WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1984

Compiled By Sharon L. Green

U. S. Geological Survey

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WILLIAM P. CLARK, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

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Utah State Engineer
Wyoming Department of Agriculture
Wyoming Department of Economic Planning and Development
Wyoming Department of Environmental Quality
Wyoming Highway Department
Wyoming State Engineer
Wyoming Water Development Commission

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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(m)	3.281	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
cubic meter (m^3)	35.31	cubic foot
cubic meter per second (m^3/s)	35.31	cubic foot per second

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Compiled by S. L. Green

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 has five data-collection activities and 45 water-resources appraisal projects in Wyoming during fiscal year 1984 (October 1, 1983, through September 30, 1984).

The data-collection activities include (1) collecting records for streamflow and reservoir storage; (2) collecting 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) measuring 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 conducted during fiscal year 1984 and projects completed in previous fiscal years, but for which final reports were in preparation at the end of fiscal year 1984.

This report describes the water-resources investigations being done in Wyoming. The report also intends to inform cooperating officials and the public about the accomplishments in the various investigations during the fiscal year 1983 (October 1, 1982, through September 30, 1983) and planned work for fiscal year 1984. 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 Wyoming State Engineer. A. J. Parshall became the first resident hydrographer for the Geological Survey in Wyoming in 1901. For the next 6 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). During 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. During 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 is in the Missouri River Basin were 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 during 1941 for the Rural Electric Association (REA), and a continuous series of studies of Yellowstone and Grand Teton National Parks for the National Park Service starting during the early 1960's and ending during 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. During 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 Missouri River Basin program of the Department of Interior. 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 in 1959 to evaluate the effects of the Kendrick Project on the North Platte River. 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 when the office was opened in 1946. 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 in Wyoming 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. During 1981 and 1982, however; energy-related programs decreased significantly due to reductions in Federal funds. The field office in Worland was closed in 1982 and the field office in Buffalo was closed in 1983. Today the District has approximately 50 employees, with field offices in Casper, Green River, and Riverton. Approximately two-thirds of the funding is for work done in cooperation with other agencies, and one-third is for participation in 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 Engineer)	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.

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FTS 328-5485

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

1225 Market Street
P.O. Box 431
Riverton, WY 82501
(307) 856-3771

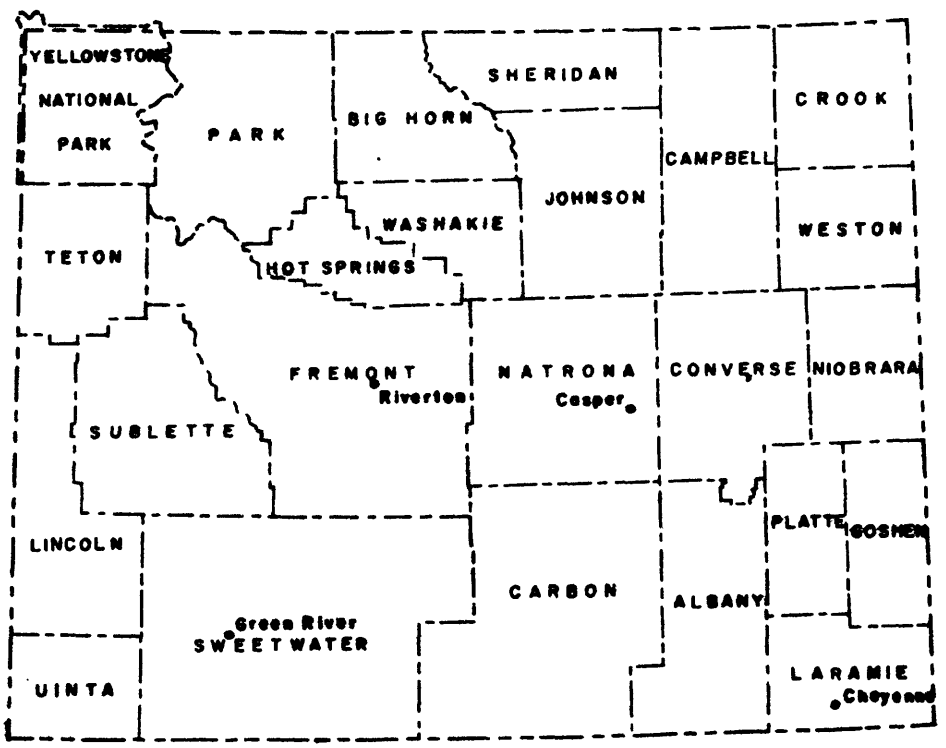


Figure 1.--Location of offices in Wyoming.

WYOMING DISTRICT ORGANIZATION CHART

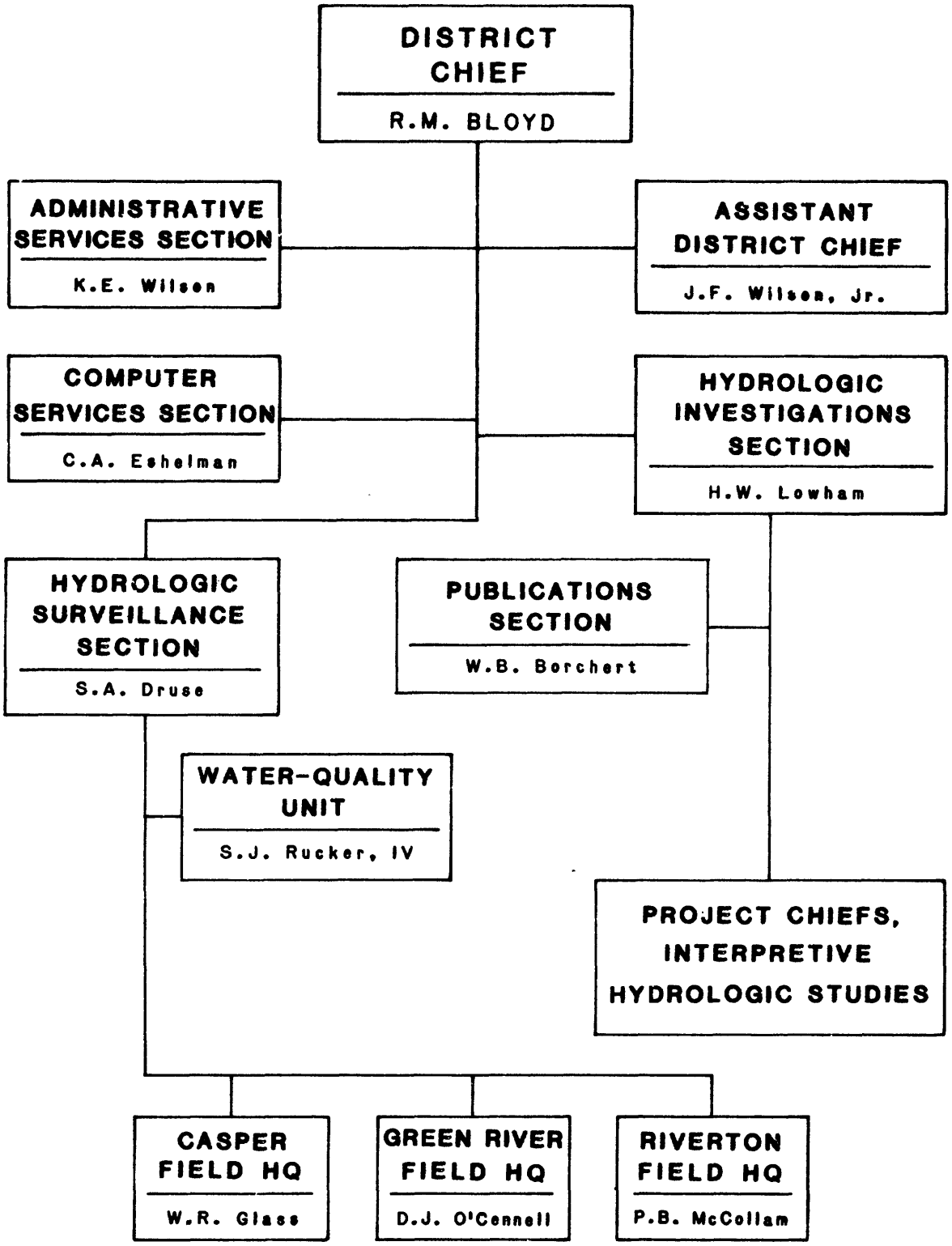


Figure 2.

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.

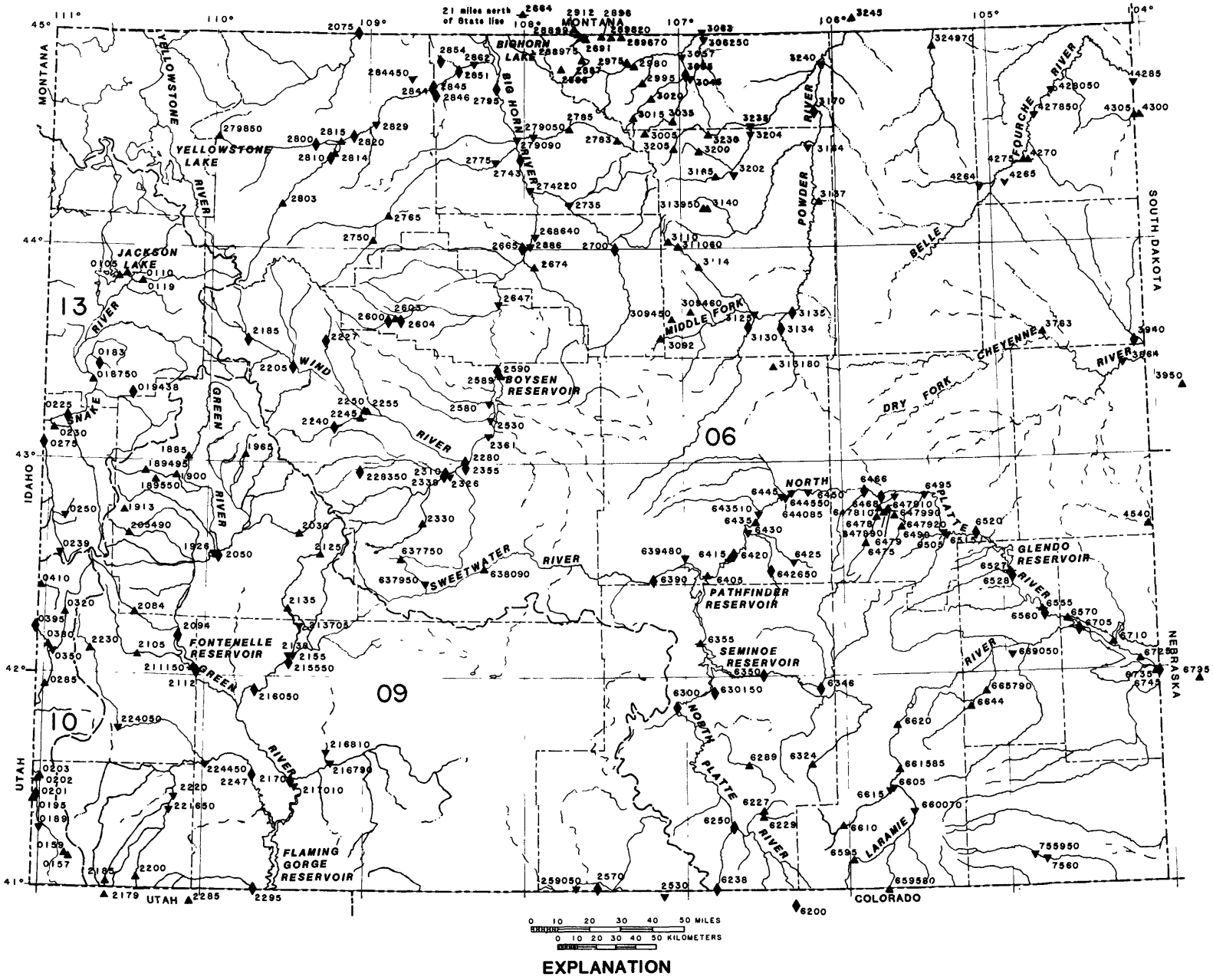


Figure 3.--Map showing locations of streamflow, reservoir, water-quality, and sediment stations, 1984 water year.

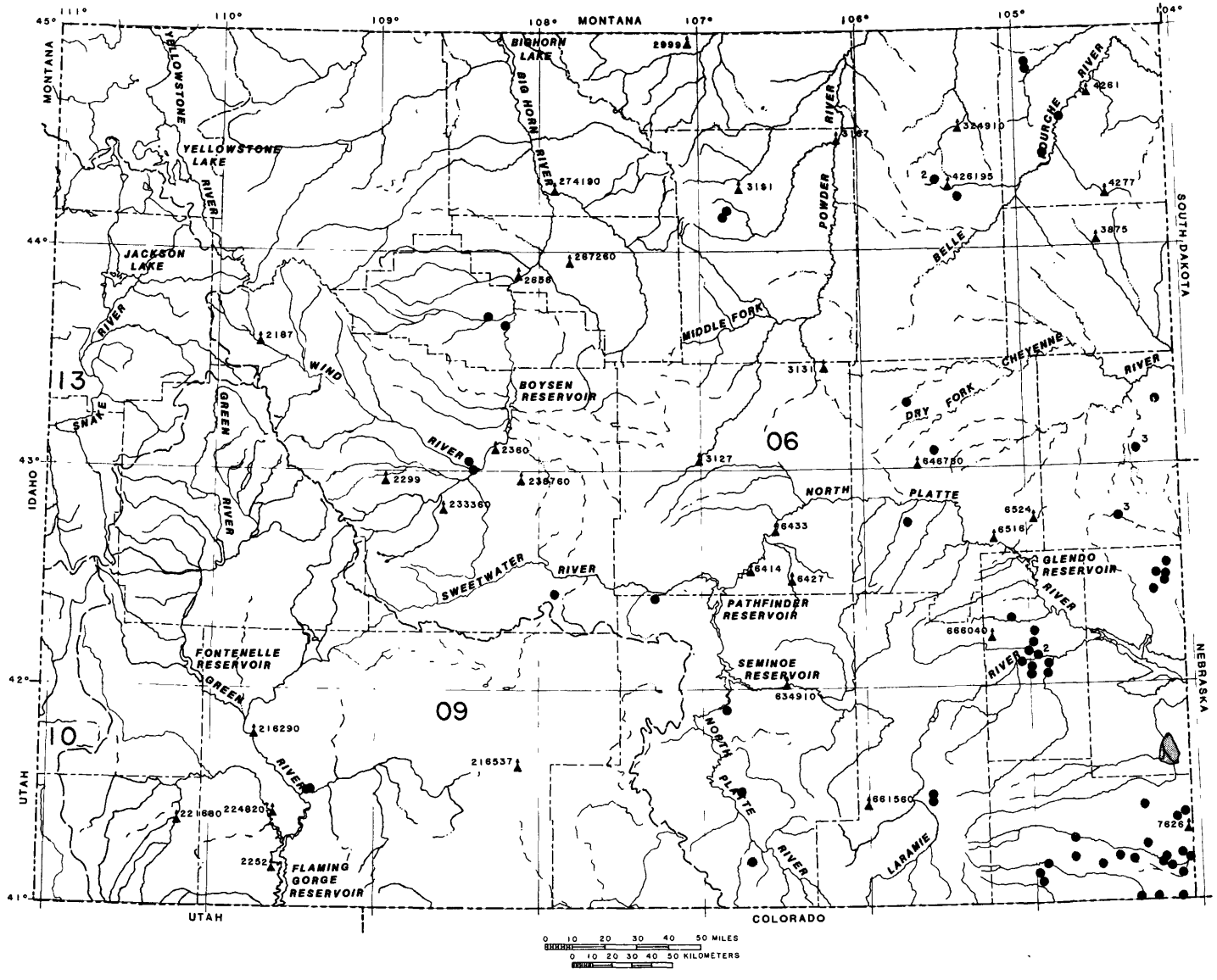


Figure 4.—Map showing locations of crest-stage partial-record stations and ground-water observation wells.

