WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEARS 1986 AND 1987

Compiled by Sharon L. Green and Joel R. Schuetz

U.S. Geological Survey

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Cheyenne, Wyoming

1987

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

FUNDING AGENCIES

State Agencies

Wyoming Attorney General
Wyoming Department of Agriculture
Wyoming Department of Environmental Quality
Wyoming Economic Development and Stabilization Board
Wyoming Highway Department
Wyoming State Engineer
Wyoming Water Development Commission
Utah State Engineer

County Agencies

Sublette County
Uinta County

City Agency

City of Cheyenne

Federal Agencies

Federal Energy Management Agency
Office of the Secretary of the Interior
U.S. Air Force
U.S. Army, Corps of Engineers
U.S. Bureau of Indian Affairs
U.S. Bureau of Land Management
U.S. Bureau of Reclamation

For additional information
write to:

District Chief
U.S. Geological Survey
2120 Capitol Avenue
P.O. Box 1125
Cheyenne, Wyoming

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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
square mile (mi^2)	2.590	square kilometers

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ABSTRACT

This report describes the two types of water-resources activities of the Wyoming District: collection of hydrologic data, and water-resources-appraisal projects. Much of the work is done in cooperation with other agencies; during fiscal year 1986 and 1987 cooperators included eight State agencies, two counties, one muncipality, and seven Federal agencies. This report serves both as a biennial progress report to the cooperating agencies and the general public, and as one means of coordination of water-resources activities with other agencies.

Lists and location maps are included for 162 streamflow stations, 15 reservoir stations, 107 surface-water-quality stations, 24 sediment stations, and 89 ground-water-observation wells, all of which were in operation at the beginning of water year 1987. During fiscal years 1985 and 1986, 12 streamflow stations, 39 surface-water-quality stations, six sediment stations, and five ground-water-observation wells were discontinued.

Descriptions, location maps, and progress statements are given for four data-collection projects and 23 water-resources-appraisal projects that were active (funded) during fiscal year 1986 and (or) fiscal year 1987. Also included are a list of nine projects for which funding ended prior to 1986 and that are completed except for the final report(s), and a list of four new projects that will be funded during fiscal year 1987. The final section of the report is a bibliographic listing of reports about the water resources of Wyoming, prepared by the U.S. Geological Survey authors.

INTRODUCTION

The U.S. Geological Survey is the Federal agency responsible for appraising the quantity, quality, and distribution of the Nation's surface-water and ground-water resources. Through its Water Resources Division, the Survey maintains data-collection networks, conducts interpretive studies, and supports hydrologic research 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 these activities provide a basis for many major water-management decisions.

The purpose of this report is to describe the water-resources activities being done in Wyoming. The report also provides information to cooperating officials and the public about the accomplishments in the various appraisal projects during the fiscal year 1986 (October 1, 1985, through September 30, 1986) and planned work for fiscal year 1987. It is one phase of an effort to coordinate the water-resources activities of the Geological Survey with other water-related organizations.

Most of the water-resources activities in Wyoming are cooperatively financed by local, State, and other Federal agencies; these cooperating agencies are identified throughout this report. An extensive listing of reports of results of the activities is provided at the back of this report. The activities are classified into two groups: (2) data-collection programs (projects), and (2) water-resources-appraisal projects.

The data-collection programs and networks include (1) collecting records of streamflow and reservoir storage; (2) sampling and chemical analysis of water from streams; (3) sediment sampling and analysis of surface water; and (4) measuring water levels in wells. This report contains tables of monitoring sites for these four data-collection programs and networks. All four types of data collection also are done as part of many water-resources-appraisal projects; these short-term sites are not included in the tables in this report.

Water-resources-appraisal projects described in this report include the projects conducted during fiscal years 1986 and 1987. Projects completed prior to fiscal year 1986, but for which final reports were in preparation at the end of fiscal year 1986, are listed separately.

MESSAGE FROM THE DISTRICT CHIEF

The employees of the Wyoming District, Water Resources Division, U.S. Geological Survey, contribute to the understanding of Wyoming's water resources by measuring and appraising the water resources of the State. The work we do not only benefits Wyoming, but the Nation as well, because water, whether above ground in streams and lakes or below ground in aquifers, follows no political boundaries.

As you can see in the pages that follow, our work consists of two groups of interrelated activities: (1) monitoring of water quantity and quality at specific sites, and (2) studies of the hydrology of specific areas and (or) the hydrologic consequences of human activities. The information gathered in both types of activities, including any scientific interpretations of the information, is made available to the public as a basis for long-term as well as immediate use in managing Wyoming's finite water resources.

Over the years, our work has changed in response to changes in needs for water-resources information. Our monitoring, or network, operations have been and will continue to be the foundation upon which problem-oriented, multidisciplinary hydrologic studies are based. New activities include the expansion of our Statewide network for monitoring ground-water quality, a network of flood-monitoring stations in and around Cheyenne, and assessments of contamination of ground and surface water by organic compounds and (or) trace elements in selected areas. Also, we are beginning to apply a new computerized process known as GIS (Geographic Information System) to water-management problems, such as an assessment of cumulative hydrologic impacts of coal mining in the Powder River basin.

Our capacity to carry out our investigations is greatly enhanced by our partnerships with local, State, and other Federal agencies. For example, under the unique Federal-State Cooperative Water Resources Program, the Wyoming State Engineer has been our partner in hydrologic-network activities since 1915 and in intrepretive studies since the 1940's; this cooperation is continuing. Another example is a 28-year project to determine the magnitude and frequency of floods in Wyoming, done in cooperation with the Wyoming Highway Department; this project will end this year. In recent years, the U.S. Bureau of Land Management has sponsored important investigations related to land and energy. The many other agencies that co-sponsor the work we do are identified throughout this report. Needless to say, the Geological Survey values these partnerships highly.

The staff of the Wyoming District is dedicated to serving the public. In spite of budgetary uncertainties and the increasingly technical complexity of our work, I am confident that we can meet the challenges that lie ahead.

James E. Kircher
District Chief
U.S. Geological Survey
Water Resources Division
Cheyenne, Wyoming

ORIGIN OF THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey was established by an act of Congress on March 3, 1879, providing a permanent Federal agency to conduct the systematic and scientific "classification of the public lands, and examination of the geological structure, mineral resources, and products of National domain." An intergral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

Since 1879, the research and fact-finding role of the Geological Survey has expanded and been modified to meet the changing needs of the Nation it serves. As part of that evolution, the Geological Survey has become the Federal Government's largest earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists. Today's programs serve a diversity of needs and users. Programs include:

Conducting detailed assessments of the energy and mineral potential the Nation's land and offshore area.

Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.

Conducting research on the geologic structure of the Nation.

Studying the geologic features, structure, processes, and history of the other planets of our solar system.

Conducting topographic surveys of the Nation, and preparing topographic and thematic maps and related cartographic products.

Developing and producing digital cartographic data bases and products.

Collecting data on a routine basis to determine the quantity, quality, and use of surface and gound water.

Conducting water-resource appraisals in order to describe the consequences of alternative plans for developing land and water resources.

Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

Using remotely sensed data to develop new cartographic, geologic, and hydrologic-research techniques for natural resources planning and management.

Providing earth-science information through an extensive publications program and a network of public access points.

Along with its continuing commitment to meet the expanding and changing earth-science needs of the Nation, the Geological Survey remains dedicated to its original mission: to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation--providing Earth Science in the public Service.

MISSION OF THE WATER RESOURCES DIVISION

The mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States.

This is accomplished, in a large part, through cooperation with other Federal and non-Federal agencies, by

Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

Conducting analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water.

Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques to understand hydrologic systems sufficiently well to quantitatively predict their response to stress, either natural or manmade.

Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground water.

Providing scientific and technical assistance in hydrologic fields to other Federal, State and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the U.S. Department of State.

DISTRICT ORGANIZATION

The water-resources activities of the Wyoming District are carried out by two operating sections (fig. 1). The Hydrologic Surveillance Section has principal responsibility for the data-collection activities. The Hydrologic Investigations Section has principal responsibility for the interpretive hydrologic studies, or water-resources appraisal projects. Small administrative services and computer services groups support the two large sections.

The District headquarters is located in Cheyenne; small offices called Field Headquarters are located in Casper and Riverton (fig. 2). Personnel of the Field Headquarters offices do most of the hydrologic-data collection; the Casper office covers the eastern side of the State, and the Riverton office the western side. All members of the Investigations Section are headquartered in Cheyenne.

Inquiries regarding activites described in this report may be directed to the District Office or Field Headquarters in which the work originated. (See figure 2 for locations.)

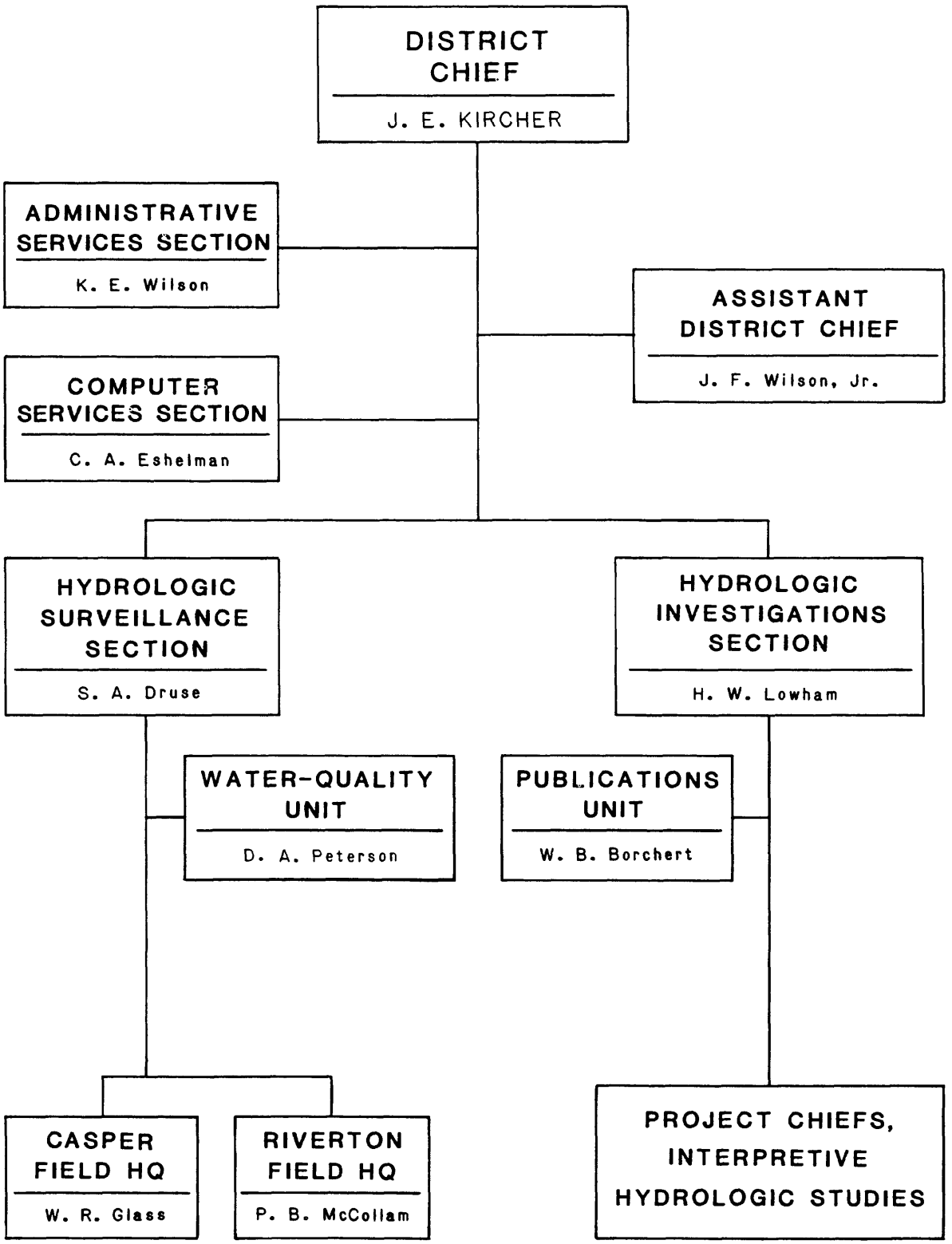


Figure 1.--Wyoming District organization.

Inquiries regarding activities described in this report may be directed to the District Office or Field Headquarters in which the work originated. (See figure 2 for locations.)

Wyoming District Office

U.S. Geological Survey
Water Resources Division
2120 Capitol Avenue
P.O. Box 1125
Cheyenne, WY 82003
(307) 772-2153
FTS 328-2153

Field Headquarters

2020 Fairgrounds Road
Plaza West, Suite 102
Casper, WY 82604
(307) 261-5485
FTS 328-5485

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

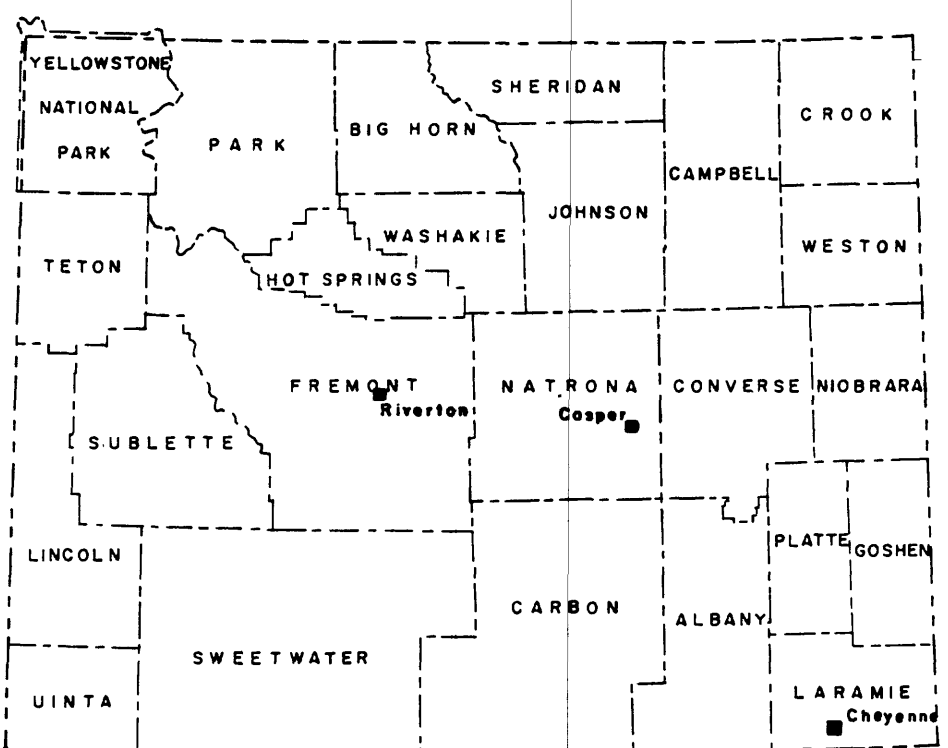
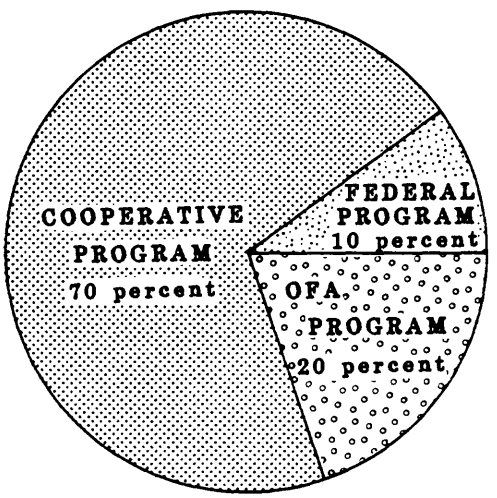


Figure 2.--Location of U.S. Geological Survey, Water Resources Division offices in Wyoming.

SOURCES OF FUNDING

Funds for carrying out the water-resources investigations of the Geological Survey in Wyoming are provided by many agencies. The agencies are classified by three major categories (fig. 3): (1) State and local agencies that provide funds or services or both generally matched on a 50-50 (percent) basis by Geological Survey funds (cooperative program); (2) other Federal agencies that transfer funds to Geological Survey (OFA program); and (3) Geological Survey funds received by direct appropriation for activities that are national in scope (Federal program). The diagram below shows the distribution of these funds by major category for Fiscal Year 1987 (as of January 1987). During 1987 about 50 percent of the funds were used for collection of hydrologic data and about 50 percent for interpretive hydrologic studies.



FISCAL YEAR 1987
TOTAL, ABOUT $2,700,000

Figure 3.--Sources of funding.

DATA-COLLECTION SITES

Lists of data-collection sites and the kinds of hydrologic data being collected at each, for fiscal year 1987, are given as follows: Table 1, streamflow and reservoir stations; table 2, water-quality stations; table 3, sediment stations; and table 4, ground-water observation wells. Lists of data-collection sites that were discontinued during fiscal years 1985 and 1986 are given in tables 5-8.

The station numbers for the stations listed in tables 1-3 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.

Two stations listed in table 2 and the observation wells listed in table 4 have 15-digit station numbers. 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 a sequence number.

The local well numbers listed in table 4, ground-water observation wells, are based on the Federal system of land subdivision. A detailed explanation of this system can be found on the page preceding table 4. The wells are listed in numerical order by county.

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

The location of streamflow, reservoir, water-quality and sediment stations are shown in figure 4. The station numbers are abbreviated by not showing the two-digit number and the last two digits if zero. The location of ground-water observation wells are shown in figure 5.

