey.

PROJECT LEADER: Marlin E. Lowry.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: November 1974 to September 1980 (complete except reports).

STATUS: Nine reports were in process at the beginning of the year. Two reports were published: (1) Empirical techniques to determine infiltration and runoff; and (2) Ground-water data for alluvial aquifers. The report on time of travel of solutes in the North Platte River was submitted for approval. Two other reports were submitted, but were returned for technical revisions, which were made. Another report had colleague review, and was prepared for the approval process. Two reports received evaluation by a detailee, prior to further processing. The report on storage analysis for ephemeral streams was dropped with approval of the Regional Hydrologist.

REPORTS PUBLISHED DURING FISCAL YEAR 1982:

Rankl, J. G., 1982, An empirical method for determining average soil infiltration rates and runoff, Powder River structural basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 81-76, 38 p.

Wells, D. K., 1982, Ground-water data from selected wells in alluvial aquifers, Powder River basin, northeastern Wyoming: U.S. Geological Survey Open-File Report 82-856, 35 p.

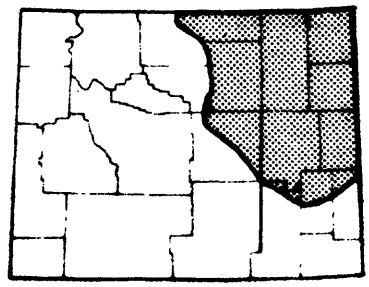
REPORTS COMPLETED DURING FISCAL YEAR 1983:

Armentrout, G. W., Jr., and Larson, L. R., 1983, Time of travel and dispersion of solutes in a 36.4-mile reach of the North Platte River downstream from Casper, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 82-4103 (in press).

Glover, K. C., 1983, Storage analyses for ephemeral streams in semiarid regions: U.S. Geological Survey Water-Resources Investigations Report 83-4078 (in press).

Lowry, M. E., and Rankl, J. G., 1983, Hydrology of the White Tail Butte area, northern Campbell County, Wyoming: U.S. Geological Water-Resources Investigations Report 82-4117 (in press).

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



FUNDING AGENCY: Geological Survey.

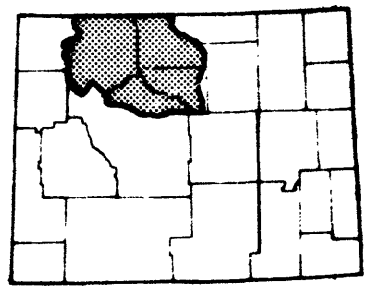
PROJECT LEADER: (vacant).

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: November 1974 to September 1980 (complete except reports).

STATUS: Very little progress was made on the four remaining reports. The Apparent water resistivity (Rwa) report received an outside evaluation after review had been completed. In 1983 a decision to publish or not will be made for each of the four remaining reports. Processing will be completed for those judged to be salvageable.

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



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Maurice E. Cooley.

FIELD LOCATION: North-central Wyoming.

PERIOD OF PROJECT: December 1974 to September 1977 (complete except reports).

STATUS: Both of the remaining reports were submitted for approval as Water-Resources Investigation reports. The report on the alluvial deposits of Owl Creek was approved and camera-ready copy prepared. The report on the Paleozoic aquifers was returned for technical revisions, which were made.

REPORT PUBLISHED DURING FISCAL YEAR 1982:

Cooley, M. E. and Head, W. J., 1982, Hydrogeologic features of the alluvial deposits in the Owl Creek Valley, Bighorn Basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 82-4007, 33 p.

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

FUNDING AGENCIES: Wyoming Department of Agriculture and Geological Survey.

PROJECT LEADER: Samuel J. Rucker, IV.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: June 1977 to September 1982 (completed Jan. 28, 1983).

PROBLEM: Local weed- and pest-control district personnel 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 Central Laboratory. Results will be examined and the effects on water quality determined.

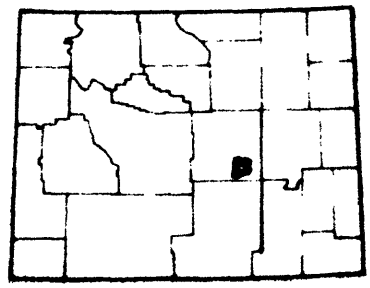
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: The most commonly detected herbicides in the water samples were picloram (36 percent non-zero values; highest concentration 0.71 µg/h) and 2,4-D (30 percent non-zero values; highest concentration 4.3 µg/h). These herbicide concentrations are not dangerous or harmful to humans or to the environment, based on available toxicity data and water-quality criteria.

STATUS: The project ended September 30, 1982. Sampling will continue at approximately the same level in fiscal year 1983, but will be a part of project WY 00-003. It is anticipated that some ground water will be monitored in critical areas. The report of results for 1978-81 was approved for publication in 1983.

REPORT COMPLETED DURING FISCAL YEAR 1983:

Butler, D. L., 1983, Pesticide data for Wyoming streams: U.S. Geological Survey Water-Resources Investigations Report 83-4127 (in press).

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



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Kent C. Glover.

FIELD LOCATION: Central Wyoming.

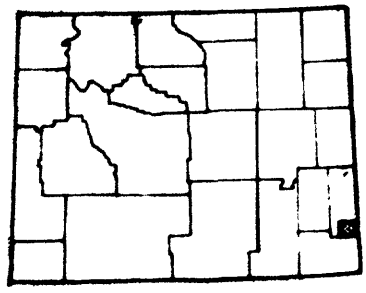
PERIOD OF PROJECT: October 1977 to September 1980 (completed Oct. 22, 1982).

STATUS: The final report was reviewed by the cooperator. Revisions were made in statements that may have compromised the State Engineer's ability to administer water rights. The report was approved for publication early in fiscal year 1983.

REPORT PUBLISHED DURING FISCAL YEAR 1983:

Glover, K. C., 1983, Digital model of the Bates Creek alluvial aquifer near Casper, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 82-4068, 45 p.

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



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: William B. Borchert.

FIELD LOCATION: Southeastern Wyoming.

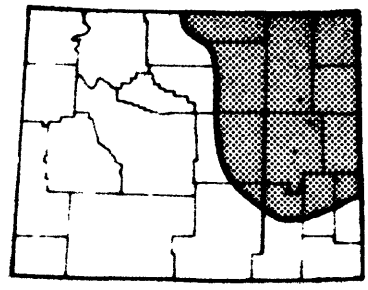
PERIOD OF PROJECT: October 1977 to September 1981 (completed Feb. 22, 1983).

STATUS: Colleague review of the final report was completed and revisions made. The report was submitted and approved for publication in 1983.

REPORT COMPLETED DURING FISCAL YEAR 1983:

Borchert, W. B., 1983, The ground-water system in the La Grange aquifer near La Grange, southeastern Wyoming: U.S. Geological Survey Water-Resources Investigations Report 83-4024 (in press).

PROJECT TITLE: Northern Great Plains regional aquifer-system analysis, Wyoming (WY 78-049).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Dwight T. Hoxie.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1981 (complete except report).

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.

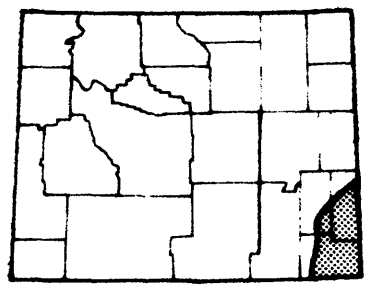
APPROACH: The areal extent of potential aquifers will be defined from previous studies, existing geohydrologic data will be compiled and evaluated, and a program will be developed to selectively collect additional data. The physical parameters of aquifers will be determined by machine processing of digitized 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.

STATUS: All data-collection and analyses has been completed. The principal final report on the digital model of the Dakota Sandstone is in review. Review of six secondary reports has been completed: evapotranspiration rates; linear-features maps of Wyoming, Montana, South Dakota, and North Dakota; and fracture-permeability map of the Northern Great Plains. These reports are being prepared for final approval.

REPORT COMPLETED DURING FISCAL YEAR 1983:

Lenfest, L. W., Jr., 1983, Evapotranspiration rates at selected sites in the Powder River Basin, Wyoming and Montana: U.S. Geological Survey Water-Resources Investigations Report 82-4105 (in press).

PROJECT TITLE: High Plains regional aquifer-system analysis, Wyoming (WY 78-050).[1]



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Charles F. Avery.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: October 1977 to September 1982 (complete except report).

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

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[1] This project is subsidiary to project CR 78-229, described on page 100.

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 Geological Survey 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 the 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.

STATUS: The two principal final reports received colleague review during 1982, but technical problems remain for one of them. Two linear-features maps have been reviewed and a third map report is inactive. The final reports will be reevaluated and processed for publication in 1983.

REPORT PUBLISHED DURING FISCAL YEAR 1983:

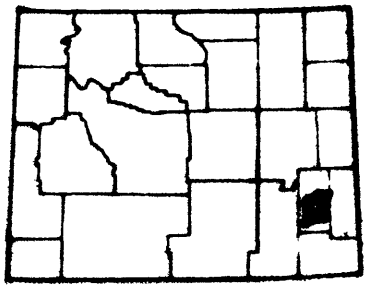
Avery, C. F., 1983, Pumpage data from irrigation wells in eastern Laramie County, Wyoming, and Kimball County, Nebraska: U.S. Geological Survey Open-File Report 83-29, 23 p.

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

FUNDING AGENCIES: Wyoming State Engineer, Wyoming Department of Economic Planning and Development, and Geological Survey.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: Southeastern Wyoming.



PERIOD OF PROJECT: April 1979 to March 1982 (completed Mar. 30, 1983).

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 to: (1) 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) 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) provide a means of predicting the effect of water-management decisions.

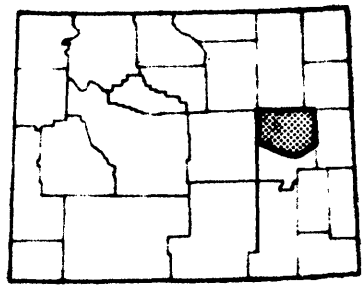
APPROACH: Well-inventory, pumpage, and surface-water-use data will be updated. Additional data will be collected to include the adjacent area around Wheatland Flats where irrigation wells have been constructed. An observation-well network will be established and mass water-level measurements will be 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.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Net water-level decline over approximately 20 years (1958, 1960 to 1979) is generally less than 3 m, although declines of about 4 m have occurred in the Arikaree Formation at specific locations. Output from a digital model, constructed to simulate hydrologic conditions, indicates ground-water discharge to streams decreased by 10 percent from 1971 to 1978. Stream-discharge measurements are not available to verify the loss. However, it is reasonable to assume, on the basis of hydraulic-head decline in the aquifers, that there has been some loss of ground-water contribution to the streams. The final report was completed; it was approved for publication early in fiscal year 1983.

REPORT PUBLISHED DURING FISCAL YEAR 1983:

Crist, M. A., 1983, Hydrologic conditions in the Wheatland Flats area, Platte County, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 83-4047, 36 p.

PROJECT TITLE: Hydrologic reconnaissance of the Powder River Basin Uranium District, Wyoming (WY 80-053).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Pamela B. Daddow.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: January to September 1980 (complete except report).

STATUS: The final report is still in preparation. The water-quality section of the report will be rewritten, probably by someone other than the authors. Colleague review will be done and the report processed for publication in 1983.

PROJECT TITLE: Precipitation, infiltration, and runoff relations for small basins in Wyoming (WY 80-054).

FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: James G. Rankl.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: January 1980 to September 1982 (complete except report).

PROBLEM: Federal regulations concerning surface coal mining and reclamation operations specify use of precipitation-frequency criteria for hydraulic design. The problem is to determine runoff volumes from small drainage basins for selected precipitation frequencies. Variability of infiltration rates of soil and other surficial material requires an understanding of the hydrologic processes controlling the relations of precipitation, infiltration, and runoff in small drainage basins.

OBJECTIVE: The objectives of this study are to define infiltration-rate curves for soils and other surficial materials and determine the relations between infiltration rates computed from basin studies and those computed from infiltration tests.

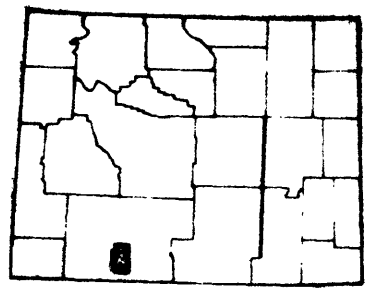
APPROACH: Existing rainfall-runoff data collected at small ephemeral basins will be used with Soil Conservation Service soil maps and descriptions to define infiltration-rate curves. Infiltrometer data will be collected using a hand-portable model developed by McQueen (Geological Survey) and the rainfall simulator of the Geological Survey Public Lands Hydrology Program. These data will be analyzed statistically and compared to basin runoff.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Curves separating rainfall events that produce runoff from those that do not, were defined mathematically on graphs of rainfall intensity versus rainfall duration. The method is more accurate than the previously published empirical method and also provides a physical basis for defining infiltration parameters for use in a rainfall-runoff simulation model.