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:

- 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 auxiliary 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	D,M	Y	R	MRB, BIA	
*06222700	Crow Creek near Tipperary	H	30.2	1962-	20	7N	4W	D,G,M	Y	R	MRB	
*06224000	Bull Lake Creek above Bull Lake	H	187	1941-53, 1966-	2	2N	4W	D,M	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	
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	D,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	D,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	
*06270000	Nowood River near Tensleep	P	803	1938-43, 1950-55, 1972-	27	47N	88W	D,M	Y	R	WSE	
*06274300	Bighorn River at Basin	C	--	1984-	21	51N	93W	D,M	Y	R	WDEQ	
06275000	Wood River at Sunshine	C,H	194	1945-	15	47N	101W	D,M	Y	R	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					
YELLOWSTONE RIVER BASIN--Continued												
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	D,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	D,G,M	Y	R	MRB	
06280300	South Fork Shoshone River near Valley	B,H	297	1956-	24	49N	106W	D,G,M	Y	R	USGS	
*06281000	South Fork Shoshone River above Buffalo Bill Reservoir	P	585	1903, 1905-08, 1921-26, 1973-	33	52N	103W	D,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	D,M	Y	R	MRB	
*06285100	Shoshone River near Lovell	C,R	2,350	1966-	16	56N	96W	D,M	Y	R	MRB	
*06285400	Sage Creek at Sidon Canal, near Deaver	C	341	1958-60, 1968-	34	57N	97W	D,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	C	WWDC	
06288700	Dry Fork Little Bighorn River below Lick Creek, near Burgess Junction	C	54.1	1983-	28	57N	89W	D,G,M, W	Y	C	WWDC	
06288975	Elkhorn Creek above Fuller Ranch Ditch, near Parkman	C	4.58	1983-	21	58N	89W	D,G,M	Y	C	WWDC	
06288990	West Fork Little Bighorn River near Parkman	C	38.2	1983-	17	58N	89W	D,G,M	Y	C	WWDC	
06289100	Red Canyon Creek near Parkman	C	3.2	1983-	27	58N	89W	D,G,M	Y	C	WWDC	
06289600	West Pass Creek near Parkman	C	15.4	1983-	21	58N	88W	D,W	Y	C	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												
06289820	East Pass Creek near Dayton	C	21.7	1983-	24	58N	88W	D,W	Y	C	WWDC	
06289870	Twin Creek near Parkman	C	27	1983-	22	58N	87W	D,W	Y	C	WWDC	
06291200	Lodgegrass Creek at State line, near Wyola, Mont.	C	16.7	1983-	34	9S	32E	D,G,M	Y	C	WWDC	
06297500	Highline Ditch near Dayton	C	--	1919-23, 1940-	11	56N	87W	G,W	S	C	WSE	
06298000	Tongue River near Dayton	B,C,H	204	1918-29, 1940-	11	56N	87W	D,W	Y	C	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	C	WSE	
06309200	Middle Fork Powder River near Barnum	H	45.2	1961-	26	42N	86W	D,G,M, W	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	C	WSE	
06311060	North Fork Powder River below Bull Creek, near Hazelton	C	32.3	1974-	25	47N	85W	D,W	Y	C	WSE	
06311400	North Fork Powder River below Pass Creek, near Mayoworth	C,H	100	1974-	36	46N	84W	D,W	Y	C	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	C	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	3,090	1938-40, 1950-57, 1977-	13	43N	79W	D,G,M	Y	C	BLM	
06313700	Dead Horse Creek near Buffalo	H	151	1971-	15	49N	77W	G,M	Y	C	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					
YELLOWSTONE RIVER BASIN--Continued												
06313950	North Fork Crazy Woman Creek below Pole Creek, near Buffalo	C,H	43.4	1973-	28	49N	83W	G,M	Y	C	DEPD	
06314000	North Fork Crazy Woman Creek near Buffalo	C,H	44.9	1942-49, 1973-	27	49N	83W	G,M	Y	C	DEPD	AWG
*#06317000	Powder River at Arvada	C,P	6,050	1919-	21	54N	77W	G,M	Y	C	WSE	
06318500	Clear Creek near Buffalo	C	120	1894, 1896-99, 1917-27, 1938-	6	50N	82W	G,W	Y	C	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.	--	8,088	1929-72, 1974-	8	9N	48W	G,W	Y	MT	--	
06324970	Little Powder River above Dry Creek, near Weston	P	1,235	1972-	13	57N	71W	D,G,M	Y	C	WSE	
CHEYENNE RIVER BASIN												
06376300	Black Thunder Creek near Hampshire	H	535	1972-	31	42N	65W	D,G,M	Y	C	WSE	
*06394000	Beaver Creek near Newcastle	B,P	1,320	1943-	18	41N	60W	D,G,W	Y	C	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	
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	--	

* 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												
*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	
#06630150	Saint Marys Ditch tributary near Hanna	H	--	1984-	1	22N	84W	D,M	Y	CP	USGS	
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
06637750	Rock Creek above Rock Creek Reservoir	C,H	9.2	1962-	27	30N	100W	D,W	Y	R	WSE	
06638090	Sweetwater River near Sweetwater Station	P	849	1973-	12	29N	96W	D,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	11,439	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	

* 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												
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	
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	

* 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												
*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	D,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	D,M	Y	GR	WSE	
09189495	North Horse Creek above Sherman Ranger Station	C	42.8	1983-	1	34N	114W	D,G,M	Y	GR	WWDC	
09189550	South Horse Creek near Merna	C	33.3	1983-	22	34N	113W	D,G,M	Y	GR	WWDC	
09190000	Horse Creek near Daniel	C	106	1931-54, 1983-	2	33N	111W	D,G,M	Y	GR	WWDC	
09191300	South Cottonwood Creek near Big Piney	C	21.4	1983-	15	32N	115W	D,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,M	Y	GR	WSE	
*09205000	New Fork River near Big Piney	P	1,230	1954-	22	30N	110W	D,M	Y	GR	WSE	
09205490	North Piney Creek above Apperson Creek, near Mason	C	29.6	1983-	24	31N	115W	D,G,M	Y	GR	WWDC	
09208400	La Barge Creek above Viola	C	122	1983-	36	27N	115W	D,G,M	Y	GR	WWDC	
*09209400	Green River near La Barge	C,P	3,910	1963-	33	26N	112W	D,M	Y	GR	WSE	
09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	C,H	152	1951-	2	24N	115W	D,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	D,M	S	GR	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					
GREEN RIVER BASIN--Continued												
09213500	Big Sandy River near Farson	C,R	322	1914-17, 1920-24, 1926-34, 1935-	17	27N	106W	D,M	S	GR	WSE	
*09215550	Big Sandy River below Farson	C,R	1,097	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,M	Y	GR	BRUC	
*#09217000	Green River near Green River	C,R	14,000	1951-	26	18N	107W	D,G,M	Y	GR	USGS	
09217900	Blacks Fork near Robertson	H	130	1937-39, 1966-	27	3N	12E	D,M	Y	GR	USE	
09218500	Blacks Fork near Millburne	C	152	1939-	11	12N	117W	D,M	Y	GR	WSE	
09220000	East Fork of Smiths Fork near Robertson	C,H	53.0	1939-	5	12N	115W	G,M	S	S	WSE	
09223000	Hams Fork below Pole Creek, near Frontier	C,H	128	1952-	35	25N	117W	D,M	Y	GR	USGS	
*09224700	Blacks Fork near Little America	C,R	3,100	1962-	15	18N	109W	D,M	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,M	Y	GR	USGS	
*09257000	Little Snake River near Dixon	C,P	988	1910-23, 1938-	8	12N	90W	G,M	S	CO	WSE	
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	--	

* 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--Continued												
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:

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	
06299900	Slater Creek near Monarch	18.0	1967-81, 1984-	18	57N	84W	CSI	C	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	C	WHD	
06319100	Bull Creek near Buffalo	10.8	1969-	29	50N	82W	CSI	C	WHD	
06324910	Cow Creek tributary near Weston	.72	1971-	26	53N	71W	CSI	C	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	C	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	

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										
06651800	Sand Creek near Orin	27.8	1955, 1961-	11	31N	70W	CSI	C	WHD	
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
F	five times during the year
HL	high and low flow samples only
HLI	high flow, low flow, under ice, and one other sample
HLJ	high flow, low flow, under ice, and one during July or August
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
SS	sample during spraying season (frequency determined in late spring)
T	twenty-four samples during April 15 to October 15

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
11	field determinations of specific conductance and temperature
12	specific conductance and temperature (continuous monitors)

Field office:

C	Casper	ID	Idaho District
CH	Cheyenne Hydrologic Surveillance Section	MT	Montana District
		R	Riverton
CO	Colorado District	S	Wyoming State Engineer
CR	Green River	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 WDA	HLI SS	1 9	MT	
@06218500	Wind River near Dubois	232	1947-50, 1965-	25	42N	108W	WDA	HLI	1	R	
#@06220500	East Fork Wind River near Dubois	427	1975-	34	6N	6W	MRB	M	11	R	
@06222700	Crow Creek near Tipperary	30.2	1974-	20	7N	4W	MRB	M	11	R	
@06224000	Bull Lake Creek above Bull Lake	187	1974-	2	2N	4W	MRB	M	11	R	
@06228000	Wind River at Riverton	2,309	1947-50, 1953, 1965-	2	1S	4E	WDA	HLI	1	R	
@06228350	South Fork Little Wind River above Washakie Reservoir, near Fort Washakie	90.3	1976-	18	1S	2W	BIA	M	1,11	R	
@06231000	Little Wind River above Arapahoe	660	1966-	23	1S	3E	WDA	HLI	1	R	
06232600	Popo Agie River at Hudson Siding, near Lander	--	1984-	30	2S	2E	WDEQ	M	5,6,7	R	
@06233900	Popo Agie River near Arapahoe	--	1979-	27	1S	3E	BIA WDA	HLI SS	1 9	R	
@06235500	Little Wind River near Riverton	1,904	1965-	11	15N	4E	WDA	HLI	1	R	
06236100	Wind River above Boysen Reservoir, near Shoshoni	4,390	1974-	25	2N	5E	WDEQ	M	5,6,7	R	
#06253000	Fivemile Creek near Shoshoni	418	1949-51, 1953, 1965-	19	3N	6E	WDA	HLI	1	R	
#@06259000	Wind River below Boysen Reservoir	7,701	1953-54, 1960-	9	5N	6E	USGS WDEQ	BM BM	1,5,6,7,8 1,5,6,7	R R	
@06260000	South Fork Owl Creek near Anchor	85.5	1974-	28	43N	100W	BRUM	M	11	R	
@06260400	South Fork Owl Creek below Anchor Reservoir	131	1974-	25	43N	100W	BRUM	M	11	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	HLI	1	R	
@06270000	Nowood River near Ten Sleep	803	1967-	27	47N	88W	WDA WDA	HLI SS	1 9	R	
06273500	Paint Rock Creek near mouth, below Hyattville	376	1951-53, 1967-	19	49N	90W	WDA	SS	9	R	
06274220	Nowood River at Manderson	2,000	1965-	30	50N	92W	WDA	MQ	1	R	
@06274300	Bighorn River at Basin	--	1984-	21	51N	93W	WDEQ	M	5,6,7	R	
06277500	Greybull River near Basin	1,115	1951-53, 1965-	8	51N	94W	WDA WDA	MQ SS	1 9	R	

