

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES INVESTIGATIONS OF THE
U.S. GEOLOGICAL SURVEY IN MONTANA,
OCTOBER 1983 THROUGH SEPTEMBER 1984

Compiled by Robert S. Roberts

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Prepared in cooperation with the
State of Montana and other agencies

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UNITED STATES DEPARTMENT OF THE INTERIOR

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WATER-RESOURCES INVESTIGATIONS OF THE
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INTRODUCTION

The U.S. Geological Survey was established as an agency in the Department of the Interior on March 3, 1879, 30 years to the day after establishment of the Department itself. The initial purpose of the Survey was to prepare a plan that would secure the best possible results at the least possible cost for surveying and mapping the Territories of the United States. One mission of the Geological Survey 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 mission is accomplished, in large part, through cooperation with other Federal and non-Federal agencies by:

1. Collecting data needed for the continuing determination and evaluation of the Nation's water resources;
2. Conducting water-resources investigations to describe the occurrence, availability, and characteristics of surface and ground waters;
3. Conducting supportive research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurements and to understand hydrologic systems sufficiently well to be able to predict their response to stress;
4. Disseminating the water data and the results of these investigations and research through reports, maps, and other forms of public release;
5. Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, and ground waters; and
6. Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies; to licensees of the Federal Energy Regulatory Commission; and to international agencies on behalf of the Department of State.

The Montana district of the Geological Survey conducts its hydrologic work through a headquarters office in Helena (Federal Office Building, 301 S. Park), a subdistrict office in Billings, and field offices in Helena, Kalispell, and Fort Peck. The district employs 67 people (49 full-time and 18 less than full-time) to work on 26 funded projects. Funding for program operation comes from joint-funding agreements with State and local agencies, direct Federal allotments to the U.S. Geological Survey, and transfer of funds from other Federal agencies.

Funding agencies include:

State and local agencies

Montana Department of Natural Resources and Conservation
Montana Bureau of Mines and Geology
Montana Department of Fish, Wildlife, and Parks
Montana Department of State Lands
Flathead Tribes
Montana Department of Highways
Wyoming State Engineer
Montana Department of Health and Environmental Sciences
City of Helena

Federal agencies

U.S. Geological Survey
U.S. Bureau of Indian Affairs
U.S. Bureau of Land Management
U.S. Army Corps of Engineers
U.S. Department of State-International Joint Commission
Federal Energy Regulatory Commission
U.S. Bureau of Reclamation
Bonneville Power Administration
U.S. Forest Service

Distribution of funding for program operation is illustrated in figure 1.

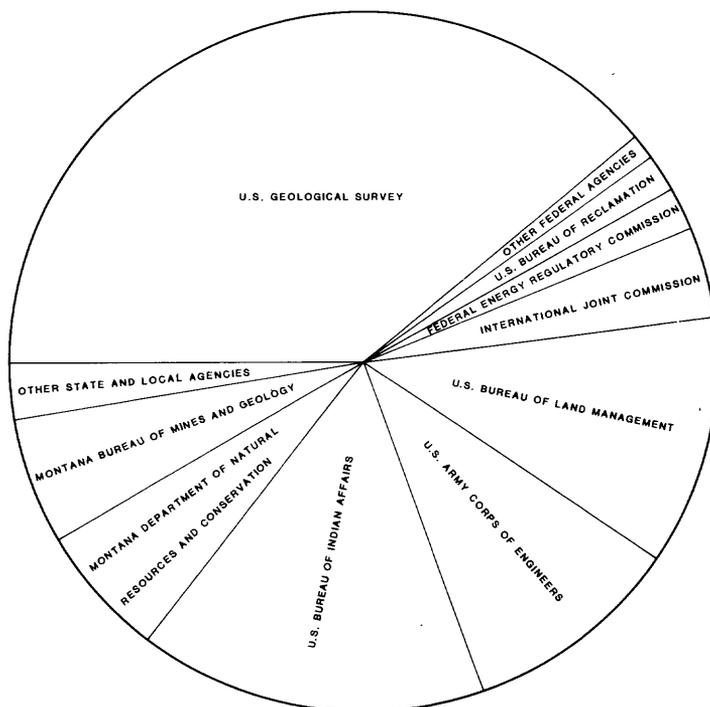


Figure 1.--Sources of funding for the water-resources program in Montana.

The following projects are funded for fiscal year 1984 in Montana:

001	Surface-Water Stations	086	Buried Channel
002	Ground-Water Stations	088	Mountain Streamflow
003	Water-Quality Stations	090	Redwater River Salinity Model
004	Sediment Stations	094	Impacts of Mining, Otter Creek
005	Precipitation Stations	095	Yellowstone River Tributary Flow
007	Water Use	097	Flathead Indian Reservation
023	Bridge-Site Investigations	098	Ground Water Beneath Rangelands
059	Coal-Lease Monitoring	099	Streamflow Variability
066	EMRIA Sites	100	Meteorologic Data
077	Willow Creek Modeling	101	Mapping of Billings Quadrangle
079	Stillwater Complex	102	Lake Koocanusa Model
080	Coal-Area Hydrology	103	Mine Spoils
085	Big Hole Basin	104	Ground Water Near Communities

These projects are described in following sections of this report under the general headings of: (1) Data-collection programs, (2) Problem-oriented studies, (3) Areal appraisals, (4) Coal-related studies, and (5) Research projects. An additional section describes contracts administered by the Montana district to research organizations.

DATA-COLLECTION PROGRAMS

Hydrologic-data stations are maintained at selected sites throughout Montana to collect basic information concerning streamflow, ground-water levels, quality of water, sediment concentrations in streams, and depth and water content of snowpack. The network of stations is revised periodically to ensure collection of meaningful and worthwhile data. Information collected from the network is kept on file for use by managers, investigators, and users of water resources. Much of the information is published annually in water-data reports, most is stored in computer files for efficient processing and retrieval, and all is available to requesters.

The locations of data-collection stations in Montana are shown in figure 2 for surface water and figure 3 for surface-water quality. Surface-water stations in operation as of October 1983 are listed in table 1. Surface-water-quality stations are listed in table 2.

In addition to the data collected within the State, the Montana district has access to water data collected nationwide. The National Water Data Exchange (NAWDEX) of the Geological Survey indexes water data available from more than 400 organizations. The National Water Data Storage and Retrieval System (WATSTORE) serves as a central repository of water data collected by the Geological Survey, including large volumes of data on the quantity and quality of both surface and ground waters. The Office of Water Data Coordination (OWDC) coordinates Federal water-data acquisition activities and maintains a "Catalog of Information on Water Data." Information on the programs and availability of the water data can be obtained from the District Chief, U.S. Geological Survey, 428 Federal Building, 301 South Park, Drawer 10076, Helena, MT 59626-0076.

Surface-Water Stations

(MT001)

Location: Statewide

Period of project: Continuing

Project chief: George M. Pike, Helena



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

Information products: Missouri River Basin Ground Water Resources Work Group, 1980, Inventory of ground-water resources, technical paper of Upper Missouri River Basin Level B Study: Missouri River Basin Commission, 54 p.

Moore, L. G., and Shields, R. R., 1980, Streamflow characteristics of the Yellowstone River basin, Montana, through 1976: U.S. Geological Survey Water-Resources Investigations 80-41, 67 p.

Omang, R. J., Parrett, Charles, and Hull, J. A., 1983, Flood estimates for ungaged streams in Glacier and Yellowstone National Parks, Montana: U.S. Geological Survey Water-Resources Investigations Report 83-4147, 10 p.

Parrett, Charles, Carlson, D. D., Craig, G. S., Jr., and Chin, E. H., Floods of May 1978 in southeastern Montana and northeastern Wyoming: U.S. Geological Survey Professional Paper 1244 (in press).