Split samples were used to test the reliability of optimized infiltration parameters within a basin. The between-basin reliability of the method also was tested by computing runoff from rainfall using optimized infiltration parameters from a nearby basin. A report of results, to be published in 1983, was nearly completed at year's end.

PLANS FOR FISCAL YEAR 1983: The final report will be completed and processed for publication in the Water-Resources Investigations Report series.

PROJECT TITLE: Quality of runoff from small basins in plains areas--Wyoming (WY 80-055).



FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Lewis L. DeLong.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: January 1980 to September 1981 (complete except report).

STATUS: Data collection and analysis were completed in fiscal year 1981. Disposition of the final report will be decided and action taken to complete the report.

PROJECT TITLE: Streamflow characteristics of energy-mineral areas in Wyoming (WY 80-056).

FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Hugh W. Lowham.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: March 1980 to September 1982 (complete except report).

PROBLEM: Substantial development of mineral resources is occurring in Wyoming. Planning and design related to such developments often require information concerning streamflow characteristics. Gaged data are sparse for the arid and semiarid areas where most of the energy-mineral development is occurring.

Techniques for transferring or estimating streamflow information are therefore required. Existing techniques for estimating flow characteristics are limited mainly to peak flows. More complete information is needed concerning annual and seasonal runoffs.

OBJECTIVE: This study will help solve problems currently being encountered in estimating runoff of arid and semiarid energy-mineral areas. Specific objectives are to: (1) Develop techniques and relations for estimating monthly and annual runoff with greater accuracy than now possible, and (2) refine relations for estimating peak flows for streams in these areas.

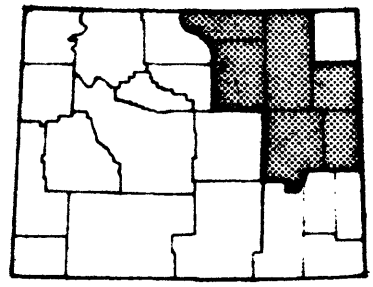
APPROACH: Existing techniques for estimating flow characteristics in Wyoming were developed using streamflow data available through 1973. Since then many new gaging stations have been established in the plains areas; those having suitable records will be included in the analysis. Because runoff from plains areas is highly variable, regional-analysis techniques will be developed considering average characteristics for groups of stations, with minimum reliance on individual short-term records. Regression techniques using basin features and channel-geometry measurements will be used in the analysis. Also, relations showing seasonal runoffs derived from an analysis of snowmelt and rainfall contributions will be investigated. The use of streambed-material size to improve channel-geometry relations will be examined.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Regression equations for estimating peak flows and annual runoff of Wyoming streams were refined. Streamflow data available through the 1980 water year were used in the analysis. Peak flows were analyzed for each station using guidelines of Water Resources Council Bulletin 17B. Two different methods were investigated for estimating streamflow at ungaged sites. One method uses basin characteristics; the other uses channel-geometry measurements. For the plains area of the State, the analysis using basin characteristics showed that a nonlinear regression model yielded more accurate equations than a linear model, especially for estimating streamflow from drainage areas of less than 25.9 km^2.

To improve upon channel-geometry relations developed previously, detailed measurements of the channels and samples of the streambed and bank materials were obtained for 23 gaged sites. Various indices of channel size and composition were added to regressions of width versus peak flows. Regression analysis is being used to evaluate the effects of these variables.

PLANS FOR FISCAL YEAR 1983: The estimating equations developed for this project will also be used for project WY 59-010. Some modification may be necessary after historical adjustment is made for about 14 streamflow stations, which will be completed within several months. The final report will then be completed and submitted for review.

PROJECT TITLE: Biological communities of small streams in Wyoming (WY 80-057).



FUNDING AGENCY: Geological Survey.

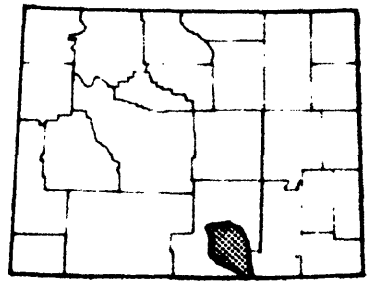
PROJECT LEADER: David A. Peterson.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: January 1980 to September 1981 (complete except report).

STATUS: The flow-duration patterns of streams in the Powder River coal basin, Wyo., were analyzed to determine their relationship to productivity and composition of the invertebrate community. Perennial streams are more productive than intermittent or ephemeral streams, in terms of benthic biomass, drift biomass, and number of taxa per sample, both benthic and drift. Invertebrate communities adapted to flowing water characterize perennial streams; communities adapted to standing water characterize ephemeral streams. The communities of intermittent streams are intermediate to those of perennial and ephemeral streams, and are dependent on the pattern of flow duration. Limitations imposed by water quality and substrate on community development were also identified. During 1983 the final report will be completed, reviewed, and processed for publication in the Water-Resources Investigations Report series.

PROJECT TITLE: Reconnaissance of the water resources of the Saratoga Valley, south-central Wyoming (WY 80-058).



FUNDING AGENCIES: Wyoming State Engineer, Wyoming Department of Economic Planning and Development, and Geological Survey.

PROJECT LEADER: Leslie W. Lenfest, Jr.

FIELD LOCATION: South-central Wyoming.

PERIOD OF PROJECT: March 1980 to June 1982 (complete except report).

PROBLEM: Recent increases in the development of water resources in the Saratoga Valley necessitate a better appraisal of the resources available and of the extent to which development is taking place. This information is needed by the Wyoming State Engineer's Office to carry out its regulatory functions. Definition of the hydrologic system is needed and would include hydraulic properties and head in the aquifer, hydraulic head between aquifers, stream-aquifer relationships, irrigation and precipitation recharge of the aquifer, and the response of the aquifers to pumpage.

OBJECTIVE: The objectives are to: (1) Determine the present status of ground-water development, and the hydrology and hydraulic properties of the aquifers within the study area, based on the collected data; and (2) evaluate the need for additional studies and, if needed, recommend an approach for further investigations.

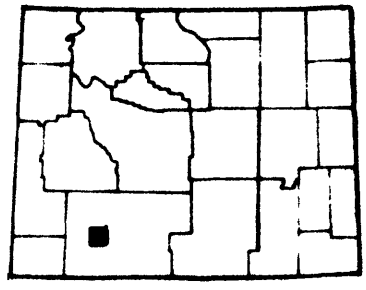
APPROACH: An inventory will be made of wells from documented information and field reconnaissance. A water-level network will be designed that consists of 20 to 25 wells to be measured monthly. A mass water-level measurement of all wells will be done to establish water levels and to monitor water-level changes in areas of extensive pumpage. An inventory of irrigated acreage will be made using infrared photographs and field reconnaissance. Seepage runs will be made to estimate stream-aquifer relationships. Tests will be done to determine hydraulic properties of aquifers.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Ground-water development for agriculture use has increased substantially in the Saratoga Valley during the 1960's and 1970's and will probably increase in the 1980's. There are at least 30 major irrigation wells capable of producing over 13 dm^3/s in the valley; about two-thirds of these have been drilled since 1960, and at least five new well permits have been approved for 1981. Approximately 3.3 hm^3 of water in 1980 and 5.2 hm^3 in 1981 were pumped from shallow aquifers for irrigation purposes.

Water levels were measured in about 140 wells in the late summer and fall of 1980. Forty-one of these wells were measured in studies prior to 1969. Ground-water levels in 1980 were higher than, or within five feet of, 85 percent of the water levels measured prior to 1969.

PLANS FOR FISCAL YEAR 1983: The review of the final report will be completed and the report processed for publication in the Water-Resources Investigations Report series.

PROJECT TITLE: Hydrologic investigation of the in-situ oil-shale retort area near White Mountain, southwestern Wyoming (WY 81-059).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Kent C. Glover.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: October 1980 to September 1983.

PROBLEM: Comprehensive information is lacking on the hydrologic aspects of in-situ oil-shale retorting. At present, there is also little knowledge of the environmental effects of the retort process on associated aquifers and

streams. This kind of information is needed by State and Federal agencies in planning and supervising the experimental and commercial development of oil-shale resources by retort processes.

OBJECTIVE: Broad objectives are to define the hydrologic regime, and to describe hydrologic changes due to retorting, which will permit evaluation of any environmental impacts. Specific objectives are to: (1) Identify hydrologic characteristics of the aquifers; (2) determine hydrologic relations among aquifers; (3) determine the nature and extent of the surface-water/ground-water relationship; and (4) determine the chemical characteristics of the ground water.

Although the project will be involved with a specific retort site, it is intended to be process oriented; therefore, the results should be highly transferrable to other retort sites.

APPROACH: In the first phase a planning document will be prepared based on existing information, including previous studies of the general area and related studies of other areas. A ground-water flow model will be selected and used as an aid in designing a data-collection program. A solute-transport model also will be selected. In the second phase test drilling will be done and hydrologic, geologic, geophysical, and water-quality data will be collected. The flow and transport models will be calibrated and tested. In the third phase results will be interpreted and the final reports prepared.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Ground-water sampling and analysis has confirmed extensive migration of solute from an in-situ oil-shale retort near Rock Springs, Wyo. Movement of the solute plume in the six years since retorting ceased appears to be restricted to the Tipton member of the Green River Formation. The solute plume, as indicated by thiocyanate (SCN), has not been detected in the underlying Wasatch Formation.

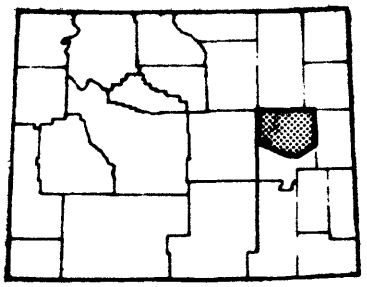
A three-dimensional finite-element model of solute transport has been revised to include a source-sink term for solute transport in the oil-shale strata. Conventional solute-transport equations are used to describe movement within the tuff beds. This description of the solute-transport system also has provided a realistic means for modeling the leaching of solute from spent shale within the retort chamber. The leaching mechanism acts as a boundary condition to the solute-transport problem. The revised model has been applied successfully to simple test problems.

PLANS FOR FISCAL YEAR 1983: Ground-water flow and solute-transport models will be calibrated. Variations in water quality will be related to lithologic changes and location of solute plume. Reports of hydrogeologic framework, water quality of oil-shale strata and solute plume, and digital model analysis will be prepared.

REPORT PUBLISHED DURING FISCAL YEAR 1982:

Glover, K. C., Zimmerman, E. A., Larson, L. R., and Wallace, J. C., 1982, A plan for hydrologic investigation of an in-situ oil-shale retorting near Rock Springs, Wyoming: U.S. Geological Survey Open-File Report 82-758, 27 p.

PROJECT TITLE: Ground-water hydrology of the Southern Powder River Uranium District, Wyoming (WY 81-060).



FUNDING AGENCIES: Wyoming State Engineer, Wyoming Department of Environmental Quality, and Geological Survey.

PROJECT LEADER: Marlin E. Lowry.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: October 1980 to September 1983.

PROBLEM: Uranium exploration in the southern Powder River Basin has resulted in thousands of test holes, many of which were poorly plugged. This has resulted in flow between formerly isolated aquifers and uncontrolled flow at the surface. Development of uranium has stressed the ground-water system by pumping for supplies and for dewatering mines. There are presently 7 surface mines, 4 underground mines, and 3 in-situ mines; additional mines are planned. Agriculture in the area is highly dependent on ground water. Therefore, the impacts of exploration and development are a concern.

OBJECTIVE: The objectives are to: (1) Determine the existing hydrologic system, (2) determine the impacts on the ground-water system of the past and present uranium exploration and development, and (3) predict effects that might result from continued or modified uranium development in the future.

APPROACH: The first phase of the project will be to analyze the data obtained from companies and to establish a data-collection network. Data analysis will include testing concepts of how the hydrologic system operates and describing the geologic framework. Consistency with water-quality data will be an additional test of the concepts. The second phase will be to construct a digital model and collect additional required data. After calibration of the model, the effects of mining in the area will be simulated.

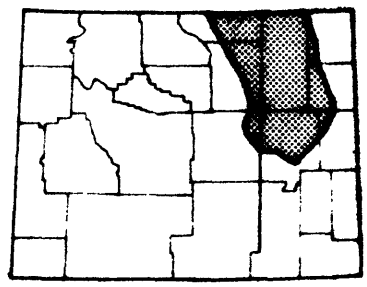
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Routine water-level and streamflow measurements continued in 1982, but model preparation was emphasized rather than fieldwork to collect ground-water and stratigraphic information. The possibility of water-level declines due to improperly plugged boreholes was investigated.