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											
06279050	Shell Creek at Porter Gulch, near Greybull	--	1983-	33	53N	92W	WDA	SS	9	R	
06279090	Shell Creek near Greybull	560	1951, 1965-	4	52N	93W	WDA	HLI	1	R	
#@06279500	Bighorn River at Kane	15,765	1947-53, 1955-57, 1960-	9	55N	94W	MRB	M	11	R	
							WDA	M	1		
							WDEQ	HLJ	5,6,7		
@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	HLI	1		
@06282000	Shoshone River below Buffalo Bill Reservoir	1,538	1947-49, 1964-	3	52N	102W	WDA	HLI	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	--	1974-	13	55N	98W	WDA	SS	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	WDEQ	HLJ	6	R	
							MRB	M	5		
@06284800	Whistle Creek near Garland	101	1959-60, 1969-	30	55N	97W	MRB	M	5	R	
@06285100	Shoshone River near Lovell	2,350	1966-	16	56N	96W	MRB	Q	1,7	R	
@06285400	Sage Creek at Sidon Canal, near Deaver	341	1958-60, 1969-	34	57N	97W	MRB	Q	5,7	R	
06286200	Shoshone River at Kane	2,989	1976-	6	56N	95W	WDEQ	HLJ	5,6,7	R	
06304500	Little Goose Creek near Sheridan	159	1979-	27	56N	84W	WDEQ	HLJ	5,6	C	
							WDA	SS	9		
@06305500	Goose Creek below Sheridan	392	1959-60, 1961-64, 1967-	15	56N	84W	WDA	M	1	C	
							WDEQ	M	5,6,7		
06305700	Goose Creek near Acme	--	1984-	27	57N	84W	WDEQ	M	5,6,7	C	
06306250	Prairie Dog Creek near Acme	358	1983-	23	58N	83W	WDA	SS	9	C	
06306300	Tongue River at State line, near Decker, Mont.	1,477	1965-	33	9S	40E	WDA	M	1	MT	
							WDEQ	HLJ	5,6,7,8		
							WDA	SS	9	C	
06312500	Powder River near Kaycee	980	1968-	13	43N	81W	WDA	HLI	1	C	
							WDEQ	HLJ	5,6,7		
#@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	HLJ	1	C	
#@06313500	Powder River at Sussex	3,090	1949-53, 1977-	13	43N	79W	BLM	M	1	C	
06316400	Crazy Woman Creek at upper station, near Arvada	945	1966-81, 1983-	18	52N	77W	WDA	SS	9	C	
#@06317000	Powder River at Arvada	6,050	1946-53, 1967-	21	54N	77W	WDA	HLI	1	C	
06320200	Clear Creek below Rock Creek, near Buffalo	322	1975-	30	51N	81W	WDEQ WDA	M SS	5,6,7 9	C	
06320400	Clear Creek at Ucross	409	1975-81, 1983-	19	53N	80W	WDA	SS	9	C	
06323500	Piney Creek at Ucross	267	1975-80, 1983-	18	53N	80W	WDA	SS	9	C	
#06324000	Clear Creek near Arvada	1,110	1950-54, 1966-	36	57N	77W	WDA WDA	HLI SS	1 9	C	
CHEYENNE RIVER BASIN											
06386400	Cheyenne River near Riverview	5,270	1975-	25	40N	61W	WDA	SS	9	C	
@06394000	Beaver Creek near Newcastle	1,320	1949-53, 1967-	18	41N	60W	WDA	HLI	1	C	
06426400	Donkey Creek near Moorcroft	--	1977-	30	50N	68W	WDEQ	HLJ	5,6,7	C	
06426500	Belle Fourche River below Moorcroft	1,670	1975-	24	50N	68W	WDEQ WDA	M SS	5,6,7 9	C	
06427850	Belle Fourche River at Devils Tower	--	1967-	7	53N	65W	WDA WDA	HLI SS	1 9	C	
06428050	Belle Fourche River below Hulett	--	1981-	6	54N	64W	WDEQ WDA	M SS	5,6,7 9	C	
06428500	Belle Fourche River at Wyoming-South Dakota State line	3,280	1965-	18	9N	1E	WDA	HLI	1	C	
PLATTE RIVER BASIN											
@06620000	North Platte River near Northgate, Colo.	1,431	1965-	11	11N	80W	WDA WDA	M SS	1 9	C	
#@06623800	Encampment River above Hog Park Creek, near Encampment	72.7	1967-	10	12N	84W	USGS USGS USGS	Q HL A	5,6,7 1,8 10	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											
@06625000	Encampment River at mouth, near Encampment	265	1965-	3	15N	83W	WDA	M	1	C	
							WDA	SS	9		
@06630000	North Platte River above Seminoe Reservoir, near Sinclair	8,134	1960-	13	22N	86W	WDA	M	1	C	
							WDEQ	HLJ	5,6,7		
@06634600	Little Medicine Bow River near Medicine Bow	966	1965-	21	23N	78W	WDA	HLI	1	C	
							WDEQ	HLJ	10		
@06635000	Medicine Bow River above Seminoe Reservoir, near Hanna	2,338	1965-	34	24N	81W	WDA	HLI	1	C	
							WDEQ	HLJ	10		
@06639000	Sweetwater River near Alcova	2,327	1964-	25	29N	87W	WDA	HLI	1	C	
							WDEQ	HLJ	10		
06639480	Horse Creek at Highway 220, near Alcova	--	1983-	15	30N	85W	WDA	SS	9	C	
#@06642000	North Platte River at Alcova	10,812	1965-	17	30N	82W	USGS	BM	5,6,7	C	
							USGS	HL	1		
							USGS	HLI	8		
							WDEQ	BM	1,5,6,7		
06642500	Bates Creek near Freeman	129	1981-	29	30N	79W	WDA	HLI	1	C	
#@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	M	1	C	
							WDEQ	HLJ	5,6,7		
06644085	North Platte River at Mills	--	1970-	7	33N	79W	WDEQ	HLJ	5,6,7	C	
06644500	Casper Creek at Casper	668	1970-	7	33N	79W	WDEQ	HLJ	5,6,7	C	
06644550	North Platte River at Casper	--	1971-	4	33N	79W	MRB	T	5	C	
							WDA	SS	9		
							WDEQ	HLJ	5,6,7		
06645000	North Platte River below Casper	12,574	1950-52, 1957-59, 1967-	4	33N	78W	WDA	M	1	C	
							WDEQ	M	5,6,7		
@06646600	Deer Creek below Millar Wasteway, at Glenrock	213	1967-	4	33N	75W	WDA	HLI	1	C	
@06646800	North Platte River near Glenrock	13,538	1960-	17	33N	74W	WDA	HLI	1	C,S	
06647990	Box Elder Creek below Interstate 25, near Careyhurst	--	1981-	13	33N	74W	WDA	HLI	1	C	
06649500	La Prele Creek near Orpha	--	1981-	15	33N	72W	WDA	HLI	1	C	
06650500	Wagonhound Creek near La Bonte	--	1981-	16	31N	71W	WDA	HLI	1	C	
06651500	La Bonte Creek near La Bonte	--	1981-	15	31N	71W	WDA	HLI	1	C	
@06652000	North Platte River at Orin	14,888	1966-	17	31N	69W	WDA	M	1	C	
							WDA	SS	9		
							WDEQ	M	5,6,7		

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											
@06652800	North Platte River below Glendo Reservoir	15,548	1966-	30	29N	67W	WDA	M	1	C	
							WDA	SS	9		
@06656000	North Platte River below Guernsey Reservoir	16,237	1950-58, 1965-	27	27N	66W	WDA	HLI	1	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	HLI	1	CH	
							WDA	SS	9		
06661500	Little Laramie River at Two Rivers	376	1965-	6	17N	74W	WDA	HLI	1	CH	
							WDA	SS3	9		
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	M	1	C	
							WDEQ	HLJ	5,6,7		
06755950	Crow Creek at F. E. Warren AFB	--	1983-	36	14N	67W	WDA	SS	9	CH	
06756000	Crow Creek near Cheyenne	--	1983-	3	13N	66W	WDA	SS	9	CH	
GREEN RIVER BASIN											
09192600	Green River near Big Piney	1,260	1967-	21	30N	110W	WDA	HLI	1	GR	
@09205000	New Fork River near Big Piney	1,230	1965-	22	30N	110W	WDA	HLI	1	GR	
@09209400	Green River near La Barge	3,910	1963-	33	26N	112W	WDA	HLI	1	GR	
							WDA	SS	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	HLI	1	GR	
09213800	Big Sandy River at Farson	--	1981-	33	25N	106W	WDA	HLI	1	GR	
09215500	Little Sandy Creek at Farson	--	1981-	34	25N	106W	WDA	HLI	1	GR	
@09215550	Big Sandy River below Farson	--	1981-	12	24N	107W	BRUC	C	12	GR	
							WDA	M	1		
							WDA	SS	9		
@09216050	Big Sandy River at Gasson Bridge, near Eden	1,720	1975-	29	23N	108W	WDA	M	1	GR	
							WDA	SS	9		
							BRUC	C	12		
09216790	Bitter Creek above Killpecker Creek, at Rock Springs	--	1983-	26	19N	105W	WDA	SS	9	GR	
09216810	Killpecker Creek at Rock Springs	--	1975-80, 1982-	26	19N	105W	WDA	SS	9	GR	
#@09217000	Green River near Green River	14,000	1951-	26	18N	107W	USGS	D	2,3	GR	
							USGS	Q	8		
							USGS	BM	1,5,6,7		

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											
09217010	Green River below Green River	--	1973-	36	18N	107W	WDEQ	M	5,6,7	GR	
							WDEQ	F	1,4		
09221650	Smiths Fork near Lyman	--	1974-	12	16N	114W	WDA	SS	9	GR	
09222000	Blacks Fork near Lyman	821	1962-	15	17N	113W	WDA	SS	9	GR	
09224050	Hams Fork near Diamondville	--	1975-	36	21N	116W	WDEQ	M	5,6,7	GR	
							WDA	SS	9		
09224450	Hams Fork near Granger	670	1965-	30	19N	111W	WDA	HLI	1	GR	
@09224700	Blacks Fork near Little America	3,100	1951-	15	18N	109W	BRUC	C	12	GR	
							USGS	M	1		
@09229500	Henrys Fork near Manila, Utah	520	1951-	23	12N	109W	WDA	M	1	GR	
							WDA	SS	9		
09253000	Little Snake River near Slater, Colo.	285	1978-	15	12N	87W	WDA	IS	1	CO	
@09257000	Little Snake River near Dixon	988	1975-	8	12N	90W	WDA	IS	1	CO	
							WDA	SS	9		
09259050	Little Snake River below Baggs	--	1981-	7	12N	92W	WDA	HLI	1	CO	
							WDA	SS	9		
							WDEQ	M	5,6,7		
BEAR RIVER BASIN											
10018900	Yellow Creek at mouth, near Evanston	--	1984-	1	15N	121W	WDEQ	M	5,6,7	GR	
@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	SS	9	UT	
@10039500	Bear River at Border	2,490	1965-	15	14S	46E	WDA	BM	1	UT	
							USGS	BM	1,5,6,7		
							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	HLI	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	

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	0.062-mm sieve analysis
4	bed material particle-size distribution

Field office:

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

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		
*06253000	Fivemile Creek near Shoshoni	418	1948-75, 1978-	19	3N	6E	BRUM	M	1	R	
06258000	Muddy Creek near Shoshoni	332	1949-68, 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		
*@06313000	South Fork Powder River near Kaycee	1,150	1950-53, 1983-	9	42N	81W	BLM	P	1	C	
							BLM	MS	2		
							BLM	HL	4		
*@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	1946-57, 1967-71, 1975-78, 1983-	21	54N	77W	BLM	D	1	C	
							BLM	I	2		
							BLM	HL	4		
PLATTE RIVER BASIN											
*@06623800	Encampment River above Hog Park Creek, near Encampment	72.7	1964-	10	12N	84W	USGS	Q	1,2, 3	C	
@06630150	Saint Marys Ditch tributary near Hanna	--	1984-	1	22N	84W	USGS	P	1,2	CP	
*@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		
							BLM	I	2		
*06643510	North Platte River above Poison Spider Creek, near Goose Egg	--	1983-	3	32N	81W	BLM	P	1	C	
							BLM	HL	4		
							BLM	I	2		

* 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					
GREEN RIVER BASIN											
*@09217000	Green River near Green River	14,000	1951-	26	18N	107W	USGS USGS USGS USGS	D I BM HML	1 2 3 4	GR	
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	124 WDRV	Wind River Formation
111 SPBK	Spoil bank (reclaimed coal mine area)	124 WSTC	Wasatch Formation
		125 FRUN	Fort Union Formation
111 TRRC	Terrace deposits	211 FXHL	Fox Hills Sandstone
121 NRPK	North Park Formation	217 LKOT	Lakota Formation
121 OGLL	Ogallala Formation	311 PRKC	Park City Formation
122 ARKR	Arikaree Formation	317 MNKT	Minnekahta Limestone
123 BRUL	Brule Formation	317 MNLS	Minnelusa Formation
123 WRVR	White River Formation or Group	317 TSLP	Tensleep Sandstone
		331 MDSN	Madison Limestone
124 TPTN	Tipton Shale Member of Green River Formation	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
Cenozoic	100
Quaternary	110
Holocene	111
Pleistocene	112
Tertiary	120
Pliocene	121
Miocene	122
Oligocene	123
Eocene	124
Paleocene	125
Mesozoic	200
Cretaceous	210
Upper	211
Lower	217
Jurassic	220
Upper	221
Middle	224
Lower	227
Triassic	230
Upper	231
Middle	234
Lower	237
Paleozoic	300
Permian	310
Upper	311
Lower	317
Paleozoic--Continued	
Pennsylvanian	320
Upper	321
Middle	324
Lower	327
Mississippian	330
Upper	331
Lower	337
Devonian	340
Upper	341
Middle	344
Lower	347
Silurian	350
Upper	351
Middle	354
Lower	357
Ordovician	360
Upper	361
Middle	364
Lower	367
Cambrian	370
Upper	371
Middle	374
Lower	377
Precambrian	400

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:

C	Casper	P	Project Personnel
CH	Cheyenne Hydrologic Surveillance Section	R	Riverton
		S	Wyoming State Engineer
GR	Green River		

Frequency of observation:

C	continuous (graphic or digital recorder)
M	monthly (12 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: Indicates a reference name of the well

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							
15-073-01DBA	411751105312701	317CSPR	WSE	S	C	1983-	Wyo. Water Research Ctr	
15-073-12DBB	411703105314001	317CSPR	WSE	S	C	1983-	Wyo. Water Research Ctr	
CAMPBELL COUNTY	MISSOURI RIVER BASIN							
49-070-31BBB01	441117105192901	211FXHL	WSE	S	C	1983-	Hampshire Energy	
50-072-21ABA01	441819105305701	124WSTC	WSE	S	C	1983-	City of Gillette	
50-072-21ADC01	441756105304701	125FRUN	WSE	S	C	1983-	City of Gillette	
CARBON COUNTY	MISSOURI RIVER BASIN							
14-083-03CAB01	411234106424601	121NRPK	WSE	P	C	1980-	Robert Helmer	
18-083-17CBD01	413148106454801	121NRPK	WSE	P	C	1980-	Burton Tuttle	Tuttle Well
22-084-01BCB01	415430106493801	111SPBK	USGS	CH	C	1983-	Arch Mineral Corp.	
28-087-16CCA01	422338107145001	122ARKR	WSE	C	C	1981-	DEPD	
CONVERSE COUNTY	MISSOURI RIVER BASIN							
32-074-08DBC01	424520105440501	331MDSN	WSE	C	C	1980-	Wm Barber, Panhandle Eastern	In Canyon
36-073-24BA	430502105334101	124WSTC	WSE	P	C	1981-	Mrs. Whiting	
38-074-03AAA	431809105430901	124WSTC	WSE	P	C	1981-	Roy Baker	
CROOK COUNTY	MISSOURI RIVER BASIN							
51-066-06DCD	442540104493501	331MDSN	WSE	S	C	1981-	City of Gillette	Gillette
53-065-18BBD02	443453104425602	337PHSP	WSE	C	M	1962-	National Park Service	
56-067-28AAB01	444854104534501	331MDSN	WSE	S	C	1983-	R. Jahnig	
56-067-28AAB02	444854104534502	331MDSN	WSE	S	C	1983-	R. Jahnig	
FREMONT COUNTY	MISSOURI RIVER BASIN							
29-093-36DB	422632107540501	122ARKR	WSE	R	C	1974-	State of Wyoming	Jeffrey City
A 1-4-28ACC	430205108243201	124WDRV	WSE	R	M	1984-	Claud Fike	Brentwood #1
A 1-4-33DDB	430051108240901	124WDRV	WSE	R	C	1951, 1961-	Teton Studs Corp.	Teton S