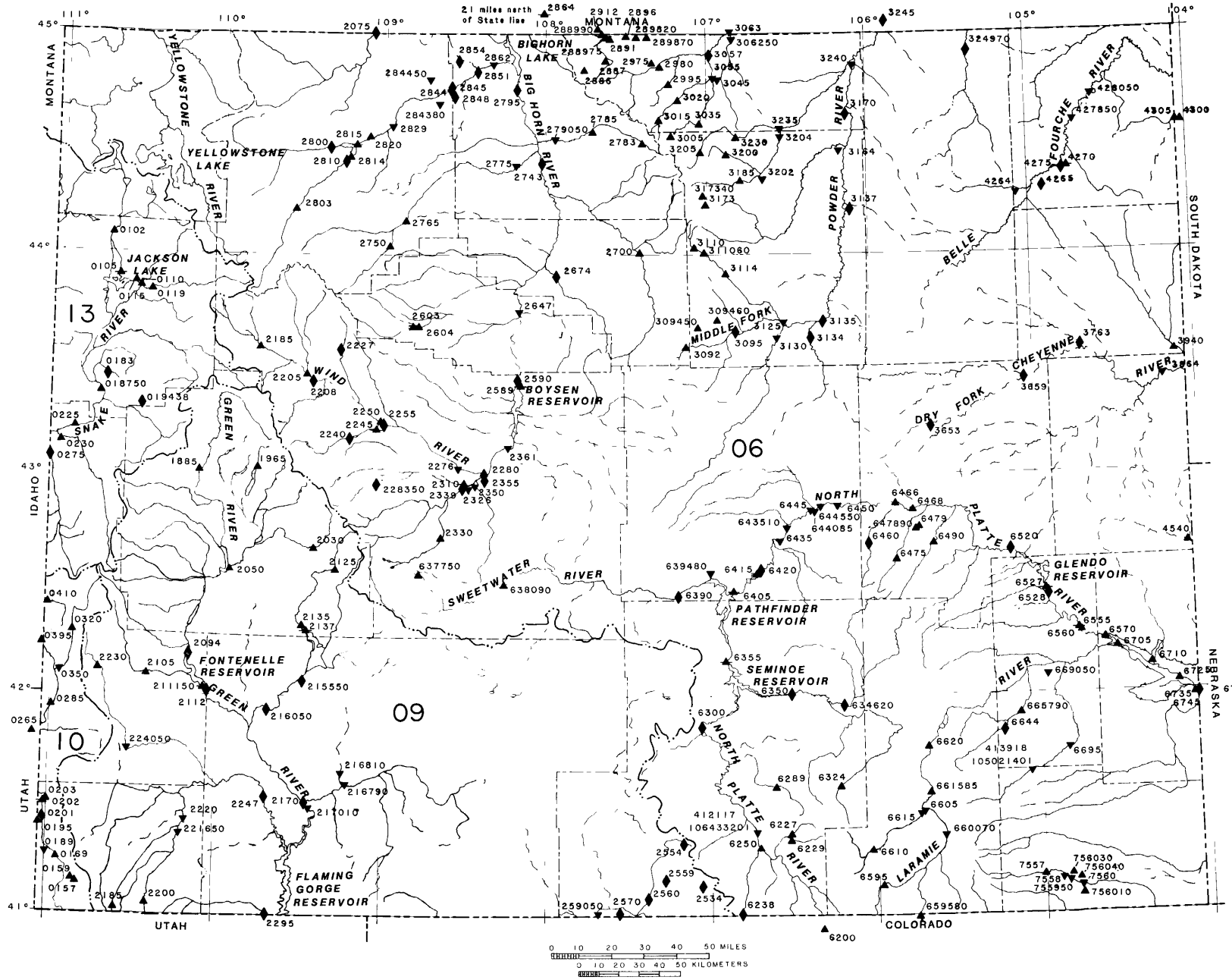
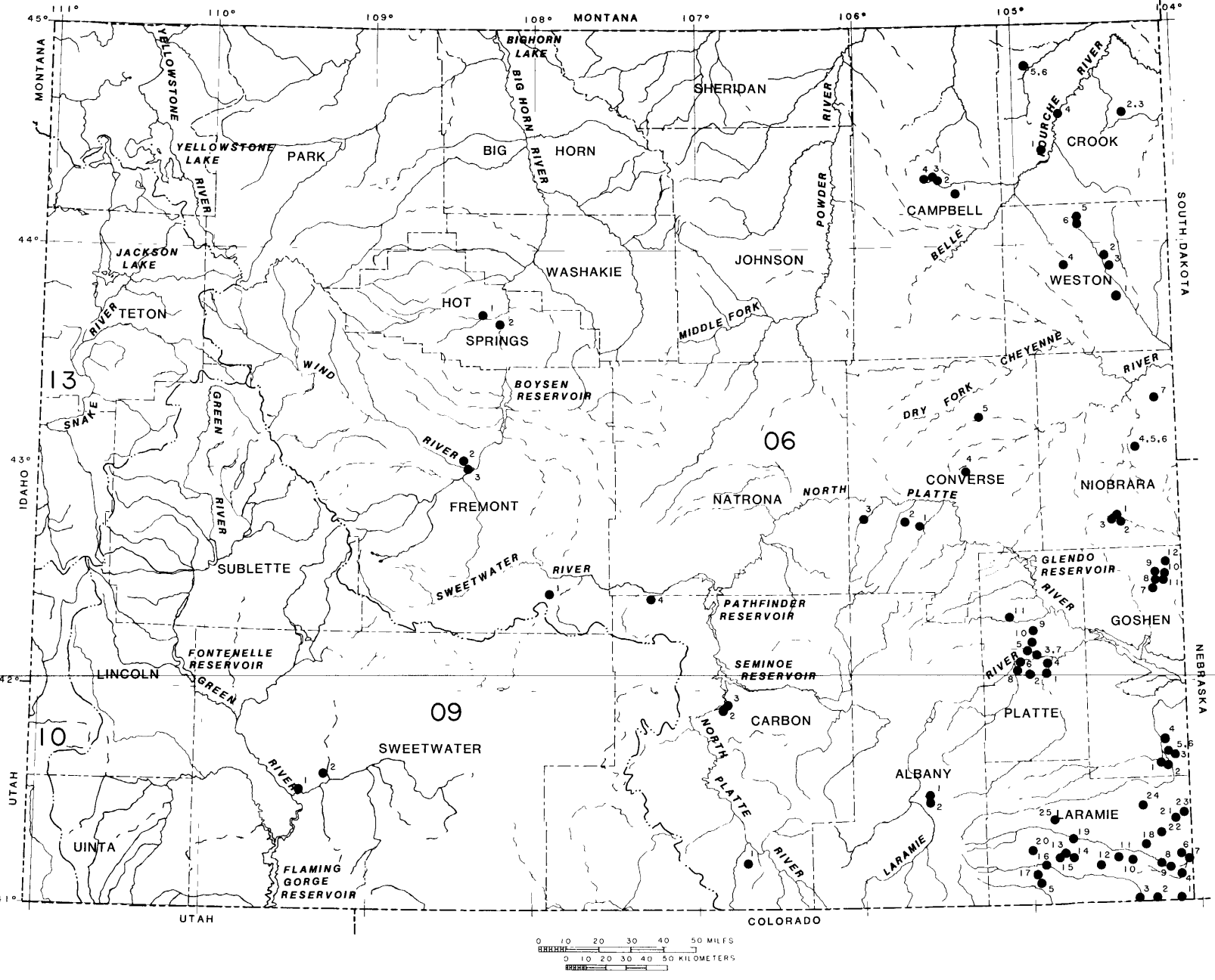


Figure 4.--Location of streamflow, reservoir, water-quality, and sediment stations, 1987 water year.



EXPLANATION

TWO-DIGIT BASIN NUMBER FOR MAJOR DRAINAGE BASIN

- 06 Missouri River basin (Yellowstone, Cheyenne, Niobrara and Platte River basins)
- 09 Upper Colorado River Basin (Green River basin)
- 10 The Great Basin (Bear River basin)
- 13 Snake River basin

● 2 GROUND-WATER OBSERVATION WELL AND MAP NUMBER--Wells are numbered sequentially in each county and are listed in table 4.

—··— MAJOR DRAINAGE DIVIDE

Figure 5.--Location of ground-water observation wells, 1987 water year.

Table 1.--Streamflow and reservoir stations

Explanation of abbreviations and codes used in table 1.

Period of record: The dates given are the calendar years in which records began or ended.

Gage equipment:

D	digital recorder	S	staff gage
G	graphic recorder	T	telemark
M	manometer gage	W	well gage
P	satellite-relay platform		

Data frequency:

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

Field office:

C	Casper	NE	Nebraska District
CH	Cheyenne	R	Riverton
CO	Colorado District	S	Wyoming State Engineer
ID	Idaho District	SD	South Dakota District
MT	Montana 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, Missouri Region
CE	Corps of Engineers
CHEY	City of Cheyenne
MRB	Geological Survey, support for other Interior Agencies
UC	Uinta County
USE	Utah State Engineer
USGS	Geological Survey, Federal Program
WAG	Wyoming Attorney General
WDEQ	Wyoming Department of Environmental Quality
WSE	Wyoming State Engineer
WWDC	Wyoming Water Development Commission
--	Not funded through Wyoming District

Remarks:

HBM	hydrologic bench mark station
NASQAN	national stream-quality accounting network station
QW	also water-quality station
SED	also sediment station
USBR	furnished by Bureau of Reclamation

Table 1.--Streamflow and reservoir stations

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN					
06207500	Clarks Fork Yellowstone River near Belfry, Mont.	1921-	--	Y	MT	--	QW
06218500	Wind River near Dubois	1945-	D,W	Y	R	WSE	
06220500	East Fork Wind River near Dubois	1950-57, 1975-	D,M	Y	R	MRB	
06222700	Crow Creek near Tipperary	1962-	D,G,M	Y	R	MRB	QW
06224000	Bull Lake Creek above Bull Lake	1941-53, 1966-	D,M	Y	R	MRB	QW
06224500	Bull Lake near Lenore	1938-	--	--	--	BRUM	USBR
06225000	Bull Lake Creek near Lenore	1918-	D,G,M,P, T	Y	R	BRUM	
06225500	Wind River near Crowheart	1945-	D,G,M,P, T	Y	R	BRUM	QW
06228000	Wind River at Riverton	1906-08, 1911-	D,G,M,T	Y	R	CE	NASQAN, QW,SED
06228350	South Fork Little Wind River above Washakie Reservoir, near Fort Washakie	1976-	D,G,M	Y	R	BIA	QW
06231000	Little Wind River above Arapahoe	1979-	D,M	Y	R	BIA	QW
06233000	Little Popo Agie River near Lander	1946-	G,W	S	S	WSE	
06233900	Popo Agie River near Arapahoe	1979-	D,M	Y	R	BIA	QW
06235500	Little Wind River near Riverton	1941-	D,M,P	Y	R	CE,BRUM	QW
06258900	Boysen Reservoir	1951-	--	--	--	MRB	USBR
06259000	Wind River below Boysen Reservoir	1951-	D,M	Y	R	BRUM	QW
06260300	Anchor Reservoir	1960-	--	--	--	MRB	USBR
06260400	South Fork Owl Creek below Anchor Reservoir	1959-	D,G,W	Y	R	BRUM	
06267400	East Fork Nowater Creek near Colter	1971-	D,G,M	Y	R	WSE	SED

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

Station number	Station name	Period of record	Gage equipment	Data frequency	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN--Continued					
06270000	Nowood River near Tensleep	1938-43, 1950-55, 1972-	D,G,M	Y	R	WSE	
06274300	Bighorn River at Basin	1984-	D,M	Y	R	WDEQ	QW
06275000	Wood River at Sunshine	1945-	D,G,M	Y	R	WSE	
06276500	Greybull River at Meeteetse	1897, 1903, 1920-	G,M	S	S	WSE	
06278300	Shell Creek above Shell Reservoir	1956-	D,W	Y	R	WSE	
06278500	Shell Creek near Shell	1940-	G,W	S	S	WSE	
06279500	Bighorn River at Kane	1928-	D,G,M,P	Y	R	MRB,CE	QW,SED
06280000	North Fork Shoshone River near Wapiti	1921-26, 1979-	D,G,M,P	Y	R	MRB, BRUM	QW
06280300	South Fork Shoshone River near Valley	1956-	D,G,M	Y	R	USGS	
06281000	South Fork Shoshone River above Buffalo Bill Reservoir	1903, 1905-08, 1921-26, 1973-	D,G,M,P	Y	R	WSE, BRUM	QW
06281400	Diamond Creek near mouth, near Cody	1981-	D,W	Y	R	MRB	
06281500	Buffalo Bill Reservoir	1909-	--	--	--	MRB	USBR
06282000	Shoshone River below Buffalo Bill Reservoir	1921-	D,W	Y	R	BRUM	
06284500	Bitter Creek near Garland	1950-53, 1957-60, 1968-	D,W	Y	R	MRB	QW

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN--Continued					
06284800	Whistle Creek near Garland	1958-60, 1968-	D,G,M	Y	R	MRB	QW
06285100	Shoshone River near Lovell	1966-	D,G,M	Y	R	MRB	QW
06285400	Sage Creek at Sidon Canal, near Deaver	1958-60, 1968-	D,G,M	Y	R	MRB	QW
06286400	Bighorn Lake near St. Xavier, Mont.	1965-	--	--	--	MRB	USBR
06288600	Little Bighorn River below Dayton Gulch, near Burgess Junction	1983-	D,G,M	S	C	WAG	
06288700	Dry Fork below Lick Creek, near Burgess Junction	1983-	D,G,M,W	Y	C	WAG	
06288975	Elkhorn Creek above Fuller Ranch Ditch, near Parkman	1983-	G,M	S	C	WAG	
06288990	West Fork Little Bighorn River near Parkman	1983-	D,G,M	S	C	WAG	
06289100	Red Canyon Creek near Parkman	1983-	D,G,M	S	C	WAG	
06289600	West Pass Creek near Parkman	1983-	D,W	S	C	WAG	
06289820	East Pass Creek near Dayton	1983-	D,W	Y	C	WAG	
06289870	Twin Creek near Parkman	1983-	D,W	S	C	WAG	
06291200	Lodgegrass Creek at State line, near Wyola, Mont.	1983-	D,G,M	S	C	WAG	
06297500	Highline Ditch near Dayton	1919-23, 1940-	G,W	S	C	WSE	
06298000	Tongue River near Dayton	1918-29, 1940-	D,W	Y	C	WSE	
06299500	Wolf Creek at Wolf	1945-	G,W	S	S	WSE	
06300500	East Fork Big Goose Creek near Big Horn	1953-	G,M	S	S	WSE	
06301500	West Fork Big Goose Creek near Big Horn	1953-	G,M	S	S	WSE	
06302000	Big Goose Creek near Sheridan	1929-	G,W	S	S	WSE	

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
	YELLOWSTONE RIVER BASIN--Continued						
06303500	Little Goose Creek in canyon, near Big Horn	1941-	G,W	S	S	WSE	
06305700	Goose Creek near Acme	1984-	D,W	Y	C	WSE	QW
06309200	Middle Fork Powder River near Barnum	1961-	D,G,M,W	Y	C	WSE	
06309450	Beaver Creek below Bayer Creek, near Barnum	1974-	D,W	Y	C	WSE	
06309460	Beaver Creek above White Panther Ditch, near Barnum	1974-	D,W	Y	C	WSE	
06309500	Middle Fork Powder River above Kaycee	1949-70, 1984-	D,W	Y	C	WWDC	QW
06311000	North Fork Powder River near Hazelton	1946-	D,G,M	Y	C	WSE	
06311060	North Fork Powder River below Bull Creek, near Hazelton	1974-	D,W	Y	C	WSE	
06311400	North Fork Powder River below Pass Creek, near Mayoworth	1974-	D,W	Y	C	WSE	
06313400	Salt Creek near Sussex	1976-81 1982-		Y	C	WDEQ	QW,SED
06313500	Powder River at Sussex	1938-40, 1950-57, 1977-84, 1985-		Y	C	WWDC, BLM	QW,SED
06313700	Dead Horse Creek near Buffalo	1971-	G,M	Y	C	WSE	SED
06317000	Powder River at Arvada	1919-	G,M	Y	C	WSE	QW,SED
06317300	Sourdough Creek near Buffalo	1985-	D,G,M	Y	C	WWDC	
06317340	Little Sourdough Creek near Buffalo	1985-	D,G,W	Y	C	WWDC	
06318500	Clear Creek near Buffalo	1894, 1896-99, 1917-27, 1938-	D,W	Y	C	WWDC	

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN--Continued					
06320000	Rock Creek near Buffalo	1941-	G,W	S	S	WSE	
06320500	South Piney Creek at Willow Park	1945-57, 1959-	G,W	S	S	WSE	
06323000	Piney Creek at Kearny	1902-06, 1910-17, 1919-23, 1940-	G,W	Y	S	WSE	
06324500	Powder River at Moorhead, Mont.	1929-72, 1974-	G,W	Y	MT	--	QW
06324970	Little Powder River above Dry Creek, near Weston	1972-	D,G,M	Y	C	WSE	QW
		CHEYENNE RIVER BASIN					
06365300	Dry Fork Cheyenne River near Bill	1976-81, 1985-	D,G,M	Y	C	BLM	QW,SED
06365900	Cheyenne River near Dull Center	1976-81, 1985-	D,G,M	Y	C	BLM	QW,SED
06376300	Black Thunder Creek near Hampshire	1972-	D,G,M	Y	C	WSE	SED
06394000	Beaver Creek near Newcastle	1943-	D,G,W	Y	C	USGS	
06426500	Belle Fourche River below Moorcroft	1943-70, 1975-83, 1986-	D,G,M	Y	C	BLM	QW,SED
06427000	Keyhole Reservoir near Moorcroft	1952-	--	--	--	MRB	USBR
06427500	Belle Fourche River below Keyhole Reservoir	1951-	G,M	Y	C	BRUM	QW
06430000	Murray Ditch at Wyoming-South Dakota State line	1954-	G,W	S	SD	WSE	