The data readily available for a three-dimensional model of ground-water flow were assessed. It was concluded that the distribution of permeability, to the extent it can be inferred from available facies maps, is better known than the distribution of head. To facilitate calibration of the model, the three-dimensional flow model was modified so that permeabilities can be changed for a given facies throughout the matrix by a program statement.

Records of over 2,000 wells were obtained and converted to Geological Survey data-base format. Not all of the wells, however, will be useful for describing the distribution of head.

PLANS FOR FISCAL YEAR 1983: Because of decreased interest in the area, the work will be terminated and a final report prepared.

PROJECT TITLE: Potentiometric maps of shallow aquifers in the Powder River Basin, northeastern Wyoming (WY 81-062).



FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Pamela B. Daddow.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: March 1981 to September 1983.

PROBLEM: Although knowledge of the ground-water system in the Powder River Basin, Wyo., has improved since the surge of new mining began in 1975, potentiometric maps, which are fundamental to understanding the ground-water system, are not available for any shallow horizon in most of the basin and are only rudimentary elsewhere. Potentiometric maps are needed to: (1) Aid current modeling efforts, (2) learn more about vertical-versus-horizontal movement and regional-versus-local movement of ground-water in the formations, and (3) assess the impacts of surface mining on water levels in shallow aquifers.

OBJECTIVE: The objectives are to: (1) Improve on the present description of the hydrologic system by mapping potentiometric surfaces in the basin, (2) document impacts of surface mines, and (3) provide more information on the relative importance of vertical-versus-horizontal and regional-versus-local movement of ground-water.

APPROACH: Wells where the producing horizon can be related to a mappable horizon for construction of potentiometric maps will be inventoried. Emphasis will be on the horizon of the Wyodak Coal and deeper units. Data will be analyzed pertinent to effects of long-term pumping on overlying or underlying aquifers. Mass water-level measurements will be made during two field seasons, concentrating in areas where there is large stress on the

system. A water-level change map will be made for the Wyodak Coal on the east side of Campbell County.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Well records and historical water-level measurements for 250 wells in the Wyodak-Anderson coal bed have been compiled and plotted for a potentiometric surface map. The correlation of the Wyodak-Anderson coal bed with the Dietz 1 coal bed expanded the areal coverage of the map into Johnson and Sheridan Counties, Wyoming, and into Montana. Drilling programs have provided data points in areas where no information previously was available. Two drill holes were cased for observation wells in the Anderson coal bed in northwestern Sheridan County in cooperation with the Minerals Management Service. Two drill holes were cased for observation wells in the Anderson coal bed in northeastern Sheridan County in cooperation with Geological Survey, Branch of Coal Resources.

Water levels were measured in about 25 Anderson observation wells, about half of these for the water-level change map in eastern Campbell County.

PLANS FOR FISCAL YEAR 1983: A potentiometric map will be constructed for the Wyodak-Anderson coal bed. A water-level change map for the Wyodak-Anderson coal in eastern Campbell County will be drawn. Water levels in some Wyodak-Anderson coal wells will be measured. A preliminary potentiometric map will be constructed for the Lance-Foxhills Formation.

PROJECT TITLE: Analysis and evaluation of side-looking radar imagery for possible use in hydrologic investigations (WY 81-063).

FUNDING AGENCY: Geological Survey (Office of Earth Resources Applications).

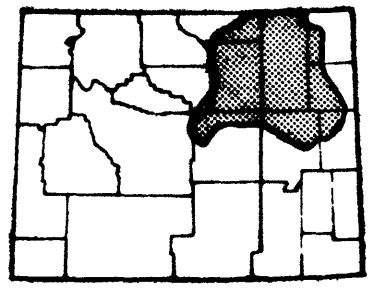
PROJECT LEADER: Maurice E. Cooley.

FIELD LOCATION: Various locations in the Rocky Mountain area.

PERIOD OF PROJECT: October 1980 to September 1981 (complete except report).

STATUS: All analytical work has been completed. Colleague review was completed for the map report on linear features for the Richfield 1:250,000-scale quadrangle. A decision will be made regarding publication of this report. A report evaluating radar imagery as a tool in hydrologic studies remained in first-draft stage.

PROJECT TITLE: Hydrology in Area 50, Northern Great Plains Coal Province, Wyoming and Montana (WY 81-064).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: James F. Wilson, Jr.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: April 1981 to September 1982 (complete July 20, 1983).

PROBLEM: Coal Area 50, comprised of the entire Powder River Basin and upper parts of the Belle Fourche and Cheyenne River Basins, is rich in energy resources--coal, oil and gas, and uranium. These resources are being developed at an accelerating pace. Because the area is semiarid, both water availability and protection of water resources are problems. Mining companies are required by law to analyze the hydrologic effects of proposed activities and to take appropriate measures to minimize adverse effects. There is a need for information about the water resources of the area that is both comprehensive in scope and easily understood.

OBJECTIVE: The objective is to describe the hydrology of Area 50 in a clear and concise manner that can be used by both the coal-mining industry and the regulatory agencies. Although specifically oriented to coal hydrology, the results should also be useful for other kinds of energy development, particularly uranium, and to other interest groups, such as environmental organizations.

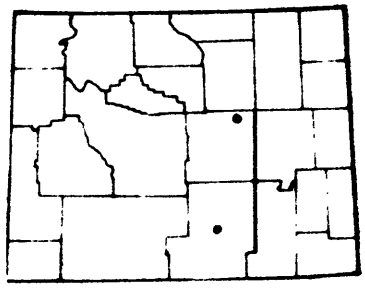
APPROACH: A topic outline will be developed, based on the Alabama Coal Area 23 report, but oriented to the hydrology and related problems of Area 50. Topics will be assigned to hydrologists for analysis and writing based on their discipline specialties. For each topic all available information will be assembled and summarized or interpreted as needed. Records and other available information on hand are sufficient; no new data will be collected. Each topic will be discussed in a text not to exceed one page, accompanied by maps, graphs, and tables as needed. Regional hydrology will be emphasized. Sources of more detailed information will be cited.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Area 50 (Powder River Basin and adjacent areas, Wyoming and Montana) has more coal than any other part of the country. Commensurate with that fact, considerable effort was expended during fiscal year 1982 on organizing the report and preparing text and illustrations for the technical subjects. At year's end, rough drafts of most of the STOP units of the report had been completed. Special attention was given to illustrations and to effective use of color to convey information.

REPORT COMPLETED DURING FISCAL YEAR 1983:

Lowry, M. E., Wilson, J. F., Jr., and others, 1983, Hydrology of Area 50, Northern Great Plains and Rocky Mountain Coal Provinces, Wyoming and Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 83-545 (in press).

PROJECT TITLE: Sediment yield from natural and reclaimed small ephemeral stream basins in Wyoming (WY 81-066).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: James G. Rankl.

FIELD LOCATION: Central and southern Wyoming.

PERIOD OF PROJECT: April 1981 to September 1984.

PROBLEM: A recurring question in describing the impacts of energy development is what will be the change, if any, in sediment transport. Although sediment data are being collected at a number of stations in the State, none of the stations are on an ephemeral stream of the size that will be impacted by surface mines. Information about potential changes in sediment transport caused by mining is needed for assessing proposed and active mining on or near ephemeral streams.

OBJECTIVE: The objectives are: (1) To relate sediment yield to rainfall and runoff and determine if there is a significant difference that can be attributed to surface mining; (2) to determine the relative importance of channel erosion and slope wash as sediment sources; and (3) if a Geological Survey transport model is approved by the Division in the period of study, the transport model will be added as a subroutine to the rainfall-runoff model of the Central Region research program, and the sediment transport calibrated.

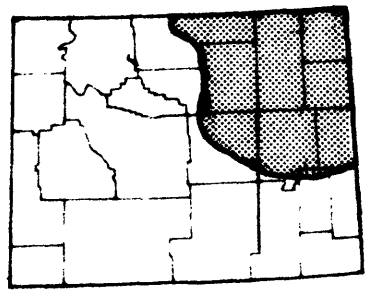
APPROACH: Dugout Creek tributary, located in the Powder River Basin, will be instrumented for the collection of sediment and rainfall data. In 1982 a small basin, constructed from coal-mine spoil, will be selected in the Hanna Basin and instrumented. Rainfall, runoff, and sediment-concentration data will be collected for each basin. Also, data will be collected on channel and upland erosional processes to determine the range of parameter values that can be expected for small natural and reclaimed basins. Provided that a sediment-transport model will be available, the data collected will be used to calibrate and test the model.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Water year 1982 was an unusually wet year, resulting in 20 runoff events, of which 18 were from convective rainstorms and two from snowmelt runoff. The results of a comparison between sediment concentrations of convective-storm runoff and

sediment concentrations of snowmelt runoff provide information on upland erosion and soil detachment by raindrop impact. Preliminary results of surveys of channel profiles, cross sections, and the dimensions of two headcuts indicate an average volume of 370 m^3 of material per year was removed from the headcut. The drainage area above the headcut is 0.26 km^2.

PLANS FOR FISCAL YEAR 1983: The reclaimed basin near Hanna, Wyo., which is constructed entirely from coal mine spoil, will be instrumented with two recording rain gages, a stage gage, and an automatic sediment sampler. Channel and basin-slope surveys will be made and documented. Two soil plots will be installed. The collection and analysis of data will continue for the Dugout Creek tributary near Midwest, Wyo.

PROJECT TITLE: Low flow of streams in the Powder River structural basin, Wyoming (WY 81-067).



FUNDING AGENCY: Geological Survey.

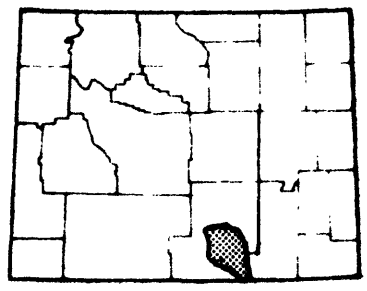
PROJECT LEADER: Gerald W. Armentrout, Jr.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: July 1981 to December 1981 (complete except report).

STATUS: The statistics of low flows were analyzed as an indication of long-term availability of water without the use of artifical storage. The annual low flow of ephemeral streams in the Powder River structural basin is zero; therefore, only low flows of the mountain streams could be described by the usual annual 7-day low-flow characteristic and frequency. A zero-flow characteristic and frequency for describing dry conditions on the prairies were defined. The maximum-annual number of no-flow days is the drought characteristic used. The drought characteristic was distributed areally through correlation with a unit-flow characteristic. The frequency distributions of the maximum-annual, continuous dry period at streamflow gage sites were used to describe the time variation of drought conditions. Colleague review of the final report will be done in fiscal year 1983, and the report will be processed for publication.

PROJECT TITLE: Hydrologic evaluation of the shallow aquifer system in Saratoga Valley, south-central Wyoming (WY 82-068).



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: South-central Wyoming.

PERIOD OF PROJECT: October 1981 to September 1983.

PROBLEM: Wells in the Saratoga Valley provide water to supplement surface water used for irrigation. About 30 irrigation wells were in use in 1981. Observation wells indicate water levels in parts of the valley declined as much as 13 feet between July 1980 and June 1981. The cause of this decline has not been identified. There is no restriction on the development of large-capacity wells such as irrigation wells. State water administrators need an evaluation of the effect of ground-water development upon water-levels and upon stream discharge.

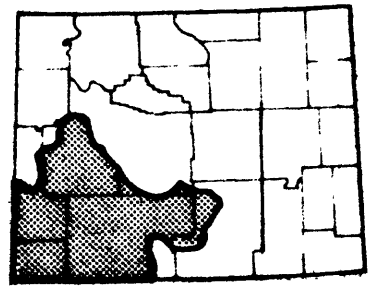
OBJECTIVE: The objectives are to: (1) Describe the effect of ground-water development upon water levels and attempt to determine the effect upon stream discharge, and (2) determine if a digital model of the hydrologic system can be used to help understand the possible responses of the stream-aquifer system to changes of stress on the system.

APPROACH: Data collected during project WY 80-058 will provide the base for this study. The water-level monitoring network established by L. W. Lenfest will be continued. A quantitative analysis will be made of the data to determine if additional data is needed to prepare a digital model of the hydrologic system. It may be desirable to make more seepage runs to help define a water budget for the valley.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Data from observation wells indicate that the water-level fluctuations over most of the study area are strongly influenced by irrigation with surface water. The total amount of water diverted from streams is not being measured. Average annual discharge were estimated for 33 drainage basins that provide water to Saratoga Valley. Four test holes were drilled to supplement lithologic information available from wells drilled for water and oil. Contour maps were prepared showing the configuration of the base of the Tertiary formations and the configuration of the water-level surface. Preparation of a water budget for the study area was started.