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

Parrett, Charles, Omang, R. J., and Hull, J. A., 1982, Floods of May 1981 in west-central Montana, with a section on Meteorological setting by John W. Fassler: U.S. Geological Survey Water-Resources Investigations 82-33, 20 p.

Shields, R. R., Knaption, J. R., White, M. K., Jacobson, M. A., and Kasman, M. L., 1983, Water resources data, Montana--Water year 1982, v. 1, Hudson Bay basin and Missouri River basin: U.S. Geological Survey Water-Data Report MT-82-1, 553 p.

_____, 1983, Water resources data, Montana--Water year 1982, v. 2, Columbia River basin: U.S. Geological Survey Water-Data Report MT-82-2, 184 p.

Shields, R. R., and White, M. K., 1981, Streamflow characteristics of the Hudson Bay and upper Missouri River basins, Montana, through 1979: U.S. Geological Survey Water-Resources Investigations 81-32, 144 p.

Waltemeyer, S. D., and Shields, R. R., 1982, Streamflow characteristics of the upper Columbia River basin, Montana, through 1979: U.S Geological Survey Water-Resources Investigations 81-82, 74 p.

Yellowstone River Compact Commission, Thirty-second annual report (in preparation).

Ground-Water Stations

(MT002)

Location: Statewide

Period of project: Continuing

Project chief: Thomas E. Reed, Helena



Objectives: (1) To collect water-level data sufficient to provide a minimum long-term data base so that the general response of the hydrologic system to natural climatic variations and induced stresses is known and potential problems can be defined early enough to allow proper planning and management. (2) To provide a data base against which the 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 management of the resource.

Information products: Coffin, D. L., Reed, T. E., and Ayers, S. D., 1977, Water-level changes in wells along the west side of the Cedar Creek anticline, southeastern Montana: U.S. Geological Survey Water-Resources Investigations 77-93, 11 p.

Roberts, R. S., 1980, Hydrogeologic data for selected coal areas, east-central Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 80-329, 63 p.

Shields, R. R., Knapton J. R., White, M. K., Jacobson, M. A., and Kasman, M. L., 1983, Water resources data, Montana--Water year 1982, v. 1, Hudson Bay basin and Missouri River basin: U.S. Geological Survey Water-Data Report MT-82-1, 553 p.

_____, 1983, Water resources data, Montana--Water year 1982, v. 2, Columbia River basin: U.S. Geological Survey Water-Data Report MT-82-2, 184 p.

Water-Quality Stations

(MT003)

Location: Statewide

Period of project: Continuing

Project chief: J. Roger Knapton, Helena



Objectives: (1) To provide a national bank of water-quality data for broad Federal and State planning and action programs. (2) To provide data for Federal management of interstate and international waters.

Information products: Knapton, J. R., 1978, Evaluation and correlation of water-quality data for the North Fork Flathead River, northwestern Montana: U.S. Geological Survey Water-Resources Investigations 78-111, 95 p.

Knapton, J. R., and Jacobson, M. A., 1980, Simulation of water-quality data at selected stream sites in the Missouri River basin, Montana: U.S. Geological Survey Water-Resources Investigations 80-76, 30 p.

Shields, R. R., Knapton, J. R., White, M. K., Jacobson, M. A., and Kasman, M. L., 1983, Water resources data, Montana--Water year 1982, v. 1, Hudson Bay basin and Missouri River basin: U.S. Geological Survey Water-Data Report MT-82-1, 553 p.

1983, Water resources data, Montana--Water year 1982, v. 2, Columbia River basin: U.S. Geological Survey Water-Data Report MT-82-2, 184 p.

Sediment Stations

(MT004)

Location: Statewide

Period of project: Continuing

Project chief: J. Roger Knapton, Helena



Objectives: (1) To provide a national bank of sediment data for use in broad Federal and State planning and action programs. (2) To provide data for Federal management of interstate and international waters.

Information products: Shields, R. R., Knapton, J. R., White, M. K., Jacobson, M. A., and Kasman, M. L., 1983, Water resources data, Montana--Water year 1982, v. 1, Hudson Bay basin and Missouri River basin: U.S. Geological Survey Water-Data Report MT-82-1, 553 p.

1983, Water resources data, Montana--Water year 1982, v. 2, Columbia River basin: U.S. Geological Survey Water-Data Report MT-82-2, 184 p.

Precipitation Stations

(MT005)

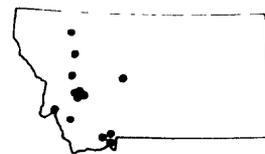
Location: West-central Montana

Period of project: Continuing

Project chief: Ronald R. Shields, Helena

Objective: To obtain the depth and water content of the snowpack at 13 designated snow courses for use in runoff forecasting.

Information product: Results of measurements are included in U.S. Soil Conservation Service report, "Water supply outlook for Montana."



Water Use

(MT007)

Location: Statewide

Period of project: Continuing

Project chief: Charles Parrett, Helena

Objective: To develop and maintain a water-use data system for Montana that is responsive to the needs of users at both State and national levels.

Information product: Water-use information will be supplied to requesters. Contributed water-use data for the report by Solley, W. B., Chase, E. B., and Mann, W. B., 1983, Estimated use of water in the United States in 1980: U.S. Geological Survey Circular 1001, 56 p.



Meteorologic Data

(MT100)

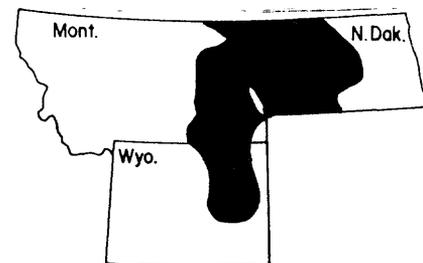
Location: Coal areas in Montana, North Dakota, and Wyoming

Period of project: October 1983 to September 1984

Project chief: Lawrence E. Cary, Billings

Objectives: (1) To locate sources of meteorologic data useful to application of the Geological Survey's Precipitation Runoff Modeling System (PRMS) model. (2) To compile and evaluate the data, and where necessary synthesize missing data. (3) To establish computer files for the data that would be accessible to PRMS model users.

Information product: Cary, L. E., Meteorologic data from the Fort Union and Powder River coal regions, Montana, North Dakota, and Wyoming: U.S. Geological Survey Open-File Report (in preparation).



PROBLEM-ORIENTED STUDIES

The Geological Survey is often asked by Federal, State, or local agencies to investigate hydrologic problems of limited areal extent. These problem-oriented studies range in scope from cursory examination of baseline conditions to detailed investigations of cause and effect. For problems of a recurring nature, such as bridge-site investigations for the Montana Department of Highways, continuing projects are established to provide an ongoing service to the funding agency. Some problems are of sufficient scope to warrant formal projects. Other problems, such as evaluation of ground-water conditions beneath local areas, may or may not be of a recurring nature.

Bridge-Site Investigations

(MT023)

Location: Statewide

Period of project: Continuing

Project chief: Robert J. Omang, Helena

Objective: To supply the Montana Department of Highways with sufficient hydrologic and hydraulic information at selected sites to allow the most economic and hydraulically safe bridge or culvert design possible.

Information product: Johnson, M. V., 1978, Floods of June 4 and 12, 1976, at Culbertson, Montana: U.S. Geological Survey Open-File Report 78-429, 6 p.



Ground Water Beneath Rangelands

(MT098)

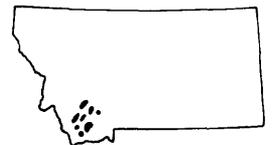
Location: Selected tracts near Dillon, Mont.