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		CHEYENNE RIVER BASIN--Continued					
06430500	Redwater Creek at Wyoming-South Dakota State line	1929-31, 1936-37, 1954-	G,W	Y	SD	WSE	
		NIOBRARA RIVER BASIN					
06454000	Niobrara River at Wyoming-Nebraska State line	1955-	D,W	Y	NE	--	
		PLATTE RIVER BASIN					
06620000	North Platte River near Northgate, Colo.	1904, 1915-	D,M	Y	C	USGS	
06622700	North Brush Creek near Saratoga	1960-	D,G,M	Y	C	WSE	
06622900	South Brush Creek near Saratoga	1960-74, 1976-	G,W	S	S	WSE	
06623800	Encampment River above Hog Park Creek, near Encampment	1964-	G,M	Y	C	USGS	HBM,QW, SED
06625000	Encampment River at mouth, near Encampment	1940-	D,W	Y	C	WSE	
06628900	Pass Creek near Elk Mountain	1957-	G,M	Y	C	WSE	
06630000	North Platte River above Seminoe Reservoir, near Sinclair	1939-	G,W,T	Y	C	WSE	NASQAN, QW,SED
06632400	Rock Creek above King Canyon Canal, near Arlington	1965-	G,M	Y	C,S	WSE	
06634620	Little Medicine Bow River at Boles Spring, near Medicine Bow	1984-	D,M	Y	C	WSE	QW

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

Station number	Station name	Period of record	Gage equipment	Data frequency	Field office	Funding agency	Remarks
	PLATTE RIVER BASIN--Continued						
06635000	Medicine Bow River above Seminoe Reservoir, near Hanna	1939-	G,W,T	Y	C	WSE	QW
06635500	Seminoe Reservoir near Leo	1939-	--	--	--	MRB	USBR
06637750	Rock Creek above Rock Creek Reservoir	1962-	D,W	Y	R	WSE	
06638090	Sweetwater River near Sweetwater Station	1973-	D,M	Y	R	WSE	
06639000	Sweetwater River near Alcova	1913-24, 1938-	D,W,T	S	S	WSE	QW
06640500	Pathfinder Reservoir near Alcova	1909-	--	--	--	MRB	USBR
06641500	Alcova Reservoir at Alcova	1938-	--	--	--	MRB	USBR
06642000	North Platte River at Alcova	1904-05, 1934-	D,W	Y	C	WSE	QW
06646000	Deer Creek in canyon, near Glenrock	1946-51, 1985-	D,G,M	Y	C	WWDC	QW,SED
06646600	Deer Creek below Millar Wasteway, at Glenrock	1961-	D,G,M	Y	C	WSE	
06646800	North Platte River near Glenrock	1959-	D,W,P	Y	C	WSE,CE	
06647500	Box Elder Creek at Boxelder	1946-51, 1961-67, 1971-	D,W	Y	C	WSE	
06647890	Little Box Elder Creek near Careyhurst	1974-	D,W	Y	C	WSE	
06647900	Little Box Elder Creek at Little Box Cave, near Careyhurst	1974-	G,W	Y	C	WSE	
06649000	La Prele Creek near Douglas	1919-	G,W	S	S	WSE	
06652000	North Platte River at Orin	1895-99, 1917-18, 1924, 1958-	D,W,T	Y	C	WSE	QW
06652700	Glendo Reservoir near Glendo	1957-	--	--	--	MRB	USBR

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		PLATTE RIVER BASIN--Continued					
06652800	North Platte River below Glendo Reservoir	1957-	D,W,T	Y	C	WSE	QW
06655500	Guernsey Reservoir near Guernsey	1928-	--	--	--	MRB	USBR
06656000	North Platte River below Guernsey Reservoir	1900-	D,M,W,T	Y	C	WSE	
06657000	North Platte River below Whalen Diversion Dam	1909-	G,M	Y	C	WSE	
06659500	Laramie River and Pioneer Canal near Woods	1912-24, 1926-27, 1931-	G,W	S	S	WSE	
06659580	Sand Creek at Colorado-Wyoming State line	1968-	G,W	S	S	WSE	
06661000	Little Laramie River near Filmore	1902-03, 1911-26, 1932-	G,W	S	S	WSE	
06661585	Laramie River near Bosler	1972-	G,W	Y	S	WSE	
06662000	Laramie River near Lookout	1912-17, 1921-27, 1932-	G,W	S	S	WSE	
06664400	Sybille Creek above Mule Creek, near Wheatland	1974-	G,W	S	S	WSE	QW
06665790	Sybille Creek above Canal No. 3, near Wheatland	1980-	G,W	S	S	WSE	
06670500	Laramie River near Fort Laramie	1915-	G,M,P,T	Y	C	WSE,CE	
06671000	Rawhide Creek near Lingle	1928-	G,W	S	S	WSE	
06672500	Cherry Creek Drain near Torrington	1931-32, 1935-	G,W	S	S	WSE	
06673500	Katzer Drain near Henry, Nebr.	1928-	G,W	S	S	WSE	
06674500	North Platte River at Wyoming-Nebraska State line	1929-	D,G,W,P	Y	C	WSE,CE	QW

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		PLATTE RIVER BASIN--Continued					
06679500	North Platte River at Mitchell, Nebr.	1901-10, 1911, 1912-13, 1916-18, 1920-	D,G,W	Y	NE	--	
06755700	Crow Creek below North Fork, at Silver Crown	1987-	D,W	Y	CH	CHEY	
06756010	Allison Draw at U.S. Highway 85/87, at Cheyenne	1987-	D,W,T	S	CH	CHEY	
06756030	Dry Creek at Vista Lane, at Cheyenne	1987-	D,W,T	S	CH	CHEY	
06756040	Dry Creek tributary at Converse Avenue, at Cheyenne	1987-	D,W,T	S	CH	CHEY	
		GREEN RIVER BASIN					
09188500	Green River at Warren Bridge, near Daniel	1931-	D,M,P	Y	R	WSE	
09196500	Pine Creek above Fremont Lake	1954-	D,W	Y	R	USGS	
09203000	East Fork River near Big Sandy	1938-	D,M	Y	R	WSE	
09205000	New Fork River near Big Piney	1954-	D,M,P	Y	R	WSE	
09209400	Green River near La Barge	1963-	D,M,P	Y	R	WSE	NASQAN, QW,SED
09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	1951-	D,M	Y	R	USGS	
09211150	Fontenelle Reservoir near Fontenelle	1964-	--	--	--	--	USBR
09211200	Green River below Fontenelle Reservoir	1963-	D,G,M,P	Y	R	BRUC	QW
09212500	Big Sandy River at Leckie, Ranch, near Big Sandy	1910-11, 1939-	D,M	S	R	WSE	

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

Station number	Station name	Period of record	Gage equipment	Data frequency	Field office	Funding agency	Remarks
		GREEN RIVER BASIN--Continued					
09213500	Big Sandy River near Farson	1914-17, 1920-24, 1926-34, 1935-	D,M,P	S	R	WSE	
09213700	Big Sandy Reservoir	1987-	P	Y	R	BRUC	
09215550	Big Sandy River below Farson	1981-	D,M	Y	R	WSE	QW
09216050	Big Sandy River at Gasson Bridge, near Eden	1972-	D,M	Y	R	WSE	QW
09217000	Green River near Green River	1951-	D,G,M,P	Y	R	USGS, BRUC	QW,SED
09218500	Blacks Fork near Millburne	1939-	D,M	Y	R	WSE	
09220000	East Fork of Smiths Fork near Robertson	1939-	G,M	S	S	WSE	
09223000	Hams Fork below Pole Creek, near Frontier	1952-	D,G,M	Y	R	USGS	
09224700	Blacks Fork near Little America	1962-	D,M,P	Y	R	USGS	QW
09229500	Henrys Fork near Manila, Utah	1928-	D,M,P	Y	R	USGS	QW
09253400	Battle Creek near Encampment	1956-63, 1985-	G,M	Y	C	WWDC	SED
09255400	East Fork Savery Creek near Encampment	1956-58, 1985-	G,M	Y	C	WWDC	SED
09255900	Big Sandstone Creek near Savery	1956-58, 1985-	G,M	Y	C	WWDC	SED
09256000	Savery Creek near Savery	1941-71, 1972, 1985-	G,M	Y	C	WWDC	QW,SED
09257000	Little Snake River near Dixon	1910-23, 1938-	G,M	S	C	WSE	QW

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		BEAR RIVER BASIN					
10015700	Sulphur Creek above reservoir, near Evanston	1957-	G,W	Y	UT	--	
10015900	Sulphur Creek below reservoir, near Evanston	1958-	D,W	Y	UT	--	
10016900	Bear River at Evanston	1984-	D,M	S	R	UC	
10019500	Chapman Canal at State line, near Evanston	1942-	G,W	Y	UT	--	
10020100	Bear River above reservoir, near Woodruff, Utah	1961-	G,W	Y	UT	--	QW
10020200	Woodruff Narrows Reservoir near Woodruff, Utah	1965-	--	--	--	--	
10020300	Bear River below reservoir, near Woodruff, Utah	1961-	D,W	Y	UT	--	
10026500	Bear River near Randolph, Utah	1943-	--	Y	UT	--	
10028500	Bear River below Pixley Dam, near Cokeville	1941-43, 1952-56, 1958-	G,W	S	UT	--	
10032000	Smiths Fork near Border	1942-	G,W	Y	UT	--	
10039500	Bear River at Border	1937-	G,W	Y	UT	--	
10041000	Thomas Fork near Wyoming-Idaho State line	1949-	D,W	Y	UT	--	
		SNAKE RIVER BASIN					
13010200	Snake River above Jackson Lake, at Flagg Ranch	1983-	--	Y	ID	--	
13010500	Jackson Lake near Moran	1908-79, 1984-	--	Y	ID	--	USBR

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

Station number	Station name	Period of record	Gage equip-ment	Data fre-quency	Field office	Funding agency	Remarks
		SNAKE RIVER BASIN--Continued					
13011000	Snake River near Moran	1903-	D,W	Y	ID	--	
13011500	Pacific Creek at Moran	1906, 1917-18, 1944-75, 1978-	--	Y	ID	--	
13011900	Buffalo Fork above Lava Creek, near Moran	1965-	G,M	Y	ID	--	
13018300	Cache Creek near Jackson	1962-	G,W	Y	ID	USGS	HBM,QW, SED
13018750	Snake River below Flat Creek, near Jackson	1975-	D,G,M	Y	ID	USGS	
13019438	Little Granite Creek at mouth, near Bondurant	1982-	D,G,M	Y	ID	--	QW,SED
13022500	Snake River above reservoir, near Alpine	1917-18, 1937-39, 1953-	G,W	Y	ID	--	
13023000	Greys River above reservoir, near Alpine	1917-18, 1937-39, 1953-	G,M	Y	ID	--	
13027500	Salt River above reservoir, near Etna	1953-	D,W	Y	ID	--	QW

Table 2.--Water-quality 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.

Data frequency:

A	annual
BM	bimonthly
C	continuous (recorder)
D	daily
HL	high and low flow samples only
HLM	high flow, low flow, mid-summer
M	every six weeks plus two events
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
5A	field determinations of: pH, specific conductance, and temperature
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)
13	stable isotopes
14	field alkalinity

Field office:

C	Casper
CH	Cheyenne
CO	Colorado District
ID	Idaho District
MT	Montana District
R	Riverton

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

Funding agency:

BIA	Bureau of Indain Affairs
BLM	Bureau of Land Management
BRUC	Bureau of Reclamation, Colorado Region
BRUM	Bureau of Reclamation, Missouri Region
MRB	Geological Survey, support for other Interior Agencies
USGS	Geological Survey, Federal Program
WDA	Wyoming Department of Agriculture
WDEQ	Wyoming Department of Environmental Quality
WWDC	Wyoming Water Development Commission
--	Not funded through Wyoming District

Remarks:

HBM	hydrologic benchmark station
NASQAN	national stream-quality accounting network station
SED	also sediment station
SW	also streamflow station

Table 2.--Water-quality stations

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN					
06207500	Clarks Fork Yellowstone River near Belfry, Mont.	1965-	SS	9	MT	WDA	SW
06220800	Wind River above Red Creek, near Dubois	1986-	BM	1,8,9	R	BIA	
06222700	Crow Creek near Tipperary	1974-	M	11	R	MRB	SW
06224000	Bull Creek above Bull Lake	1974-	M	11	R	MRB	SW
06225500	Wind River near Crowheart	1986-	BM	1,8,9	R	BIA	SW
06227600	Wind River near Kinnear	1985-	Q	10	R	BIA	
06228000	Wind River at Riverton	1947-50,	Q	10	R	BIA	NASQAN,
		1953,	BM	1,5,6,7,		USGS	SW,SED
		1965-	BM	13,14		USGS	
			Q	8		USGS	
06228350	South Fork Little Wind River above Washakie Reservoir, near Fort Washakie	1976-	BM	1,11	R	BIA	SW
06231000	Little Wind River above Arapahoe	1966-	Q	10	R	BIA	SW
06232600	Popo Agie River at Hudson Siding, near Hudson	1984-	Q	5,6,7	R	WDEQ	
06233900	Popo Agie River near Arapahoe	1979-	BM	1	R	BIA	SW
			Q	10		BIA	
			SS	9		WDA	
06235000	Beaver Creek near Arapahoe	1950-53, 1958-81, 1985-	Q	10	R	BIA	
06235500	Little Wind River near Riverton	1965-	Q	10	R	BIA	SW
06236100	Wind River above Boysen Reservoir, near Shoshoni	1974-	Q	5,6,7	R	WDEQ	
06259000	Wind River below Boysen Reservoir	1953-54,	Q	13	R	USGS	SW
		1960-	Q	1,5,6,7		WDEQ	

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN--Continued					
06264700	Bighorn River at Lucerne	1966-	Q	5,6,7	R	WDEQ	
06274300	Bighorn River at Basin	1984-	Q	5,6,7	R	WDEQ	SW
06277500	Greybull River near Basin	1951-53, 1965-	SS	9	R	WDA	
06279050	Shell Creek at Porter Gulch, near Greybull	1983-	SS	9	R	WDA	
06279500	Bighorn River at Kane	1947-53,	M	11	R	MRB	SW,SED
		1955-57,	SS	9		WDA	
		1960-	Q	5,6,7		WDEQ	
06280000	North Fork Shoshone River near Wapiti	1979-	C	3	R	MRB	SW
06281000	South Fork Shoshone River above Buffalo Bill Reservoir	1981-	C	3	R	MRB	SW
06282900	Shoshone River above Dry Creek, near Cody	1974-	Q	5,6,7	R	WDEQ	
06284380	Roan Wash near Garland	1985-	SS	9	R	WDA	
06284400	Shoshone River near Garland	1974-	SS	9	R	WDA	
06284450	Bitter Creek below sewage lagoon, near Powell	1981-	Q	5,6,7	R	WDEQ	
06284500	Bitter Creek near Garland	1958-60,	M	5A	R	MRB	SW
		1969-	SS	9		WDA	
			Q	6		DEQ	
06284800	Whistle Creek near Garland	1959-60, 1969-	M	5A	R	MRB	SW
06285100	Shoshone River near Lovell	1966-	Q	1,7	R	MRB	SW
			Q	11		USGS	
06285400	Sage Creek at Sidon Canal, near Deaver	1958-60,	Q	1,7	R	MRB	SW
		1969-	Q	11		USGS	
06286200	Shoshone River at Kane	1976-	Q	5,6,7	R	WDEQ	

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN--Continued					
06304500	Little Goose Creek near Sheridan	1979-	Q	5,6	C	WDEQ	
			SS	9		WDA	
06305500	Goose Creek below Sheridan	1959-60, 1961-64, 1967-	Q	5,6,7	C	WDEQ	
06305700	Goose Creek near Acme	1984-	Q	5,6,7	C	WDEQ	SW
06306250	Prairie Dog Creek near Acme	1983-	SS	9	C	WDA	
06306300	Tongue River at State line, near Decker, Mont.	1965-	Q	5,6,7,8	MT	WDEQ	
			SS	9		WDA	
06309500	Middle Fork Powder River above Kaycee	1949-54, 1984-	M	1,5,6,7	C	WWDC	SW
06312500	Powder River near Kaycee	1968-	Q	1,5,6,7	C	WDEQ	
			BM	1		WWDC	
06313000	South Fork Powder River near Kaycee	1968-81, 1983-	M	1,5	C	BLM	SED
06313400	Salt Creek near Sussex	1967-81, 1983-	Q	1	C	WDEQ	SW,SED
			BM	1		WWDC	
06313500	Powder River at Sussex	1949-53, 1977-	Q	1	C	WDEQ	SW,SED
			BM	1		WWDC	
06316400	Crazy Woman Creek at upper station, near Arvada	1966-81, 1983-	SS	9	C	WDA	
06317000	Powder River at Arvada	1946-53, 1967-	M	2	C	USGS	SW,SED
			Q	1		WDEQ	
			BM	1		WWDC	
06320200	Clear Creek below Rock Creek, near Buffalo	1975-	SS	9	C	WDA	
			Q	5,6,7		WDEQ	
06320400	Clear Creek at Ucross	1975-81, 1983-	SS	9	C	WDA	