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	MISSOURI RIVER BASIN							
19-061-02CCD	413816104094901	111ALVM	WSE	S	SA	1943, 1949-69, 1972-	City of La Grange	
19-061-04ABC	413852104115801	111ALVM	WSE	S	C	1972-	Frank Sanders	
19-061-10AAB01	413810104102301	123BRUL	WSE	S	C	1980-	State of Wyoming	
19-061-13BAA	413715104082701	123BRUL	WSE	S	M	1972-	Flora Vandehei	
20-060-30BBB	414049104074501	123BRUL	WSE	S	C	1980-	State of Wyoming	
20-061-03DAD01	414348104101301	123WRVR	WSE	S	C	1980-	State of Wyoming	
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.	
20-061-21DDD	414050104112301	111ALVM	WSE	S	M	1970-	Curtis Meier	
20-061-22AAA03	414139104101503	123BRUL	WSE	S	M	1978-	Horse Creek Conserv. Dist.	
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.	
20-061-23CCC	414051104100701	111ALVM	WSE	S	C	1972-	John Meier & Son, Inc.	
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	
20-061-31DAD	413919104134101	123BRUL	WSE	S	M	1972-	Ward Hay & Cattle Company	
20-061-35AAB	413953104091001	123BRUL	WSE	S	M	1970-76, 1978-	John Meier & Son, Inc.	
28-061-06ABA	422512104135501	122ARKR	WSE	S	C	1979-	State of Wyoming	Goshen #2
29-061-17AAD	422928104121401	122ARKR	WSE	S	C	1980-	State of Wyoming	
29-061-23ABB	422849104090801	122ARKR	WSE	S	C	1979-	State of Wyoming	Goshen #1
29-061-26CBB01	422730104094801	122ARKR	WSE	S	C	1980-	State of Wyoming	Prairie Ctr #3
30-061-09BBB	423549104120901	122ARKR	WSE	S	C	1980-		Prairie Ctr #5
HOT SPRINGS COUNTY	MISSOURI RIVER BASIN							
43-095-18CBA01	434136108183301	317TSLP	WSE	R	C	1983-	City of Thermopolis	
43-095-25CDD01	433933108121901	311PRKC	WSE	R	C	1983-	City of Thermopolis	
JOHNSON COUNTY	MISSOURI RIVER BASIN							
48-083-05DCC	440912106512001	374FLTD	WSE	C	C	1974-	Mobil Oil	Flathead
49-083-27DBA02	441112106493502	331MDSN	WSE	C	C	1974-	Mobil Oil	Crazy Woman Cyn
LARAMIE COUNTY	MISSOURI RIVER BASIN							
12-060-07DDD	410059104072401	123BRUL	WSE	S	C	1977-	State of Wyoming	Laramie #1
12-062-13BAA	410100104160301	111TRRC	WSE	S	C	1975-	State of Wyoming	
12-063-15AAA02	410111104223102	123BRUL	WSE	S	C	1973-	Geological Survey	

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--Continued		MISSOURI RIVER BASIN						
13-060-05CCB	410703104071201	123BRUL	WSE	S	C	1969-	Elmer Glantz	
13-068-13CCC	410530104574001	121OGLL	WSE	CH	C	1942-50, 1969-	City of Cheyenne	
14-060-05BCB	411238104070801	123BRUL	WSE	S	C	1957-	C. C. Gross	
14-060-10DBB	411131104041801	123BRUL	WSE	S	C	1973-	Geological Survey	
14-061-18DDD01	411022104141201	123WRVR	WSE	S	C	1977-	State of Wyoming	Laramie #2
14-061-22DCC	410900104110701	123BRUL	WSE	S	C	1975-	Sheril Brown	
14-063-15AAA	411114104242501	122ARKR	WSE	S	C	1977-	State of Wyoming	Laramie #3
14-064-01DCB	411214104293301	121OGLL	WSE	S	C	1977-	Andy Hollenbeck	Hollenbeck
14-064-19BCC	411005104355001	121OGLL	WSE	S	C	1977-	State of Wyoming	Laramie #9
14-066-10ABA	411210104452001	121OGLL	WSE	S	C	1977-	State of Wyoming	Laramie #8
14-067-18DDC	411034104554001	121OGLL	WSE	CH	C	1956-	City of Cheyenne	
14-068-35DDC02	410757104582302	121OGLL	WSE	CH	C	1969-	Art King	King #3
15-062-20AAA	411531104194701	121OGLL	WSE	S	C	1977-	State of Wyoming	Laramie #4
15-066-10BAB	411725104454601	121OGLL	WSE	S	C	1977-	State of Wyoming	Laramie #7
16-060-07BBB02	412227104081401	121OGLL	WSE	S	C	1975-	State of Wyoming	SW of Albin
16-061-17AAA01	411136104125301	121OGLL	WSE	S	C	1977-	Laramie Co. Well #5	Laramie #5
17-060-33CBB	412343104053101	121OGLL	WSE	S	C	1975-	State of Wyoming	
17-062-17CCC	412605104203001	121OGLL	WSE	S	M	1982-	State of Wyoming	Laramie #6
NIOBRARA COUNTY		MISSOURI RIVER BASIN						
32-062-05BAA	424709104194101	122ARKR	WSE	S	C	1979-	State of Wyoming	
32-062-32BBB	424244104202001	122ARKR	USGS	C	C	1970-	Richard Pfister	Node
32-063-08DAA	424544104260601	122ARKR	WSE	S	C	1979-	State of Wyoming	
36-062-28AB 01	430422104183201	331MDSN	USGS	C	C	1974-	Energy Trans. Co.	Madison
36-062-28AB 02	430422104183202	217LKOT	WSE	C	C	1974-	Energy Trans. Co.	Lakota
36-062-28BBD01	430421104200701	317MNLS	WSE	S	C	1983-	ETSI	
38-061-35DCA01	431321104090001	317MNLS	WSE	S	C	1983-	ETSI	
PLATTE COUNTY		MISSOURI RIVER BASIN						
24-067-21AAB	420237104532101	111ALVM	WSE DEPD	S	C	1979-	Ed Preuit	
24-068-22AAB	420246104590301	122ARKR	WSE	S	C	1980-	State of Wyoming	Platte #1
25-067-19DDA01	420718104553901	122ARKR	WSE DEPD	P	C	1979-	Ed Wilhelm	Wilhelm
25-067-34CCD	420524104530201	122ARKR	WSE	S	C	1980-	State of Wyoming	Platte #2
25-068-12DDA	420859104565001	122ARKR	WSE	S	C	1980-	State of Wyoming	Platte #4
25-068-15BBD	420840105000401	122ARKR	WSE	S	C	1980-	State of Wyoming	Platte #6

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
PLATTE COUNTY--Continued		MISSOURI RIVER BASIN						
25-068-24AAD	420748104565051	122ARKR	WSE	S	C	1980-	State of Wyoming	Platte #3
25-068-31AAA	420613105024401	122ARKR	WSE DEPD	P	C	1979-	Ernie Douglas	Platte #7
26-068-12CBD01	421443104574601	122ARKR	WSE	S	C	1980-	State of Wyoming	Rutherford
26-068-36BBB01	421128104575801	122ARKR	WSE	S	C	1981-	State of Wyoming	Platte #5
27-069-25ABC01	421722105042401	123WRVR	WSE	S	C	1981-		
SWEETWATER COUNTY		GREEN RIVER BASIN						
18-106-16ADA01	413228109220801	124WSTC	USGS	GR	C	1981-	Geological Survey	Oil Shale
18-106-16ADB01	413228109221201	124TPTN	USGS	GR	C	1981-	Geological Survey	Oil Shale

WATER-RESOURCES PROJECTS

Water-resources projects being conducted by the U.S. Geological Survey in Wyoming are described on the following pages. The descriptions reflect project status as of March 1984. The project number is given following each title.

The funding agencies during the fiscal year 1984 are shown for each project. 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. The area shown on the map covers only that portion of the project located in Wyoming, even though some projects include portions of surrounding states.

The paragraph "Progress and Significant Results" covers the period for fiscal year 1983. If the project ended in fiscal year 1983, a "Status" paragraph is shown instead of "Plans for fiscal year 1984." If the project ended in fiscal year 1982 or earlier, only a "Status" paragraph is shown.

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: Stanley A. Druse.

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) prediction 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) collection of 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 1983: Hydrologic data collection was performed on schedule. Computation of the 1982 water-year records was completed. During the year, 7 gaging stations were installed and 13 were discontinued. Funding for eight of the discontinued stations, from the USGS Coal Hydrology funds, was withdrawn. The Buffalo Field Headquarters was officially closed on September 2, and all field responsibilities were transferred to the Casper Field Headquarters. Numerous requests for tables of daily flows and statistical summaries of flow data were received and filled.

PLANS FOR FISCAL YEAR 1984: Data collection is expected to remain at approximately the same level. Minor adjustments will be made to the gaging-station network to meet Federal, State, and local cooperator needs.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

Green, S. L., 1983, Water-resources investigations of the U.S. Geological Survey in Wyoming, fiscal year 1983: U.S. Geological Survey Open-File Report 83-770, 120 p.

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1982: U.S. Geological Survey Water-Data Report WY-82-1, 504 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) assist in the prediction of future supplies, and (c) provide data for management of the resource. (2) Short-term water-level records are also needed for (a) ground-water resources assesments, (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 hydrological response to climatic variations and induced stresses is known and potential problems can be defined early enough to allow planning and management; and (2) 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. 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 1983: About 1,000 water-level measurements were made in a total of 189 wells, of which 61 have continuous digital recorders. Eighty-six percent of all the historical data has been entered into the Ground Water Site Inventory (GWSI). A program for plotting hydrographs suitable for publication using GWSI and Daily Values files has been developed.

PLANS FOR FISCAL YEAR 1984: Measurements of all hand-measured wells will be discontinued, except for a few in the eastern one-third of the State. Continuous digital recorders will be installed on selected wells in areas where use of ground water is expected to increase. Water-level data will be retrieved from GWSI and National Water Data Storage and Retrieval System (WATSTORE) Daily Values Files. Hydrographs will be plotted for an open-file report showing changes in ground-water levels in Wyoming during the period 1973-83.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1982: U.S. Geological Survey Water-Data Report WY-82-1, 504 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, 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 1983: The water-quality network increased from 125 stations in fiscal year 1982 to 135 stations in fiscal year 1983. Increases were mainly in the Wyoming Department of Environmental Quality Coop Program to replace stations discontinued by the Environmental Protection Agency. Four stations were added in a program with the Bureau of Land Management. Sampling frequencies were decreased at some stations due to funding decreases. Special sampling activities were done in a program with the Department of Energy at the White Mountain in-situ oil-shale retorting site. Pesticide sampling formerly done in Project 77-043 is now included in this project. All water-quality data for the 1982 annual data report series were compiled and prepared for publication.

PLANS FOR FISCAL YEAR 1984: Operation of the network will be continued, with the following changes: (1) Eight stations funded under the USGS Energy Program will be discontinued; and (2) four will be added and four discontinued in the Wyoming Department of Environmental Quality program.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1982: U.S. Geological Survey Water-Data Report WY-82-1, 504 p.

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: Stanley A. Druse.

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 1983: Sediment-data collection and processing continued at 27 sediment sites. Pumping samplers were installed at South Fork Powder River near Kaycee and Stinking Creek above Lawn Creek near Alcova. A pumping sampler was moved from Belle Fourche River below Rattlesnake Creek, near Piney to Powder River at Arvada. Daily sampling stations were installed at Powder River at Sussex and North Platte River near Goose Egg. Sample collection at 19 stations, funded jointly with the Wyoming State Engineer, was suspended for the year. All efforts were devoted to analyzing the data collected over the past 10 years, in order to recommend a program for fiscal year 1984.

PLANS FOR FISCAL YEAR 1984: Data collection and processing will continue on a reduced scale during 1984. Pumping samplers at two stations and monthly sampling at six stations will be discontinued because of the lack of Federal energy funds. Reconnaissance sampling will be proposed in the Cody-Lovell reach of the Shoshone River and the Casper-Orin reach of the North Platte River to identify sources of sediment in these two streams.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1982: U.S. Geological Survey Water-Data Report WY-82-1, 504 p.

PROJECT TITLE: Flood investigations (WY 84-006).

FUNDING AGENCY: Federal Emergency Management Agency.

PROJECT LEADER: Leslie W. Lenfest.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: February 1984 through September 1985.

PROBLEM: The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 provides for the operation of a flood insurance program. The Federal Emergency Management (FEMA) needs flood studies in selected areas to determine applicable flood insurance premium rates.

OBJECTIVE: The objective is to conduct the necessary hydrologic and hydraulic evaluations and studies of areas assigned by FEMA and to present the results in an appropriate format.

APPROACH: Evaluations or surveys will be conducted by ground or photogrammetric methods. Flood-discharge frequency relationships will be determined using local historical information, gaging station records, or other applicable information. Water-surface profiles will be determined using step-backwater models or by other acceptable methods and the results will be furnished in reports prepared to FEMA specifications.

PLANS FOR FISCAL YEAR 1984: Priority and methods for study will be determined for 21 communities. This information and the estimated cost will be given to the U.S. Geological Survey, Surface Water Branch, who will prepare an open-file report summarizing the information for FEMA.

PROJECT TITLE: Water-use data system for Wyoming (WY 84-007).

FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Joel R. Schuetz.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: January 1984 through September 1987.

PROBLEM: The demand for water for a variety of competing uses in Wyoming is expected to continue to increase. Planners and managers at all levels of government need detailed, accurate water information in order to assure that maximum benefits are derived from the available water. Available water-use data for Wyoming are incomplete or of doubtful accuracy. The Geological Survey has designed and implemented a program to develop a uniform national data base of water-use information. A water-use data system is needed in Wyoming, not only to meet national needs, but to provide State agencies with the detailed information needed for water planning and administration.

OBJECTIVE: The objective of the Water-Use Program for Wyoming is to establish a water-use data system that is responsive to the needs of water planners at both the State and national levels. The system will provide for the collection, storage, retrieval, and dissemination of water-use data. The data base will include quantitative information about water rights, withdrawals, transfers, and returns.

APPROACH: The State Water Forum will be consulted and a detailed work plan will be developed. The State Water-Use Data System will be loaded on the Prime computer with the assistance of personnel in the Computer Services Section of the Wyoming District. Personnel with the Wyoming State Engineer's Office will assist with the coding and verification of data on the ground-water permits.