Period of project: October 1983 to December 1984

Project chief: Julianne F. Levings, Helena

Objectives: (1) To evaluate hydrogeologic conditions beneath selected tracts of rangeland managed by the U.S. Bureau of Land Management (BLM). (2) To provide BLM with information that will be useful for water-development projects in the tracts.

Information product: Levings, J. F., Hydrogeology of selected BLM tracts, Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).



Ground Water Near Communities

(MT104)

Location: Selected communities in Montana

Period of project: October 1983 to September 1986

Project chief: Gary W. Levings, Helena

Objective: To describe the generalized geology and the occurrence, movement, and availability of ground water near selected communities in Montana.

Information product: Pamphlet--Availability of ground water near *selected community*, Montana



AREAL APPRAISALS

The Geological Survey has a continuing program of areal studies designed to provide hydrologic information needed in managing the State's water resources. These studies evaluate the occurrence and movement of ground water, thickness and extent of aquifers, distribution of streamflow in time and space, and quality of surface and ground waters. The studies generally include a ground-water basin, hydrologic unit, county, or other convenient subunit of the State.

Each areal investigation is uniquely designed to address hydrologic conditions, development potential, and specific hydrologic problems associated with the area in question. Some studies are aimed primarily at evaluating the potential for development of ground-water or surface-water supplies, some deal primarily with water-quality problems, and some are broad investigations of the hydrologic system. All are intended to provide a clearer understanding of the State's water resources.

Willow Creek Modeling

(MT077)

Location: Willow Creek watershed in Valley County

Period of project: October 1980 to September 1984

Project chief: Charles Parrett, Helena

Objectives: (1) To develop a runoff model of Willow Creek basin. (2) To evaluate the effects of reservoirs and water-conservation structures on runoff.

Information product: Parrett, Charles, Effects of water conservation on runoff in the Willow Creek basin, Montana: U.S. Geological Survey Water-Resources Investigation Report (planned).



Stillwater Complex

(MT079)

Location: Stillwater and Sweet Grass Counties

Period of project: October 1980 to September 1984

Project chief: Richard D. Feltis, Billings

Objectives: (1) To collect hydrologic information needed to assess the effects of mining in the Stillwater Complex. (2) To inventory wells and springs in areas subject to population increases. (3) To develop baseline water-quality information needed to approve exploration and mining permits.

Information products: Feltis, R. D., 1982, Selected hydrogeologic data from southern Sweet Grass County, south-central Montana: U.S. Geological Survey Open-File Report 82-265, 12 p.

Geohydrology of the Stillwater Complex and vicinity, Sweet Grass and Stillwater Counties, Montana: Montana Bureau of Mines and Geology Memoir (in preparation).



Big Hole Basin

(MT085)

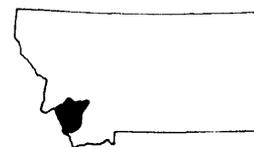
Location: Big Hole basin in southwestern Montana

Period of project: October 1981 to September 1984

Project chief: Julianne F. Levings, Helena

Objectives: (1) To compile existing data on streamflow, aquifer characteristics, geology, and water chemistry. (2) To design and implement a hydrologic-data-collection program. (3) To describe the hydrologic system including cause-effect relationships. (4) To evaluate the effects of water-management plans on the hydrologic system.

Information product: Levings, J. F., Water resources of the Big Hole basin, southwestern Montana: Montana Bureau of Mines and Geology Memoir (in preparation).



Buried Channel

(MT086)

Location: Sheridan County

Period of project: April 1982 to September 1984

Project chief: Gary W. Levings, Helena



Objectives: (1) To define the geometry, aquifer characteristics, water quality, and water budget of the ancestral Missouri River channel aquifer. (2) To determine potential effects of increased withdrawals on water levels, water quality, and pot-hole or lake levels in the area.

Information product: Levings, G. W., Availability of water from a buried channel of the Missouri River, northeastern Montana: Montana Bureau of Mines and Geology Memoir (in preparation).

Mountain Streamflow

(MT088)

Location: Mountainous areas in western Montana

Period of project: March 1982 to September 1984

Project chief: Charles Parrett, Helena

Objective: To determine flow characteristics for typical stream sites in mountainous areas using miscellaneous streamflow measurements obtained at index sites.

Information product: Parrett, Charles, and Hull, J. A., Streamflow characteristics of mountain streams in western Montana: U.S. Geological Survey Water-Supply Paper (in review).



Yellowstone River Tributary Flow

(MT095)

Location: Upstream Yellowstone River basin

Period of project: November 1982 to February 1985

Project chief: James A. Hull, Helena

Objective: To determine percentile discharges for tributaries using miscellaneous streamflow measurements obtained at index sites.

Information product: Hull, J. A., Flow characteristics of tributaries in the upper Yellowstone River basin, south-central Montana: U.S. Geological Survey Water-Resources Investigations Report (planned).



Flathead Indian Reservation

(MT097)

Location: Northwestern Montana

Period of project: April 1983 to March 1986



Project chief: Steven E. Slagle, Helena

Objectives: (1) To acquire information on aquifer properties, ground-water withdrawals, water-level fluctuations, and water-quality variations. (2) To define the ground-water system in terms of recharge-discharge relationships, areal and vertical distribution of aquifers, patterns of ground-water flow, and hydrochemical relationships. (3) To develop a hydrologic model of the system capable of simulating the potential effects of various management plans.

Information products: Slagle, S. E., Hydrologic data for the Flathead Indian Reservation, northwestern Montana: U.S. Geological Survey Open-File Report (in preparation).

Ground-water resources of the Flathead Indian Reservation, northwestern Montana:
U.S. Geological Survey Water-Resources Investigations Report (in preparation).

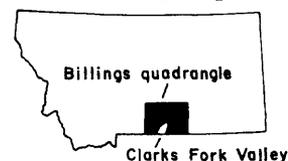
Mapping of Billings Quadrangle

(MT101)

Location: South-central Montana

Period of project: October 1983 to September 1985

Project chiefs: Richard D. Feltis, Billings
Julianne F. Levings, Helena



Objectives (hydrogeologic inventory in Billings quadrangle): (1) To determine the altitude and configuration of the potentiometric surface and stratigraphic top of several shallow and deep geologic units. (2) To characterize the quality of water in all aquifers.

Objectives (planning study of Clarks Fork Valley): (1) To determine the configuration of the potentiometric surface in aquifers, quality of water in aquifers and the river, areal and vertical extent of valley alluvium, aquifer characteristics, and relationships of flow among aquifers and between aquifers and the river. (2) To develop a plan of study for a quantitative assessment of hydrologic problems in the valley.

Information products (hydrogeologic inventory): Feltis, R. D., Several maps showing water quality, altitude and configuration of the potentiometric surface, and stratigraphic top of selected aquifers: Montana Bureau of Mines and Geology, scale 1:250,000.

Information product (planning study): Levings, J. F., Hydrologic data from the Clarks Fork Valley, south-central Montana: U.S. Geological Survey Open-File Report (in preparation).

Plan of study of hydrologic problems in the Clarks Fork Valley, south-central Montana: U.S. Geological Survey Water-Resources Investigations Report (tentative, planned).

COAL-RELATED STUDIES

The nation's pressing need for an expanded domestic energy base has resulted in increased interest in Montana's vast coal resources. Environmental impacts associated with exploration, mining, conversion, and transportation of coal must be considered in planning and managing the coal-mining activities. Many of the activities associated with coal utilization may significantly affect the water resources in Montana. To address these problems, the Geological Survey is involved in several hydrologic projects relating to coal development.

Projects include investigations in the coal areas of Montana designed to provide baseline hydrologic information at proposed coal-lease sites, to monitor the quantity and quality of streamflow, to map the areal distribution of aquifer units, and to evaluate the impact of mining on shallow ground-water systems.