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN--Continued					
06323500	Piney Creek at Ucross	1950-54, 1983-	SS	9	C	WDA	
06324000	Clear Creek near Arvada	1950-54, 1966-	SS	9	C	WDA	
06324500	Powder River near Moorhead, Mont.	1951-53, 1956-57, 1969-72, 1975-83, 1987-	SS	9	MT	WDA	SW
06324970	Little Powder River above Dry Creek, near Weston	1972-81, 1986-	Q	1	C	DEQ	SW
		CHEYENNE RIVER BASIN					
06365300	Dry Fork Cheyenne River near Bill	1977-81, 1987-	M	1,5A	C	BLM	SW,SED
06365900	Cheyenne River near Dull Center	1977-81, 1987-	M	1,5A	C	BLM	SW,SED
06386400	Cheyenne River near Riverview	1975-	SS	9	C	WDA	
06426400	Donkey Creek near Moorcroft	1977-	Q	5,6,7	C	WDEQ	
06426500	Belle Fourche River below Moorcroft	1975-	M	1	C	BLM	SW,SED
			BM	5A		BLM	
			Q	5,6,7		WDEQ	
			SS	9		WDA	
06427500	Belle Fourche River below Keyhole Reservoir	1984-	SS	9	C	WDA	SW

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
			CHEYENNE RIVER BASIN--Continued				
06427850	Belle Fourche River at Devils Tower	1967-	SS	9	C	WDA	
06428050	Belle Fourche River below Hulett	1981-	Q	5,6,7	C	WDEQ	
			SS	9		WDA	
			PLATTE RIVER BASIN				
06623800	Encampment River above Hog Park Creek, near Encampment	1967-	Q	1,5,6,7,	C	USGS	HBM,SW,
			Q	8,13,14		USGS	SED
			HL	10		USGS	
412117-106433201	North Platte River at Highway 130, north of Saratoga	1977-78, 1984-	SS	9	C	WDA	
06630000	North Platte River above Seminoe Reservoir, near Sinclair	1960-	Q	5,6,7	C	WDEQ	SW,SED
			BM	1,5,6,7,		USGS	
			BM	13,14		USGS	
			Q	8		USGS	
06634620	Little Medicine Bow River at Boles Spring, near Medicine Bow	1985-	Q	10	C	WDEQ	SW
06635000	Medicine Bow River above Seminoe Reservoir, near Hanna	1965-	Q	10	C	WDEQ	SW
06639000	Sweetwater River near Alcova	1964-	Q	10	C	WDEQ	SW
06639480	Horse Creek at Highway 220, near Alcova	1983-	SS	9	C	WDA	
06642000	North Platte River at Alcova	1965-	Q	13	C	USGS	SW
			Q	1,5,6,7		WDEQ	
06643500	North Platte River near Goose Egg	1983, 1986-	M	1,5A	C	BLM	SED

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		PLATTE RIVER BASIN--Continued					
06643510	North Platte River above Poison Spider Creek, near Goose Egg	1977-80, 1983-	Q	5,6,7	C	WDEQ	
06644085	North Platte River at Mills	1970-	Q	5,6,7	C	WDEQ	
06644500	Casper Creek at Casper	1970-	Q	5,6,7	C	WDEQ	
06644550	North Platte River at Casper	1971-	A	1	C	MRB	
			T	5		MRB	
			SS	9		WDA	
			Q	5,6,7		WDEQ	
06645000	North Platte River below Casper	1950-52, 1957-59, 1967-	Q	5,6,7	C	WDEQ	
06646000	Deer Creek in canyon, near Glenrock	1985-	M	1,5,6,7	C	WWDC	SW,SED
			HLM	8		WWDC	
06652000	North Platte River at Orin	1966-	SS	9	C	WDA	SW
			Q	5,6,7		WDEQ	
06652800	North Platte River below Glendo Reservoir	1966-	SS	9	C	WDA	SW
06660070	Laramie River above Howell	1980-	Q	5,6,7	CH	WDEQ	
06660500	Laramie River at Two Rivers	1966-	SS	9	CH	WDA	
06661500	Little Laramie River at Two Rivers	1965-	SS	9	CH	WDA	
06664400	Sybille Creek above Mule Creek, near Wheatland	1984-	SS	9	CH	WDA	SW
06669050	Wheatland Creek below Wheatland	1983-	Q	5,6,7	CH	WDEQ	
413918-105021401	Chugwater Creek at Platte-Laramie County line, near Chugwater	1984-	SS	9	CH	WDA	
06669500	Chugwater Creek at Chugwater	1984-	SS	9	CH	WDA	
06674500	North Platte River at Wyoming-Nebraska State line	1965-	Q	5,6	C	WDEQ	SW

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		PLATTE RIVER BASIN--Continued					
06755800	Crow Creek at Roundtop Road, near Cheyenne	1986-	SS	9	CH	WDA	
06755950	Crow Creek at F. E. Warren AFB	1983-	SS	9	CH	WDA	
06756000	Crow Creek near Cheyenne	1983-	SS	9	CH	WDA	
		GREEN RIVER BASIN					
09209400	Green River near La Barge	1963-	BM	1,5,6,7	R	USGS	NASQAN,
			BM	13,14		USGS	SW,SED
			Q	8		USGS	
			SS	9		WDA	
09211200	Green River below Fontenelle Reservoir	1967-	M	1	R	BRUC	SW
09215550	Big Sandy River below Farson	1981-	M	1,11	R	WSE	SW
09216050	Big Sandy River at Gasson Bridge, near Eden	1981-	SS	9	R	WDA	SW
			M	1,11		WSE	
09216790	Bitter Creek above Killpecker Creek, at Rock Spings	1983-	SS	9	R	WDA	
09216810	Killpecker Creek at Rock Springs	1975-80, 1982-	SS	9	R	WDA	
09217000	Green River near Green River	1951-	BM	1	R	BRUC	SW,SED
			BM	13		USGS	
			D	2,3		USGS	
09217010	Green River below Green River	1973-	Q	1,4,5,6,7	R	WDEQ	
09221650	Smiths Fork near Lyman	1974-	SS	9	R	WDA	
09222000	Blacks Fork near Lyman	1962-	SS	9	R	WDA	

Table 2.--Water-quality stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
			GREEN RIVER BASIN--Continued				
09224050	Hams Fork near Diamondville	1975-	SS	9	R	WDA	
			Q	5,6,7		WDEQ	
09224700	Blacks Fork near Little America	1951-	C	12	R	USGS	SW
			M	1		USGS	
09229500	Henrys Fork near Manila, Utah	1951-	SS	9	R	WDA	SW
09256000	Savery Creek near Savery	1985-	M	1,5,6,7	C	WWDC	SW,SED
			HLM	8			
09257000	Little Snake River near Dixon	1975-	SS	9	CO	WDA	SW
09259050	Little Snake River below Baggs	1981-	SS	9	CO	WDA	
			Q	5,6,7		WDEQ	
			BEAR RIVER BASIN				
10018900	Yellow Creek at mouth, near Evanston	1984-	Q	5,6,7	R	WDEQ	
10020100	Bear River above reservoir, near Woodruff, Utah	1968-	Q	5,6,7	R	WDEQ	SW
10035000	Smiths Fork near Cokeville	1983-	SS	9	R	WDA	
			SNAKE RIVER BASIN				
13018300	Cache Creek near Jackson	1965-	--	--	ID	--	HBM,SW, SED
13019438	Little Granite Creek at mouth, near Bondurant	1982-	--	--	ID	--	SW,SED
13027500	Salt River above reservoir, near Etna	1965-	SS	9	R	WDA	SW

Table 3.--Sediment 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.

Data frequency:

BM	bimonthly
D	daily (observer)
HL	high and low flow seasonal 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
P	automatic 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 District
R	Riverton

Funding agency:

BLM	Bureau of Land Management
MRB	Geological Survey, support for other Interior Agencies
USGS	Geological Survey, Federal Program
WSE	Wyoming State Engineer
WWDC	Wyoming Water Development Commission

Remarks:

HBM	hydrologic benchmark station
NASQAN	national stream-quality accounting network station
QW	also water-quality station
SW	also streamflow station

Table 3.--Sediment stations

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
		YELLOWSTONE RIVER BASIN					
06228000	Wind River at Riverton	1986-	BM	1,3	R	USGS	NASQAN, SW,QW
06267400	East Fork Nowater Creek near Colter	1986-	S	1	C	WSE	SW
06279500	Bighorn River at Kane	1946-64,	M	1	R	MRB	SW,QW
		1969-	I	2		MRB	
06313000	South Fork Powder River near Kaycee	1949-53,	M	1	C	BLM	QW
		1983-	I	2		BLM	
			HL	4		BLM	
06313400	Salt Creek near Sussex	1976-81,	M	1	C	BLM	SW,QW
		1983-84,	I	2		BLM	
		1986-	HL	4		BLM	
06313500	Powder River near at Sussex	1949-53,	M	1	C	BLM	SW,QW
		1967,	I	2		BLM	
		1976-84,	HL	4		BLM	
		1986-					
06313700	Dead Horse Creek near Buffalo	1986-	S	1	C	WSE	SW
06317000	Powder River at Arvada	1946-57,	M	1	C	BLM	SW,QW
		1967-79,	I	2		BLM	
		1983-84,	HL	4		BLM	
		1986-					
		CHEYENNE RIVER BASIN					
06365300	Dry Fork Cheyenne River near Bill	1977-81,	M	1	C	BLM	SW,QW
		1986-	I	2		BLM	
			HL	4		BLM	

Table 3.--Sediment stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
			CHEYENNE RIVER BASIN--Continued				
06365900	Cheyenne River near Dull Center	1975-81,	M	1	C	BLM	SW,QW
		1986-	I	2		BLM	
			HL	4		BLM	
06376300	Black Thunder Creek near Hampshire	1986-	S	1	C	WSE	SW
06426500	Belle Fourche River below Moorcroft	1947-52,	M	1	C	BLM	SW,QW
		1976-83,	I	2		BLM	
		1986-	HL	4		BLM	
			PLATTE RIVER BASIN				
06623800	Encampment River above Hog Park near Encampment	1964-	Q	1,2,3	C	USGS	HBM,SW, QW
06630000	North Platte River above Seminoe Reservoir, near Sinclair	1986-	BM	1,3	C	USGS	SW,QW
06643500	North Platte River near Goose Egg	1983-84,	M	1	C	BLM	QW
		1986-	I	2		BLM	
			HL	4		BLM	
06646000	Deer Creek in canyon, near Glenrock	1985-	M	1	C	WWDC	SW,QW
			I	2		WWDC	
			GREEN RIVER BASIN				
09209400	Green River near LaBarge	1986-	BM	1,3	R	USGS	NASQAN, SW,QW

Table 3.--Sediment stations--Continued

Station number	Station name	Period of record	Data frequency	Analysis schedule	Field office	Funding agency	Remarks
			GREEN RIVER BASIN--Continued				
09217000	Green River near Green River	1951-	D	1	R	USGS	SW,QW
			I	2		USGS	
			M	1		USGS	
			HML	4		USGS	
09253400	Battle Creek near Encampment	1986-	S	1	C	WWDC	SW
			I	2,4		WWDC	
09255400	East Fork Savery Creek near Encampment	1986-	S	1	C	WWDC	SW
			I	2,4		WWDC	
09255900	Big Sandstone Creek near Savery	1986-	S	1	C	WWDC	SW
			I	2,4		WWDC	
09256000	Savery Creek near Savery	1985-	M	1	C	WWDC	SW,QW
			I	2		WWDC	
			SNAKE RIVER BASIN				
13018300	Cache Creek near Jackson	1968-	--	--	ID	USGS	HBM,SW, QW
13019438	Little Granite Creek at mouth, near Bondurant	1982-	--	--	ID	USGS	SW,QW

Table 4.--Ground-water observation wells

Explanation of abbreviations and codes used in table 4.

Map no.: Sequential number (by county) used to show location of well on figure 5.

Local well no.:

The well-numbering procedure used is based on the Federal system land subdivision. 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-NE 1/4, b-NW 1/4, c-SW 1/4, d-SE 1/4). Well 30-108-05bcd2, for example, is in the SE1/4 of the SW1/4 of the NW1/4 of section 5, Township 30 North, Range 108 West. The number 2 indicates it is the second well in the quarter-quarter-quarter section. Numbers for wells in Fremont County begin with an additional uppercase letter that 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.

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.

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

Geologic source code: The following codes have been retrieved from Water Data Storage and Retrieval System (WATSTORE) of the U.S. Geological Survey and may not follow the current usage of the USGS.

Era	System	Series	Geologic Source Code	Formation name
Cenozoic	Quaternary	Holocene	111ALVM	Alluvium
			111TRRC	Terrace deposits
	Tertiary	Pliocene	121NRPK	North Park Formation[1]
			1210GLL	Ogallala Formation[1]
		Miocene	122ARKR	Arikaree Formation
		Oligocene	123BRUL	Brule Formation
			123WRVR	White River Formation or Group
		Eocene	124WDRV	Wind River Formation
			124WLWD	Willwood Formation
			124WSTC	Wasatch Formation
		Paleocene	125FRRS	Ferris Formation
			125LEBO	Lebo member of Fort Union Formation[2]
Mesozoic	Cretaceous	Upper Cretaceous	211FXHL	Fox Hills Sandstone
		Lower Cretaceous	217LKOT	Lakota Formation
Paleozoic	Permian	Upper Permian	311PRKC	Park City Formation[3]
		Lower Permian	317CSPR	Casper Formation
			317MNLS	Minnelusa Formation[4]
			317TSLP	Tensleep Formation[5]

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

Era	System	Series	Geologic Source Code	Formation name
Paleozoic	Mississippian	Upper Mississipian	331MDSN	Madison Limestone
		Lower Mississipian	337PHSP	Pahasapa Limestone
	Cambrian	Middle Cambrian	374FLTD	Flathead Quartzite or Sandstone

[1] Now designated Miocene by the U.S. Geological Survey
[2] Includes Upper Cretaceous
[3] Includes Lower Permian
[4] Includes Pennsylvanian
[5] Includes Upper and Middle Pennsylvanian

Data frequency:
C continuous (graphic or digital recorder)
M monthly (12 visits per year)

Field office:
C Casper
CH Cheyenne Hydrologic Surveillance Section
P Project Personnel
R Riverton
S Wyoming State Engineer

Funding agency:
SE/PD Wyoming State Engineer with support from Wyoming Economic Development and Stabilization Board
USGS Geological Survey, Federal Program

Local name: Indicates a reference name of the well

Table 4.--Ground-water observation wells

Map no.	Station no.	Local well no.	Period of record	Geo-logic source	Data fre-quency	Field office	Funding agency	Local name
				ALBANY COUNTY				
1	411751105312701	15-073-01dba01	1983-	317CSPR	C	S	SE/PD	Huntoon #1
2	411703105314001	15-073-12dbb01	1983-	317CSPR	C	S	SE/PD	Huntoon #2
				CAMPBELL COUNTY				
1	441117105192901	49-070-31bbb01	1983-	211FXHL	C	S	SE/PD	HE #1
2	441748105323301	50-072-20cab01	1985-	125LEBO	C	S	SE/PD	Dickinson
3	441819105305701	50-072-21aba01	1983-	124WSTC	C	S	SE/PD	Gillette H-13
4	441817105293901	50-072-22dba01	1985-	125LEBO	C	S	SE/PD	S-8
				CARBON COUNTY				
1	411234106424601	14-083-03cab01	1980-	121NRPK	C	C	USGS	Helmer
2	415430106493801	22-084-01bcb01	1983-	111SPBK	C	C	USGS	St. Marys
3	415535106482301	23-083-31bbb01	1984-	125FRRS	C	C	USGS	Medicine Bow #1
4	422338107145001	28-087-16cca01	1981-	122ARKR	C	C	SE/PD	Split Rock
				CONVERSE COUNTY				
1	424420105364201	32-073-16cdb01	1986-	--	C	S	SE/PD	Natural Bridge
2	424520105440501	32-074-08dbc01	1980-	331MDSN	C	C	SE/PD	Barber
3	424555105563801	32-076-03ccd01	1986-	--	C	S	SE/PD	Little Deer Creek
4	425902105210701	35-071-23ccd01	1986-	--	C	S	SE/PD	Pan Eastern
5	431140105151901	37-070-10cbb01	1986-	--	C	S	SE/PD	Bill #6