PLANS FOR FISCAL YEAR 1984: An advisory group of representatives from State agencies with water-related activities will be organized and consulted with for suggestions and review of the program. Data that is currently in computer files of the State Engineer will be used as a base for the State Water-Use Data System. Data collection, storage, and retrieval procedures will be established.

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 through September 1985.

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 certain 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.

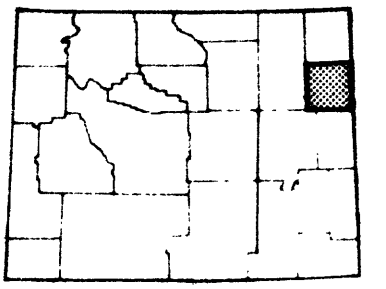
PROGRESS AND SIGNIFICANT RESULTS FOR 1983: The program continued at a reduced level, collecting peak-flow data at 33 gages in a network designed to monitor long-term hydrologic trends. Indirect measurements of peak discharge were made at one crest-stage gage site and two miscellaneous sites. Data collection and a report draft on a paleohydrologic study, which dates and determines discharge of flood peaks outside the period of record, or assigns historical significance to systematic peaks, were completed. The study considers geomorphic and botanic features, flood deposits, soils, and historical information in dating peaks at 14 sites. Resulting adjustments to flood-frequency relations were significant at several sites for the 50-year recurrence interval floods (-63 to +86 percent change). Preliminary analyses, which will fulfill the objectives of the project, were started.

PLANS FOR FISCAL YEAR 1984: Operation of the crest-stage gage network will continue. The report on the paleohydrologic study will be reviewed. The final project report, which will summarize program history and present a compilation of techniques for estimating flow characteristics of Wyoming streams, will be completed; publication is planned for 1985.

REPORTS PUBLISHED DURING FISCAL YEAR 1983:

U.S. Geological Survey, 1983, Water-resources data for Wyoming, water year 1982: U.S. Geological Survey Water-Data Report WY-82-1, 504 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.

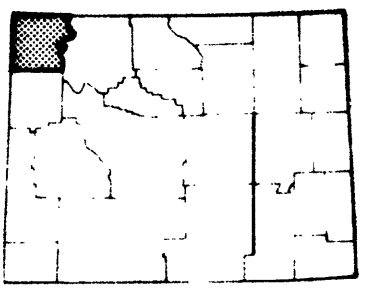
PERIOD OF PROJECT: March 1974 through June 1976 (completed March 19, 1984).

STATUS: The final report has received Director approval and will be published in the Water-Resources Investigations series.

REPORT COMPLETED DURING FISCAL YEAR 1984:

Lowry, M.E., Head, W.J., Rankl, J.G., and Busby, J.F., 1984, Water resources of Weston County, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 84-4079 (in press).

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



FUNDING AGENCY: National Park Service.

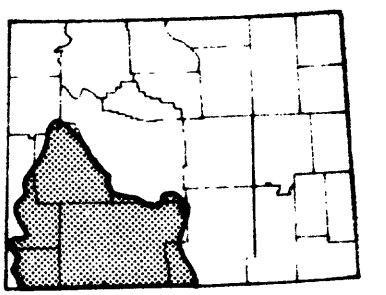
PROJECT LEADER: Edward R. Cox.

FIELD LOCATION: Northwestern Wyoming.

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

STATUS: The final report was completed early in fiscal year 1984 and revisions following colleague review have been made.

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 through September 1980 (completed February 3, 1984).

STATUS: Through fiscal year 1983, 26 reports, abstracts, and short articles had been published. As of May 31, 1984, two reports remained to be processed: the report on ground-water data was approved for release as an open-file report in October 1983, and the report on water quality of streams and springs is being processed for printing. The report on sediment discharge was published in May 1984.

REPORT COMPLETED DURING FISCAL YEAR 1984:

Zimmerman, E. A., and Collier, K. R., 1984, Ground-water data, Green River basin, Wyoming: U.S. Geological Survey Open-File Report 83-943 (in press).

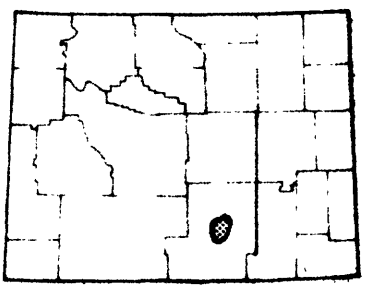
REPORT PUBLISHED DURING FISCAL YEAR 1984:

Ringen, B. H., 1984, Relationship of suspended sediment to streamflow in the Green River basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 84-4026, 14 p.

RELATED REPORT COMPLETED DURING FISCAL YEAR 1983:
The following report from project WY 82-069 includes information from this project and is directly related to the purposes of this project:

Lowham, H. W., and others, 1984, Hydrology of Area 52, Northern Great Plains and Rocky Mountain Coal Province, Wyoming, Colorado, Idaho, and Utah; U.S. Geological Survey Water-Resources Investigations Open-File Report 83-761 (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.

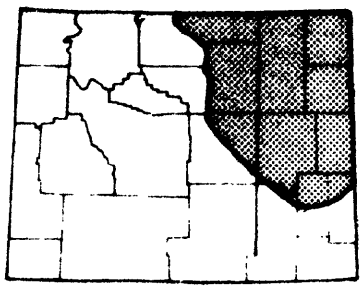
PERIOD OF PROJECT: July 1974 through September 1980 (complete except report).

STATUS: The one remaining report will be completed and reviewed as an open-file hydrologic data report during fiscal year 1984.

RELATED REPORT PUBLISHED DURING FISCAL YEAR 1984:
The following report, prepared by the Colorado District, includes information from this project and is directly related to the purposes of this project:

Kuhn, Gerhard, Daddow, P. B., and Craig, G. S., Jr., and others, 1983 [1984], Hydrology of Area 54, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado and Wyoming: U.S. Geological Survey Water-Resources Investigations Open-File Report 83-146, 95 p.

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 through September 1980 (complete except reports).

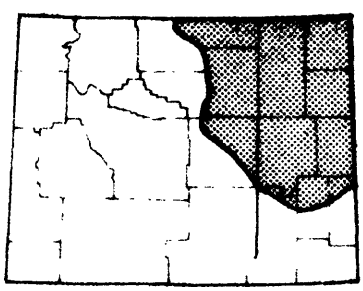
STATUS: Through fiscal year 1983, 12 reports, abstracts, and short articles had been completed. As of May 31, 1984, two reports remain to be completed. Both reports have had review; one was submitted for approval in April 1984, and the other report requires extensive revision.

REPORTS PUBLISHED DURING FISCAL YEAR 1984:

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, 17 p.

Glover, K. C., 1983, Storage analyses for ephemeral streams in semiarid regions: U.S. Geological Survey Water-Resources Investigations Report 83-4078, 55 p.

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



FUNDING AGENCY: Geological Survey.

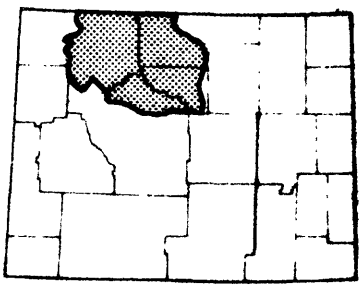
PROJECT LEADER: (vacant).

FIELD LOCATION: Northeastern Wyoming.

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

STATUS: One report, a compilation of ground-water and surface-water data for the Madison Limestone in Wyoming, is in preparation. Completion of this report is planned for fiscal year 1984.

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



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

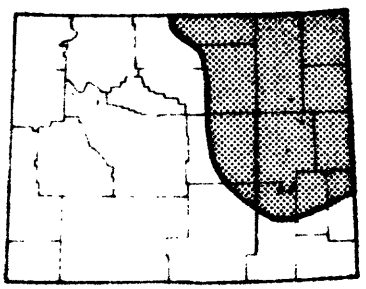
PROJECT LEADER: Maurice E. Cooley.

FIELD LOCATION: North-central Wyoming.

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

STATUS: Three of four reports have been published as of May 30, 1984. The last report on Paleozoic aquifers has been revised and prepared for resubmittal for Water Resources Division review and approval.

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 through September 1981 (complete except report).

STATUS: During fiscal year 1983, review of the principal report, model of the Dakota Sandstone, was completed and extensive revision started. During the summer and fall of 1983, linear-features maps of South Dakota, Wyoming, Montana, and North Dakota were approved as open-file reports. A hydrologic-data report on ground-water quality also was approved. A map report on areas of potential fracture permeability in rocks of the Northern Great Plains was submitted for Division review and approval in October 1983, returned for revisions in March 1984, and resubmitted for Division approval in May 1984.

REPORTS COMPLETED DURING LATE FISCAL YEAR 1983 AND EARLY FISCAL YEAR 1984:

Cooley, M. E., 1983a [1984], Linear features determined from Landsat imagery in Wyoming: U.S. Geological Survey Open-File Report 83-935, map, scale 1:500,000 (in press).

___ 1983b [1984], Linear features determined from Landsat imagery in Montana: U.S. Geological Survey Open-file Report 83-936, map, scale 1:500,000, 2 sheets (in press).

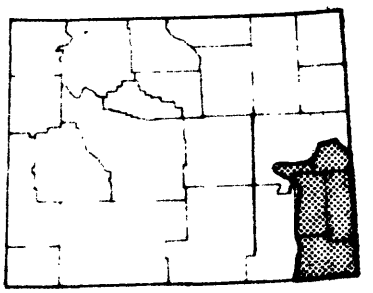
___ 1983c [1984], Linear features determined from Landsat imagery in North Dakota: U.S. Geological Survey Open-File Report 83-937, map, scale 1:500,000 (in press).

Larson, L. R., and Daddow, R. L., 1984, Ground-water quality data from the Powder River basin, northeastern Wyoming: U.S. Geological Survey Open-File Report 83-939 (in press).

REPORT PUBLISHED DURING FISCAL YEAR 1984:

Cooley, M. E., 1983 [1984], Linear features determined from Landsat imagery in South Dakota and parts of adjacent states: U.S. Geological Survey Open-File Report 83-548, map, scale 1:500,000.

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 through 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 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.

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[1] This project is subsidiary to project CR 78-229, described on page 90.

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 the Wyoming District 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.

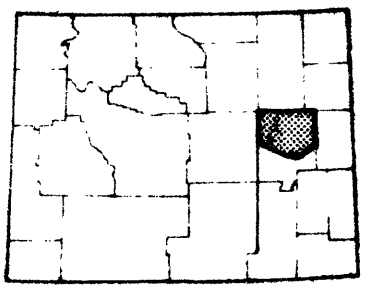
STATUS: One of two principal reports prepared by the Wyoming District was published in August 1983. The other report has been revised by a hydrologist from another District and approved by the Director in February 1984. Review of two linear-features maps was completed previously; one for western Kansas was approved as an open-file report in March 1984, and the other was submitted for Water Resources Division approval in April 1984. The map of relative fracture permeability will be completed during fiscal year 1984.

REPORTS COMPLETED DURING EARLY FISCAL YEAR 1984:

Avery, C. F., and Pettijohn, R. A., 1984, Generalized potentiometric-surface map of the High Plains aquifer in Wyoming, 1981: U.S. Geological Survey Water-Resources Investigations Report 84-4033.

Cooley, M. E., 1984, Linear features determined from Landsat imagery in western Kansas: U.S. Geological Survey Open-File Report 84-241 (in press).

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 through September 1980 (terminated March 19, 1984).

STATUS: The project was terminated with concurrence of the Regional Hydrologist, Central Region. Because of overlap in purposes of this project and project WY-060 and because of the unanticipated decline in uranium exploration, mining, and milling, information compiled for this project has been included in the report for WY 81-060.

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

FUNDING AGENCY: Bureau of Land Management.

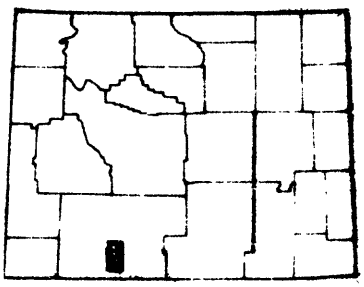
PROJECT LEADER: James G. Rankl.

FIELD LOCATION: Statewide.

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

STATUS: Runoff was recomputed for Dugout Creek tributary near Midwest. The first draft of the final report is complete. The final report will be completed and submitted for review during fiscal year 1984.

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 through September 1981 (complete except report).

STATUS: No progress was made on the final report. The author, who has transferred and is now working in a research position, was contacted and a scheduled plan for completing the report in fiscal year 1984 was developed.

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

FUNDING AGENCY: Bureau of Land Management.

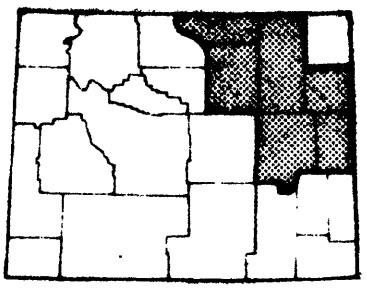
PROJECT LEADER: Hugh W. Lowham.

FIELD LOCATION: Statewide.

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

STATUS: Final estimating relations have been developed, and maps showing location of streamflow-gaging stations, mean-annual precipitation, and geographic coefficients for floods have been completed. The estimating equations for this project will also be used for project WY 59-010. The final report will be completed and submitted for review during fiscal year 1984.

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



FUNDING AGENCY: Geological Survey.

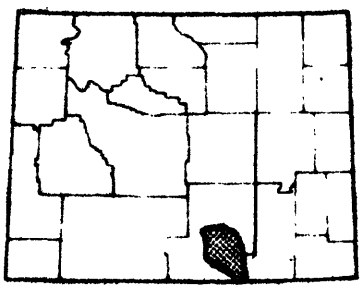
PROJECT LEADER: David A. Peterson.

FIELD LOCATION: Northeastern Wyoming.

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

STATUS: The first draft of the final report is complete. During fiscal year 1984, colleague review of the final report will be completed and the report will be submitted for Water Resources Division review and approval.

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.

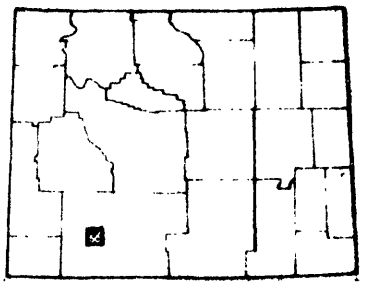
PERIOD OF PROJECT: March 1980 through June 1982 (completed February 16, 1984).

STATUS: The report was approved by the Director in February 1984 for publication as a Water-Resources Investigations Report.

REPORT COMPLETED DURING FISCAL YEAR 1984:

Lenfest, L. W., Jr., 1984, Ground-water levels and use of water for irrigation in the Saratoga Valley, south-central Wyoming, 1980-81: U.S. Geological Survey Water-Resources Investigations Report 84-4040 (in press).