Coal-Lease Monitoring

(MT059)

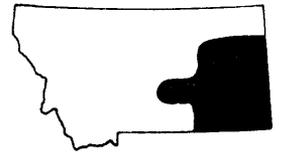
Location: Southeastern Montana

Period of project: Continuing

Project chief: Ronald R. Shields, Helena

Objectives: (1) To determine the characteristics of the regional water-resources system. (2) To detect and document changes in the system or in its components that may be associated with coal mining should changes occur.

Information products: Results of measurements are included in reports of other projects.



EMRIA Sites

(MT066)

Location: Eastern Montana

Period of project: October 1977 to April 1985

Project chief: Neal E. McClymonds, Helena

Objectives: (1) To collect hydrologic data at selected coal-lease application sites. (2) To evaluate potential hydrologic impacts of coal development at the sites. (3) To design monitoring networks to define baseline conditions and document changes in the hydrologic system associated with mining and reclamation.

Information products: Cannon, M. R., 1982, Potential effects of surface coal mining on the hydrology of the Cook Creek area, Ashland coal field, southeastern Montana: U.S. Geological Survey Open-File Report 82-681, 30 p.



1983, Potential effects of surface coal mining on the hydrology of the Snider Creek area, Rosebud and Ashland coal fields, southeastern Montana: U.S. Geological Survey Water-Resources Investigations 82-4051, 28 p.

1983, Potential effects of surface coal mining on the hydrology of the Bloomfield coal tract, Dawson County, eastern Montana: U.S. Geological Survey Water-Resources Investigations Report 83-4229, 33 p.

Potential effects of surface coal mining on the Circle West coal tracts, McCone County, east-central Montana: U.S. Geological Survey Water-Resources Investigations Report (in review).

Levings, G. W., 1983, Potential effects of surface coal mining on the hydrology of the Greenleaf-Miller area, Ashland coal field, southeastern Montana: U.S. Geological Survey Water-Resources Investigations 82-4101, 31 p.

McClymonds, N. E., 1982, Hydrology of the Prairie Dog Creek drainage basin, Rosebud and Big Horn Counties, Montana: U.S. Geological Survey Water-Resources Investigations 81-37, 64 p.

Potential effects of surface coal mining on the hydrology of the Corral Creek area, Hanging Woman Creek coal field, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report 83-4260 (in press).

Potential effects of surface coal mining on the hydrology of the West Otter area, Ashland and Birney-Broadus coal fields, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in review).

Potential effects of surface coal mining on the hydrology of the Horse Creek drainage basin, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in review).

Potential effects of surface coal mining on the hydrology of the Little Bear Creek drainage basin, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

Potential effects of surface coal mining on the hydrology of the southwest Glendive mining unit, east-central Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

Potential effects of surface coal mining on the hydrology of the upper Otter Creek/Pasture Creek basin, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

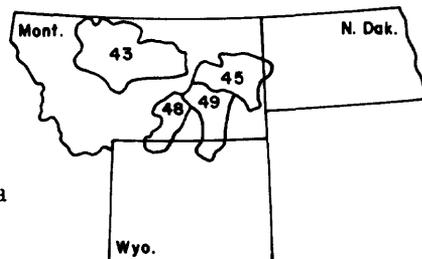
Coal-Area Hydrology

(MT080)

Location: Coal areas in Montana, North Dakota, and Wyoming

Period of project: April 1981 to September 1984

Project chiefs: Steven E. Slagle and John H. Lambing, Helena



Objective: To describe the surface-water, ground-water and water-quality conditions in coal areas of the Northern Great Plains and Rocky Mountain Coal Provinces in a manner that will be most useful to land managers, coal developers, regulatory agencies, and water users.

Information products: Slagle, S. E., and others, 1983, Hydrology of Area 49, Northern Great Plains and Rocky Mountain Coal Provinces, Montana and Wyoming: U.S. Geological Survey Water-Resources Investigations Open-File Report 82-682, 94 p.

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Lambing J. H., Hydrology of Area 43, Northern Great Plains and Rocky Mountain Coal Provinces, Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report (in preparation).

Impacts of Mining, Otter Creek

(MT094)

Location: Otter Creek area in southeastern Montana

Period of project: October 1982 to September 1984

Project chief: Michael R. Cannon, Helena

Objective: (1) To determine the probable cumulative impacts of coal mining on the surface-water and shallow-ground-water resources in the downstream 16-mile reach of the Otter Creek valley.

Information product: Cannon, M. R., Probable cumulative impacts of surface coal mining on the hydrology of the Otter Creek valley, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).



Streamflow Variability

(MT099)

Location: Southeastern Montana

Period of project: October 1983 to September 1984

Project chief: John H. Lambing, Helena



Objectives: (1) To obtain water quantity and quality data from stream reaches near areas of proposed mine leases and from springs and seeps in the drainages of these reaches. (2) To delineate stream reaches receiving ground-water inflow from specific mine areas. (3) To determine if refinement of ground-water input for existing Geological Survey salinity models is needed. (4) To provide a detailed data base of water quantity and quality from which future changes can be measured.

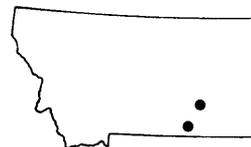
Information products: Data will be published in annual water-data reports for 1984 and 1985.

Lambing, J. H., Downstream variability of water quantity and quality of Otter Creek and Rosebud Creek, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

Mine Spoils

(MT103)

Location: Decker and Big Sky Mines, Montana
West-central United States



Period of project: October 1983 to September 1985

Project chief: Robert E. Davis, Helena

Objectives (Montana): (1) To expand previous knowledge by determining which geochemical processes are responsible for water-quality changes resulting from the contact of spoils water with coal. (2) To assist other Geological Survey offices with data acquisition during similar studies.

Objectives (United States): (1) To document the current level of knowledge related to mine spoils in the west-central United States. (2) To illustrate the transferability of that knowledge throughout the region. (3) To explain the techniques of investigation applicable to mine-spoils studies.

Information products: Davis, R. E., Geochemical processes in mine spoils, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

Geochemical and geohydrologic processes related to surface coal mining in the west-central United States: U.S. Geological Survey Professional Paper (planned).

RESEARCH PROJECTS

The Montana district program includes basic and applied research on various hydrologic principles. All projects directly or indirectly benefit from the results of research activities and contribute data needed in research programs. However, certain projects are primarily research-oriented and are designed to develop or apply new or unconventional hydrologic methods. Two such projects are currently underway.

Redwater River Salinity Model

(MT090)

Location: Redwater River, northeastern Montana

Period of project: May 1982 to September 1984

Project chief: Rodger F. Ferreira, Helena



Objective: To develop a computer model capable of spatial simulation of streamflow and dissolved solids in the Redwater River for selected hydrologic conditions under various coal-mining and agricultural development plans.

Information product: Ferreira, R. F., Modeled impacts of surface coal mining on dissolved solids in the Redwater River, northeastern Montana: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

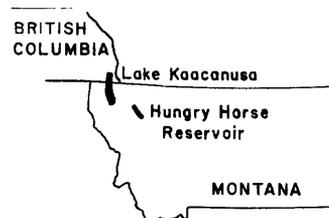
Lake Koocanusa Model

(MT102)

Location: Northwestern Montana

Period of project: October 1983 to September 1984

Project chief: Rodger F. Ferreira, Helena



Objectives: (1) To evaluate various ecosystem model techniques and select models for application to Lake Koocanusa. (2) To construct and test a simulation model that could relate reservoir drawdown to trophic dynamics of Lake Koocanusa. (3) To evaluate the adequacy of data-collection programs for use in developing models of Lake Koocanusa. (4) If successful in previous objectives, extend project to include Hungry Horse Reservoir.