Table 4.--Ground-water observation wells--continued

Map no.	Station no.	Local well no.	Period of record	Geo-logic source	Data fre-quency	Field office	Funding agency	Local name
				CROOK COUNTY				
1	442540104493501	51-066-06dcb01	1981-	331MDSN	C	S	SE/PD	Madison M-8
2	442734104215001	52-063-25dcd01	1985-	--	M	S	SE/PD	Cole Well 3-A
3	442734104215002	52-063-25dcd02	1985-	--	M	S	SE/PD	Cole Well 3-B
4	443453104425602	53-065-18bbd02	1962-	337PHSP	M	C	SE/PD	Devils Tower
5	444854104534501	56-067-28aab01	1983-	331MDSN	C	S	SE/PD	#41 Madison
6	444854104534502	56-067-28aab02	1983-	331MDSN	C	S	SE/PD	#41 Minnelusa
				FREMONT COUNTY				
1	422632107540501	29-093-36db01	1974-	122ARKR	C	R	SE/PD	Jeffrey City
2	430205108243201	A 1-4-28acc01	1984-	124WDRV	M	R	SE/PD	Brentwood #1
3	430051108240901	A 1-4-33ddb01	1951, 1961-	124WDRV	C	R	SE/PD	Teton S
				GOSHEN COUNTY				
1	413852104115801	19-061-04abc01	1972-	111ALVM	C	S	SE/PD	Sanders
2	413810104102301	19-061-10aab01	1980-	123BRUL	C	S	SE/PD	LaGrange #1
3	414049104074501	20-060-30bbb01	1980-	123BRUL	C	S	SE/PD	LaGrange #2
4	414348104101301	20-061-03dad01	1980-	123WRVR	C	S	SE/PD	LaGrange #3
5	414128104094502	20-061-23bdb02	1978-	123BRUL	C	S	SE/PD	Rain Station
6	414051104100701	20-061-23ccc01	1972-	111ALVM	C	S	SE/PD	Meir
7	422512104135501	28-061-06aba01	1979-	122ARKR	C	S	SE/PD	Goshen #2
8	422519104095101	28-061-02ccd01	1986-	--	C	S	SE/PD	Prairie Center #6
9	422928104121401	29-061-17aad01	1980-	122ARKR	C	S	SE/PD	Prairie Center #4

Table 4.--Ground-water observation wells--continued

Map no.	Station no.	Local well no.	Period of record	Geologic source	Data frequency	Field office	Funding agency	Local name
			GOSHEN COUNTY--Continued					
10	422849104090801	29-061-23abb01	1979-	122ARKR	C	S	SE/PD	Goshen #1
11	422730104094801	29-061-26cbb01	1980-	122ARKR	C	S	SE/PD	Prairie Center #3
12	423549104120901	30-061-09bbb01	1980-	122ARKR	C	S	SE/PD	Prairie Center #5
			HOT SPRINGS COUNTY					
1	434136108183301	43-095-18cba01	1983-	317TSLP	C	R	SE/PD	UTW-1
2	433933108121901	43-095-25cdd01	1983-	311PRKC	C	R	SE/PD	UTW-3
			LARAMIE COUNTY					
1	410059104072401	12-060-07ddd01	1977-	123BRUL	C	S	SE/PD	Laramie #1
2	410100104160301	12-062-13baa01	1975-	111TRRC	C	S	SE/PD	SE Carpenter
3	410111104233102	12-063-15aaa02	1973-	123BRUL	C	S	SE/PD	SW Carpenter
4	410703104071201	13-060-05ccb01	1969-	123BRUL	M	S	SE/PD	Glantz
5	410530104574001	13-068-13ccc01	1942-50, 1969-	1210GLL	C	CH	SE/PD	Borie
6	411238104070801	14-060-05bcb01	1957-	123BRUL	C	S	SE/PD	Gross
7	411131104041801	14-060-10dbb01	1973-	123BRUL	C	S	SE/PD	Pine Bluffs
8	411022104141201	14-061-18ddd01	1977-	123WRVR	C	S	SE/PD	Laramie #2
9	410900104110701	14-061-22dcc01	1975-	123BRUL	C	S	SE/PD	Brown
10	411114104242501	14-063-15aaa01	1977-	122ARKR	C	S	SE/PD	Laramie #3
11	411214104293301	14-064-01dcb01	1977-	1210GLL	C	S	SE/PD	Hollenbeck
12	411005104355001	14-064-19bcc01	1977-	1210GLL	C	S	SE/PD	Laramie #9
13	411147104490501	14-066-07add01	1984-	1210GLL	C	S	SE/PD	Nat'l Land Co. #1

Table 4.--Ground-water observation wells--continued

Map no.	Station no.	Local well no.	Period of record	Geologic source	Data frequency	Field office	Funding agency	Local name
			LARAMIE COUNTY--Continued					
14	411210104452001	14-066-10aba01	1977-	1210GLL	C	S	SE/PD	Laramie #8
15	411213104501401	14-067-12abb01	1984-	1210GLL	C	S	SE/PD	Laramie #10
16	411034104554001	14-067-18ddc01	1956-	1210GLL	C	CH	SE/PD	Bell #14
17	410757104582302	14-068-35ddc02	1969-	1210GLL	C	CH	SE/PD	King #3
18	411531104194701	15-062-20aaa01	1977-	1210GLL	C	S	SE/PD	Laramie #4
19	411725104454601	15-066-10bab01	1977-	1210GLL	C	S	SE/PD	Laramie #7
20	411400104595901	15-068-27ccc01	1984-	1210GLL	C	S	SE/PD	MX West B-7
21	412227104081401	16-060-07bbb02	1975-	1210GLL	C	S	SE/PD	SW of Albin
22	411136104125301	16-061-17aaa01	1977-	1210GLL	C	S	SE/PD	Laramie #5
23	412343104053101	17-060-33cbb01	1975-	1210GLL	C	S	SE/PD	Albin
24	412605104203001	17-062-17ccc01	1982-	1210GLL	C	S	SE/PD	Laramie #6
25	412400104533901	17-067-33baa01	1986-	1210GLL	C	S	SE/PD	MX North B-1
			NIOBRARA COUNTY					
1	424709104194101	32-062-05baa01	1979-	122ARKR	C	S	SE/PD	Niobrara #1
2	424244104202001	32-062-32bbb01	1970-	122ARKR	C	C	USGS	Node
3	424544104260601	32-063-08daa01	1979-	122ARKR	C	S	SE/PD	Niobrara #2
4	430422104183201	36-062-28ab01	1974-	31MDSN	C	C	USGS	ETSI T-2
5	430422104183202	36-062-28ab02	1974-	217LKOT	C	C	SE/PD	ETSI O-2
6	430421104200701	36-062-28bbd01	1983-	317MNLS	C	S	SE/PD	ETSI T-1
7	431321104090001	38-061-35dca01	1983-	317MNLS	C	S	SE/PD	ETSI M-1

Table 4.--Ground-water observation wells--continued

Map no.	Station no.	Local well no.	Period of record	Geologic source	Data frequency	Field office	Funding agency	Local name
			PLATTE COUNTY					
1	420237104532101	24-067-21aab01	1979-	111ALVM	C	S	SE/PD	Preuit
2	420246104590301	24-068-22aab01	1980-	122ARKR	C	S	SE/PD	Platte #1
3	420718104553901	25-067-19dda01	1979-	122ARKR	C	P	SE/PD	Wilhelm
4	420524104530201	25-067-34ccd01	1980-	122ARKR	C	S	SE/PD	Platte #2
5	420859104565001	25-068-12dda01	1980-	122ARKR	C	S	SE/PD	Platte #4
6	420840105000401	25-068-15bbd01	1980-	122ARKR	C	S	SE/PD	Platte #6
7	420748104565051	25-068-24aad01	1980-	122ARKR	C	S	SE/PD	Platte #3
8	420613105024401	25-068-31aaa01	1979-	122ARKR	C	P	SE/PD	Platte #7
9	421443104574601	26-068-12cbd01	1980-	122ARKR	C	S	SE/PD	Rutherford
10	421128104575801	26-068-36bbb01	1981-	122ARKR	C	S	SE/PD	Platte #5
11	421722105042401	27-069-25abc01	1981-	123WRVR	C	S	SE/PD	Cottonwood
			SWEETWATER COUNTY					
1	413228109220801	18-106-16ada01	1981-	124WSTC	C	R	USGS	Oil Shale Green River
2	413850109150601	19-105-10bbb01	1984-	--	C	R	SE/PD	Rock Spgs Golf Course
			WESTON COUNTY					
1	434544104233701	44-063-26cac01	1982-	--	M	S	SE/PD	WSW #1
2	435822104243101	46-063-10cda01	1982-	--	M	S	SE/PD	BHP #3
3	435807104224901	46-063-15add01	1984-	--	M	S	SE/PD	BHP #4
4	435610104433001	46-066-25dbb01	1984-	331MDSN	M	S	SE/PD	Terra
5	440633104364201	47-065-01bab01	1983-	--	M	S	SE/PD	Upton #6
6	440530104381001	48-065-35ccb01	1982-	337PHSP	M	S	SE/PD	Upton #4

Table 5.--Streamflow stations discontinued in water years 1985 and 1986

Table 5.--Streamflow stations discontinued in water years 1985 and 1986

Station number	Station name	Period of record	Other data still being collected
	YELLOWSTONE RIVER BASIN		
06260000	South Fork Owl Creek near Anchor	1932, 1939-43, 1959-85	
06268500	Fifteenmile Creek near Worland	1951-72, 1978-86	
	PLATTE RIVER BASIN		
06643500	North Platte River near Goose Egg	1917-19, 1924, 1950-60, 1983-85	water quality, sediment
06647910	Little Box Elder Spring near Careyhurst	1981-86	
	GREEN RIVER BASIN		
09189550	South Horse Creek near Merna	1982-85	
09190000	Horse Creek near Daniel	1931-54, 1982-85	
09192750	New Fork River above New Fork Lakes	1985	
09196940	Fremont ditch near Pinedale	1985-86	
09196960	Highland ditch near Pinedale	1985-86	
09197000	Pine Creek below Fremont Lake	1910-12, 1915-18, 1985-86	
09217900	Blacks Fork near Robertson	1937-39, 1966-86	
	BEAR RIVER BASIN		
10038000	Bear River below Smiths Fork, near Cokeville	1954-86	

Table 6.--Water-quality stations discontinued in water years 1985 and 1986

Table 6.--Water-quality stations discontinued in water years 1985 and 1986

Station number	Station name	Period of record	Other data still being collected
	YELLOWSTONE RIVER BASIN		
06218500	Wind River near Dubois	1947-50, 1965-86	streamflow
06220500	East Fork Wind River near Dubois	1975-86	streamflow
06253000	Fivemile Creek near Shoshoni	1949-51, 1953, 1965-86	
06260000	South Fork Owl Creek near Anchor	1974-85	
06260400	South Fork Owl Creek below Anchor Reservoir	1974-85	streamflow
06268600	Bighorn River at Worland	1966-86	
06268640	Slick Creek near Worland	1981-86	
06270000	Nowood River near Tensleep	1967-86	streamflow
06274220	Nowood River at Manderson	1965-86	
06279090	Shell Creek near Greybull	1951, 1965-86	
06280300	South Fork Shoshone River near Valley	1985	streamflow
06282000	Shoshone River below Buffalo Bill Reservoir	1947-49, 1964-86	streamflow
	CHEYENNE RIVER BASIN		
06394000	Beaver Creek near Newcastle	1949-53, 1967-86	streamflow
06428500	Belle Fourche River at Wyoming-South Dakota State line	1965-86	
	PLATTE RIVER BASIN		
06620000	North Platte River near Northgate, Colo.	1965-86	streamflow
06625000	Encampment River at mouth, near Encampment	1965-86	streamflow
06642500	Bates Creek near Freeland	1981-86	
06642650	Stinking Creek above Lawn Creek, near Alcova	1982-85	
06643000	Bates Creek near Alcova	1970-86	
06646600	Deer Creek below Millar Wasteway, at Glenrock	1967-86	streamflow

Table 6.--Water-quality stations discontinued in water years 1985 and 1986--Continued

Station number	Station name	Period of record	Other data still being collected
	PLATTE RIVER BASIN--Continued		
06646800	North Platte River near Glenrock	1960-86	streamflow
06647990	Box Elder Creek below Interstate 25, near Careyhurst	1981-86	
06649500	La Prele Creek near Orpha	1981-86	
06650500	Wagonhound Creek near La Bonte	1981-86	
06651500	La Bonte Creek near La Bonte	1981-86	
06656000	North Platte River below Guernsey Reservoir	1950-58, 1965-86	streamflow
06669850	Chugwater Creek near Uva	1984-85	
06670500	Laramie River near Fort Laramie	1965-86	streamflow
	GREEN RIVER BASIN		
09192600	Green River near Big Piney	1967-86	
09205000	New Fork River near Big Piney	1965-86	streamflow
09213705	Big Sandy River below Big Sandy Reservoir	1981-86	
09213800	Big Sandy River at Farson	1981-86	
09215500	Little Sandy Creek at Farson	1981-86	
09224450	Hams Fork near Granger	1965-86	
09253000	Little Snake River near Slater, Colo.	1978-86	
	BEAR RIVER BASIN		
10039500	Bear River at Border	1965-86	streamflow
	SNAKE RIVER BASIN		
13022500	Snake River above reservoir, near Alpine	1965-86	streamflow
13023900	Salt River near Smoot	1981-86	
13025000	Swift Creek near Afton	1981-86	

Table 7.--Sediment stations discontinued in water years 1985 and 1986

Table 7.--Sediment stations discontinued in water years 1985 and 1986

Station number	Station name	Period of record	Other data still being collected
	YELLOWSTONE RIVER BASIN		
06220500	East Fork Wind River near Dubois	1975-86	streamflow
06253000	Fivemile Creek near Shoshoni	1948-75, 1978-85	
06258000	Muddy Creek near Shoshoni	1949-68, 1983-85	
06259000	Wind River below Boysen Reservoir	1979-86	streamflow, water quality
06268500	Fifteenmile Creek near Worland	1949-72, 1979-86	
	PLATTE RIVER BASIN		
06642000	North Platte River near Alcova	1979-86	streamflow, water quality

Table 8.--Ground-water observation wells discontinued
in water years 1985 and 1986

Table 8.--Ground-water observation wells discontinued in water years 1985 and 1986

Station number	Local well number	Period of record	Local name
		CARBON COUNTY	
413148106454801	18-083-17cdb01	1980-85	Tuttle Well
		JOHNSON COUNTY	
440912106512001	48-083-05dcc01	1974-86	Flathead
441112106493502	49-083-27dba02	1974-86	Crazy Woman Canyon
		PARK COUNTY	
442130108425301	51-099-26dd01	1984-86	YU Bench
445638109102501	51-102-03ccd01	1984-86	--

Data-Collection Projects

PROJECT TITLE: Surface-water stations (WY 00-001).

FUNDING AGENCIES: Wyoming State Engineer, Wyoming Attorney General's Office, Wyoming Department of Environmental Quality, Wyoming Water Development Commission, Utah State Engineer, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, Corps of Engineers, Laramie County, Uinta County, City of Cheyenne, and Geological Survey.

PROJECT LEADER: Stanley A. Druse.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: Ongoing.

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 diposal 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 and lakes 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: Computation and compilation of surface-water data for the 1985 water year data report were completed on schedule as was the transmittal of the report for publication. The project operated at about the same level during the 1986 fiscal year as in 1985. Four stations were discontinued and five were activated. The Wyoming State Engineer continued to operate 24 of the stations, most on a seasonal basis, for direct-service credit. Processing of the records was done using the Interim Analog to Digital Recorder and all station manuscripts and other information for the 1985 data report were processed using the computer. Numerous requests for discharge data and statistical summaries were processed.

PLANS FOR FISCAL YEAR 1987: As many as eight streamgaging stations, mainly those operated for other Federal agencies, may be discontinued for the 1987 fiscal year. Two new stations will be added as of October 1, 1986, and four more are proposed. The National Weather Service will assume operation of four data-collection platforms in the Green River basin. Priority will be given to receiving and processing data from 13 data-collection platforms operating within the State. The Wyoming State Engineer will continue to operate 24 gages for direct-service credit.

REPORTS PUBLISHED DURING FISCAL YEARS 1985 AND 1986:

Druse, S.A., and Rucker, S.J., IV, 1985, Water-resources data for Wyoming, water year 1984: U.S. Geological Survey Water-Data Report, WY-84-1, 470 p.

———, 1986, Water-resources data for Wyoming, water year 1985: U.S. Geological Survey Water-Data Report, WY-85-1, 499 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: Hugh I. Kennedy.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: Ongoing.

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 assessment, (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 (a) provide 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 properites, and the stresses to which they are subjected.

PROGRESS AND SIGNIFICANT RESULTS: Records were worked and hydrographs prepared for inclusion in an open-file report of wells in the ground-water-level monitoring network, for the period 1976-1985. The monitoring network during fiscal year 1986 remained at the same level as the previous year. The Wyoming State Engineer received direct-service credit for operation of 61 observation wells.

PLANS FOR FISCAL YEAR 1987: The monitoring network will be evaluated, and some additions and discontinuations are anticipated. The Wyoming State Engineer will continue to operate about the same number of wells for direct-service credit. Plans are to report data from all wells in the State data report, rather than publishing a separate report.

REPORTS PUBLISHED DURING FISCAL YEARS 1985 AND 1986:

Druse, S.A., and Rucker, S.J., IV, 1985, Water-resources data for Wyoming, water year 1984: U.S. Geological Survey Water-Data Report, WY-84-1, 470 p.

———, 1986, Water-resources data for Wyoming, water year 1985: U.S. Geological Survey Water-Data Report, WY-85-1, 499 p.

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

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

PROJECT LEADER: David A. Peterson.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: Ongoing.

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: The water-quality network increased to 174 stations through 1985. Sampling was started to monitor water quality upstream and downstream from uranium-mill tailings near Riverton, monitoring of herbicides was slightly expanded, and salinity and nutrient sampling was initiated at possible water-development sites. Direct-service credit was given to the Wyoming Department of Agriculture for analysis of salinity and nutrient samples collected at stations in their cooperative network.