PLANS FOR FISCAL YEAR 1983: The compilation of data will be completed. It will be determined if a digital model can be used to help define surface-water ground-water interconnection. A report that describes the results of the study will be prepared and published in the Water-Resources Investigations Report series.

PROJECT TITLE: Hydrology of Area 52, Rocky Mountain Coal Province, Wyoming, Colorado, Idaho, and Utah (WY 82-069).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Hugh W. Lowham.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: April 1982 to September 1983.

PROBLEM: Coal Area 52, comprised of the Upper Green River, Great Divide, and Upper Bear River Basins, is rich in mineral resources--coal, trona, oil and gas, oil shale, and uranium. These resources are being developed at an accelerating pace. Because much of the area is semiarid, both water availability and protection of water resources are problems. Mining companies are required by law to analyze the hydrologic effects of proposed activities and to take appropriate measures to minimize adverse effects. There is a need for information about the water resources of the area that is both comprehensive in scope and easily understood.

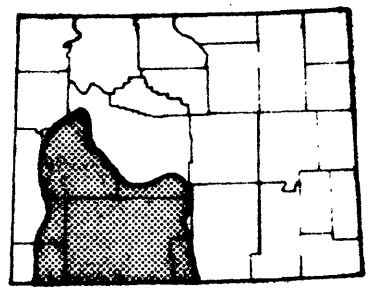
OBJECTIVE: The objective is to describe the hydrology of Area 52 in a clear and concise manner that can be used by both the coal-mining industry and the regulatory agencies. Although specifically oriented to coal hydrology, the results should also be useful for other kinds of mineral development, such as trona, oil shale, and oil and gas, and to other interest groups, such as environmental organizations.

APPROACH: A topic outline will be developed, based on other coal area reports but oriented to the hydrology and related problems of Area 52. Topics will be assigned to hydrologists for analysis and writing based on their descipline specialties. For each topic, all available information will be assembled and summarized or interpreted as needed. Records and other available information on hand are sufficient; no new data will be collected. Each topic will be discussed in a text not to exceed one page, accompanied by maps, graphs, and tables as needed. Regional hydrology will be emphasized. Sources of more detailed information will be cited.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: A topic outline was developed using recently published coal hydrology reports as examples. Several interpretive studies and a significant amount of data are available concerning hydrology of the area. This information will aid the preparation of a comprehensive description of the possible effects of coal mining on water resources in the area. Topic sections were assigned to five hydrologists for analysis and writing. Base maps are being prepared; most of the map information will be at a scale of 1:1,500,000.

PLANS FOR FISCAL YEAR 1983: The report will be completed, reviewed and submitted for approval.

PROJECT TITLE: Upper Colorado River Basin regional aquifer-system analysis, Wyoming (WY 82-070).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Everett A. Zimmerman.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: October 1981 to September 1985.

PROBLEM: Ground-water supplies are needed to augment surface-water supplies for increasing industrial, municipal, and domestic use consequent to energy-mineral resource development in the greater Green River Basin, Wyo. The regional availability and quality of supply, hydrologic consequences of development and subsequent disposal of waste water need to be investigated. Knowledge of the overall operation of the three-dimensional ground-water flow system and its interaction with the surface-water regime is required to assess the effects of ground-water development and to ensure such development does not impair compliance with compacts affecting the upper Colorado River and its tributaries.

OBJECTIVE: The objectives are to: (1) Identify aquifer units within the overall hydrogeologic framework, (2) estimate quantitatively aquifer and confining-unit hydraulic properties and parameters, (3) identify structural settings favorable for the development of secondary permeability, (4) infer ground-water flow-system operation and its interaction with the surface-water flow regime, (5) assess regional distribution of ground-water quality and availability of supply, and (6) develop capability of assessing consequences of current and projected ground-water use.

APPROACH: Existing water-well, drill-stem-test, and geophysical data will be used to establish the overall hydrogeologic framework, to estimate aquifer and confining-bed hydraulic properties and parameters, and to infer spatial distribution of ground-water quality. Digital-modeling and parameter-estimation techniques will be employed to the extent feasible to develop and refine a conceptualization of overall ground-water flow-system operation. Current and historical ground-water-use data will be collected.

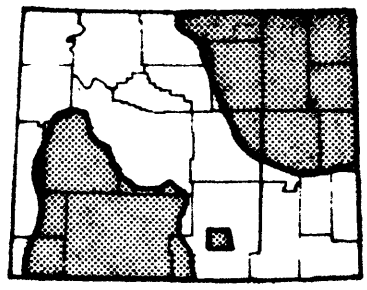
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: The upper Green River Basin, a generally arid basin, is underlain by fluvial and lacustrine aquifers of Tertiary age. Yields from the more than 1,000 ground-water wells tapping these complexly intertonguing aquifers generally are less than 0.6 dm^3/s, but local variations of the lithology and thickness exceeding 3,500 m in places make yields in excess of 63 dm^3/s attainable. The presence of a remarkable suite of sodium minerals in the lacustrine beds may pose special geochemical problems. Shallow circulation through some of these beds may be an important contributor to vexing salinity problems in the Colorado River.

Planning documents were prepared and a data base was established during the first year of the study. Data from oil tests were obtained; these data will be combined with water-well data for use in preparing hydrologic maps.

A computer procedure was developed to facilitate updating the data base with ground-water data from computer-compatible files of State agencies.

PLANS FOR FISCAL YEAR 1983: Computer-compatible data from State agencies will be used to update the Ground Water Site Inventory (GWSI) data base. Potentiometric, isopach, and structure contour maps will be prepared and used as a part of a map report. These and other maps will also be used as sources of data input for an attempt to prepare a digital model.

PROJECT TITLE: Chemical quality of surface water in the Powder River, Green River, Great Divide, and Hanna Basins, Wyoming (WY 82-071).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: David A. Peterson.

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

PERIOD OF PROJECT: October 1981 to September 1982 (complete except report).

PROBLEM: The collection and analysis of hydrologic information in Wyoming was greatly expanded during the period 1975-81, in response to the sudden increase in the stripmining of coal. The Geological Survey Coal Hydrology Program and the Bureau of Land Management Energy, Mineral Inventory and Analysis Program (EMRIA) provided most of the funding for the intensified data-collection activities. In the principal coal areas repetitive water-quality sampling was increased from a few stations to about 70 stations. The results of the sampling program have not been summarized comprehensively in any of the reports of investigations prepared to date. Such a summary in a single report would be useful for a wide variety of purposes.

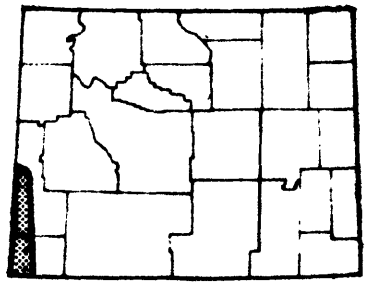
OBJECTIVE: The objectives are to: (1) Summarize statistically the surface-water-quality data collected by the U.S. Geological Survey in the principal coal-producing basins in Wyoming, and (2) evaluate the adequacy of the water-quality data and make recommendations for future water-quality data-collection activities in the coal areas of Wyoming.

APPROACH: Descriptive statistics of constituents at each station sampled on a regular basis will be tabulated. Miscellaneous samples from sites in some areas may be used due to lack of repetitive data. Statistics will include the following for each constituent: sample size, maximum, minimum, median, geometric or arithmetic mean, and standard deviation. Regression relationships will be developed among some or all of the following: major ions, sediment, total dissolved solids, specific conductance, and discharge. The report will also include examples of graphs, descriptions of impacts of energy development for stations where impacts have been identified, and suggestions for future data-collection programs.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Water-quality data for 73 streamflow stations in the Powder River coal basin, the Hanna coal field, and the Green River coal region were summarized statistically. The summary includes descriptive statistics, such as percentiles, and regression relations for each constituent measured at each station. Significant regression equations relating the most common ions and dissolved solids to specific conductance, were developed for most stations.

PLANS FOR FISCAL YEAR 1983: Colleague review of the final report will be done and the report processed for publication in the Water-Resources Investigations series.

PROJECT TITLE: Stream-aquifer interaction in the Upper Bear River Valley of Wyoming and Utah (WY 82-072).



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Kent C. Glover.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: January 1982 to September 1983.

PROBLEM: Water of the Bear River drainage is allocated among the states of Idaho, Utah, and Wyoming by interstate compact. The compact has recently been interpreted to include ground-water withdrawals that result in streamflow depletion. However, there is an insufficient amount of information available to quantify the contribution of the ground-water system to streamflows of the Bear River and its tributaries. Such information is needed before decisions can be made concerning the allocation of ground-water.

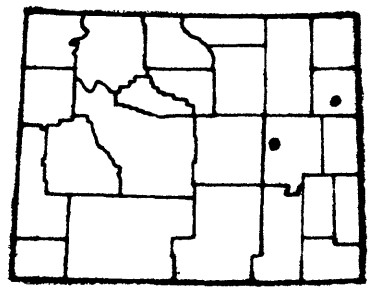
OBJECTIVE: The objectives are to: (1) Determine the effect of existing ground-water pumpage on streamflows, (2) determine the total amount of surface and subsurface water in alluvium flowing across the state boundaries, and (3) provide the methodology for evaluating the effect that future ground-water development may have on streamflow.

APPROACH: This study will be made on the Bear River valley upstream from the Idaho-Wyoming border. Work tasks include mapping the potentiometric surface of alluvium, conducting a pumpage inventory, measuring water levels and streamflow diversions periodically, estimating flow from ungaged drainages, conducting seepage runs, estimating evapotranspiration, and conducting surveys of channel geometry. Data will be used to calibrate a digital stream-aquifer model and establish error tolerances for model parameters. The model will be used to evaluate the effects of existing pumpage on streamflow and to predict the effects of additional pumpage during years of low streamflow.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Data-collection activities include completion of seepage runs along major streams of the drainage, development of a ground-water-level monitoring network, scheduling of alluvial wells, mapping of lands irrigated by stream diversions and wells, delineation of areas with phreatophytes, and compilation of streamflow, diversion and pumpage records. A major effort has been to provide a geo-hydrologic framework that can be used in the development of a management-oriented flow model. To this end a time-dependent, lumped-parameter convolution model was developed and successfully tested on a number of hypothetical stream-aquifer problems. The chief advantage of this model is the ease with which water managers can superimpose analytical solutions for stream depletion due to new wells on results of the convolution model. This advantage is maintained by minimizing spatial variations in aquifer parameters, utilizing simplified but reasonable lateral aquifer boundaries, and emphasizing the voluminous streamflow and diversion data instead of the meager ground-water-level data.

PLANS FOR FISCAL YEAR 1983: The data-collection phase of the study will be completed and a water budget of the study area will be developed. The convolution model will be calibrated to subregions within the study area using various time periods. The calibration will then be tested over the entire study area. The level of effort in 1983 will be reduced, with a full effort in 1984 to complete the project.

PROJECT TITLE: Recharge of shallow aquifers through ephemeral stream channels in Wyoming (WY 82-073).



FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Leslie W. Lenfest, Jr.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: October 1981 to September 1984.

PROBLEM: The Surface Mining Act requires the protection of the essential hydrologic function of alluvial valley floors by either preservation or reclamation. The concern is principally for protection of subirrigation and flood irrigation. However, another important function of the alluvium in some areas is its role in recharge to bedrock aquifers. Water that infiltrates from overland runoff may not extend below the root zone and is discharged by evapotranspiration. Because alluvium often is more permeable than the upland soil, flow in ephemeral streams can infiltrate rapidly and be held in transient storage for recharge to underlying bedrock. The recharge function of alluvium in coal-producing areas is not known.

OBJECTIVE: The objectives are to: (1) Determine the relationship of water in the alluvium to streamflow, and the relationship of water in the alluvium to water in bedrock aquifers; and (2) evaluate the potential use of streamflow records to determine seepage from ephemeral streams.

APPROACH: A basin with an ephemeral reach will be selected and equipped with stage recorders and supplemental crest-stage gages. Observation wells will be drilled in the alluvial and bedrock aquifers adjacent to the streams. Hydrographs from a finite-difference routing model will be compared with observed hydrographs for possible use in estimating recharge if corresponding changes occur in the wells. Water levels and soil-moisture measurements will be used to determine downward movement from the stream to the saturated zone. A second site with a single gage will be used to verify hydraulic properties of the alluvium.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Two ephemeral stream basins were instrumented to test hypotheses of streamflow loses to shallow and bedrock aquifers. The primary site, North Fork Dry Fork Cheyenne River near Glenrock, is equipped with a pair of stage recorders; the recorders are approximately 4 km apart along the stream reach. Located at each of the surface-water stations are wells with recorders to measure water levels in the shallow (alluvial) and bedrock aquifers in a cross section normal to the stream. The secondary site is located at an existing streamflow station on Black Thunder Creek. Water levels are monitored in the alluvial and bedrock aquifers by recorders, also located normal to the stream.