Information product: Ferreira, R. F., Simulation of trophic dynamics of Lake Koocanusa, Montana and British Columbia: U.S. Geological Survey Water-Resources Investigations Report (tentative, planned).

CONTRACT PROGRAM

In addition to the projects conducted by its own personnel, the Montana district administers contracts to other agencies and universities to participate in hydrologic studies and perform research on particular problems. This program not only provides research essential to program operation, but it also greatly increases the district capabilities by utilizing expertise of personnel in other agencies. In the past, this program has funded test-drilling projects, research in stream biology, and development of computer programs for data storage and retrieval.

Investigation of Soluble Salts and Quality of Water in Mine Spoils

Contractor: Montana Bureau of Mines and Geology

Project chief: Wayne A. Van Voast, Billings

Objectives: To investigate methods to predict water quality in mine spoils and monitor ground-water conditions in and around surface coal mines.

SOURCES OF GEOLOGICAL SURVEY PUBLICATIONS

Current reports are listed in a pamphlet, "New Publications of the Geological Survey." Subscription to the pamphlet, which is issued monthly, is free upon request to the U.S. Geological Survey, 329 National Center, Reston, VA 22092.

Professional papers, bulletins, water-supply papers, techniques of water-resources investigations, circulars, and publications of general interest (such as leaflets, pamphlets, booklets) are available by mail from the Branch of Distribution, U.S. Geological Survey, 604 South Pickett Street, Alexandria, VA 22304.

Miscellaneous investigations maps, hydrologic investigations atlases, hydrologic unit maps, and other maps pertaining to Montana are available for sale from the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

Records of streamflow, ground-water levels, and quality of water have been published for many years as Geological Survey water-supply papers. Beginning with the 1971 water year, however, this series was replaced by a new publications series, U.S. Geological Survey Water-Data Reports. This new series combines for each State: streamflow data, water-quality data for surface and ground water, and ground-water-level data from the basic network of observation wells. For Montana, an example title is, "Water-Resources Data, Montana--Water Year 1982: U.S. Geological Survey Water-Data Report MT-82-1." Additional information on these publications can be obtained from the District Chief, U.S. Geological Survey, 301 South Park, Drawer 10076, Helena, MT 59626-0076.

Open-file reports and water-resources investigations reports are available for inspection at the District office of the Geological Survey in Helena, Mont. Most reports in these series can be purchased in microfiche and paper-copy forms from sources in Denver, Colo., or Springfield, Va. Availability of the reports can be obtained from the District office.

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Table 1.--Surface-water gaging stations in operation as of October 1983

Station number

Stations are listed in downstream order by standard drainage basin number: Part 5 (Hudson Bay basin), Part 6 (Missouri River basin), and Part 12 (Upper Columbia River basin). Each station number contains a 2-digit part number plus a 6-digit downstream order number. Locations of streamflow and major-reservoir stations are shown in figure 2; locations of stations for small reservoirs are not identified on the map.

Supported by

BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BPA	Bonneville Power Administration
CH	City of Helena
FERC	Federal Energy Regulatory Commission
MBMG	Montana Bureau of Mines and Geology
MDH	Montana Department of Highways
MDHES	Montana Department of Health and Environmental Sciences
MDNRC	Montana Department of Natural Resources and Conservation
MDFWP	Montana Department of Fish, Wildlife, and Parks
MDSL	Montana Department of State Lands
USAE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
WSE	Wyoming State Engineer
WWT	U.S. Department of State-International Joint Commission, Waterways Treaty

Gage equipment

- A - Thermograph recorder
- C - CDCP
- D - Digital recorder
- G - Graphic recorder
- M - Manometer (bubbler) gage
- O - Observer record only
- P - Electrical power
- R - Rain gage
- S - Selsyn unit
- T - Telemark, BDT satellite
- U - Other agency Telemark
- W - Well gage

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 5</u>			
05014500	Swiftcurrent Creek at Many Glacier	USGS	GPW
05015500	Lake Sherburne at Sherburne	WWT	DGMP
05016000	Swiftcurrent Creek at Sherburne	USBR	GPW
05017500	St. Mary River near Babb	WWT	GW
05018500	St. Mary Canal at St. Mary Crossing, near Babb	WWT	GW
05020500	St. Mary River at international boundary	WWT	GPTW
<u>Part 6</u>			
06012000	Lima Reservoir near Monida	MDNRC	O
06015300	Clark Canyon Reservoir near Grant	USGS	G
06016000	Beaverhead River at Barretts	USBR	DGPW
06018500	Beaverhead River near Twin Bridges	USGS	DGW
06019500	Ruby River above reservoir, near Alder	MDNRC	DGW
06020500	Ruby River Reservoir near Alder	MDNRC	O
06020600	Ruby River below reservoir, near Alder	MDNRC	DW
06024590	Wise River near Wise River	MDNRC	DGM
06025500	Big Hole River near Melrose	MDNRC	ACDGPW
06035000	Willow Creek near Harrison	MDNRC	DGW
06036000	Willow Creek Reservoir near Harrison	MDNRC	O
06036650	Jefferson River near Three Forks	MDFWP	DGMP
06036905	Firehole River near West Yellowstone	USGS	BDGM
06037000	Gibbon River near West Yellowstone	USGS	BDGM
06037500	Madison River near West Yellowstone	USGS	BDGM
06038000	Hebgen Lake near West Yellowstone	FERC	O
06038500	Madison River below Hebgen Lake, near Grayling	FERC	DGPW
06038800	Madison River at Kirby Ranch, near Cameron	MDFWP	O
06040300	Jack Creek near Ennis	MDNRC	DGPW
06040500	Ennis Lake near McAllister	FERC	O
06041000	Madison River below Ennis Lake, near McAllister	FERC	ADGPSW
06049500	Middle Creek Reservoir near Bozeman	MDNRC	O
06050000	Hyalite Creek at Hyalite ranger station, near Bozeman	MDNRC	DGW
06052500	Gallatin River at Logan	USAE	ADGPTW
06054500	Missouri River at Toston	USGS	ADGPW
06058500	Canyon Ferry Lake near Helena	USGS	GPSW
06061500	Prickly Pear Creek near Clancy	MDNRC	DGW
06062500	Tenmile Creek near Rimini	CH	DGPW
06064500	Lake Helena near Helena	FERC	O
06065000	Hauser Lake near Helena	FERC	O

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 6--Continued</u>			
06066000	Holter Lake near Wolf Creek	FERC	0
06066500	Missouri River below Holter Dam, near Wolf Creek	FERC	DGPSW
06075000	Smith River Reservoir near White Sulphur Springs	MDNRC	0
06076690	Smith River near Fort Logan	MDFWP	DGM
06078200	Missouri River near Ulm	USAE	DGW
06079500	Gibson Reservoir near Augusta	MDNRC	0
06080500	Pishkun Reservoir near Augusta	MDNRC	0
06082000	Willow Creek Reservoir near Augusta	MDNRC	0
06083000	Nilan Reservoir near Augusta	MDNRC	0
06088300	Muddy Creek near Vaughn	USGS	DGW
06088500	Muddy Creek at Vaughn	USGS	DGM
06089000	Sun River near Vaughn	FERC	DGPW
06090200	Morony Reservoir near Great Falls	FERC	0
06090300	Missouri River near Great Falls	FERC	DGMPS
06090800	Missouri River at Fort Benton	USGS	DGPTW
06090900	Lower Two Medicine Lake near East Glacier	MDNRC	0
06091700	Two Medicine River below South Fork, near Browning	BIA	DGM
06091800	Two Medicine Canal near Browning	BIA	DW
06092600	Four Horns Canal near Browning	BIA	GW
06093000	Four Horns Lake near Heart Butte	MDNRC	0
06093200	Badger Creek below Four Horns Canal, near Browning	BIA	DGPW
06094000	Swift Reservoir near Dupuyer	MDNRC	0
06095500	Lake Frances near Valier	MDNRC	0
06099000	Cut Bank Creek at Cut Bank	BIA	DGM
06099500	Marias River near Shelby	USGS	CDGMP
06101300	Lake Elwell near Chester	USGS	0
06101500	Marias River near Chester	USBR	DW
06101560	Pondera Coulee near Chester	MDNRC	DGM
06108000	Teton River near Dutton	USGS	DGMP
06109500	Missouri River at Virgelle	USAE	CDGPRW
06110500	Ackley Lake near Hobson	MDNRC	0
06115200	Missouri River near Landusky	USAE	CDGMPR
06116500	Bair Reservoir near Delpine	MDNRC	0
06119000	Martinsdale Reservoir near Martinsdale	MDNRC	0
06120500	Musselshell River at Harlowton	MDNRC	DGTW
06122500	Deadmans Basin Reservoir near Shawmut	MDNRC	0
06126470	Half Breed Creek near Klein	USGS	DGM
06126500	Musselshell River near Roundup	MDNRC	DGPW
06127500	Musselshell River at Musselshell	MDNRC	DGW
06130500	Musselshell River at Mosby	MDNRC, USAE	GM