The water-quality program suffered a severe reduction in June 1986 when funding limitations required a cooperating agency to eliminate their entire program consisting of 65 stations, where monthly salinity and nutrient samples were obtained. A ground-water-quality monitoring network was initiated. Direct-service credit was given the Wyoming Department of Agriculture for analysis of salinity and nutrient samples. The ongoing quality-assurance policies, both national and district, continued to show that field personnel were doing their job very well.

PLANS FOR FISCAL YEAR 1987: Funding will be obtained from other agencies for part of the 65 stations that were discontinued. Sampling will be expanded in the vicinity of the Wind River Indian Reservation. The ground-water-quality monitoring network will be established in a second of three areas of the State. The Wyoming Department of Agriculture Laboratory will continue to process salinity and nutrient samples for direct-service credit.

REPORTS PUBLISHED DURING FISCAL YEARS 1985 AND 1986:

Druse, S.A., and Rucker, S.J., IV, 1985, Water-resources data for Wyoming, water year 1984: U.S. Geological Survey Water-Data Report, WY-84-1, 470 p.

———, 1986, Water-resources data for Wyoming, water year 1985: U.S. Geological Survey Water-Data Report, WY-85-1, 499 p.

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

FUNDING AGENCIES: Wyoming State Engineer, Wyoming Water Development Commission, Bureau of Land Management, Bureau of Reclamation, and Geological Survey.

PROJECT LEADER: Stanley A. Druse.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: Ongoing.

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: Sediment-data collection and processing at 12 gaging stations continued during 1985. Monitoring was discontinued at three of four stations equipped with pumping samplers. One daily-observer station was continued and two were discontinued. The remaining stations were special or infrequent sampling. An initital draft of a report relating peak discharge to total sediment load for a storm event was prepared.

Computation and compilation of sediment data were processed on schedule during 1986 and all data collected as part of the monitoring network were published. Two continuous-record suspended-sediment stations were in operation and intermittent or special samples were obtained at 14 stations. The special-type sampling includes continuous sampling of flood events at three plains stations to establish relations between total load and maximum discharge; and suspended and bed-load sampling at three mountain stations during the snowmelt runoff period. Results from each of the two special-type sampling efforts are encouraging.

PLANS FOR FISCAL YEAR 1987: One continuous-record suspended-sediment station will remain in operation along with 11 stations where intermittent or special-type samples will be collected. One station will be added to the three existing stations to help establish relations of total load to maximum discharge. An open-file report of the suspended and bed-load sampling results from the three mountain stations will be published.

REPORTS PUBLISHED DURING FISCAL YEARS 1985 AND 1986:

Druse, S.A., and Rucker, S.J., IV, 1985, Water-resources data for Wyoming, water year 1984: U.S. Geological Survey Water-Data Report, WY-84-1, 470 p.

———, 1986, Water-resources data for Wyoming, water year 1985: U.S. Geological Survey Water-Data Report, WY-85-1, 499 p.

Water-Resources-Appraisal Projects

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

FUNDING AGENCY: Federal Emergency Management Agency.

PROJECT LEADER: Joel R. Schuetz.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: February 1984 through September 1986.

PROBLEM: The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 provide for the operation of a flood insurance program. The Federal Emergency Management Agency (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.

PROGRESS AND SIGNIFICANT RESULTS: Four "limited detail" flood-insurance studies were completed. Reports for two of the studies: (1) North Platte River at Glenrock, Wyoming, and (2) North Platte River at Orin, Wyoming, received Regional approval and were sent to the Federal Emergency Management Agency. The other two reports: (3) Little Snake River at Baggs, Wyoming, and (4) Tongue River at Ranchester, Wyoming, received Regional approval on October 20, 1986.

STATUS: The project is completed.

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 1989.

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. Some of the available water-use data for Wyoming may be 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.

OBJECTIVES: 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. Personnel with the Wyoming State Engineer's Office will assist with the coding and verification of data on the ground-water permits.

PROGRESS AND SIGNIFICANT RESULTS: Much of the time was spent collecting and compiling data for the 1985 edition of the 5-year circular. Emphasis was on irrigation data, municipal use and supplies, and wastewater-discharge values. Data were compiled by county and by 4-digit Hydrologic Unit Code. A digital Geographic Information System (GIS) was acquired and implemented for processing water-use and related information for the Wind River Indian Reservation. The Wyoming State Engineer collected and processed data for direct-services credit.

PLANS FOR FISCAL YEAR 1987: The 4-digit Hydrologic Unit Code data will be disaggregated to 8-digit data for entry into the National Water Use Data System. Work will begin on the 1987 National Water Summary dealing with water use. Work on the Wind River Indian Reservation GIS will continue.

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 1987.

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 characteritics 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: Hydrologic Atlas 699, "Flood of August 1, 1985, in Cheyenne, Wyoming," was completed and published. The final report summarizing highway program activities, "Floodflow characteristics of Wyoming streams, a compilation of previous investigations," was submitted for colleague review. The draft of the report using historic flood information was completed and submitted for processing. A special hydraulic investigation was done at a bridge site near Afton, Wyoming. The project was extended to September 1987 at the request of the cooperator to provide a more comprehensive analysis of floodflows using historic flood information.

PLANS FOR FISCAL YEAR 1987: The remaining reports will be completed and submitted for Water Resources Division review and approval.

REPORTS PUBLISHED DURING FISCAL YEAR 1986:

Druse, S.A., Cooley, M.E., Green, S.L., and Lowham, H.W., 1986, Flood of August 1, 1985, in Cheyenne, Wyoming: U.S. Geological Survey Hydrologic Investigations Atlas HA 699, 2 sheets.

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; October 1986 through September 1987.

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

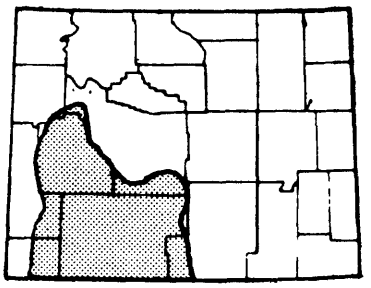
OBJECTIVE: The objective is to define infiltration-rate-curves for soils and other surficial materials and determine the relation between infiltration rates computed from basin studies and those computed from infiltration tests.

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

PROGRESS AND SIGNIFICANT RESULTS: There has been no funding for this project for fiscal years 1983 through 1986. The project received additional funding for fiscal year 1987. Revisions of the final report were started, in response to colleague reviews.

PLANS FOR FISCAL YEAR 1987: Extensive revisions of the final report will be completed, in response to previous technical reviews. The report will be submitted for Water Resources Division review and approval.

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 1987.

PROBLEM: Ground-water supplies are needed to augment surface-water supplies for mineral development in the Green River basin of Wyoming. The regional availability and quality of supply, hydrologic consequences of development and subsequent disposal of waste water need to be investigated. Overall 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 the 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. Current and historical ground-water-use data will be collected.

PROGRESS AND SIGNIFICANT RESULTS: All five of the final reports have been completed and are in various stages of technical review. A report describing water-quality characteristics of Tertiary-age aquifers is complete. The report identifies areas of recharge, discharge, and interaquifer leakage with the aid of water-quality data. A five-layer model of ground-water flow in the study area has been completed. The model is regional in scope but sufficiently detailed to show relationships between local-scale and regional-scale flow paths. A water budget was developed prior to modeling. Funding to finish processing of the final reports during fiscal year 1987 has been authorized, so the project was extended to September 1987.

PLANS FOR FISCAL YEAR 1987: Technical reviews will be completed on all reports and they will be submitted for approval.

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 1987.

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.

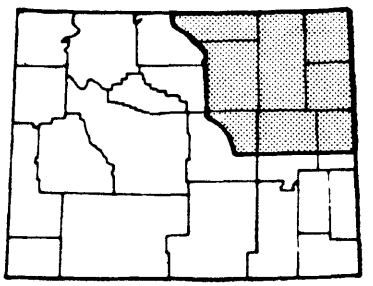
OBJECTIVE: The objective is to describe how the fluvial systems function in energy-mineral areas and how these systems can be expected to respond to various activities related to development of the resources. In particular, information will be presented for dealing with (1) crossing of streams by pipelines and roads, (2) disturbance of areas by test holes for oil and gas, (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: A literature search was made to summarize knowledge applicable to channel formation and drainage development. Field inspections were made of reconstructed channels to determine problems in design. Quantitative relations were developed to assist in the planning and design of reconstructed channels.

PLANS FOR FISCAL YEAR 1987: The final report will be completed and submitted for Water Resources Division review and approval.

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 1986.

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 basic hydrologic data needed for scientific, engineering, and management purposes.

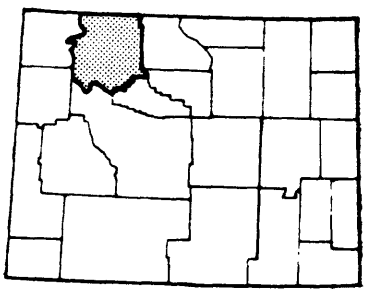
OBJECTIVE: The objective is to assess the existing observation-well program and recommend changes that will make the program responsive to present and future needs for water-level data. The procedures developed in this project may be applied to subsequent evaluations of the observation-well program in 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: A plan for establishing observation wells was developed for the Powder River basin area. The report lists nine steps to follow for establishing observation wells. The plan used for the Powder River basin area could also be used to help design a statewide observation network. Ground-water data collected from observation wells in the Powder River basin area are included in the report in a format that could serve as an example for future ground-water reports for Wyoming.

STATUS: The two reports originally planned are combined into one report and will be submitted for Water Resources Division review and approval.

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



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Marlin E. Lowry (retired).

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 outdoor recreation. 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.

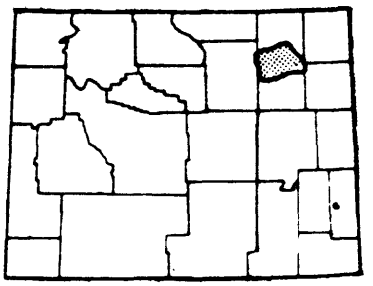
OBJECTIVE: The objectives are to (1) assess the hydrology of the terrace and flood-plain deposits, (2) determine the water quality of the Madison Limestone as a potential municipal supply, and (3) improve overall information on the hydrology of the area in anticipation of future needs.

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 the Ground Water Site Inventory data base. 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 inventory will be made and potentiometric maps will be drawn for the principal aquifers. Water samples will be obtained from wells tapping the Madison Limestone.

PROGRESS AND SIGNIFICANT RESULTS: Field work was completed and the final report was completed and submitted for technical review. Radiochemicals in several water supplies became a concern with the cooperator, and a special intensive sampling effort was made to identify the problem areas in the Madison Limestone. It was determined that several local areas have significant concentrations of Radium 226. Pesticide concentrations in shallow ground waters of agriculture areas also appear to be a problem.

STATUS: The final report will be given technical review, revised, and submitted for Water Resources Division review and approval.

PROJECT TITLE: Effects of population growth and coal mining activity on the hydrologic system near Gillette, Wyoming (WY 85-082).



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: October 1984 through September 1986.

PROBLEM: Local water users near Gillette, Wyoming have complained that pumping of deep wells affects water levels in shallow aquifers. Water administrators need verification of the declines and identification of stratigraphic zones in which declines are occurring.

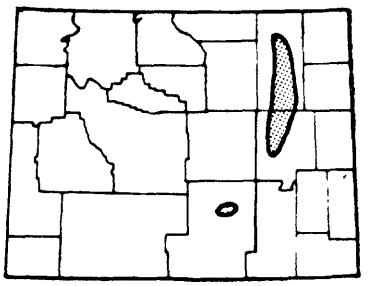
OBJECTIVE: The principal objective of this study is to test and improve concepts of ground-water flow on the Powder River structural basin by investigating the effects of pumping in a relatively small area. Specific objectives are (1) determine if ground-water pumping near Gillette, Wyoming has caused significant water-level declines; (2) if declines have occurred, attempt to relate wells, showing declines, to pumping wells stratigraphically and areally; and (3) attempt to evaluate the relative importance of local variations in aquifer properties, water levels, and other hydrologic characteristics to regional flow patterns.

APPROACH: This project is planned for two phases. Phase 1 will be a reconnaissance to verify if there are declining water levels and if so, determine where the declines are occurring. Phase 1 will include field work to inventory wells and measure water levels. Data collected during Phase 1 will be evaluated to determine the adequacy of this information for additional detailed study that would be done during Phase 2. After Phase 1 is completed, a new plan and cost estimate will be prepared for work recommended for Phase 2.

PROGRESS AND SIGNIFICANT RESULTS: The inventory has been completed of representative wells producing water from the Fort Union Formation. An observation-well system has been established to monitor ground-water levels in the Fort Union. The average age of the observation wells is about 7 years and most of the well records indicate a water-level decline of more than 100 feet. Work has been started on the analysis of water-level data and on a map of the potentiometric surface.

STATUS: The final report will be submitted for Water Resources Division review and approval.

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



FUNDING AGENCIES: Bureau of Land Management and Geological Survey.

PROJECT LEADER: L. Rodney Larson.

FIELD LOCATION: Campbell, Converse and Carbon counties, Wyoming.

PERIOD OF PROJECT: February 1984 through September 1986.

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 amount of 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.

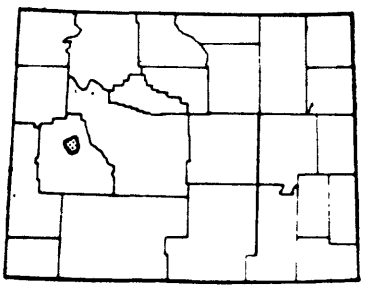
APPROACH: Mine permits on file with the Wyoming Department of Environmental Quality (DEQ) will be reviewed to determine the available data for each of the three mine sites. A visit to each of the mines will follow in order to supplement the data obtained from DEQ and to determine the predominate flow 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 types of reclamation.

PROGRESS AND SIGNIFICANT RESULTS: The two final reports were completed. Colleague review of the report on ground-water and coal-spoil chemical data from two mines sites was completed.

STATUS: The final reports will be given technical review, and will be submitted for Water Resources Division review and approval.

PROJECT TITLE: A comprehensive study of two dilute-solution lakes in western Wyoming (WY 85-086).



FUNDING AGENCIES: Sublette County and Geological Survey.

PROJECT LEADER: David A. Peterson.

FIELD LOCATION: West-central Wyoming.

PERIOD OF PROJECT: October 1984 through September 1988.

PROBLEM: Dilute-solution lakes in southwestern Wyoming are susceptible to a variety of influences, such as lake-shore development, water-level manipulation, and acid precipitation. Acid precipitation is of particular concern because of existing and planned sources of acidic emissions upwind of the lakes, such as natural gas sweetening plants. Too little information of the type necessary to predict the impacts of these influences is available.

OBJECTIVE: The objectives are to (1) describe the physical, chemical, and biological composition of Fremont and New Fork Lakes; (2) determine the lakes' inorganic and organic chemical composition and attempt to describe their influence on the biological community; (3) compare the physical, chemical, and biological composition of inlet water with outlet water; (4) determine the sorption of materials on sediments, especially as a source or sink of nutrients to plants; (5) predict responses to man-caused changes in the lake environment; and (6) describe transfer value of these data to lakes with similar characteristics.

APPROACH: Profiles of water temperature, dissolved oxygen, pH, and specific conductance with depth in the lakes will be made six to eight times per year. Chemical analyses from several dates, depths, and stations in the lakes, as well as in the inflow and outflow streams, will include principal ions, dissolved solids, nutrients, trace metals, and organic compounds such as hydrophobic, humic, and fulvic acids, and amino acids and sugars. Samples of phytoplankton, chlorophylls, zooplankton, and benthic invertebrates will be collected for several dates, depths, and stations. Sediments will be subjected to organic extraction analyses. Rain quantity and quality and snow quality will be sampled.

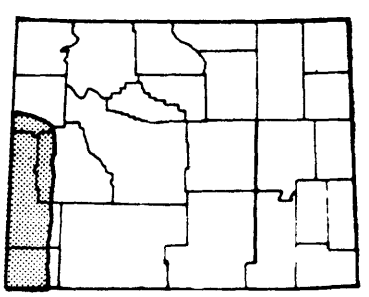
PROGRESS AND SIGNIFICANT RESULTS: The report "Water quality of Fremont Lake and New Fork Lakes, western Wyoming--a progress report," was approved as Water-Resources Investigations Report 86-4016. Field work continued, with emphasis on the diel and seasonal fluctuations in the water quality of Pine Creek upstream from Fremont Lake. The initial cooperator, the Wyoming Water Development Commission, suspended funding for the project. Another cooperator, Sublette County, is providing funds to complete the project. The period of study as been extended to compensate for a decreased annual budget.

PLANS FOR FISCAL YEAR 1987: Measurements and sampling of water quality in Pine Creek upstream from Fremont Lake will be continued, with special emphasis on diel and seasonal fluctuations of dissolved constituents.

REPORTS PUBLISHED DURING FISCAL YEAR 1987:

Peterson, D.A, Averett, R.C., and Mora, K.L., 1987, Water quality of Fremont Lake and New Fork Lakes, western Wyoming--a progress report: U.S. Geological Survey Water Resources Investigations Report 86-4016, 55 p.

PROJECT TITLE: Ground-water resources in the Overthrust area, Wyoming (WY 85-087).



FUNDING AGENCIES: Wyoming State Engineer and Geological Survey.

PROJECT LEADER: M. L. Maderak.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: October 1984 through September 1987.