Surface- and ground-water data have been collected at these sites since April 1982. A survey line was run between the surface-water sites along the North Fork Dry Fork Cheyenne River in anticipation of surveying cross sections along the stream reach for surface-water modeling purposes. One slope-area measurement was made at each of the four sites along the North Fork Dry Fork Cheyenne River to aid in determining a stage-discharge relationship.

PLANS FOR FISCAL YEAR 1983: The collection of flood-hydrograph and ground-water level data will continue. A stage-discharge relationship will be established at streamgaging stations on North Fork Dry Fork Cheyenne River using step-backwater technique, and direct and indirect measurement of discharge. A channel-geometry survey will be completed and routing flood hydrographs from upper to lower sites along North Fork Dry Fork Cheyenne River will begin. Recorders on shallow wells will be replaced at primary sites with soil moisture tubes. These tubes will be calibrated when they are installed.

PROJECT TITLE: Ground-water quality in Wyoming (WY 82-074).

FUNDING AGENCY: Geological Survey.

PROJECT LEADER: L. Rodney Larson.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: June 1982 to September 1983.

PROBLEM: The demand for ground-water supplies in Wyoming for municipal, agriculture, and industrial use is increasing rapidly, largely because of the growth in development of energy resources. In order to evaluate the ground-water resource and to provide for its protection, water planners need an adequate information base. Existing ground-water quality information probably is inadequate to meet most of these requirements. A comprehensive statewide compilation and analysis of existing data is needed to provide a minimal basis for planning and to identify deficiencies that can be corrected by acquisition of additional data.

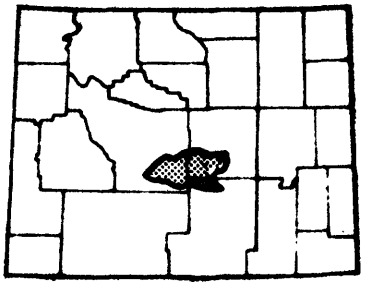
OBJECTIVE: The objectives are to: (1) Summarize and evaluate the adequacy of ground-water quality data for Wyoming, (2) describe the ground-water quality data areally by aquifers or aquifer groups, and (3) make recommendations for future sampling and analyses.

APPROACH: All available ground-water chemical-quality data for Wyoming will be located and inventoried. Geological Survey data not in the National Water Data Storage and Retrieval System (WATSTORE) will be entered. Water quality of aquifers or aquifer groups will be characterized by statistical summaries of critical constituents. Dissolved-solids concentration will be emphasized; ranges in concentration in wells will be shown on maps. Known or potential hazardous-waste problems in Wyoming will be determined in consultation with other agencies. The adequacy of existing data for assessing ground-water quality will be evaluated and recommendations made for future data aquisition.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Existing reports relevant to the study were identified and reviewed. Ground-water quality in Wyoming varies greatly; aquifers were grouped by rock type to facilitate assessment of water quality. A National Water Data Exchange (NAWDEX) retrieval was made to identify data sources. Oil field data were obtained from the Northern Great Plains RASA project. A Statistical Analysis System (SAS) data set was created from WATSTORE data and stored on tape. More than 5,000 Wyoming sites have data in WATSTORE; additional data are available from Federal, State, and private sources.

PLANS FOR FISCAL YEAR 1983: Pertinent Geological Survey data not entered into WATSTORE will be identified and incorporated into WATSTORE. Inventory of non-Geological Survey data will be completed and evaluated. Oil field data will be merged, using SAS, with WATSTORE data. The merged data will be sorted and statistically summarized, using SAS, by rock groups. The final report will be prepared.

PROJECT TITLE: Preliminary digital model of the Arikaree aquifer in the Sweetwater River Basin, central Wyoming (WY 82-075).



FUNDING AGENCIES: Wyoming State Engineer, Wyoming Department of Economic Planning and Development, and Geological Survey.

PROJECT LEADER: William B. Borchert.

FIELD LOCATION: Central Wyoming.

PERIOD OF PROJECT: October 1981 to September 1983.

PROBLEM: Increased demand for water supplies in Wyoming are foreseen in the immediate future. The Sweetwater River Basin is an area with potentially large supplies of ground water available. The North Platte and Sweetwater Rivers and small tributary streams may be hydraulically connected to the Arikaree aquifer. Water administrators are concerned about possible ground-water-development impacts on ground-water levels and streamflow in the area. Additional hydrologic information is needed to update and refine a preliminary model developed with limited data in 1977. Data collection from existing wells and a drilling program are necessary to improve the model.

OBJECTIVE: The objectives during the first year will be to: (1) Collect hydrologic data useful for better definition of the hydrologic system, emphasizing evaluation of the discharge from and recharge to the aquifer, and collection of water-level data; and (2) design a drilling program that, if implemented, would provide data necessary for a management model. The objective during subsequent years, if data are sufficient, will be to provide the means for making water-management decisions by updating and refining the existing flow model.

APPROACH: Surface-water records will be analyzed for low-flow characteristics possibly related with ground water. Gain-and-loss studies will be made of the Sweetwater River and selected tributaries. Recharge from most northward-flowing streams will be estimated. Wells south of the Granite Mountains will be inventoried, water levels measured, an updated water-level contour map made, and an observation well network established. The drilling of observation wells necessary for model update and refinement is contingent upon the availability of supplemental funds from the Wyoming State Engineer for drilling. The feasibility of updating and refining the existing flow model will be determined.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Streamflow measurements of the Sweetwater River in the eastern half of the study area indicated the river was gaining during the fall and early spring. Streamflow measurements of seven small northward-flowing creeks identified gaining and losing sections of perennial reaches.

Seventeen wells were drilled and cased in areas where water-level information was either lacking or questionable. A water-level contour map was prepared using water-level measurements at 105 wells, in order to update a 1977 map that was based on 1964-65 water-level measurements at 36 wells.

PLANS FOR FISCAL YEAR 1983: Streamflow measurements of the Sweetwater River will be made in the fall. Observation wells will be measured periodically. Surface-water records of the Sweetwater River will be analyzed using statistical procedures such as flow-duration curves and mean hydrograph comparison. The feasibility of a ground-water flow model incorporating parameter-estimation techniques will be considered and a decision made either to continue or terminate the project. A water-level contour map will be prepared and published.

PROJECT TITLE: Fluvial system in energy-mineral areas of Wyoming (WY 83-076).

FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Hugh W. Lowham.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: October 1982 to September 1985.

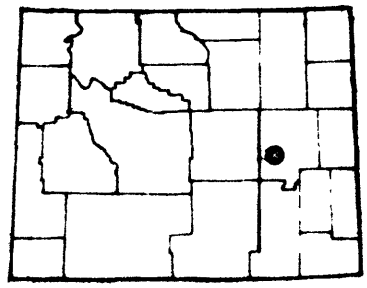
PROBLEM: Considerable development of energy-mineral resources and an associated disturbance of significant amounts of land surface are occurring in Wyoming. These developments commonly affect stream channels and drainage networks. The result may be an undesirable modification of the stream channel and drainage network, and an increase in sedimentation and erosion. The Bureau of Land Management and other groups need information about the natural functioning of fluvial systems and the responses of the systems to disturbances caused by changes in land use, including mining and reclamation.

OBJECTIVE: The objective is to describe how the fluvial systems function in energy-mineral areas and how these systems can be expected to respond to various activities related to development of the resources. In particular, information will be presented for dealing with: (1) Crossing of streams by pipelines and roads, (2) disturbance of areas by oil-and-gas site locations, (3) disturbance and reclamation of areas that are strip mined, and (4) activities such as channelization and disposition of production waters that may create instability of stream channels.

APPROACH: A literature search will be made of important concepts, and of guidelines and regulations applicable to the design of reclaimed drainages. An investigation will be made of channel response to past developments, and case histories will be documented to highlight the need for planning and design. Methods currently being used by mining companies for design of drainages disturbed by strip mining will be reviewed and evaluated. Mathematical models of landform evaluation will be investigated to determine if they can be applied as an aid to initial contouring of reclaimed landscapes.

PLANS FOR FISCAL YEAR 1983: A literature search will be made of information important to the formation and behavior of stream systems. Mining companies involved with strip mining will be contacted and asked for a copy of their reclamation plans. Existing guidelines and regulations used by various agencies in Wyoming for design of developments that disturb streams will be reviewed. An investigation will be started of mathematical models that might be applied to landscape design.

PROJECT TITLE: Hydrology of the Madison Limestone in the Glenrock area, east-central Wyoming (WY 83-077).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: David A. Peterson.

FIELD LOCATION: East-central Wyoming.

PERIOD OF PROJECT: January 1983 to September 1984.

PROBLEM: Water from the Madison Limestone may be used to supplement surface-water supplies for a proposed coal-gasification plant. Several deep wells (6,000 ft) have been drilled in an area near Glenrock where little is known about vertical movement of water in the Madison or about the magnitude of recharge from streams crossing Madison outcrops. The new wells and existing paired streamflow stations provide a rare opportunity to study the local hydrologic system and to test and improve concepts developed previously in the regional study of the Madison. Such knowledge is needed by those considering the use of Madison water for energy-resource development.

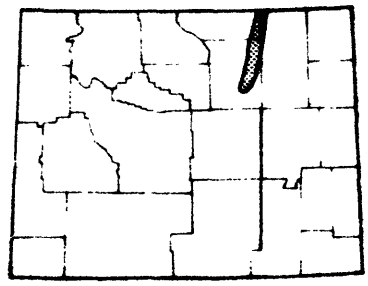
OBJECTIVE: The objectives are to improve the understanding of: (1) Movement of water between the shallow and deep parts of the Madison Limestone, (2) vertical velocity of water between the Madison and overlying rock, and (3) the relationship of water in the Madison Limestone to streamflow.

APPROACH: Wells and springs in Paleozoic aquifers will be inventoried. Existing water-level and water-quality data will be compiled and evaluated for two Madison wells and the Douglas City spring. Streamflow data will be compiled and evaluated for three pairs of gaging stations upstream and downstream from the Madison outcrop. Water-level data will be collected in a deep well to compare seasonal changes with those of streams and the Douglas spring. Isotope and salinity samples will be collected as possible indicators of water movement within the Madison. Vertical velocities will be measured from temperature profiles in a deep well.

PLANS FOR FISCAL YEAR 1983: A water-level recorder will be placed on the Madison deep well after the Borehole Geophysics Unit has run a temperature

log. Wells and springs in Paleozoic aquifers will be inventoried. The water-level and water-quality data for the wells and springs will be compiled and evaluated, as will the streamflow data. Isotope and salinity samples will be collected at locations determined from the data analysis.

PROJECT TITLE: Hydrologic properties of the alluvial deposits along the Powder River between Sussex, Wyoming and Moorhead, Montana (WY 83-078).



FUNDING AGENCIES: Bureau of Land Management and Geological Survey.

PROJECT LEADER: Bruce H. Ringen.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: March 1983 to September 1984.

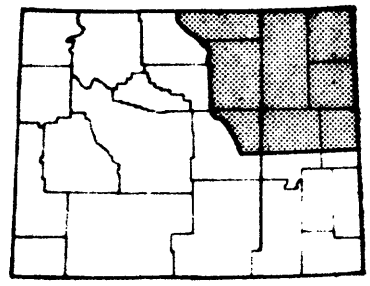
PROBLEM: The Powder River, a major drainage of the Powder River coal basin, is reported to be a "principal" aquifer; however, there are indications that the alluvium would yield less than 100 gallons per minute of poor-quality water at most places. Wyoming statutes recognize the interconnection between ground water and surface water, which may also limit the development of the aquifer. As energy development continues and additional water sources are considered, there will be a need for an assessment of the potential for development and the effect of development on surface-water supplies.

OBJECTIVE: The objective is to assess the potential for development of water supplies from the alluvium by determing: (a) The availability of the water, (b) the quality of the water, and (c) the relation between water in the alluvium and water in the river and in the shallow bedrock.

APPROACH: Wells in the alluvium and selected bedrock wells will be inventoried and water levels measured. A few new wells will be drilled. The plane dimensions of the alluvial deposits will be measured on topographic maps and the thickness will be measured at selected locations by aquifer tests. One site will be instrumented with continuous water-level recorders to determine the relation between water-surface elevation in the Powder River, the alluvium, and the bedrock. Selected wells will be sampled to determine the quality of water in the alluvium.

PLANS FOR FISCAL YEAR 1983: An inventory will be made of existing wells in the alluvium or shallow bedrock in the study area. A pair of new wells will be constructed; one in the alluvium and one in bedrock, and at least one additional alluvial well will be constructed. The three new wells will be equipped with recorders. The dimensions of the alluvial deposits will be determined at one location. Aquifer tests will be made in selected wells.