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 6--Continued</u>			
06131000	Big Dry Creek near Van Norman	USAE, USGS	DGM
06131120	Timber Creek near Van Norman	MDSL	GM
06131200	Nelson Creek near Van Norman	BLM	DGM
06131500	Fort Peck Lake at Fort Peck	USAE	GW
06131800	Missouri River stage station No. 1 at Fort Peck	USAE	DPW
06132000	Missouri River below Fort Peck Dam	USAE, USGS	DGM
06132200	South Fork Milk River near Babb	WWT	GPW
06133000	Milk River at western crossing of international boundary	WWT	GW
06133500	North Fork Milk River above St. Mary Canal, near Browning	WWT	GPW
06134000	North Milk River near international boundary	WWT	GW
06134500	Milk River at Milk River, Alberta	WWT	GPTW
06135000	Milk River at eastern crossing of international boundary	WWT	DGPTW
06135500	Sage Creek at Q Ranch, near Wild Horse, Alberta	WWT	GW
06136000	Sage Creek at international boundary	WWT	GW
06136500	Fresno Reservoir near Havre	MDNRC	0
06137400	Big Sandy Creek at reservation boundary, near Rocky Boy	BIA	DGM
06137570	Boxelder Creek near Rocky Boy	BIA	DGPW
06140500	Milk River at Havre	USAE	DGM
06144260	Altawan Reservoir near Govenlock, Saskatchewan	WWT	GM
06144270	Spangler Ditch near Govenlock, Saskatchewan	WWT	GW
06144350	Middle Creek near Saskatchewan boundary	WWT	GW
06144360	Middle Creek Reservoir near Battle Creek, Saskatchewan	WWT	GM
06144395	Middle Creek below Middle Creek Reservoir, near Govenlock, Saskatchewan	WWT	GW
06145500	Lodge Creek below McRae Creek, at international boundary	WWT	GPTW
06147950	Gaff Ditch near Merryflat, Saskatchewan	WWT	GW
06148500	Cypress Lake west inflow canal near West Plains, Saskatchewan	WWT	GW
06148700	Cypress Lake west inflow canal drain near Oxarat, Saskatchewan	WWT	GW
06149000	Cypress Lake west outflow canal near West Plains, Saskatchewan	WWT	GPW
06149100	Vidora Ditch near Consul, Saskatchewan	WWT	GW
06149200	Richardson Ditch near Consul, Saskatchewan	WWT	GW
06149300	McKinnon Ditch near Consul, Saskatchewan	WWT	GW

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 6--Continued</u>			
06149400	Nashlyn Canal near Consul, Saskatchewan	WWT	GW
06149500	Battle Creek at international boundary	WWT	CDGW
06151000	Lyons Creek at international boundary	WWT	GW
06154100	Milk River near Harlem	MDNRC	GDM
06154140	Fifteenmile Creek tributary near Harlem	BIA	GW
06154400	Peoples Creek near Hays	BIA	GW
06154410	Little Peoples Creek near Hays	USGS	GM
06154490	Willow Coulee near Dodson	BIA	GW
06154500	Peoples Creek near Dodson	BIA	DGMW
06154510	Kuhr Coulee tributary near Dodson	BIA	GW
06155000	Nelson Reservoir near Saco	MDNRC	O
06155030	Milk River near Dodson	MDNRC	DGM
06156500	Belanger Creek diversion canal near Vidora, Saskatchewan	WWT	GPW
06157000	Cypress Lake near Vidora, Saskatchewan	WWT	GW
06157500	Cypress Lake east outflow canal near Vidora, Saskatchewan	WWT	GPW
06158500	Eastend Canal at Eastend, Saskatchewan	WWT	GW
06159000	Eastend Reservoir at Eastend, Saskatchewan	WWT	GM
06159500	Frenchman River below Eastend Reservoir, near Eastend, Saskatchewan	WWT	GPW
06161300	Huff Lake pumping canal near Val Marie, Saskatchewan	WWT	GW
06161500	Huff Lake gravity canal near Val Marie, Saskatchewan	WWT	GW
06162000	Huff Lake near Val Marie, Saskatchewan	WWT	GM
06162500	Newton Lake main canal near Val Marie, Saskatchewan	WWT	GW
06163000	Newton Lake near Val Marie, Saskatchewan	WWT	GM
06163050	Frenchman River below Newton Lake, near Val Marie, Saskatchewan	WWT	GW
06164000	Frenchman River at international boundary	WWT	GPTW
06164510	Milk River at Juneberg Bridge, near Saco	USBR	DGMP
06164590	Beaver Creek near Zortman	BIA	DGM
06164615	Little Warm Creek at reservation boundary, near Zortman	BIA	DGM
06164623	Little Warm Creek tributary near Lodge Pole	BIA	GW
06164630	Big Warm Creek near Zortman	BIA	DGM
06166000	Beaver Creek below Guston Coulee, near Saco	USGS	GM
06169500	Rock Creek below Horse Creek, near international boundary	USGS	DGPW
06169600	South Fork Rock Creek tributary No. 1 near Opheim	BLM	GW
06169700	South Fork Rock Creek tributary No. 2 near Opheim	BLM	GW

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 6--Continued</u>			
06169800	South Fork Rock Creek tributary No. 3 near international boundary	BLM	GW
06170050	Rock Creek below McEachern Creek near international boundary	BLM	GDM
06170080	Rock Creek tributary near international boundary	BLM	GW
06172000	Milk River near Vandalia	MDNRC	GDM
06174000	Willow Creek near Glasgow	USGS	GM
06174500	Milk River at Nashua	USAE	CDGMPRW
06175000	Porcupine Creek at Nashua	BIA	GM
06175100	Missouri River stage station No. 3 at West Frazer pumping plant, near Frazer	USAE	DPW
06175510	Missouri River stage station No. 4 at East Frazer pumping plant, near Frazer	USAE	DPW
06175520	Missouri River stage station No. 5 near Oswego	USAE	DGM
06175540	Prairie Elk Creek near Oswego	USGS	DGM
06176500	Wolf Creek near Wolf Point	BIA	GMW
06177000	Missouri River near Wolf Point	USAE	ACDGMPRW
06177400	McCune Creek near Circle	MDSL	GW
06177500	Redwater River at Circle	USGS	DGPW
06177650	Redwater River near Richey	MDSL	GM
06177700	Cow Creek tributary near Vida	MDSL	GW
06177825	Redwater River near Vida	BLM	GM
06178000	Poplar River at international boundary	MDNRC	CDGMPW
06178500	East Poplar River at international boundary	MDNRC	CDGPW
06181000	Poplar River near Poplar	BIA	GW
06181995	Beaver Creek at international boundary	WWT	GPW
06183450	Big Muddy Creek near Antelope	USGS	DGMP
06185110	Big Muddy Creek near mouth, near Culbertson	BIA	GM
06185500	Missouri River near Culbertson	USAE	CDGMR
06186500	Yellowstone River at Yellowstone Lake outlet, Yellowstone National Park	USGS	BDGW
06187550	Yellowstone River at Tower Junction, Yellowstone National Park	USGS	BDGM
06191500	Yellowstone River at Corwin Springs	USAE	CDGPW
06191800	Big Creek near Emigrant	MDFWP	DW
06192500	Yellowstone River near Livingston	USAE	DGPTW
06195600	Shields River near Livingston	MDFWP	DGM
06200000	Boulder River at Big Timber	MDNRC	DGPTW
06202510	Stillwater River above Nye Creek, near Nye	MDFWP	0
06204000	Mystic Lake near Roscoe	FERC	0
06204050	West Rosebud Creek near Roscoe	FERC	DGPW
06205000	Stillwater River near Absarokee	USAE	DGMTW
06207500	Clarks Fork Yellowstone River near Belfry	MDNRC, WSE	DGMW
06208400	Elbow Creek near Joliet	BLM	0