PROBLEM: The overthrust area of Wyoming is rich in mineral resources, including coal, oil and gas, and phosphate. Aggressive development of these resources is occurring now with much greater development planned for the future. Due to the accelerated development, the potential for adverse impacts on ground-water resources is high; however, the lack of baseline information makes it difficult to assess the magnitude of adverse impacts.

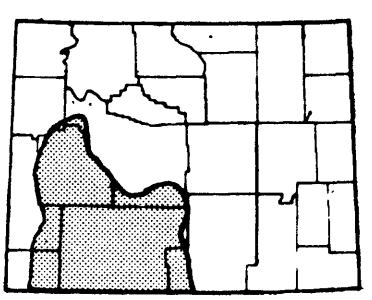
OBJECTIVE: The two principal objectives of the study are to gather sufficient hydrologic information to define the ground-water system in the area and to gather information on the types and locations of existing and planned minerals development in the area. Baseline conditions will be defined and the potential impacts on the ground-water system will be identified.

APPROACH: Collection of baseline hydrologic and water-quality data will be the major emphasis of this project. Water-quality data will be collected from all aquifers that will be affected by development in the Overthrust area. Once sufficient premining water-quality data have been collected and compiled from the aquifers within the Overthrust area, interpretation of the water-quality data will be made. The first step in data interpretation will consist of basic statistical analysis to define intra- and interformational chemical variance, data ranges, and significant subpopulations.

PROGRESS AND SIGNIFICANT RESULTS: Most of the field work was completed, except for the collection of herbicide samples in the Farson Irrigation District and collection of a few additional samples in areas of high fluoride concentrations. Base map and maps showing dissolved-solid concentrations by aquifer were prepared. At the request of the cooperator, the project study area was modified to include an additional area with water-quality problems. The study period was extended so additional water samples could be included in the analysis.

PLANS FOR FISCAL YEAR 1987: One or two herbicide samples will be collected this fall in the Farson irrigation area. A few additional samples also will be taken to determine the extent of the high fluoride concentration. The final report will be completed and submitted for review.

PROJECT TITLE: Summary of hydrologic studies pertaining to oil shale in Wyoming (WY 85-088).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: James F. Wilson, Jr.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: January 1985 to September 1986.

PROBLEM: The response of the U.S. Geological Survey to the national energy crisis of the mid-1970's included a program of water-resources investigations and hyrologic research related to oil shale in Colorado, Utah, and Wyoming. The program ended in 1985. Results of the program are described in numerous scientific reports. A comprehensive summary of the oil-shale program is needed. The summary will serve as documentation of what was done, the principal findings, and problems identified for additional study, should interest in oil-shale hydrology be revived in the future.

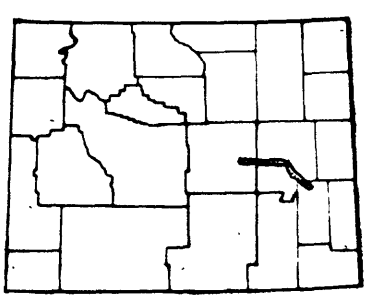
OBJECTIVE: The objective is to summarize the accomplishments and findings of the Wyoming part of the Geological Survey's oil-shale hydrology program, 1974-85. The Wyoming summary will be combined with those for Colorado and Utah as a U.S. Geological Survey Professional Paper.

APPROACH: Principal topics in the report include summary of hydrologic studies, physical setting, water resources, and water for oil-shale development. The Utah District will prepare the introductory sections and will merge the summaries for the three states into the final report. The summary for Wyoming will be drawn chiefly from the reports prepared for previous oil-shale hydrology projects: WY-030, Water and its relation to economic development in the Green River and Great Divide basins in Wyoming; WY-059, Hydrologic investigation of the in situ oil-shale retort area near White Mountain, southwestern Wyoming; and CR-181, Sorption of residual organic substances in retort waters by spent oil-shale residues. Infomation needed to describe the physical setting and water resources will be drawn from reports from coal-hydrology and other projects.

PROGRESS AND SIGNIFICANT RESULTS: A second draft of the Wyoming section of the final report was prepared and transferred to the senior author in the Utah District. The Wyoming, Utah, and Colorado sections were combined, edited, and submitted for technical review. The report was revised extensively in response to reviews and retyped, in preparation for Water Resources Division review. The Utah District submitted the final report for Water Resources Division review and approval during September 1986.

STATUS: The project is complete.

PROJECT TITLE: Reaeration coefficients and traveltime for major rivers in Wyoming (WY 85-090).



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

PROJECT LEADER: James G. Rankl.

FIELD LOCATION: Northwestern, southeastern, and southwestern Wyoming.

PERIOD OF PROJECT: March 1985 through September 1988 (suspended January 1, 1986; re-activated 1987).

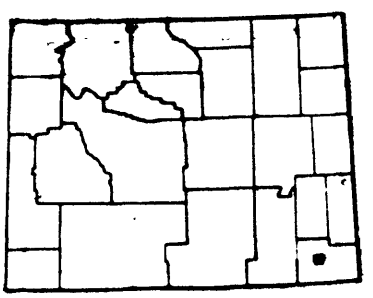
PROBLEM: The water quality of major rivers in Wyoming is being impacted by discharge of wastewater by industry and municipalities, and by return flow from irrigation. The Wyoming Department of Environmental Quality, Water Quality Division, requires information on reaeration for management activities relative to discharge requirements for municipalities and industries. In addition, information is needed for predicting the downstream dispersion of hazardous material spills and non-point source pollutants such as sediment and nutrients.

OBJECTIVE: The objectives are to (1) determine reaeration coefficients for reaches of major rivers in Wyoming, which can be used to quantify the process of reaeration by which the stream replaces the dissolved oxygen consumed by organic waste; and (2) determine traveltime and dispersion of solutes.

APPROACH: Propane will be injected into the stream by bubbling the gas through a porous tube diffuser like those used for aeration in waste-water treatment plants. A solution of rhodamine dye and water will be injected at the same injection point. Eight sites on four rivers have been selected for reaeration studies. At a minimum, each site will require measurements at two cross sections. Twenty gas-water samples will be needed at each cross section to define the gas concentration curve. Traveltime measurements will be made at high and low flows on the North Platte River, the Bear River, and the Shoshone River.

STATUS: High-flow travel-time measurements for the North Platte River between Casper and Glendo Reservoir were completed. Half of the manpower for the time-of-travel measurements was provided by the Wyoming Department of Environmental Quality. Low-flow travel-time measurements were made on the North Platte River between Casper, and Orin, Wyoming. Propane gas was injected into North Platte River at Casper and the river was sampled for propane gas at three sites downstream from the point of injection. Travel-time data were compiled and reaeration coefficients were computed. Work was suspended indefinitely due to lack of funding during 1986; a small amount of funding was obtained for 1987 to complete the report on the North Platte River. Future work is uncertain.

PROJECT TITLE: Geohydrology of the High Plains Aquifer, Cheyenne, Wyoming (WY 85-091).



FUNDING AGENCIES: Wyoming State Engineer, City of Cheyenne, and Geological Survey.

PROJECT LEADER: Marvin A. Crist.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: May 1985 through September 1987.

PROBLEM: The study area includes about 380 square miles of High Plains aquifer near Cheyenne, Wyoming. There is concern about declining ground-water levels in some parts of the study area where rural development has occurred. There is no published information that describes the local lithology in detail or the relationship of lithology to ground-water levels for the proposed study area. A better understanding of the local geohydrology would be helpful in describing the operation of the regional hydrologic system.

OBJECTIVE: The principal objective is to describe in detail the geohydrology of the High Plains aquifer in the Cheyenne, Wyoming area. Specific objectives are to (1) characterize the deposition of shallow deposits making up the Ogallala Formation, (2) interpret the effect of these characteristics on recharge and discharge of ground water, and (3) attempt to define areas of related hydraulic head so the different potentiometric surfaces could be mapped.

APPROACH: Existing geologic and hydrologic data will be compiled during the first year of the project. If there are insufficient data, a test-drilling program will be implemented in the second year for information for the geologic and potentiometric-surface maps. A report will be prepared that includes a detailed map of the surficial deposits and, where possible, any extensive layers of clay, sand, or gravel. The shallow water table will be mapped in addition to other potentiometric surfaces that can be identified.

PROGRESS AND SIGNIFICANT RESULTS: Field work was completed for mapping surficial geology, and drafting of the final geologic maps was nearly completed for about 35 square miles. Work continued on the potentiometric-surface map. The study area was reduced to about 45 square miles because of a lack of reliable water-level data. Preparation of the report was started.

PLANS FOR FISCAL YEAR 1987: All geologic mapping will be completed. The geologic map will be released to the open files. The final report, a Hydrologic Investigations Atlas, will be completed and submitted for technical review and approval.

PROJECT TITLE: Streamflow characteristics of Wyoming rivers and streams, through 1984 (WY 85-092 and WY 85-093).

FUNDING AGENCIES: Bureau of Reclamation, Bureau of Land Management, and Wyoming Water Development Commission.

PROJECT LEADER: David A. Peterson.

FIELD LOCATION: Statewide.

PERIOD OF PROJECT: June 1985 through September 1986.

PROBLEM: Planning for the development and management of Wyoming's surface-water resources requires knowledge of the expected streamflow characteristics of the rivers and streams within the State. A detailed compilation of the streamflow characteristics of Wyoming's surface-water resources is not currently available.

OBJECTIVE: The objective is to present statistical data compiled from existing streamflow records in Wyoming. The statistical analysis of the streamflow data will consist of monthly and annual mean discharge; magnitude and probability of instantaneous peak flow, annual low-flow, and annual high-flow; and flow duration of daily mean flow.

APPROACH: Streamflow records are available for approximately 510 stream-gaging stations in Wyoming. Approximately 300 of these stations have sufficient record to compile statistical information. A statistical analysis of the data will result in determination of the monthly and annual mean discharge, magnitude and probability of instantaneous peak streamflow, low-flow frequency, high-flow frequency, and flow duration for each streamflow-gaging station. The statistical data will be tabulated. Statistics for monthly mean discharge, instantaneous peak-flow frequency, and flow duration will be presented graphically.

PROGRESS AND SIGNIFICANT RESULTS: Stations were selected and data analysis, tabulation, and graphing were completed. The two final reports were completed and received intra-district review and colleague review. In January 1987, both reports were approved for publication.

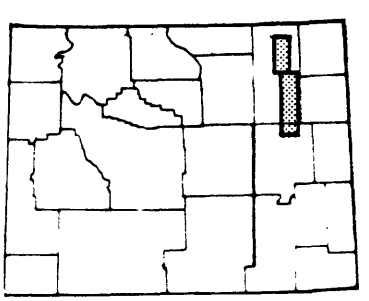
STATUS: The projects are completed.

REPORTS COMPLETED DURING FISCAL YEAR 1987:

Peterson, D.A., in press, Streamflow characteristics of the Missouri River basin, Wyoming, through 1984: U.S. Geological Survey Water Resources Investigations Report 87-4018.

Peterson, D.A., in press, Streamflow characteristics of the Green, Bear, and Snake River basins, Wyoming, through 1984: U.S. Geological Survey Water Resources Investigations Report 87-4022.

PROJECT TITLE: The occurrence, mobility, and geochemical controls effecting selenium concentrations in ground waters and associated rocks disturbed by mining, Powder River basin, Wyoming (WY 86-094).



FUNDING AGENCY: Geological Survey.

PROJECT LEADER: David L. Naftz.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: February 1986 through February 1988.

PROBLEM: Recent mining for coal and uranium in the Powder River basin of Wyoming has increased the selenium concentrations above baseline levels in some ground water from Tertiary-age aquifers. Ground water from these shallow aquifers is frequently utilized for domestic and livestock uses. Present and future development of coal and uranium resources in the area has the potential to degrade ground water beyond the Class III Use Suitability for livestock.

OBJECTIVE: The objectives are to (1) characterize the pre-mining selenium in ground water at each of two selected mine sites, (2) characterize the occurrence of selenium in lithologic materials at each mine site, (3) determine the effects of mining on selenium mobility in post-production water, and (4) investigate the geochemical controls on selenium concentration in post-development ground water.

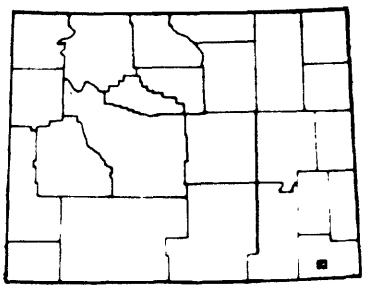
APPROACH: Selenium and other constituents will be analyzed in the pre-mining ground water in close proximity to post-development ground water at three selected mine sites. The post-development ground water will also be analyzed. Weathered and unweathered overburden samples will be obtained and analyzed by a variety of techniques, including mineralogical analyses, sulfur and carbon form analyses, and sequential extraction methods. Results gained from the overburden analyses and ground-water analyses of pre- and post-development water will be used to investigate geochemical controls on the selenium concentration.

PROGRESS AND SIGNIFICANT RESULTS: Drill cores and chip samples were obtained from three mines for the selenium study. Arrangements for solid-phase analyses were made with the Geologic Division and a university researcher. Ground-water samples at two mines were collected and are currently being analyzed.

A Geographic Information System data base was established for the cumulative-impacts analysis. Coal-lease areas and areas projected for disturbance by coal mining were digitized. Data from the State Engineer's Office for approximately 7,000 water wells in the study area were entered into a data base. Statistical analyses of 700 aquifer tests in the study area were completed.

PLANS FOR FISCAL YEAR 1987: The solid-phase analyses will be completed on the core and chip samples for the selenium study. Additional ground-water samples will be collected. Data interpretation will begin. Cumulative impacts of surface mining on ground-water levels will be assessed for the cumulative-impacts analysis. Potential impacts on ground-water users will be addressed. Landscape stability of reclaimed topography will be assessed. Investigation of impact of surface mining on surface-water quality and quantity will be conducted.

PROJECT TITLE: Organic and inorganic contaminants in the shallow aquifer at Francis E. Warren Air Force Base, Wyoming (WY 86-095).



FUNDING AGENCY: U.S. Air Force.

PROJECT LEADER: L. Rodney Larson.

FIELD LOCATION: Southeastern Wyoming.

PERIOD OF PROJECT: December 1985 through September 1988.

PROBLEM: Trichloroethylene (TCE) leakage from a storage vessel was detected in October 1982 at Francis E. Warren Air Force Base. The Base is adjacent to the city of Cheyenne, Wyoming. In response, soil from around the contaminated area was excavated, and a ground-water monitoring program was initiated. Samples collected at some of the wells drilled near the TCE spill site contain concentrations of TCE up to 1,200 micrograms per liter. Additional organic contaminants were also indentified.

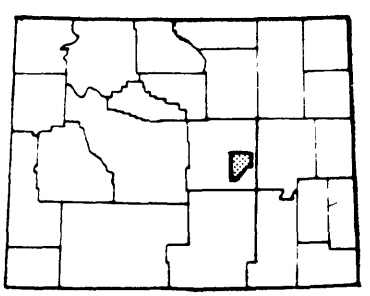
OBJECTIVE: The objectives are to (1) identify the presence and concentrations of organic contaminants in the shallow aquifer underlying the Base, (2) determine if organic contaminants are entering Crow Creek, a perennial stream that flows through the Base and the city of Cheyenne, and (3) determine the effects of sampling material (PVC, Teflon, stainless steel, glass) and methods (bailer and various types of pumps) on sample concentrations.

APPROACH: Twenty-seven wells will be sampled for purgeable organics. Ten of these will be selected for a Gas Chromatography/Mass Spectrometry (GC/MS) scan and inorganic analysis. One well will be sampled and analyzed for polychlorinated byphenyls (PCB's), herbicides, and pesticides. Consultation will be made with experts in organic chemistry from the U.S. Geological Survey Central Region Research Group and Laboratory. The results, including data on the effects of sampling device and material, will be presented in maps and tables of a final report.

PROGRESS AND SIGNIFICANT RESULTS: Field work was completed. Samples for volatiles were collected twice at 30 ground-water and three surface-water sites. Twenty-six samples were collected for gas-chromatography/mass spectrometry (GC/MS), trace-metal, and salinity analyses. Two samples were collected for pesticides. The final report on the work to date is in preparation.

PLANS FOR FISCAL YEAR 1987: The project will be extended two years to include extensive new work under the U.S. Air Force Installation Restoration Program (IRP). The Air Force has identified 17 sites at Warren Air Force Base to be investigated in an IRP. The sites include landfill areas that were used for disposal of residential refuse and shop waste, and sites where organic solvents and (or) gasoline were spilled. A site-safety plan will be prepared, and followed throughout the study. The work will consist of (1) site characterization to determine and quantify the presence or absence of contamination, and (2) remedial-action planning. For site characterization, extensive drilling will be done to delineate the potentiometric surface of shallow ground water, to detemrine the associated lithology, and to construct observation wells for monitoring water levels and for collecting water samples. Surface geophysical techniques will be used to help delineate landfills. Soil samples will be obtained from shallow borings, soil-gas and water-quality analyses will be performed. Preparation of a final report on site characterization will be started. Remedial-action planning will be started, with engineering assistance from the U.S. Bureau of Reclamation.

PROJECT TITLE: Water-quality field screening of irrigation drainage from the Kendrick Project near Casper, Wyoming (WY 86-096).



FUNDING AGENCY: Office of the Secretary of the Interior.

PROJECT LEADER: David A. Peterson.

FIELD LOCATION: Central Wyoming.

PERIOD OF PROJECT: January 1986 through September 1987.