PROJECT TITLE: Evaluation of the ground-water observation-well program for the Powder River Basin and adjacent area, northeastern Wyoming (WY 83-079).



FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Pamela B. Daddow.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: April 1983 to September 1985.

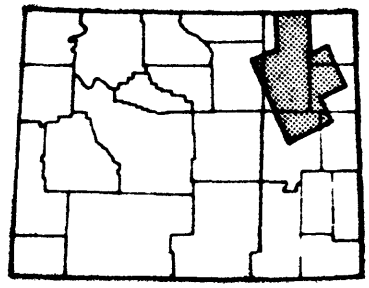
PROBLEM: The rapid development of energy minerals in northeastern Wyoming has changed the pattern of ground-water use from agricultural to a combination of agricultural, urban, and industrial uses. Because of these changes, the observation-well network needs to be evaluated, then modified, in order to provide the basic hydrologic data needed for scientific, engineering, and management purposes.

OBJECTIVE: The objective is to assess the existing observation-well program and recommend changes that will make the program responsive to present and future needs for ground-water water-level data. The procedures developed in this project may be applied to subsequent evaluations of the observation-well program in other parts of the State.

APPROACH: The concept of overlapping networks of observation wells will be applied. Each network of wells will be established to meet a separate hydrologic objective. An inventory of new wells in the area will be made and field-checked. Well records and water-level data for all wells will be tabulated, evaluated, and filed. Each network will be evaluated by checking and determining deficiencies of the network. Changes, including both additions and deletions, will be recommended. Procedures will be established for annual review of the networks.

PLANS FOR FISCAL YEAR 1983: Activities in the first year will be confined to preparation for a full level of effort in subsequent years. Well records will be organized into files, water-level data will be entered into Ground Water Site Inventory (GWSI), and forms will be designed for use in the observation-well program and for network evaluation.

PROJECT TITLE: Evaluation of the individual and cumulative impacts of mine operations on the surface and ground-water hydrology in the eastern Powder River Basin of Wyoming (WY 83-080).



FUNDING AGENCIES: Wyoming Department of Environmental Quality and Geological Survey.

PROJECT LEADER: Richard M. Bloyd.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: March 1983 to September 1984.

PROBLEM: Strip mining of coal may disrupt watersheds and may alter the quantity and quality of ground water and surface water. Federal and State regulations require that an assessment be made of the probable commulative impacts of all anticipated mining on the hydrology of the geologic/drainage basin each time there is an application for a permit to mine. The Wyoming Department of Environmental Quality needs such an assessment immediately, because several new applications are pending for mines in the eastern Powder River Basin. The study area includes the Belle Fourche and Little Powder Rivers and their tributaries.

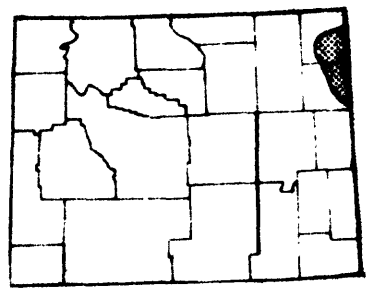
OBJECTIVE: The objective is to evaluate the probable individual and cumulative impacts of mine operations on the surface-water and ground-water hydrology of the area. This evaluation will be somewhat cursory because of time constraints; an in-depth evaluation should be done in a follow-on project.

APPROACH: Three tasks will be accomplished: (1) Pertinent information will be assembled from reports, permit documents, and State and Federal data files; (2) impacts, past or present, for each mine, will be identified, tabulated, and displayed on a map; and (3) cumulative impacts of the mines will be assessed separately for surface water and ground water, using mathematical simulation models calibrated to natural or existing conditions. Streamflow will be modeled for three cases: (a) No development, (b) present development, and (c) projected development. A series of ground-water model runs will be made, including worst- and best-case conditions. Water-quality aspects will be evaluated to the extent permitted by existing data.

PLANS FOR FISCAL YEAR 1983: All available data will be compiled, including pertinent information from mining-permit documents. A variety of maps will be obtained or compiled, including structural-contour, thickness, and potentiometric-surface maps. Streamflow and ground-water flow models will be prepared and tested. A preliminary assessment (conceptual model) will be made.

Water-Resources Projects Conducted by other Districts

PROJECT TITLE: Quality and availability of ground water in the Black Hills area, South Dakota and Wyoming (SD 81-059).



FUNDING AGENCIES: South Dakota Department of Water and Natural Resources, Black Hills Conservancy Subdistrict, and Geological Survey.

PROJECT LEADER: Kathy D. Peter. (Rapid City, South Dakota)

FIELD LOCATION: Eastern South Dakota and northeastern Wyoming.

PERIOD CF PROJECT: May 1981 to September 1984.

PROBLEM: Increasing development in the Black Hills area is placing increased demands on the ground-water system. The data and interpretations at the scale necessary to make specific management decisions are not available. There is concern about the effects of unplugged or improperly plugged uranium test holes, concern about the effect proposed withdrawals from the Madison Group will have on streams and aquifers in South Dakota, and concern about the effect of the numerous septic systems on the quality of water in the Minnelusa Formation, the principal aquifer supplying water to the residents in the area.

OBJECTIVE: The objectives are to: (1) Evaluate the quality and quantity of ground-water resources of the sedimentary aquifers in the Black Hills area of South Dakota and eastern Wyoming; (2) document, at a detailed scale, current water quality and head conditions of the sedimentary aquifers and determine recharge; (3) evaluate the effects of septic systems on the Minnelusa and Madison aquifers in the Piedmont Valley area; (4) develop the data base necessary for application of a digital model(s) to predict the effects of potential stress on the ground-water systems; and (5) evaluate the effects of selected ground-water management alternatives on the aquifers.

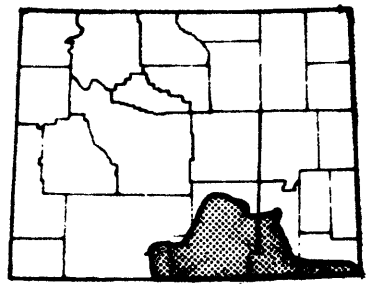
APPROACH: Streamflow and spring discharge data will be obtained as needed to evaluate net aquifer recharge. Water samples from wells in the Piedmont Valley area will be collected and analyzed. Additional wells will be inventoried and evaluated for prospective water quality and water-level observation networks. The Geological Survey three-dimensional model will be used to predict the effects of stresses on the system and simulate recharge. The feasibility of using a geochemical model to evaluate effects of septic systems in the Piedmont Valley area will be evaluated and if practical, implemented. Reports on quality and availability of ground water will be prepared.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: Radium-226 occurs naturally in ground water in the Black Hills area. To investigate the extent of areas where concentrations of radium-226 exceeds Environmental Protection Agency (EPA) standards, a total of 29 ground-water samples were collected for analysis in 1982. Ten of the 29 samples are being analyzed for radium-228, the concentration of which may also exceed EPA standards.

The sedimentary aquifers have had relatively little development in most of the Black Hills in South Dakota. As a result, data normally collected from existing wells are not available in many areas. However, observation-well records and the results of well inventories made in 1982 are being evaluated. A digital model of the Black Hills in Wyoming and South Dakota is being prepared to evaluate potential supply based on available information. To verify this large-scale, coarse-grid model, two smaller areas along the northern and eastern flanks of the Hills are also being modeled. These models have a finer grid and include the areas with the most ground-water development.

PLANS FOR FISCAL YEAR 1983: Water-level and spring-discharge measurements will be continued. Data collected to date will be added to computer files. Water-quality maps will be updated and interpreted. A map showing the orientation of the secondary permeability of the Madison Limestone, based on mapped cave passages, will be prepared. Digital models will be constructed and calibrated.

PROJECT TITLE: Coal region data and information reports in Colorado (CO 81-157).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: David J. Lystrom. (Lakewood, Colorado)

FIELD LOCATION: Central and northern Colorado and south-central Wyoming.

PERIOD OF PROJECT: April 1981 to September 1983.

PROBLEM: Development of coal resources are now taking place or being planned throughout the State of Colorado. The planning process requires current information concerning the hydrology, physiography, geology, and climate of coal resource regions. This information at present is dispersed in a variety of reports and unpublished data residing in the files of Water Resources Division (WRD) or other government agencies. Because this information is diversely located and may not be understandable to planners and managers, there is a need to compile available information in a form that will provide a basic description of hydrologic conditions for each coal resource region in Colorado.

OBJECTIVE: The objective of this project is to compile information and publish a report describing basic hyrologic conditions for each major coal region in Colorado. These reports are intended for audiences ranging from the lay reader to the more technically oriented planners and managers. With this audience in mind, the reports are not to be highly technical or interpretive. The basic information presented will primarily provide a background information base describing hydrologic conditions prior to mining. Where

information related to hydrologic impacts of mining are available, a section describing these impacts will be included. For the most part, only existing data will be used.

APPROACH: The report format will consist of a narrative page headed by a short subject title and a brief abstract. The narrative is supported by complimentary illustrations on the adjacent page. A list of subjects, maps, graphs, and photos will be selected based on a preliminary assessment of available data for each coal region report. Because only existing data will be used, flexibility will be given to authors to encourage innovation of subjects and illustrations.

STATUS: Available data describing all phases of hydrology in coal areas 54 and 61 were documented in stop-format reports. No significant new results were found. The reports for areas 54 and 61 will be published and the final drafts for coal areas 59 and 53 will be completed during fiscal year 1983.

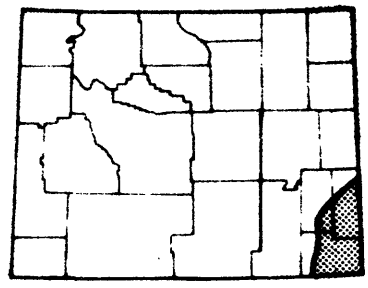
Water-Resources Projects Conducted by Central Region Staff

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

FUNDING AGENCY: Geological Survey.

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: October 1978 to September 1985.

PROBLEM: The Ogallala Formation is the principal aquifer underlying the High Plains. The aquifer contains about 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 in eight states is dependent upon the capacity of the aquifer to sustain withdrawals. A detailed knowledge of the aquifer system is needed so that the system can be simulated, water-management alternatives evaluated, and the economic life of the aquifer projected.

OBJECTIVE: Previous studies of the hydrology of the High Plains have been limited by political boundaries. This study will provide a regional description of the water resources and the operation of the hydrologic system consistent with the natural hydrologic boundaries of the High Plains. Computer models of the aquifer system will be developed and used to project the future response of the system to proposed future withdrawals and provide a basis for the economic evaluation of water-management alternatives.

APPROACH: Existing hydrologic data will be compiled and reviewed. Data-collection networks will be revised or initiated to provide adequate coverage for the study area. The data will be regionalized to provide a detailed description of the aquifer system and stored in a digital computer for processing and retrieval. The computerized data file will provide the data base needed for the development of computer models of the aquifer system. Proposed water-management alternatives and their effects on the aquifer system will be simulated by the models to evaluate the economic life of the system for each alternative.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1982: The High Plains aquifer underlies 450,000 km^2 in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Over 20 percent of the irrigated land in the United States is in the High Plains, and about 35 percent of the ground water used in the United States is pumped from the High Plains aquifer. In 1978, an estimated 170,000 wells pumped 28,000 hm^3 of water to irrigate 5.3 million ha.

The High Plains aquifer is a water-table aquifer mainly consisting of hydraulically connected near-surface sand and gravel deposits of Tertiary and Quaternary age. The Tertiary Ogallala Formation, which underlies about 80 percent of the High Plains, is the principal geologic unit in the aquifer. The maximum saturated thickness of the aquifer is about 300 m and averages 60 m. About 4 million hm^3 of drainable water is stored in the aquifer. Approximately 66 percent of the water in storage is in Nebraska, and 12 percent in Texas. New Mexico, the State with the smallest water resource in the High Plains, has only 1.5 percent of the volume of water in storage.

Pumpage has caused areally extensive water-level declines in the aquifer. Since irrigation began, water levels have declined more than 3 m in 130,000 km^2 of the aquifer and more than 15 m in 31,000 km^2 of the aquifer. Water-level declines of as much as 60 m have occurred in Texas since irrigation pumpage started. The volume of water in storage in the aquifer has decreased 205,000 hm^3 since ground-water development began. About 70 percent of the depletion has occurred in Texas; about 16 percent of the depletion has occurred in Kansas.

PLANS FOR FISCAL YEAR 1983: The calibration of the ground-water-flow model will be completed. Management scenarios will be developed and scenarios will be simulated to evaluate effects on the aquifer. The reports on the model and use of Lansat imagery to determine irrigated acreage will be completed.

SELECTED REFERENCES ON WATER RESOURCES

General Information

Publications pertaining to water resources in Wyoming are listed below. The list includes all reports published during the last 10 years and selected older reports. Many of these publications are available for inspection at the Geological Survey offices in Cheyenne, Casper, Green River, and Riverton and at large public and university libraries.