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 through September 1983 (complete except report).

PROBLEM: Comprehensive information about the hydrologic aspects of in situ oil-shale retorting is lacking. 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 for 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.

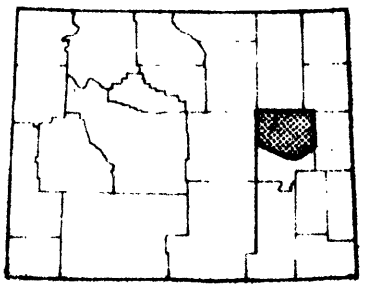
Although involved with a specific retort site, the project is intended to be process oriented; therefore, the results should be transferrable to other retort sites.

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 1983: Models of ground-water flow and solute transport were calibrated. Variations in baseline water quality were related to lithology. Reports were prepared that describe the hydrogeologic framework, monitoring techniques and digital model analysis. Review of the report describing the hydrogeologic model analysis was started.

STATUS: During 1984, the analysis of water-quality data will be completed and a report of the results will be prepared. Review of the remaining three reports will be completed and the reports submitted for Water Resources Division review and approval.

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 through September 1984.

PROBLEM: Uranium exploration in the southern Powder River basin has resulted in thousands of test holes; many of which were poorly plugged. These poorly plugged test holes have resulted in flow between formerly isolated aquifers and uncontrolled flow at the surface. Development of uranium has resulted in impacts on the ground-water system from pumping for supplies and for dewatering mines. There are presently seven surface mines, four underground mines, and three 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.

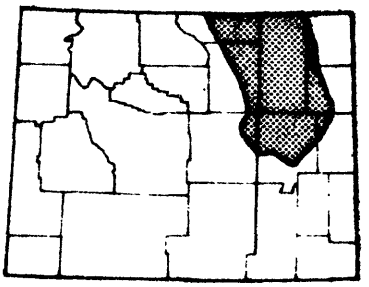
OBJECTIVE: The objectives are to (1) determine the existing hydrologic system, (2) determine the impacts on the ground-water system of the past and present uranium exploration and development, and (3) predict effects that might result from continued or modified uranium development in the future.

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 1983: A report that qualitatively describes the effects of uranium exploration and development is complete. The changes in water levels that could be documented as the result of development were less than 50 feet. A digital model of the area that could accurately predict this small response using the available data was not possible. Therefore, attempts to develop a model for the area were terminated.

PLANS FOR FISCAL YEAR 1984: The final report has been revised to include information previously compiled for project WY 80-053. The revised report is in review. The project was extended through fiscal year 1984 for additional monitoring of water levels and for completion of the report.

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 through September 1983 (complete except report).

PROBLEM: Knowledge of the ground-water system in the Powder River basin in Wyoming has improved since the surge of new mining began during 1975. However, 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 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 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-Anderson 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 great stress is on the system. A water-level-change map will be made for the Wyodak-Anderson Coal on the east side of Campbell County.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: A potentiometric-surface map for the Wyodak-Anderson coal is complete. Potentiometric-surface maps for mine areas were obtained from the mine permits. Several wells were cleaned and water levels were measured. The water-level data and well-completion data were tabulated for publication. Water levels and well completions were analyzed for use in preparing the potentiometric-surface map. Two wells were completed in the Wyodak-Anderson coal.

STATUS: A brief text will be written and the map report on the potentiometric-surface in the Wyodak-Anderson coal will be reviewed during fiscal year 1984.

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.

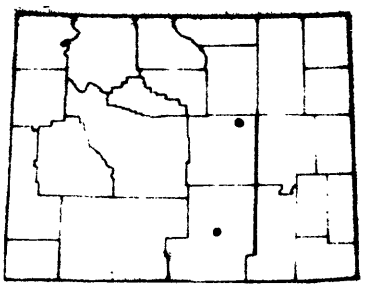
PERIOD OF PROJECT: October 1980 through September 1981 (completed November 18, 1983).

STATUS: An evaluation report was submitted to the Program Manager. One report, a linear-features map, was approved as an open-file report early in fiscal year 1984.

REPORT COMPLETED DURING FISCAL YEAR 1984:

Cooley, M. E., 1984, Linear features determined from Landsat imagery for the Richfield 1° by 2° quadrangle and adjacent areas, southwestern Utah: U.S. Geological Survey Open-File Report 83-934, map, scale 1:500,000 (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 through 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 the effects of proposed and active mining on or near ephemeral streams.

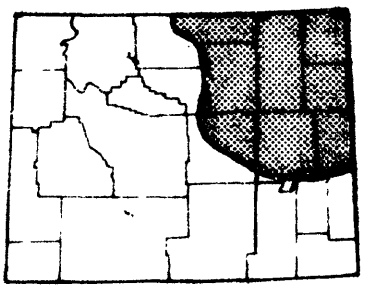
OBJECTIVE: The objectives are (1) to relate sediment yield to rainfall and runoff and determine if a significant difference can be attributed to surface mining; (2) to determine the relative importance of channel erosion and slope wash as sediment sources; and (3) if a Geological Survey transport model is approved by the Division during 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 1983: The reclaimed basin near Hanna, Wyo., which is constructed entirely from coal-mine spoil, has been instrumented with a rain gage, a stage gage, and an automatic sediment sampler. Channel slope, channel cross sections, and two slope transects have been surveyed and documented. Data collection continued at Dugout Creek tributary, and data collection was started at the Hanna station. Headcuts at Dugout Creek tributary, that were surveyed during 1982, were resurveyed during 1983. The rainfall, runoff, evaporation, and temperature data have been prepared for the Precipitation-Runoff Modeling System (PRMS).

PLANS FOR FISCAL YEAR 1984: The sediment data collected at soil plots, headcuts, and at the gaging station will be analyzed to determine the major source area of sediment. The PRMS model will be used to aid in the analysis. The final report will be completed and processed for publication in the Water-Resources Investigations series.

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



FUNDING AGENCY: Geological Survey.

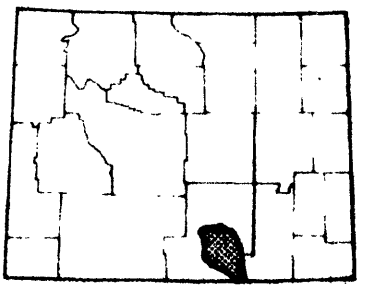
PROJECT LEADER: Gerald W. Armentrout, Jr.

FIELD LOCATION: Northeastern Wyoming.

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

STATUS: The final report is in rough-draft form. Revision will be completed and the report will be started through colleague review during fiscal year 1984. The report will then 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 through September 1984.

PROBLEM: Wells in the Saratoga Valley provide water to supplement surface water used for irrigation. About 30 irrigation wells were in use during 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. Development of large-capacity wells such as irrigation wells is not restricted. State water administrators need an evaluation of the effect of ground-water development upon water-levels and upon stream discharge.

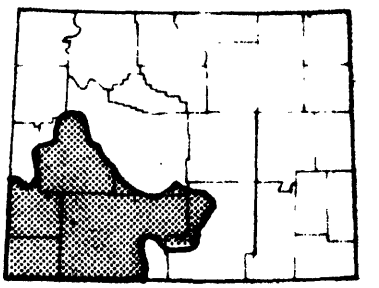
OBJECTIVE: The objectives are to (1) describe the effects of ground-water development upon water levels and attempt to determine the effects upon stream discharge, and (2) determine if a digital model of the hydrologic system can be used to help understand the possible responses of the stream-aquifer 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 are 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 1983: More than 450 meters of saturated thickness has been mapped in the northwest part of the study area near Pass Creek although ground-water discharge to Pass Creek is estimated to be less than 0.3 cubic meters per second. Total ground-water discharge from the study area was estimated to be nearly 3 cubic meters per second, nearly all of which leaves as streamflow. Preliminary results from a digital model of the hydrologic system indicate that irrigation pumpage probably will have a noticeable affect on stream discharge of Lake Creek in the near future. Elsewhere, irrigation pumpage probably has had a negligible effect on streamflow, but approximately 1 meter of water-level decline has occurred in a pumpage area east of Encampment, Wyo. The project was extended through fiscal year 1984 to adjust the digital model to be more representative of the physical system.

PLANS FOR FISCAL YEAR 1984: The input data to the digital model will be adjusted and the report describing all study results will be finished and published in the Water-Resources Investigations 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 through September 1983 (completed September 27, 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. Information about the water resources of the area that is both comprehensive in scope and easily understood is needed.

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.

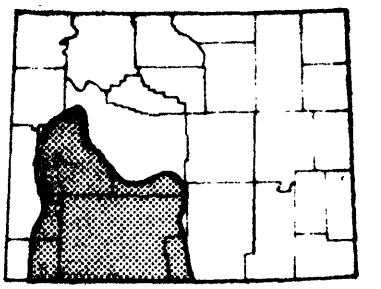
APPROACH: A topic outline will be developed, based on other coal area reports but oriented to the hydrology and related problems of Area 52. Topics will be assigned to hydrologists for analysis and writing based on their descipline specialties. For each topic, all available information will be assembled 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 1983: The final report was completed and approved by the Director as Open-File Report 83-761.

REPORT COMPLETED DURING FISCAL YEAR 1983:

Lowham, H. W., and others, 1984, Hydrology of Area 52, Northern Great Plains and Rocky Mountain Coal Province, Wyoming, Colorado, Idaho, and Utah: U.S. Geological Survey Water-Resources Investigations Open-File Report 83-761 (in press).

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



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: Kent C. Glover.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: October 1981 through 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. Overall operation knowledge of the three-dimensional ground-water-flow system and the 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.

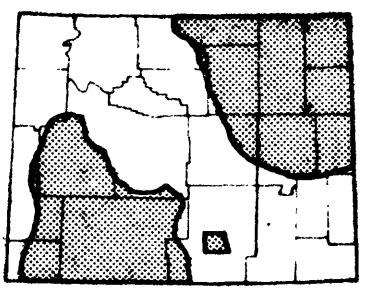
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: A planning report, including input from Wyoming, was prepared for the overall Regional Aquifer Systems Analysis (RASA), reviewed, and approved for publication. A background Hydrologic Atlas is in preparation. The Wyoming contribution has been submitted to the RASA project chief for inclusion. More than 1,300 sites were entered into Ground Water Site Inventory (GWSI) from computer-compatible data from a State agency. Hydraulic data from about 200 drill-stem tests also were entered. Petroleum Information Corporation data have been put in the computer to be accessed for use in plotting for structure and thickness maps. A preliminary potentiometric-surface map for the Wasatch Formation was prepared.

PLANS FOR FISCAL YEAR 1984: Structural, thickness, and potentiometric maps will be compiled for a Hydrologic Atlas on the Tertiary aquifers in the RASA. Preparation of a chapter about Tertiary aquifers for the final professional paper will begin.

REPORT PUBLISHED DURING FISCAL YEAR 1984:

Taylor, O. J., Hood, J. W., and Zimmerman, E. A., 1983, Plan of study for the Regional Aquifer Systems Analysis of the Upper Colorado River basin in Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Water-Resources Investigations Report 83-4184, 23 p.

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.

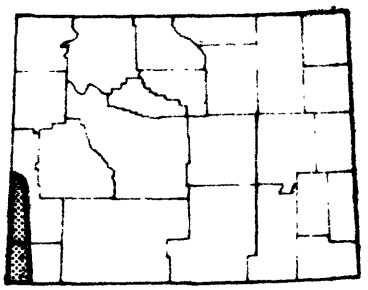
PERIOD OF PROJECT: October 1981 through September 1982 (completed April 5, 1984).

STATUS: The report was approved by the Director in April 1984 for publication as a Water-Resources Investigations Report.

REPORT COMPLETED DURING FISCAL YEAR 1984:

Peterson, D. A., 1984, Statistical summary of the chemical quality of surface water in the Powder River coal basin, Hanna coal field, and the Green River coal region, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 84-4092 (in press).

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. Clover.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: January 1982 through September 1984.

PROBLEM: Water of the Bear River drainage is allocated by interstate compact among the states of Idaho, Utah, and Wyoming. The compact has recently been interpreted to include ground-water withdrawals that result in streamflow depletion. However, insufficient information is 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.

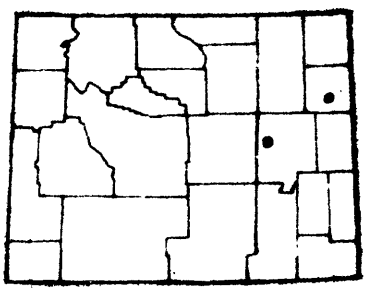
OBJECTIVE: The objectives are to (1) determine the effect of existing ground-water pumpage on streamflows, (2) determine the total amount of surface and subsurface water in alluvium flowing across the state boundaries, and (3) provide the methodology for evaluating the effect that future ground-water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

APPROACH: The Bear River valley upstream from the Idaho-Wyoming border will be studied. 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 DURING FISCAL YEAR 1983: Data collection was completed with a few minor exceptions. A steady-state water budget of the northern Bear River valley was completed. The convolution model was calibrated to Smiths Fork but results were no more reliable than those obtained through simpler correlation of upstream and downstream gages. Therefore, the convolution technique was abandoned. A finite-element model of steady-state flow was calibrated in the northern Bear River valley using least-squares methods that provided reliable results. A conceptual model of flow in the southern Bear River valley was formed. Sections of the final report describing the geology and conceptual models of the stream-aquifer flow system were written.

PLANS FOR FISCAL YEAR 1984: The steady-state model of flow in the northern Bear River valley will be extended to transient conditions. A sensitivity analysis of aquifer properties will be done using a flow model in the southern Bear River valley. The effects of planned ground-water pumpage will be evaluated by making predictive simulations with the models. The final report will be completed.

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 through 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-level 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 1983: Flow in the North Fork Dry Fork Cheyenne River was very sparse during 1983, and although data collection was continued, very few significant events were recorded. Soil-moisture tubes were installed, and calibration data and samples were collected during December 1982. Channel-geometry survey was completed during November 1982. Surface-water/ground-water relations are being investigated as an alternative method for determining ground-water recharge directly from well data. Stage-discharge relationships were established for the three stream gaging stations on the Cheyenne River. Well-data collection was continued at gages along Black Thunder Creek. These data will be used to calculate recharge using a method described by Moench and Kisiel (1970).

PLANS FOR FISCAL YEAR 1984: Streamflow losses will be calculated between paired sites to give a maximum boundary for ground-water recharge at Cheyenne River sites. Ground-water/surface-water relations will be used to directly calculate the approximate recharge to the ground-water system from well records at Black Thunder Creek and possibly from the Cheyenne River well gages. Analysis will include the possible correlation of the gage-height hydrograph to estimated ground-water recharge. A report summarizing study results will be prepared and reviewed.