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 6--Continued</u>			
06208800	Clarks Fork Yellowstone River near Silesia	MDNRC, WSE	DGM
06211000	Red Lodge Creek above Cooney Reservoir, near Boyd	MDNRC	GW
06211500	Willow Creek near Boyd	MDNRC	GW
06212000	Cooney Reservoir near Boyd	MDNRC	O
06212500	Red Lodge Creek below Cooney Reservoir, near Boyd	MDNRC	DPW
06214500	Yellowstone River at Billings	USAE	DGPTW
06216000	Pryor Creek at Pryor	USGS	DPW
06216900	Pryor Creek near Huntley	USGS	DGM
06286400	Bighorn Lake near St. Xavier	USGS	GW
06286490	Bighorn Canal near St. Xavier	USBR	GW
06287000	Bighorn River near St. Xavier	USBR	DGPW
06289000	Little Bighorn River at State line, near Wyola	USGS	DGW
06290000	Pass Creek near Wyola	BIA	DGM
06290500	Little Bighorn River below Pass Creek, near Wyola	USGS	DGW
06291000	Owl Creek near Lodge Grass	BIA	DGM
06291500	Lodge Grass Creek above Willow Creek diversion, near Wyola	BIA	DGM
06294000	Little Bighorn River near Hardin	MDNRC, WSE	DW
06294500	Bighorn River above Tullock Creek,	MDNRC, WSE	DGM
06294600	East Cabin Creek tributary near Hardin	MDSL	GW
06294940	Sarpy Creek near Hysham	USGS	DGW
06294950	Starve to Death Creek near Sanders	USGS	O
06294995	Armells Creek near Forsyth	USGS	GW
06295000	Yellowstone River at Forsyth	USBR	DGMP
06295100	Rosebud Creek near Kirby	MDSL	GW
06295113	Rosebud Creek at reservation boundary, near Kirby	USGS	GM
06295250	Rosebud Creek near Colstrip	BIA	DGM
06296003	Rosebud Creek at mouth, near Rosebud	MDNRC	DGM
06296100	Snell Creek near Hathaway	MDSL	GW
06306100	Squirrel Creek near Decker	MDSL	DGM
06306300	Tongue River at State line, near Decker	MDNRC	DGPW
06306950	South Fork Leak Rock Creek near Kirby	MDSL	GW
06307000	Tongue River Reservoir near Decker	MDNRC	O
06307500	Tongue River at Tongue River Dam, near Decker	MDNRC	DGW
06307528	Prairie Dog Creek near Birney	USGS	DGM
06307600	Hanging Woman Creek near Birney	BLM	GW
06307616	Tongue River at Birney Day School Bridge, near Birney	USGS	GPW
06307717	Otter Creek below Fifteenmile Creek, near Otter	MDSL	DGM

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 6--Continued</u>			
06307740	Otter Creek at Ashland	MDSL	DGPW
06307830	Tongue River below Brandenburg Bridge, near Ashland	MDNRC	DGPW
06308400	Pumpkin Creek near Miles City	MDSL	DGW
06308500	Tongue River at Miles City	MDNRC, WSE	DGMW
06309000	Yellowstone River at Miles City	USAE	DGMP
06309075	Sunday Creek near Miles City	MDNRC	DGM
06324500	Powder River at Moorhead	MDNRC	DGPW
06324710	Powder River at Broadus	USGS	GM
06326300	Mizpah Creek near Mizpah	MDNRC	GDM
06326500	Powder River near Locate	MDNRC, WSE	DGMP
06326600	O'Fallon Creek near Ismay	MDNRC	DGM
06326952	Clear Creek near Lindsay	MDSL	GW
06328200	Lower Sevenmile Creek near Bloomfield	MDSL	GW
06329200	Burns Creek near Savage	USGS	GMP
06329500	Yellowstone River near Sidney	USAE	ACDGMP
06336447	Duck Creek near Wibaux	MDSL	GM
<u>Part 12</u>			
12301300	Tobacco River near Eureka	USAE	AGW
12301920	Lake Koocanusa near Libby	USAE	GW
12301933	Kootenai River below Libby Dam, near Libby	USAE	DGMPU
12302055	Fisher River near Libby	USAE	AGPUW
12303000	Kootenai River at Libby	USAE	DGPUW
12303100	Flower Creek near Libby	USGS	GW
12303500	Lake Creek at Troy	FERC	DGM
12304500	Yaak River near Troy	USAE	AGPUW
12322500	Silver Bow Creek above Blacktail Creek at Butte	MBMG	DW
12322800	Blacktail Creek near Butte	MBMG	DGM
12323000	Silver Bow Creek below Blacktail Creek at Butte	MBMG	DGM
12323770	Warm Springs Creek at Warm Springs	MDFWP	DW
12324200	Clark Fork at Deer Lodge	MDFWP	DGM
12324590	Little Blackfoot River near Garrison	MDNRC	DGM
12324680	Clark Fork at Goldcreek	MDFWP	DGM
12325000	Georgetown Lake near Southern Cross	FERC	O
12325500	Flint Creek near Southern Cross	FERC	DOW
12329500	Flint Creek at Maxville	MDNRC	DGW
12330000	Boulder Creek at Maxville	MDNRC	DGW
12331900	Clark Fork near Clinton	MDFWP	O
12332000	Middle Fork Rock Creek near Philipsburg	MDNRC	DGW
12332500	East Fork Rock Creek Reservoir near Philipsburg	MDNRC	O
12334510	Rock Creek near Clinton	MDNRC	CDGPW