U.S. Geological Survey announces all its publications in a monthly report, "New Publications of the Geological Survey." Subscription to this monthly listing is available free upon request to the U.S. Geological Survey, 329 National Center, Reston, VA 22092. All publications are for sale unless specifically stated otherwise; prepayment is required. Prices, which are subject to change, are not included here. Information on price and availability should be obtained from listed sales offices before placing an order. A pamphlet entitled "Geologic and Water-Supply Reports and Maps for Wyoming" is available free upon request to the U.S. Geological Survey, 420 National Center, Reston, VA 22092.

Water-Resources Information.--A monthly summary of the national water situation is presented in the "Water Resources Review." Water-resources investigations folders are available for each of the 50 States, Puerto Rico, and the Virgin Islands. The Review and the folders are available free upon request to the U.S. Geological Survey, 420 National Center, Reston, VA 22092. The Wyoming folder also is available from the District Office in Cheyenne.

Records of streamflow, ground-water levels, and quality of water were published for many years as Geological Survey water-supply papers as explained below.

Streamflow records.--Records of daily flows of streams prior to 1971 were published in the Water-Supply Paper series "Surface-Water Supply of the United States," which was released in numbered parts as determined by natural drainage basins. Until 1961, this was an annual series; monthly and yearly summaries of these data were compiled in two reports: "Compilation of Records of Surface Waters of the United States through September 1950," and "Compilation of Records of Surface Waters of the United States, October 1950 to September 1960." For the period, 1961-70, 5-year compilations were published. Data for Wyoming are published in Parts 6, 9, 10, and 13.

Ground-water records.--Ground-water levels and artesian pressures in observation wells prior to 1975 were reported by geographic areas in a 5-year Water-Supply Paper series. Data for Wyoming are in "Ground-Water Levels in the United States, Northwestern States."

Quality-of-water records.--Data on quality of surface water prior to 1971 were published annually in the Water-Supply Paper series "Quality of Surface Waters of the United States," which also was released in numbered parts as determined by natural drainage basins. Data for Wyoming are in Parts 6, 9, 10, and 13.

Hydrologic data after 1970.--Beginning with the 1971 water year, the Water-Supply Paper series described above were replaced by a new publication series, "U.S. Geological Survey Water-Data Reports." For Water Years 1971-74 surface-water records and water-quality records were published in separate volumes. Beginning with 1975 this series combines under one cover streamflow data, water-quality data for surface and ground water, and ground-water level data for each State. For Wyoming the title is "Water Resources Data for Wyoming - Water Year (date): U.S. Geological Survey Water-Data Report [WY-(year)-1 or 2]". Reports for 1971-74 are unnumbered.

Flood information.--Methods for estimating the magnitude and frequency of floods for streams in Wyoming are given in two reports: Water-Resources Investigations 76-112 and Water-Supply Paper 2056 (see listings that follow). The U.S. Geological Survey also outlines flood-prone areas on topographic maps as part of a nationwide Federal program for managing flood losses. In Wyoming 225 topographic maps have been completed. These maps are available from the District Office in Cheyenne.

Publications

Professional Papers

Professional papers are sold by the U.S. Geological Survey, Eastern Distribution Branch, Text Products Section, 604 South Pickett Street, Alexandria, VA 22304.

P 492. Thermal springs of the United States and other countries of the world--a summary, by G. A. Waring. 1965.

P 501-D. Variation of permeability in the Tensleep Sandstone in the Bighorn Basin, Wyoming, as interpreted from core analyses and geophysical logs, by J. D. Bredehoeft, in Geological Survey Research 1964, Chap. D, by U.S. Geological Survey, p. D166-D170. 1964.

P 550-D. The White River Formation as an aquifer in southeastern Wyoming and adjacent parts of Nebraska and Colorado, by M. E. Lowry, in Geological Survey Research 1966, Chap. D, by U.S. Geological Survey, p. D217-D222. 1966.

P 622-A. The hydraulics of overland flow on hillslopes, by W. W. Emmett. 1970.

P 700-D. Synthesizing hydrographs for small semiarid drainage basins, by G. S. Craig, Jr., in Geological Survey Research 1970, Chap. D, by U.S. Geological Survey, p. D238-D243. 1970.

P 813-C. Summary appraisals of the Nation's ground-water resources--Upper Colorado Region, by Don Price and Ted Arnow. 1974.

P 813-G. Summary appraisals of the Nation's ground-water resources--Great Basin Region, by T. E. Eakin, Don Price, and J. R. Harrill. 1976.

P 813-Q. Summary appraisals of the Nation's ground-water resources--Missouri Basin Region, by O. J. Taylor. 1978.

P 813-S. Summary appraisals of the Nation's ground-water resources--Pacific Northwest Region, by B. L. Foxworthy. 1979.

P 1117. Scour and fill in a stream channel, East Fork River, western Wyoming, by E. D. Andrews. 1979.

P 1130. Hydrologic and human aspects of the 1976-77 Drought, by H. F. Matthai. 1979.

P 1139. A field calibration of the sediment-trapping characteristics of the Helley-Smith bedload sampler, by W. W. Emmett. 1980.

P 1164. Effects of coal mine subsidence in the Sheridan, Wyoming area, by C. R. Dunrud and F. W. Osterwald. 1980.

P 1244. Floods of May 1978 in southeastern Montana and northeastern Wyoming, by Charles Parrett, D. D. Carlson, G. S. Craig, Jr., and E. H. Chin. In press.

P 1273-E. Potentially favorable areas for large-yield wells in the Red River Formation and Madison Limestone in parts of Montana, North Dakota, South Dakota, and Wyoming, by L. M. MacCary, E. M. Cushing, and D. L. Brown. 1983.

P 1275. Geological Survey research 1981, by U.S. Geological Survey. 1982.

Journal of Research of the Geological Survey

The Journal of Research has been discontinued. Separate prints of the articles listed below are available from the District Chief, Cheyenne, Wyoming.

Iron in water near wastewater lagoons in Yellowstone National Park, Wyoming, by E. R. Cox. vol. 6, no. 3, p. 319-324. 1978.

Hydrologic characteristics of the Madison Limestone, the Minnelusa Formation, and equivalent rocks as determined by well-logging formation evaluation, Wyoming, Montana, South Dakota, and North Dakota, by W. J. Head and R. H. Merkel. vol. 5, no. 4, p. 473-485. 1977.

Water-Supply Papers

Water-Supply Papers are sold by the U.S. Geological Survey, Eastern Distribution Branch, Text Products Section, Alexandria, VA 22304

W 1261. A postglacial chronology for some alluvial valleys in Wyoming, by L. B. Leopold and J. P. Miller. 1954.

W 1360-E. Geology and ground-water resources of the Kaycee irrigation project, Johnson County, Wyoming, by F. A. Kohout, with a section on Chemical quality of the water, by F. H. Rainwater. 1957.

W 1373. Sedimentation and chemical quality of surface waters in the Wind River basin, Wyoming, by B. R. Colby, C. H. Hembree, and F. H. Rainwater. 1956.

W 1375. Ground-water resources of the Riverton irrigation project area, Wyoming, by D. A. Morris, O. M. Hackett, K. E. Vanlier, and E. A. Moulder, with a section on Chemical quality of ground-water, by W. H. Durum. 1959.

W 1377. Geology and ground-water resources of Goshen County, Wyoming, by J. R. Rapp, F. N. Visher, and R. T. Littleton, with a section on Chemical quality of the ground water, by W. H. Durum. 1957.

W 1458. Geology and ground-water resources of the Rawlins area, Carbon County, Wyoming, by D. W. Berry. 1960.

W 1483. Geology and ground-water resources of the upper Lodgepole Creek drainage basin, Wyoming, by L. J. Bjorklund, with a section on Chemical quality of the water, by R. A. Krieger and E. R. Jochens. 1959.

W 1490. Geology and ground-water resources of Platte County, Wyoming, by D. A. Morris and H. M. Babcock, with a section on Chemical quality of the water, by R.H. Langford. 1960.

W 1531. Hydrology of the upper Cheyenne River basin: Part A. Hydrology of stock-water reservoirs in upper Cheyenne River basin, by R. C. Culler; Part B. Sediment sources and drainage-basin characteristics in upper Cheyenne River basin, by R. F. Hadley and S. A. Schumm. 1961.

W 1532-A. Hydrologic effects of water spreading in Box Creek basin, Wyoming, by R. F. Hadley, I. S. McQueen, and others. 1961.

W 1535-E. Chemical degradation on opposite flanks of the Wind River Range, Wyoming, by C. H. Hembree and F. H. Rainwater. 1961.

W 1539-V. Availability of ground water in the Bear River Valley, Wyoming, by C. J. Robinove and D. W. Berry, with a section on Chemical quality of the water, by J. G. Conner. 1963.

W 1576-I. Ground-water resources of the Wind River Indian Reservation, Wyoming, by L. J. McGreevy, W. G. Hodson, and S. J. Rucker IV. 1969.

W 1596. Geology and ground-water resources of the Greybull River--Dry Creek area, Wyoming, by C. J. Robinove and R. H. Langford. 1963.

W 1669-E. Ground-water resources and geology of the Lyman-Mountain View area, Uinta County, Wyoming, by C. J. Robinove and T. R. Cummings. 1963.

W 1698. Ground-water resources and geology of northern and western Crook County, Wyoming, by H. A. Whitcomb and D. A. Morris, with a section on Chemical quality of the ground water, by R. H. Langford. 1964.

W 1783. Hydrologic conditions in the Wheatland Flats area, Platte County, Wyoming, by E. P. Weeks. 1964.

W 1788. Ground-water resources and geology of Niobrara County, Wyoming, by H. A. Whitcomb, with a section on Chemical quality of the ground water, by T. R. Cummings. 1965.

W 1806. Ground-water resources and geology of northern and central Johnson County, Wyoming, by H. A. Whitcomb, T. R. Cummings, and R. A. McCullough. 1966.

W 1807. Ground-water resources of Sheridan County, Wyoming, by M. E. Lowry and T. R. Cummings. 1966.

W 1809-C. Ground water in the Upper Star Valley, Wyoming, by E. H. Walker. 1965.

W 1834. Geology and ground-water resources of Laramie County, Wyoming, by M. E. Lowry and M. A. Crist, with a section on Chemical quality of ground water and of surface water, by J. R. Tilstra. 1967.

W 1897. Ground-water resources of Natrona County, Wyoming, by M. A. Crist and M. E. Lowry. 1972.

W 2009-C. Chemical quality of surface water in the Flaming Gorge Reservoir area, Wyoming and Utah, by R. J. Madison and K. M. Waddell. 1973.

W 2023. Selenium in waters in and adjacent to the Kendrick Project, Natrona County, Wyoming, by M. A. Crist. 1974.

W 2039-A. Chemical quality and temperature of water in Flaming Gorge Reservoir, Wyoming and Utah, and the effects of the reservoir on the Green River, by E. L. Bolke and K. M. Waddell. 1975.

W 2056. Analysis of runoff from small drainage basins in Wyoming, by G. S. Craig, Jr. and J. G. Rankl. 1978.

W 2058. Dissolved-oxygen depletion and other effects of storing water in Flaming Gorge Reservoir, Wyoming and Utah, by E. L. Bolke. 1979.

W 2193. Streamflow characteristics related to channel geometry of streams in western United States, by E. R. Hedman and W. R. Osterkamp. 1982.

W 2199. Verification of step-backwater computations on ephemeral streams in northeastern Wyoming, by S. A. Druse. 1982.

Circulars

Single copies of circulars still in print are available free from the U.S. Geological Survey, Eastern Distribution Branch, Text Product Section, 604 South Pickett Street, Alexandria, VA 22304.

C 656. Index of surface-water records to September 30, 1970--Part 6, Missouri River basin. 1971.

C 659. Index of surface-water records to September 30, 1970--Part 9, Colorado River basin. 1971.

C 660. Index of surface-water records to September 30, 1970--Part 10, The Great Basin. 1971.

C 663. Index of surface-water records to September 30, 1970--Part 13, Snake River basin. 1971.

C 743. Land and natural resource information and some potential environmental effects of surface mining of coal in the Gillette area, Wyoming, by W. R. Keefer and R. F. Hadley. 1976.

C 777. A guide to obtaining information from the USGS, 1982, compiled by P. F. Clark, H. E. Hodgson, and G. W. North. 1982.

C 839. Assessment of impacts of proposed coal-resource and related economic development on water resources, Yampa River basin, Colorado and Wyoming--A summary, compiled and edited by T. D. Steele and D. E. Hillier. 1981.

C 875. U.S. Geological Survey activities, Fiscal Year 1981, by U.S. Geological Survey. 1982.