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 through September 1983 (completed February 7, 1984).

PROBLEM: The demand for Wyoming ground-water supplies for municipal, agriculture, and industrial use is increasing rapidly, largely because of the growth in development of energy resources. To evaluate and protect the ground-water resource, water planners need an adequate information base. Existing ground-water-quality information 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 during consultation with other agencies. The adequacy of existing data for assessing ground-water quality will be evaluated and recommendations made for future data aquisition.

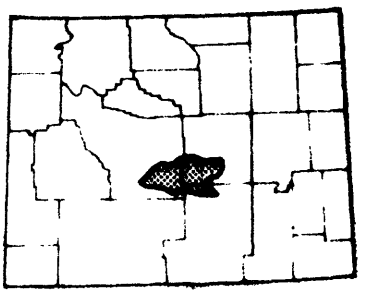
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: The following critical constituents were analyzed on a statewide basis: dissolved solids, nitrate, fluoride, arsenic, barium, cadmium, chromium, lead, mercury, selenium, iron, and manganese. The most critical constituent (dissolved solids) was analyzed by county and by aquifer. The data was graphically summarized using a STOP-format report.

STATUS: The final report was approved during February 1984.

REPORT COMPLETED DURING FISCAL YEAR 1984:

Larson, L. R., 1984, Ground-water quality in Wyoming: U.S. Geological Survey Water-Resources Investigations Report 84-4034 (in press).

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 through September 1983 (complete except report).

PROBLEM: Increased demand for water supplies in Wyoming are foreseen in the immediate future. The Sweetwater River basin has 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 1983: Streamflow measurements of the Sweetwater River during the fall, flow-duration curves using period of record for November, and comparison of normal monthly mean flow at the two gages were used to estimate an average net gain between Split Rock and Devils Gate. Water-level measurements were made at 18 wells located and inventoried in areas where additional water-level control was needed for the water-level contour map. Fall water-level measurements were made at 24 observation wells. The ground-water-flow model was not started, as the project was terminated by the cooperator.

STATUS: A Water-Resources Investigations Report (map) showing water-level contours will be completed and reviewed during fiscal year 1984.

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 through 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 functions of fluvial systems and the responses of the systems to disturbances caused by changes in land use, including mining and reclamation.

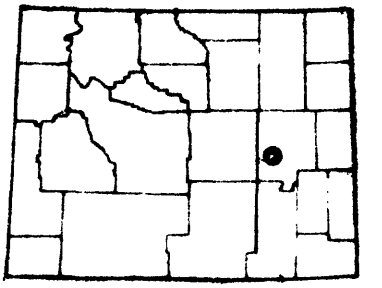
OBJECTIVE: The objective is to describe how the fluvial systems function in energy-mineral areas and how these systems can be expected to respond to various activities related to development of the resources. In particular, information will be presented for dealing with (1) crossing of streams by pipelines 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 of important concepts, and of guidelines and regulations applicable to the design of reclaimed drainages will be made. 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. Current methods 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.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: A literature search was made of important concepts and of existing knowledge regarding design of reclaimed drainages. Basin characteristics were determined for 102 selected drainage basins in the Powder River basin. Hypsometric curves were developed for each of the basins, and preliminary regressions were made to determine significant correlations among basin variables.

PLANS FOR FISCAL YEAR 1984: If funding and manpower problems are resolved, basin characteristics will be determined for drainages in the Hanna, Rock Springs, and Kemmerer areas. Further statistical analyses would then be made to determine features important to reclaimed landscapes.

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 through 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 previously developed concepts in the Madison regional study. Such knowledge is needed for the use of Madison water for energy-resource development.

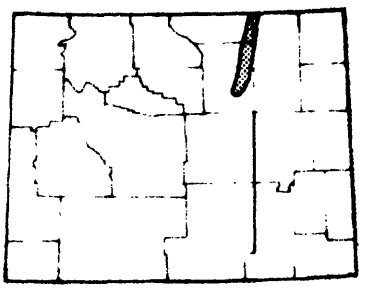
OBJECTIVE: The objectives will improve the understanding of: (1) movement of water between the shallow and deep parts of the Madison Limestone, (2) vertical velocity of water between the Madison and overlying rock, and (3) the relationship of water in the Madison Limestone to streamflow.

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 from a deep well in order to compare seasonal fluctuations of ground-water levels to the fluctuations of streamflow and of discharge of 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.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: Comparison of paired streamflow gaging stations above and below the Madison outcrop on three streams showed a large loss in streamflow across the Madison. Two seepage runs were made on one of the streams. An inventory of wells and springs yielded several additional flowing wells and springs. Samples for major ions or major ions and isotopes were collected from nine wells and springs. Samples of isotopes of carbon, sulfur, oxygen, and hydrogen were collected to help understand circulation within the Madison and connection to the overlying Casper formation. A temperature profile of the Madison deep well was run by the Borehole Geophysics Unit, but the profile has not been analyzed. Flow measurements were made instead of installing a recorder on the Madison deep well, because it has been flowing since April.

PLANS FOR FISCAL YEAR 1984: Samples for major ions and isotopes will be collected at locations determined through analysis of the previous samples. The temperature profile of the Madison deep well will be analyzed using the technique of Bredehoeft and Papadopulos (1965). Results of the study will be summarized in the final report, which will receive colleague review before the end of fiscal year 1984.

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 through 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.

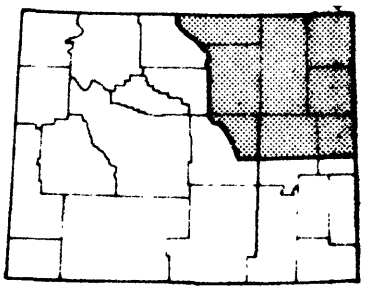
OBJECTIVE: The objective is to assess the potential for development of water supplies from the alluvium by determining (a) the availability of the water, (b) the quality of the water, and (c) the relations between water in the alluvium and water in the river and in the shallow bedrock.

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 relations between water-surface elevation in the Powder River, the alluvium, and the bedrock. Samples will be collected from selected wells to determine the quality of water in the alluvium.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: Ground-water observation wells were drilled and instrumented at existing stream-gaging sites to provide data on ground-water response to streamflow. Existing ground-water wells in the study area were inventoried. Measurement of aquifer properties and dimensions was started. Preliminary analysis of the data was completed. Ground- and surface-water quality samples were collected.

PLANS FOR FISCAL YEAR 1984: Collection of ground-water-level data, surface-water records, and quality-of-water samples will continue. Measurement of aquifer properties and dimensions will be completed. Data will be analyzed to determine ground water-surface water relationships. Relationships will be established between quality of water in the river and in the ground water. A final report will be prepared.

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: Marvin A. Crist.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: April 1983 through 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 and modified, to provide the basic hydrologic data needed for scientific, engineering, and management purposes.

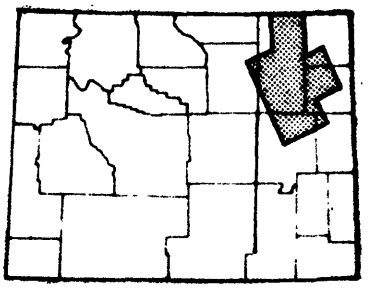
OBJECTIVE: The objective is to assess the existing observation-well program and recommend changes that will make the program responsive to present and future needs for ground-water water-level data. The procedures developed in this project may be applied to subsequent evaluations of the observation-well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

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: Thousands of well records were entered into Ground Water Site Inventory (GWSI) from the Wyoming State Engineer's well-permit records for the area. Drafts of forms to be used in the observation-well program and in the network evaluation were designed and reviewed. Site-schedule files were organized and properly filed. Water-level data were entered into GWSI, and some were retrieved in a hydrograph plot.

PLANS FOR FISCAL YEAR 1984: Well records and water-level data for all wells in the observation-well program will be tabulated, evaluated, filed, and published. The purpose of measuring each well will be determined. Each resulting network will be evaluated by plotting those wells on a map, and evaluating the adequacy of the network. An inventory of available wells will be made to substitute or add to the networks determined to be deficient.

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 through September 1984.

PROBLEM: Surface mining of coal may disrupt watersheds and may alter the quantity and quality of ground water and surface water. Federal and State regulations require assessment of the probable commulative impacts of all anticipated mining on the hydrology of the geologic/drainage basin each time an application for a permit to mine is filed. 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) Pre-mining, (b) during mining, and (c) post-mining. 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.

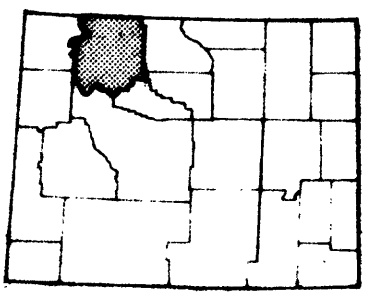
PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: The problem involved modeling efforts in ground water and surface water; quality of water was included as a part of the surface-water model. The surface-water model was completed for Caballo Creek in August 1983. A comparison of basin characteristics was made between the Belle Fourche and Little Powder River basins. Recommendations were made for estimating surface-water response to mining activities for the Little Powder River basin on a correlation of basin characteristics. Based on the surface-water model of the Caballo Creek drainage, it was determined that little impact would be made on the basin from mining activity. Data were compiled from existing data for the ground-water model of the study area. Implementation of the ground-water model began during September 1983. A progress report was completed during September 1983.

PLANS FOR FISCAL YEAR 1984: A surface-water model will be completed for the Belle Fourche River basin by mid-October 1983. Surface-water-quality data will be used in this model. Impact assessment of mining on surface water in the Powder River basin based on the comparison of basin characteristics will be made during fiscal year 1984. The ground-water model of the study area in the Powder River basin will be completed. Ground-water-quality data will be included in the final report. A progress report was published in March 1984. The final report will be prepared during fiscal year 1984.

REPORT PUBLISHED DURING EARLY FISCAL YEAR 1984:

Jordon, P. R., Bloyd, R. M., and Daddow, P. B., 1984, An assessment of cumulative impacts of coal mining on the hydrology in part of the Powder River structural basin, Wyoming--a progress report: U.S. Geological Survey Water-Resources Investigations Report 83-4235, 25 p.

PROJECT TITLE: Water resources of Park County, Wyoming (WY 84-081).



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Marlin E. Lowry.

FIELD LOCATION: Park County, northwestern Wyoming.

PERIOD OF PROJECT: October 1983 through September 1986.

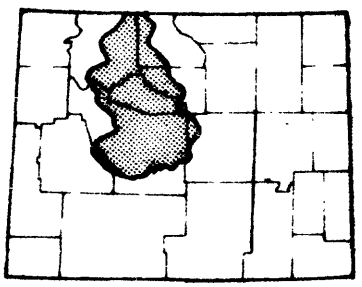
PROBLEM: There is increasing concern about water resources in Park County because of changes in land use, oil development, and increased pressure on outdoor education. The water supplies of municipalities such as Powell, and of ranchette developments, are dependent upon ground water that is recharged by irrigation. The Wyoming State Engineer needs more information than presently exists on the ground-water hydrology of the area to assess effects of new applications for water developments on existing supplies.

OBJECTIVE: The objectives are to (1) assess the hydrology of the terrace and flood-plain deposits, (2) determine the water quality of the Madison Formation as a potential municipal supply, and (3) improve overall information on the hydrology of the area in anticipation of future needs.

APPROACH: Hydrologic data and interpretations from previous investigations provide a base for the study. Well data in computer files of the Wyoming State Engineer are being entered into Ground Water Site Inventory (GWSI). A literature search will be made of reports on the geology and hydrology of the area. The study of the irrigated-alluvial aquifers will be emphasized. Well logs will be examined to determine the geometry of the alluvium. A well inventory will be made and potentiometric maps will be drawn for the principal aquifers. Water samples will be obtained from wells tapping the Madison Formation.

PLANS FOR FISCAL YEAR 1984: A work plan will be prepared for the study and a well inventory will be started. Samples will be obtained from about 25 wells in the Madison Formation. An annotated outline will be prepared for the final report.

PROJECT TITLE: Hydrology of Area 51, Rocky Mountain Coal Province, Wyoming and Montana (WY 84-083).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: David A. Peterson.

FIELD LOCATION: North-central Wyoming.

PERIOD OF PROJECT: October 1983 through September 1984.

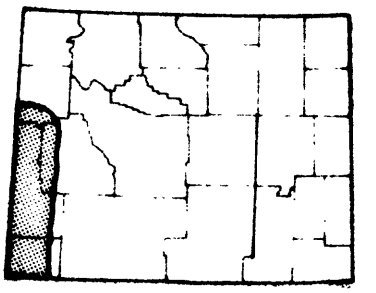
PROBLEM: Coal Area 51 is rich in mineral resources--coal, oil and gas, uranium, bentonite, gypsum, and feldspar. Because much of the area is semiarid, both water availability and protection of water resources are problems. Mining companies are required by law to analyze the hydrologic effects of proposed 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 51 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 uranium, 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 51. 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 (STOP format). Regional hydrology will be emphasized. Sources of more detailed information will be cited.

PLANS FOR FISCAL YEAR 1984: The topic outline for the report will be prepared and topics assigned to contributors. A work schedule for completion of all sections of the report will be established. Each contributor will assemble all available information for their assigned topics, summarize and interpret the information for presentation. Base maps will be obtained through the Wisconsin District. The report will be submitted to Region for approval by September 30, 1984.

PROJECT TITLE: Water quality in the Overthrust area, southwestern Wyoming (WY 84-084).



FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: L. Rodney Larson.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: October 1983 through September 1985.

PROBLEM: The Overthrust area in southwestern Wyoming is rich in mineral resources, including coal, oil and gas, and phosphate. Development in this area is currently the most aggressive that is occurring in the Rocky Mountain area. This development will impact the hydrologic resources of the area because of additional water demands and alteration of the water quality. Changes in surface-water flow and quality will be probable because of the disruption of large areas of land for mining; the increased utilization of surface water; the return of surface water with modified water-quality characteristics; and the possible decrease in spring discharges because of increases in ground-water usage.

To evaluate and plan for the proper utilization of surface-water resources in the area, water planners need an adequate information base. However, existing water-quality information is inadequate to meet these requirements. An expanded, systematic collection of basic surface-water-quality information, both in time and space, is essential to properly plan and develop the surface-water resources in this area and to evaluate the impacts of man's activities on these resources.

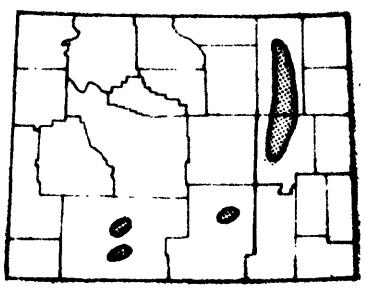
OBJECTIVES: The objectives of this study are to (1) provide baseline data on the present quality of water in streams and springs in the area, (2) determine the variability in water-quality due to seasonal change (high- and low-flow conditions) and natural downstream degradation, and (3) summarize the water-quality data collected for ease of interpretation by persons concerned with planning and managing water development and use.