PROBLEM: The Department of the Interior needs to identify and address any present or potential irrigation-drainage contamination problems associated with Interior Department irrigation projects, wildlife refuges, or other management areas that receive water from projects funded by the Department. The Department is conducting a nationwide review of water quality of irrigation drainage and the potential of the drainage waters to cause harmful effects on human health or on fish and wildlife. The Bureau of Reclamation's Kendrick Project in central Wyoming is one of the 19 areas that have been identified for further study.

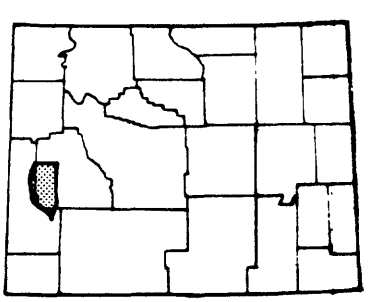
OBJECTIVE: The objective is to determine if irrigation-drainage waters from the Kendrick Project have potential to cause harmful effects on human health, fish and wildlife, or other water uses.

APPROACH: An interagency study team has been formed. The Geological Survey and Bureau of Reclamation will collect two sets of water samples and one set of bottom-material samples at approximately 12 surface-water sites. Also, five wells and the finished water from the city of Casper's treatment plant will be sampled. The samples will be analyzed for a prescribed suite of trace elements and pesticides. The Fish And Wildlife Service will do biological sampling on plants, plankton, invertebrates, fish, birds, and bird eggs. Tissue samples will be analyzed for a prescribed suite of chemical parameters. The Wyoming Game and Fish Department will be consulted on game and fish populations and related matters. The study team will prepare a final report that summarizes and assesses the data collected.

PROGRESS AND SIGNIFICANT RESULTS: The Department of Interior developed a plan to be used to screen the Kendrick Project near Casper, Wyoming, for pptential harm to health or wildlife due to pollutants being returned to streams by irrigation returns. Samples of water and (or) bottom materials were collected at nine streams and lakes and five wells. Samples of fish, birds, invertebrates, zooplankton, and algae were collected at various sites on the streams, ponds, and seeps. All samples are to be analyzed for harmful trace elements. Selected samples will be analyzed for pesticides and herbicides.

PLANS FOR FISCAL YEAR 1987: Water samples will be collected in October 1986 for trace elements. Data will be analyzed and the final screening report written.

PROJECT TITLE: Hydrogeology of the Riley Ridge-LaBarge area, southwestern Wyoming (WY 86-097).



FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: Lawrence J. Martin.

FIELD LOCATION: Southwestern Wyoming.

PERIOD OF PROJECT: June 1986 through September 1987.

PROBLEM: Extensive development of oil and gas fields in southwest Wyoming has occurred in recent years. Detailed hydrogeologic studies of the area never have been conducted to determine the extent, thickness, or water quality of aquifers in the area. This information is needed by the Bureau of Land Management to develop a consistent plan for protection of the freshwater resource and to develop a monitoring plan to evaluate the effect of oil and gas development on ground-water resources in the area.

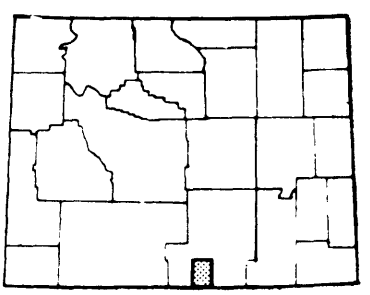
OBJECTIVE: The objective is to define the ground-water resources of the Riley Ridge-LaBarge area. Aquifers and confining units in the area will be identified, described, and mapped. This study will improve the overall understanding of the hydrologic system in the Green River basin. The scope of the study will be limited to aquifers which yield water having dissolved-solids concentrations of less than 5,000 milligrams per liter.

APPROACH: Data from water-well records at the State Engineer's Office and oil- and gas-well records at the Rock Springs Bureau of Land Management office will be compiled and used to produce maps and cross sections showing potentiometric surfaces, thickness of aquifers, structure contours, and recharge/discharge areas. Descriptions of aquifers in the study area will be made, including lithology, rates of ground-water movement, and aquifer transmissivity.

PROGRESS AND SIGNIFICANT RESULTS: Maps were prepared for surface geology, potentiometric surface of water-table aquifer, thickness of Wasatch and Fort Union Formations, and structure contours of base of Tertiary formations. Water-quality sampling was started.

PLANS FOR FISCAL YEAR 1987: Water-quality sampling will be completed. The final report will be completed, reviewed technically, and submitted for Water Resources Division review and approval.

PROJECT TITLE: Assessment of selenium concentrations in soils, sediments, and water; Sandstone Reservoir Project, Carbon County, Wyoming (WY 86-098).



FUNDING AGENCY: Wyoming Water Development Commission and Geological Survey.

PROJECT LEADER: David L. Naftz.

FIELD LOCATION: South-central Wyoming.

PERIOD OF PROJECT: June 1986 through September 1987.

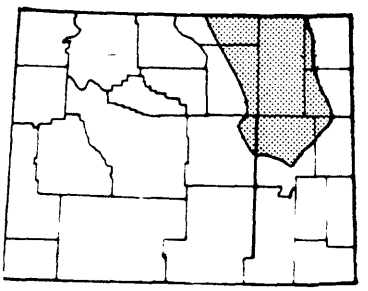
PROBLEM: The proposed Sandstone Reservoir Project located in the Sierra Madre Mountains near Baggs, Wyoming, will flood soils and sediments possibly containing high concentrations of selenium. The Steele Shale and the Haystack Member of the Mesa Verde Group, as well as alluvial and landslide deposits derived from these formations, are present in the proposed reservoir area. Flooding of the seleniferrous soils by the construction of Sandstone Reservoir could increase the selenium concentrations in the reservoir waters by dissolution, desorption, and oxidation of selenium-bearing materials.

OBJECTIVE: The objectives are to (1) determine the baseline selenium concentrations in the surface and ground water, (2) determine the baseline concentration of total selenium in soils and bedrock materials, and (3) determine the probable chemical form(s) of selenium in selected soil and bedrock samples within the area to be flooded by the proposed Sandstone Reservoir. If the occurrence and availability of selenium is determined to be significant, a second-phase study will be designed and proposed to estimate effects of the reservoir on selenium concentrations in the water.

APPROACH: Baseline selenium concentrations will be measured for surface and ground waters, soils, rocks, and vegetation in the vicinity of the proposed Sandstone Reservoir. Areas containing seleniferrous plants will be utilized as one criterion for selecting sites where soil and bedrock samples will be obtained. Maps will be prepared that show the surface geology, areas of seleniferrous vegetation, sample-site locations, and concentration of selenium at each of the sites. Selected soil and bedrock samples will undergo a series of sequential extractions to determine the chemical form(s) of the selenium.

PROGRESS AND SIGNIFICANT RESULTS: Forty-five soil samples were collected and analyzed for selenium content from the areas that will be flooded by the Sandstone Reservoir. Seven soil samples with elevated selenium content are currently undergoing a sequential-extraction analysis. Forty-five rock samples from the Cretaceous- and Tertiary-age rocks in the study area were submitted for analysis of total selenium content. Five surface-water samples, nine ground-water samples, and three water samples from irrigation return flow were collected and analyzed for selenium and selected trace-element concentrations. Also completed were compilation and maps of the results of previous studies addressing the selenium and trace-element content within the rocks, sediments, and water of the study area. Areas of seleniferrous vegetation within the study area were mapped and analyses of the selenium content from seleniferrous plants were completed by an outside contractor.

PLANS FOR FISCAL YEAR 1987: Seven rock and (or) soil samples with elevated selenium concentrations, as determined by the previous selenium analytical work, will be analyzed for an additional 40 trace elements using inductively coupled plasma atomic emmission spectrometry (ICP-AES). Interpretation and mapping of the data will be completed. Completion of additional geologic mapping within and adjacent to the proposed reservoir site will be completed by the Geologic Division. The final report will be completed and submitted for technical review.



PROJECT TITLE: Summary and assessment of investigations for evaluating the effects of coal development on ground-water resources in the Powder River basin, northeastern Wyoming (WY 86-099).

FUNDING AGENCY: Bureau of Land Management.

PROJECT LEADER: James F. Wilson, Jr.

FIELD LOCATION: Northeastern Wyoming.

PERIOD OF PROJECT: May 1986 through September 1987.

PROBLEM: Ground-water resources in the Powder River basin have been investigated for several decades; however, existing information about flow and water-quality systems is inadequate to enable responsible organizations to plan or evaluate the effects of surface mining of coal on ground water. Additional studies of both regional and local hydrologic systems are needed. As a basis for planning future investigations, the Geological Survey, Bureau of Land Management, and other agencies need a report that summarizes what is known about ground water in the area and what investigations are needed to address deficiencies of knowledge.

OBJECTIVE: The objectives are to (1) prepare a report that summarizes principal results of previous ground-water investigations in the Powder River basin of Wyoming, and (2) identify critical deficiencies in understanding of the flow and water-quality systems, and identify studies needed to address the deficiencies.

APPROACH: Published reports of the Geological Survey and other organizations and Geological Survey reports in review will be reviewed and the principal findings summarized. Shortcomings of the findings of the reports will be assessed, and new investigations will be identified that would help eliminate the deficiencies. Hydrologists of other Federal agencies, State agencies, the University of Wyoming, and mining companies will be consulted on the assessment of needs. Local and cumulative effects of coal development on shallow ground water will be emphasized--the Fox Hills Sandstone (Late Cretaceous) and younger rocks.

PROGRESS AND SIGNIFICANT RESULTS: Only a limited amount of work was done on the report, due to the late starting date of the project. A detailed outline of the report was completed. Most of the introductory and background sections (physical and economic setting) were written.

PLANS FOR FISCAL YEAR 1987: The final report will be completed. Major activities include summarizing principal results of all previous reports about shallow ground water in northeastern Wyoming; contacting hydrologists and others in other agencies and industry, regarding additional information and information deficiencies; and summarizing the deficiencies.

PROJECTS COMPLETED EXCEPT FOR REPORTS

The following is a list of projects, showing the project number, the project title, and the project leader, that have been completed except for the approval of the final report(s). Funding for these projects ended prior to fiscal year 1986.

Project number	Project title	Project leader
WY 80-056	Streamflow characteristics of energy mineral areas in Wyoming	Hugh W. Lowham
WY 81-059	Hydrologic investigation of the in-situ oil-shale retort area near White Mountain, southwestern Wyoming	Kent C. Glover
WY 81-060	Ground-water hydrology of the southern Powder River Uranium District, Wyoming	Marlin E. Lowry (retired)
WY 82-068	Hydrologic evaluation of the shallow aquifer system in Saratoga Valley, south-central Wyoming	Marvin A. Crist
WY 82-072	Stream-aquifer interaction in the Upper Bear River Valley of Wyoming and Utah	Kent C. Glover
WY 83-077	Hydrology of the Madison Limestone in the Glenrock area, east-central Wyoming	David A. Peterson
WY 83-078	Hydrologic properties of the alluvial deposits along the Powder River between Sussex, Wyoming and Moorhead, Montana	Bruce H. Ringen (retired)
WY 85-089	Hydrology of selected areas, Powder River basin, Wyoming	James L. Fogg

NEW PROJECTS IN FISCAL YEAR 1987

The following is a list of projects, showing the project number, the project title, and the project leader, are new in fiscal year 1987.

Project number	Project title	Project leader
WY 87-100	Flood Investigations for Cheyenne, Wyoming	James G. Rankl
WY 87-101	Use of earth-resources information for management of natural resources in the Greater Yellowstone Area, Wyoming, Montana, and Idaho	Charles A. Eshelman
WY 87-102	Water resources of Washakie County, Wyoming	Marvin A. Crist
WY 87-103	Water resources of Big Horn County, Wyoming	Earl W. Cassidy

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. Most of these reports are available for inspection at the Geological Survey offices in Cheyenne, Casper, and Riverton and also at large public and university libraries. The sources for obtaining copies of the reports are given for each report series. Because many of the older reports are out of print, loan copies are available from the District Office in Cheyenne.

The 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. Checks or money orders should be payable to: "Department of the Interior--USGS." 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.

Additional information on Geological Survey products and sources where they may be obtained is given in "A Guide to Obtaining USGS Information" Geological Survey Circular 900, available without cost from the Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, CO 80225.

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. 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.

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, 1965-70, 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 Papers 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 estimated the magnitude and frequency of floods for streams in Wyoming are given in two reports: Water-Resources Investigations Report 76-112 and Water-Supply Paper 2056 (see listings that follow). The U.S. Geological Survey also has outlined flood-prone areas on topographic maps as part of a nationwide Federal program for managing flood losses. In Wyoming 225 flood-prone area maps have been completed. These maps, available at no charge from the District Office in Cheyenne, show areas estimated to be inundated by a 100-year flood. Official flood-insurance maps are available from the Federal Emergency Management Agency (toll-free pnone number 1-800-638-6620).

Publications

Professional Papers (P)

Professional papers are sold by U.S. Geological Survey, Books and Open-File Reports, Box 25425, Federal Center, Denver, CO 80225.

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 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 the 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.

P 1273-A. Stratigraphy and sedimentary facies of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming, by J.A. Peterson. 1984.

P 1273-B. Correlation of Paleostructure and sediment deposition in the Madison Limestone and associated rocks in parts of Montana, North Dakota, South Dakota, Wyoming, and Nebraska, by D.L. Brown, R.K. Blankennagel, L.M. MacCary, and J.A. Peterson. 1984.

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-D. Apparent water resistivity, porosity, and water temperature of the Madison Limestone and underlying rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming, by L.M. MacCary. 1984.

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 1273-G. Geohydrology of the Madison and associated aquifers in parts of Montana, North Dakota, South Dakota, and Wyoming, by J.S. Downey. 1984.

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.

P 1400-B. Geohydrology of the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, by E.D. Gutentag, F.J. Heimes, N.C. Krothe, R.R. Luckey, and J.B. Weeks. 1984.

P 1400-C. Mapping irrigated cropland from Landsat for determination of water-use from the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota,Texas, and Wyoming, by G.P. Thelin and F.J. Heimes. In press.

P 1400-D. Digital simulation of ground-water flow in the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, by R.R. Luckey, E.D. Gutentag, F.J. Heimes, and J.B. Weeks. 1986.

P 1400-E. Effects of future ground-water pumpage on the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, by R.R. Luckey, E.D. Gutentag, F.J. Heimes, and J.B. Weeks. In press.

P 1402-A. Regional aquifer system underlying the northern Great Plains in parts of Montana, North Dakota, South Dakota, and Wyoming, by J.S. Downey and G.A. Dinwiddie. In press.

P 1402-B. Geologic framework of the ground-water system in Jurassic and Cretaceous rocks in the Northern Great Plains in parts of Montana, North Dakota, South Dakota, and Wyoming, by L.O. Anna. 1986.

P-1402-C. Geochemistry of ground water in two sandstone aquifer systems in the Northern Great Plains in parts of Montana and Wyoming, by Thomas Henderson. 1985.

P 1402-D. Freshwater heads and ground-water temperatures in aquifers of the Northern Great Plains in parts of Montana, North Dakota, South Dakota, and Wyoming, by D.H. Lobmeyer. 1985.

P 1402-E. Geohydrology of bedrock aquifers in the northern Great Plains in parts of Montana, North Dakota, South Dakota, and Wyoming, by J.S. Downey. 1986.

Journal of Research of the Geological Survey

The Journal of Research Series 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 (W)

Water-Supply Papers are sold by U.S. Geological Survey, Books and Open-File Reports, Box 25425, Federal Center, Denver, CO 80225.

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 records 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.

W 2275. National water summary 1984 - hydrologic events, selected water-quality trends, and ground-water resources, by U.S. Geological Survey. 1985.

W 2289. Artesian pressures and water quality in Paleozoic aquifers in the Ten Sleep area of the Bighorn basin, north-central Wyoming, by M.E. Cooley. 1986.

W 2300. National water summary 1985 - hydrologic events and surface-water resources, by U.S. Geological Survey. 1986.

Circulars (C)

Single copies of circulars still in print are available free from U.S. Geological Survey, Books and Open-File Reports, Box 25425, Federal Center, Denver, CO 80225.

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 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 900. Guide to obtaining USGS information, compiled by Kurt Dodd, H.K. Fuller, and P.F. Clark. (revised) 1986.

C 1001. Estimated use of water in the United States in 1980, by W.B. Solley, E.B. Chase, and W.B. Mann, IV. 1983.

C 1002. Regional Aquifer-System Analysis Program of the U.S. Geological Survey: Summary of projects, 1978-84, by R.J. Sun (editor). 1986.

Water-Resources Investigations Reports (WRIR)

Reports in this series are available for inspection at the Wyoming and Reston, Virginia, 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.

WRIR 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).

WRIR 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.

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

WRIR 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.

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

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

WRIR 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)

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

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

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

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

WRIR 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.

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

WRIR 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)

WRIR 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.

WRIR 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)

WRIR 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.

WRIR 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)

WRIR 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)

WRIR 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)

WRIR 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)

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

WRIR 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.

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

WRIR 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)

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

WRIR 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)

WRIR 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.

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The following WRIR reports may be purchased from U.S. Geological Survey, Books and Open-File Reports, Box 25425, Federal Center, Denver, CO 80225. A report listed as "In press" is not yet available.

WRIR 82-4003. Evaluation of selected surface-water-quality stations in Wyoming, by S.J. Rucker, IV and L.L. DeLong. 1987.

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Availability of most of the following reports can be determined by contacting the publisher. Separate prints of some of the articles may be obtained from the District Office in Cheyenne.

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