C 1001. Estimated use of water in the United States in 1980, by W. B. Solley, E. B. Chase, and W. B. Mann IV.

Water-Resources Investigations Reports

Reports in this series are available for inspection at the Wyoming and Reston, Va., offices of the U.S. Geological Survey. Selected reports may be purchased either as microfilm or hard copy from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161; the NTIS ordering number is given in parenthesis at the end of the citation. Further information about these reports may be obtained from the District Chief, WRD, Cheyenne.

WRI 3-75. Hydrologic analysis of the valley-fill aquifer, North Platte River valley, Goshen County, Wyoming, by M. A. Crist. 1975. (PB-243 226/AS)

WRI 63-75. Preliminary digital model of ground-water flow in the Madison Group, Powder River basin and adjacent areas, Wyoming, Montana, South Dakota, North Dakota, and Nebraska, by L. F. Konikow. 1976.

WRI 8-76. Digital model to predict effects of pumping from the Arikaree aquifer in the Dwyer area, southeastern Wyoming, by G. C. Lines. 1976.

WRI 76-77. Hydrologic effects of hypothetical earthquake-caused floods below Jackson Lake, northwestern Wyoming, by W. R. Glass, T. N. Keefer, and J. G. Rankl. 1976.

WRI 76-112. Techniques for estimating flow characteristics of Wyoming streams, by H. W. Lowham. 1976. (PB-264 224/AS)

WRI 76-118. Geohydrology of the Albin and LaGrange areas, southeastern Wyoming, by W. B. Borchert. 1976.

WRI 77-72. Physical, chemical, and biological relations of four ponds in the Hidden Creek strip-mine area, Powder River Basin, Wyoming, by D. J. Wangsness. 1977. (PB-273 512/AS)

WRI 77-103. An analysis of salinity in streams of the Green River Basin, Wyoming, by L. L. DeLong. 1977. (PB-275 728/AS)

WRI 77-107. Preliminary model of the Arikaree aquifer in the Sweetwater River basin, central Wyoming, by W. B. Borchert. 1977.

WRI 77-111. Hydrologic evaluation of the Arikaree Formation near Lusk, Niobrara and Goshen counties, Wyoming, by M. A. Crist. 1977.

WRI 78-13. An analysis of stream temperatures, Green River Basin, Wyoming, by H. W. Lowham. 1978. (PB-284 062/AS)

WRI 78-70. 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, by J. B. Weeks. 1978. (PB-284 668/AS)

WRI 78-96. Preliminary applications of Landsat images and aerial photography for determining land-use, geologic, and hydrologic characteristics--Yampa River basin, Colorado and Wyoming, by F. J. Heimes, G. K. Moore, and T. D. Steele. 1978.

WRI 78-121. The biology of Salt Wells Creek and its tributaries, southwestern Wyoming, by M. J. Engelke, Jr. 1978. (PB-300 828/AS)

WRI 78-122. Traveltime, unit-concentration, longitudinal-dispersion, and reaeration characteristics of upstream reaches of the Yampa and Little Snake Rivers, Colorado and Wyoming, by D. P. Bauer, R. E. Rathbun, and H. W. Lowham. 1979. (PB-80 129 521/AS)

WRI 78-143. Hydrologic evaluation of proposed ground-water withdrawals in Muleshoe Flat, near Wheatland, southeastern Wyoming, by D. T. Hoxie. In press.

WRI 79-6. Hydrogeologic features of the alluvial deposits in the Greybull River valley, Bighorn Basin, Wyoming, by M. E. Cooley and W. J. Head. 1979.

WRI 79-34. Plan of study for the Northern Great Plains Regional Aquifer-System Analysis in parts of Montana, North Dakota, South Dakota, and Wyoming, by U.S. Geological Survey. 1979. (PB-298 141/AS)

WRI 79-47. Effect on sediment yield and water quality of a nonrehabilitated surface mine in north-central Wyoming, by B. H. Ringen, L. M. Shown, R. F. Hadley, and T. K. Hinkley. 1979. (PB-299 868/AS)

WRI 79-1291. Hydrogeologic features of the alluvial deposits in the Nowood River drainage area, Bighorn Basin, Wyoming, by M. E. Cooley and W. J. Head. 1979.

WRI 80-8. Analysis of stream quality in the Yampa River basin, Colorado and Wyoming, by D. A. Wentz and T. D. Steele. 1980. (PB-81 108 904/AS)

WRI 80-50. Kriging analysis of mean annual precipitation, Powder River Basin, Montana and Wyoming, by M. R. Karlinger and J. A. Skrivan. 1980. (PB-81 216 806/AS)

WRI 80-72. Calibration and testing of selected portable flowmeters for use on large irrigation systems, by R. R. Luckey, F. J. Heimes, and N. G. Gaggiani. 1980. (PB-81 121 345/AS)

WRI 80-85. Water resources of upper Separation Creek basin, south-central Wyoming, by L. R. Larson and E. A. Zimmerman. 1981. (PB-81 224 263/AS)

WRI 80-111. Evaluating methods for determining water use in the High Plains in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, by F. J. Heimes and R. R. Luckey. 1980. (PB-81 205 270/AS)

WRI 80-729. Preliminary map showing freshwater heads for the Mission Canyon and Lodgepole Limestones and equivalent rocks of Mississippian age in the Northern Great Plains of Montana, North and South Dakota, and Wyoming, by R. W. Miller and S. A. Strausz. 1980.

WRI 80-730. Preliminary map showing freshwater heads for the Red River Formation, Bighorn Dolomite, and equivalent rocks of Ordovician age in the Northern Great Plains of Montana, North and South Dakota, and Wyoming, by W. R. Miller and S. A. Strausz. 1980.

WRI 80-1104. Effects of pumpage on ground-water levels as modeled in Laramie County, Wyoming, by M. A. Crist. 1980.

WRI 81-62. Hydrology of Salt Wells Creek--a plains stream in south-western Wyoming, by H. W. Lowham, L. L. DeLong, K. R. Collier, and E. A. Zimmerman. 1982. (PB-82 201 211/AS)

WRI 81-71. Streamflows and channels of the Green River Basin, Wyoming, by H. W. Lowham. 1982. (PB-82 207 416/AS)

WRI 81-72. Sediment transport and source areas of sediment and runoff, Big Sandy River basin, Wyoming, by J. E. Kircher. 1982. (PB-82 215 898/AS)

WRI 81-75. Methodology for hydrologic evaluation of a potential surface mine: the Red Rim site, Carbon and Sweetwater counties, Wyoming, by D. G. Frickel, L. M. Shown, R. F. Hadley, and R. F. Miller. 1981.

WRI 81-76. An empirical method for determining average soil infiltration rates and runoff, Powder River structural basin, Wyoming, by J. G. Rankl. 1982. (PB-82 201 732/AS)

WRI 81-692. Base flow and chemical quality of streams in the Northern Great Plains area, Montana and Wyoming, 1977-78, by S. A. Druse, K. A. Dodge, and W. R. Hotchkiss. 1981.

WRI 82-40. Method for estimating historical irrigation requirements from ground water in the high plains in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, by F. J. Heimes and R. R. Luckey. 1982. (PB-82 245 796/AS)

The following WRI reports may be purchased from the Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225.

WRI 82-4003. Evaluation of selected surface-water-quality stations in Wyoming, by S. J. Rucker, IV and L. L. Delong. In press.

WRI 82-4007. Hydrologic features of the alluvial deposits in the Owl Creek valley, Bighorn Basin, Wyoming, by M. E. Cooley and W. J. Head. 1982.

WRI 82-4008. Water quality of streams and springs, Green River basin in Wyoming, by L. L. Delong. In press.

WRI 82-4068. Digital model of the Bates Creek alluvial aquifer near Casper, Wyoming, by K. C. Glover. 1983.

WRI 82-4072. A data-management system for areal interpretive data for the High Plains in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, by R. R. Luckey and C. F. Ferrigno. 1982.

WRI 82-4103. Time of travel and dispersion of solutes in a 36.4-mile reach of the North Platte River downstream from Casper, Wyoming, by G. W. Armentrout, Jr., and L. R. Larson. In press.

WRI 82-4105. Evapotranspiration rates of selected sites in alluvial valleys in the Powder River basin, Wyoming and Montana, by L. W. Lenfest, Jr. In press.

WRI 82-4107. Machine-readable data files from the Madison Limestone and Northern Great Plains Regional Aquifer System Analysis projects, Montana, Nebraska, North Dakota, South Dakota, and Wyoming, by J. S. Downey. 1982.

WRI 82-4117. Hydrology of the White Tail Butte area, northern Campbell County, Wyoming, by M. E. Lowry and J. G. Rankl. In press.

WRI 83-4024. The ground-water system in the Arikaree aquifer near La Grange, southeastern Wyoming, by W. B. Borchert. In press.

WRI 83-4047. Hydrologic conditions in the Wheatland Flats area, Platte County, Wyoming, by M. A. Crist. 1983.

WRI 83-4127. Pesticide data for Wyoming streams, by D. L. Butler. In press.

Water-Data Reports Available only through NTIS

The water-data reports listed below may be purchased as hard copy or microfiche only from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161. They are available for inspection only at the Wyoming and Reston, Va., offices of the U.S. Geological Survey. The PB number in parentheses is the NTIS ordering number.

Water resources data for Wyoming--water year 1971, part 1, surface-water records. 1972. (PB-289 523/AS)

Water resources data for Wyoming--water year 1971, part 2, water quality records. 1972. (PB-289 524/AS)

Water resources data for Wyoming--water year 1972, part 1, surface-water records. 1973. (PB-289 525/AS)

Water resources data for Wyoming--water year 1972, part 2, water-quality records. 1973. (PB-289 526/AS)

Water resources data for Wyoming--water year 1973, part 1, surface-water records. 1974. (PB-289 527/AS)

Water resources data for Wyoming--water year 1973, part 2, water-quality records. 1974. (PB-289 528/AS)

Water resources data for Wyoming--water year 1974, part 1, surface-water records. 1975. (PB-289 529/AS)

Water resources data for Wyoming--water year 1974, part 2, water-quality records. 1975. (PB-289 530/AS)

WY-75-1. Water resources data for Wyoming--water year 1975. 1976. (PB-259 841/AS)

WY-76-1. Water resources data for Wyoming--water year 1976, volume 1, Missouri River Basin. 1977. (PB-278 818/AS)

WY-76-2. Water resources data for Wyoming--water year 1976, volume 2, Green River Basin, Bear River Basin, and Snake River Basin. 1977. (PB-285 744/AS)

WY-77-1. Water resources data for Wyoming--water year 1977, volume 1, Missouri River Basin. 1978. (PB-293 493/AS)

WY-77-2. Water resources data for Wyoming--water year 1977, volume 2, Green River Basin, Bear River Basin, and Snake River Basin. 1978. (PB-293 494/AS)

WY-78-1. Water resources data for Wyoming--water year 1978, volume 1, Missouri River Basin. 1979. (PB-80 165 152/AS)

WY-78-2. Water resources data for Wyoming--water year 1978, volume 2, Green River Basin, Bear River Basin, and Snake River Basin. 1979. (PB-80 177 587/AS)

WY-79-1. Water resources data for Wyoming--water year 1979, volume 1, Missouri River Basin. 1980. (PB-81 103 129/AS)

WY-79-2. Water resources data for Wyoming--water year 1979, volume 2, Green River Basin, Bear River Basin, and Snake River Basin. 1980. (PB-80 212 137/AS)

WY-80-1. Water resources data for Wyoming--water year 1980, volume 1, Missouri River Basin. 1981. (PB-82 153 024/AS)

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Hydrologic Investigations Atlases (and other maps of areas west of the Mississippi River) are sold by the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

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Miscellaneous Investigations Maps

Miscellaneous Investigations Maps are sold by the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225

I-847-A. Energy resources map of the Powder River basin, Wyoming and Montana, by W. R. Keefer and T. W. Schmidt. 1973.

I-847-B. Map showing streamflow volumes in northeastern Wyoming and southeastern Montana, by D. G. Frickel and L. M. Shown. 1974.

I-847-C. Maps showing configuration and thickness, and potentiometric surface and water quality in the Madison Group, Powder River basin, Wyoming and Montana, by F. A. Swenson, W. R. Miller, W. G. Hodson, and F. N. Visher. 1976.

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I-848-E. Maps showing occurrence of ground water in the Gillette area, Campbell County, Wyoming by N. J. King. 1974.

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Open-file reports which may be in manuscript form, generally are not reproduced and distributed in quantity. These reports are available for inspection in the Cheyenne, Wyoming and Reston, Va., offices of the U.S. Geological Survey. Most numbered open-file reports may be purchased from the Open-File Services Section (OFSS), Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225. Information on the availability of the unnumbered reports may be obtained from the District Chief, Cheyenne, Wyoming.

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75-631. Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming, by U.S. Geological Survey. 1975.

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