APPROACH: Water samples of streams and springs will be intensively collected during 1984 and 1985, primarily from the drainages of the Bear, Hams Fork and Blacks Fork rivers. Because the area is remote, a helicopter, contracted and paid for by U.S. Bureau of Land Management, will be used for access to many of the sample-collection sites. A similar method of sampling was used successfully during 1976-78 in the Green River basin.

About 100 sites will be sampled during the spring snowmelt and again during the fall low flows. On-site measurements will be made of streamflow, spring discharge, specific conductance, water temperature, pH and dissolved oxygen. Laboratory analysis will include calcium, magnesium, sodium, potassium, total alkalinity, sulfate, chloride, nitrate plus nitrite, ammonia, fluoride, boron, silica, dissolved solids, and total-phosphorus concentrations. Trace elements included in the drinking-water standards (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, zinc, iron and manganese) will also be sampled at selected sites.

The data will be summarized through the use of statistical analyses and graphs, using computer programs available from Statistical Analysis Systems (SAS). Downstream and seasonal trends will be described.

PROJECT TITLE: A study of the geochemical and hydrological processes in coal spoil, Wyoming (WY 84-085).



FUNDING AGENCIES: Bureau of Land Managment and Geological Survey.

PROJECT LEADER: L. Rodney Larson.

FIELD LOCATION: Converse and Carbon counties, Wyoming.

PERIOD OF PROJECT: October 1983 through September 1985.

PROBLEM: A principal concern about the hydrologic impacts of coal mining in the western states is the nature of the aquifer that will remain in the reclaimed spoil. Some specific questions are (1) What will be the short-term and long-term chemical quality of water contained in the spoil? (2) What will be the impact of the water moving from the spoil on ground water and surface water? (3) How long will it take to recharge the spoil aquifer to a near steady-state condition? (4) What will be the aquifer properties of the spoil?

The greatest need for data is in the Powder River basin because of the extensive size of the spoil being created and the importance of the coal and adjacent aquifers. In the past, hydrologic study of reclaimed coal spoil has not been possible in the Powder River Basin because large-scale mining did not begin until 1973. Studies of water quality in the spoil were not possible in the past because the reclaimed spoil was not saturated.

Although to a lesser extent, data on the geochemistry of mine-spoil water also is needed in the Hanna coal field, Wyoming. Two mining companies in the Powder River basin and one mining company in the Hanna basin have indicated they may grant permission to conduct geochemistry studies at their mine sites.

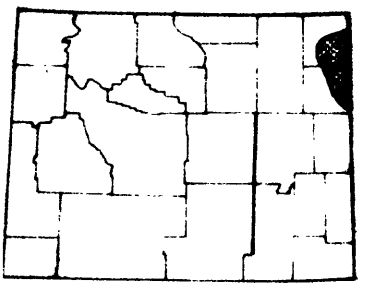
OBJECTIVE: The objective of the study is to test a geochemistry model that predicts the quality of water of overburden mineralogy. This predictive tool will be used to evaluate the long-term impacts of the spoil aquifer on the hydrologic system.

APPROACH: Mine permits on file with the Wyoming Department of Environmental Quality (DEQ) will be reviewed to determine the available data for each of the three mine sites. A visit to each of the mines will follow in order to supplement the data obtained from DEQ and to determine the predominate flow system. A plan for the sample collection of the necessary overburden material and the water chemistry then will be made.

The geochemistry-modeling system will be adjusted and tested for use in predicting the effects of the spoil aquifer on the natural hydrologic system in Wyoming. Special consideration will be given to mining methods and type of reclamation.

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: Western South Dakota and northeastern Wyoming.

PERIOD OF PROJECT: May 1981 through September 1984.

PROBLEM: Increased development in the Black Hills area is placing greater 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 (1) unplugged or improperly plugged uranium test holes, (2) proposed withdrawals from the Madison Group on streams and aquifers in South Dakota, and (3) numerous septic systems on the water quality 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 1983: At the town of Boxelder, South Dakota, the potentiometric surface of the Madison aquifer is about 150 meters below land surface. Between Rapid City and Boxelder, the potentiometric surface of the Madison slopes approximately 15 meters per kilometer to the east.

Near the town of Belle Fourche, drawdown in the Minnelusa aquifer since 1960 is estimated to be greater than 30 meters in an area of about 390 square kilometers. In one well, the drawdown from 1960 to 1972 was about 50 meters. In the same area, drawdown in the Inyan Kara aquifer is more than 15 meters since 1919 and is more than 45 meters at the town of Belle Fourche. Drawdowns are the result of uncontrolled flowing wells.

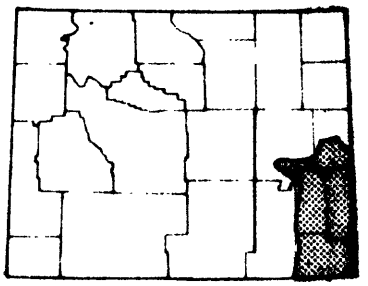
Ten water samples analyzed for radium-228 had concentrations of less than 3 picocuries per liter. However, one water sample from a well completed in the Deadwood Formation had a radium-226 concentration of 9.8 picocuries per liter. This was the only sample of the 29 collected in which the concentration of radioactive ions exceeded the maximum level recommended for community systems and is the only known instance of a prohibitively large concentration of radium-226 in water from the Deadwood northwest of Rapid City.

PLANS FOR FISCAL YEAR 1984: Two models will be completed and reports written. Stream-gaging sites and precipitation gages will be maintained.

Water-Resources Projects Conducted

by the 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 through September 1985.

PROBLEM: The High Plains aquifer is the principal source of water in parts of eight States. The aquifer contains about 3 billion acre-feet of drainable water; but it is being depleted by several million acre-feet per year. The High Plains RASA has provided the regional description of the aquifer system and developed a regional aquifer model. The study has found that information on transient stresses (pumpage, recharge, and irrigation return flow) are poorly known and critical for projecting the future state of the aquifer.

OBJECTIVE: The project will attempt to better define the relationships between total pumpage, return flow from applied water (irrigation plus precipitation) on irrigated lands, and recharge from precipitation on dryland agricultural areas. The results will be used to update the regional aquifer model. Ground-water management alternatives will be developed and simulated by the aquifer model. The model results will be reported for use by water managers.

APPROACH: Two sites, one in Texas and one in Nebraska, will be studied to better determine stresses. The period of analysis for each site will be 1972-84. Irrigated, dryland, and range-land acreage will be mapped for the sites for selected years using Landsat satellite imagery and compared to actual acreage. Irrigation demand will be calculated based on mapped acreage; and pumpage estimates will be compared to measured data. Management alternatives developed from U.S. Department of Agriculture and U.S. Department of Commerce information will be simulated using the regional aquifer model to predict future ground-water conditions that are likely to result from each alternative.

PROGRESS AND SIGNIFICANT RESULTS FOR FISCAL YEAR 1983: Chase, Perkins, and Dundy Counties, Nebr., and Castro and Parmer Counties, Texas, were selected because of existing hydrologic data networks. Pumpage, crop, and acreage data were collected at about 50 farms each in Nebraska and Texas. An aquifer storage change map (1978-82) was completed for Nebraska. Landsat imagery was acquired for 1972-82 for determination of irrigated acreage. Reports on the geohydrology of the High Plains and estimating 1980 pumpage were completed and approved.

PLANS FOR FISCAL YEAR 1984: Pumpage, crop, and acreage data will be collected at about 50 farms each in Nebraska and Texas. The analysis of Landsat data to determine irrigated acreage will be developed. The procedure to relate acreage to pumpage will be developed. Using metered pumpage data from Nebraska, a comparison will be made of pumpage to change in aquifer storage and metered pumpage data with estimates based on irrigated acreage.

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 Mailing List Unit, U.S. Geological Survey, 582 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 "List of Geological Survey Geologic and Water-Supply Reports and Maps for Wyoming" is available free upon request to the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colo. 80225.

Bulletins, Techniques of Water-Resources Investigations, Earthquake Information Bulletin, and popular leaflets, pamphlets, and booklets may be purchased from the Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 604 South Pickett Street, Alexandria, Va. 22304.

Additional information on Geological Survey products and sources where they may be obtained is given in "A Guide to Obtaining Information from the USGS, 1982," Geological Survey Circular 777, available without cost from the Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 604 South Pickett Street, Alexandria, Va. 22304, or Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colo. 80225.

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.

Water-Resources Information.--A monthly summary of the national water situation is presented in the "National Water Conditions" that is available free upon request to the Hydrologic Information Unit, U.S. Geological Survey, 419 National Center, Reston, Va. 22092. Water-resources investigations folders are available for each of the 50 States, Puerto Rico, and the Virgin Islands. The folders are available free upon request to the Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 604 South Pickett Street, Alexandria, Va. 22304. 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 Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 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 1242. Perennial-streamflow characteristics related to channel geometry and sediment in Missouri River basin, by W. R. Osterkamp and E. R. Hedman. 1982.

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-C. Relationship of porosity and permeability to petrology of the Madison Limestone in rock cores from three test wells in Montana and Wyoming, by P. A. Thayer. 1983.

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.

P 1277-A. Hydrologic and morphologic changes in channels of the Platte River basin in Colorado, Wyoming, and Nebraska; a historical perspective, by H. R. Eschner, R. F. Hadley, and K. D. Crowley. 1983.

P 1277-B. Effects of water development on surface-water hydrology, Platte River basin in Colorado, Wyoming, and Nebraska upstream from Duncan, Nebraska, by J. E. Kircher, and M. R. Karlinger. 1983.

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 Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 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.

W 2250. National water summary 1983 - hydrologic events and issues, by U.S. Geological Survey. 1984.

Circulars

Single copies of circulars still in print are available free from the Eastern Distribution Branch, Text Product Section, U.S. Geological Survey, 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 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 parentheses 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 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)

WRI 82-682. Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming, by S. E. Slagle and others. 1983.

WRI 83-146. Hydrology of Area 54, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado and Wyoming, by Gerhard Kuhn, P. B. Daddow, and G. S. Craig, Jr, and others. 1983 [1984].

WRI 83-545. Hydrology of Area 50, Northern Great Plains and Rocky Mountain Coal Provinces, Wyoming and Montana, by M. L. Lowry, J. F. Wilson, Jr., and others. 1984. In press.

WRI 83-761. Hydrology of Area 52, Northern Great Plains and Rocky Mountain Coal Provinces, Wyoming, Colorado, Idaho, and Utah, by H. W. Lowham and others. 1984. In press.

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, Colo. 80225. A report listed as "In press" is not yet available.

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. 1984.

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 83-4078. Storage analysis for ephemeral streams in semiarid regions, by K. C. Glover. 1984.

WRI 83-4093. Major geochemical processes related to the hydrology of the Madison aquifer system and associated rocks in parts of Montana, South Dakota, and Wyoming, by J. F. Busby, R. W. Lee, and B. B. Hanshaw. 1983.

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

WRI 83-4137. Computer program and data listing for two-dimensional ground-water model for Laramie County, Wyoming, by Marvin A. Crist. 1983.

WRI 83-4150. Hydrologic evaluation of proposed ground-water withdrawals in Muleshoe Flat near Wheatland, southeastern Wyoming, by Dwight T. Hoxie. 1983.

WRI 83-4184. Plan of study for the Regional Aquifer Systems Analysis of the Upper Colorado River basin in Colorado, Utah, Wyoming, and Arizona, by O. J. Taylor, J. W. Hood, and E. A. Zimmerman. 1984.

WRI 83-4235. An assessment of cumulative impacts of mining on the hydrology of part of the Powder River structural basin, Wyoming--a progress report, by P. R. Jordon, R. M. Bloyd, and P. B. Daddow. 1984.

WRI 84-4026. Relationship of suspended sediment to streamflow in the Green River Basin, Wyoming, by B. H. Ringen. 1984.

WRI 84-4033. Generalized potentiometric-surface map of the High Plains aquifer in Wyoming, 1981, by C. F. Avery, and R. A. Pettijohn.

WRI 84-4034. Ground-water quality in Wyoming, by L. R. Larson. In press.

WRI 84-4040. Ground-water levels and use of water for irrigation in the Srartoga Valley, south-central Wyoming, 1980-81, by L. W. Lenfest, Jr. In press.

WRI 84-4079. Water resources of Weston County, Wyoming, by M. E. Lowry, W. J. Head, J. G. Rankl, and J. F. Busby. In press.

WRI 84-4092. Statistical summary of the chemical quality of surface water in the Powder River coal basin, Hanna coal field, and the Green River coal region, Wyoming, by D. A. Peterson. 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)

WY-80-2. Water resources data for Wyoming--water year 1980, volume 2, Green River Basin, Bear River Basin, and Snake River Basin. 1981. (PB-82 154 337/AS)

WY-81-1. Water resources data for Wyoming--water year 1981, volume 1, Missouri River Basin. 1982. (PB-83 170 944/AS)

WY-81-2. Water resources data for Wyoming--water year 1981, volume 2, Green River Basin, Bear River Basin, and Snake River Basin. 1982. (PB-83 170 951/AS)

WY-82-1. Water resources data for Wyoming--water year 1982. 1983. (PB-84 114 669/AS)

Hydrologic Investigations Atlases

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, Colo. 80225.

HA-217. General availability of ground water and depth to water level in the Missouri River basin, by G. A. LaRocque, Jr. 1966.

HA-219. Ground-water reconnaissance of the Great Divide and Washakie basins and some adjacent areas, southwestern Wyoming, by G. E. Welder and L. J. McGreevy. 1966.

HA-270. Ground-water resources and geology of the Wind River basin area, central Wyoming, by H. A. Whitcomb and M. E. Lowry. 1968.

HA-290. Ground-water reconnaissance of the Green River basin, south-western Wyoming, by G. E. Welder. 1968.

HA-417. Quality of surface water in the Bear River basin, Utah, Wyoming, and Idaho, by K. M. Waddell and Don Price. 1972.

HA-465. Water resources of the Powder River basin and adjacent areas, northeastern Wyoming, by W. G. Hodson, R. H. Pearl, and S. A. Druse. 1973.

HA-471. Water resources of the Laramie, Shirley and Hanna basins and adjacent areas, southeastern Wyoming, by M. E. Lowry, S. J. Rucker, IV, and K. L. Wahl. 1973.

HA-477. Selected hydrologic data in the Upper Colorado River basin, by Don Price and K. M. Waddell. 1974.

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