Table 1.--Surface-water gaging stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Gage equipment
<u>Part 12--Continued</u>			
12335500	Nevada Creek above reservoir, near Finn	MDNRC	DGM
12336500	Nevada Lake near Finn	MDNRC	O
12339450	Clearwater River near Clearwater	MDNRC	DGW
12340000	Blackfoot River near Bonner	USGS	DGPTW
12340500	Clark Fork above Missoula	USAE	DGPTW
12342000	Painted Rocks Lake near Conner	MDNRC	O
12342500	West Fork Bitterroot River near Conner	MDNRC	DGPW
12344000	Bitterroot River near Darby	MDNRC	DCGPW
12344500	Lake Como near Darby	MDNRC	O
12353000	Clark Fork below Missoula	MDHES	DGPTW
12353820	Dry Creek near Superior	MDH	DGM
12354500	Clark Fork at St. Regis	USGS	DGPUW
12355000	Flathead River at Flathead, British Columbia	WWT	AGM
12355500	North Fork Flathead River near Columbia Falls	USGS	AGM
12358500	Middle Fork Flathead River near West Glacier	BPA	GWU
12362000	Hungry Horse Reservoir near Hungry Horse	USBR	GW
12362500	South Fork Flathead River near Columbia Falls	USBR	ADGPSW
12363000	Flathead River at Columbia Falls	FERC	ADGPUW
12365000	Stillwater River near Whitefish	MDNRC	GW
12366000	Whitefish River near Kalispell	MDNRC	GW
12369200	Swan River near Condon	MDFWP	GW
12370000	Swan River near Bigfork	BPA	GPTW
12370900	Teepee Creek near Polson	BIA	GW
12371500	Flathead Lake at Somers	FERC	GW
12371550	Flathead Lake at Polson	FERC	GPUW
12372000	Flathead River near Polson	FERC	AGPSW
12374250	Mill Creek above Bassoo Creek, near Niarada	BIA	GM
12374800	Cromwell Creek near Niarada	BIA	GM
12375900	South Fork Crow Creek near Ronan	BIA	DGM
12377150	Mission Creek above Reservoir, near St. Ignatius	BIA	DGM
12381400	South Fork Jocko River near Arlee	BIA	DGM
12383500	Big Knife Creek near Arlee	BIA	DGM
12387450	Valley Creek near Arlee	BIA	GW
12388400	Revais Creek below West Fork, near Dixon	BIA	DGM
12388650	Camas Creek near Hot Springs	BIA	GM
12388700	Flathead River at Perma	BIA	DGM
12389000	Clark Fork near Plains	FERC	DGPUW
12389500	Thompson River near Thompson Falls	FERC	GPW
12390000	Thompson Falls Reservoir at Thompson Falls	FERC	O
12390700	Prospect Creek at Thompson Falls	FERC	GPW
12391300	Noxon Rapids Reservoir near Noxon	FERC	GW
12391400	Clark Fork below Noxon Rapids Dam, near Noxon	FERC	O

Table 2.--Surface-water-quality stations in operation as of October 1983

Station number

Stations are listed in downstream order by standard drainage basin number: Part 5 (Hudson Bay basin), Part 6 (Missouri River basin) and Part 12 (Upper Columbia River basin). Each station number contains a 2-digit part number plus a 6-digit downstream order number. Locations of the stations are shown in figure 3.

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BIA	U.S. Bureau of Indian Affairs
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MDFWP	Montana Department of Fish, Wildlife, and Parks
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MDSL	Montana Department of State Lands
USAE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WSE	Wyoming State Engineer
WWT	U.S. Department of State-International Joint Commission, Waterways Treaty

Sampling frequency

0	Once-daily, continuous
1	Once-daily, seasonal
2	Monthly
3	Bimonthly
4	Quarterly
5	Miscellaneous
6	Continuous record

Table 2.--Surface-water-quality stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Sampling frequency				Specific conductance
			Chemical	Sediment	Temperature	Biological	
<u>Part 5</u>							
05020500	St. Mary River at international boundary	USGS	3	3	3	3	3
<u>Part 6</u>							
06025500	Big Hole River near Melrose	MDFWP	-	-	6	-	-
06036905	Firehole River near West Yellowstone	USGS	-	-	6	-	6
06037000	Gibbon River near West Yellowstone	USGS	-	-	6	-	6
06037500	Madison River near West Yellowstone	USGS	-	-	6	-	6
06041000	Madison River below Ennis Lake, near McAllister	MDFWP	-	-	6	-	-
06052500	Gallatin River at Logan	MDFWP	-	-	6	-	-
06054500	Missouri River at Toston	USGS	4	4	6	4	4
06058502	Missouri River below Canyon Ferry Dam, near Helena	USGS	2	-	0	-	0
06089000	Sun River near Vaughn	USGS	2	-	0	-	0
06090800	Missouri River at Fort Benton	USGS	3	3	3	3	3
06093600	Two Medicine River near Cut Bank	BIA	5	-	2	-	2
06097200	Blacktail Creek near Dupuyer	BIA	5	-	2	-	2
06098900	Big Rock Coulee near Santa Rita	BIA	5	-	2	-	2
06099000	Cut Bank Creek at Cut Bank	BIA	5	-	2	-	2
06099100	Spring Creek near Cut Bank	BIA	5	-	2	-	2
06101500	Marias River near Chester	USGS	3	3	3	3	3
06109500	Missouri River at Virgelle	USGS	3	3	3	3	3
06115200	Missouri River near Landusky	USGS, USAE	3	0	0	3	3
06126470	Halfbreed Creek near Klein	USGS	4	4	4	-	4
06130500	Musselshell River at Mosby	USGS, USAE	4	0	0	4	4
06132000	Missouri River below Fort Peck Dam	USGS	3	3	3	3	3
06133000	Milk River at western crossing of international boundary	WWT	5	-	5	-	5
06134000	North Milk River near international boundary	WWT	5	-	5	-	5
06135000	Milk River at eastern crossing of international boundary	WWT	5	-	5	-	5

Table 2.--Surface-water-quality stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Sampling frequency				Specific conductance
			Chemical	Sediment	Temperature	Biological	
<u>Part 6--Continued</u>							
06137400	Big Sandy Creek at reservation boundary, near Rocky Boy	BIA	5	-	2	-	2
06137540	Duck Creek near Box Elder	BIA	5	-	2	-	2
06137550	Camp Creek near Box Elder	BIA	5	-	2	-	2
06138300	Sage Creek near Box Elder	BIA	5	-	2	-	2
06138570	Big Sandy Creek above Gravel Coulee, near Laredo	BIA	5	-	2	-	2
06139900	Beaver Creek at reservation boundary, near Rocky Boy	BIA	5	-	2	-	2
06154150	White Bear Creek below Fifteenmile Creek near Dodson	BIA	5	-	2	-	2
06154390	Peoples Creek near Cleveland	BIA	5	-	2	-	2
06154410	Little Peoples Creek near Hays	USGS	4	4	4	4	4
06154430	Lodge Pole Creek at Lodge Pole	BIA	5	-	2	-	2
06154500	Peoples Creek near Dodson	BIA	5	-	2	-	2
06164510	Milk River at Juneberg Bridge, near Saco	USGS	2	-	0	-	0
06164590	Beaver Creek near Zortman	BIA	5	-	2	-	2
06164615	Little Warm Creek at reservation boundary, near Zortman	BIA	5	-	2	-	2
06164630	Big Warm Creek near Zortman	BIA	5	-	2	-	2
06166000	Beaver Creek below Guston Coulee, near Saco	USGS	2	-	2	-	2
06167100	Beaver Creek above dam, near Saco	USGS	4	-	4	-	4
06169500	Rock Creek below Horse Creek, near international boundary	USGS	4	4	4	4	4
06174500	Milk River at Nashua	USGS	3	3	3	3	3
06174550	Middle Fork Porcupine Creek near Baylor	BIA	5	-	2	-	2
06174700	West Fork Porcupine Creek near Baylor	BIA	5	-	2	-	2
06175000	Porcupine Creek at Nashua	BIA	5	-	2	-	2
06175505	Little Porcupine Creek below diversion at Frazer	BIA	5	-	2	-	2
06176500	Wolf Creek near Wolf Point	BIA	5	-	2	-	2
06177000	Missouri River near Wolf Point	MDFWP	-	-	6	-	-
06177025	Tule Creek near Poplar	BIA	5	-	2	-	2
06177500	Redwater River at Circle	BLM	4	4	4	-	4
06177650	Redwater River near Richey	MDSL	2	2	0	-	0
06177825	Redwater River near Vida	BLM	4	4	4	-	4
06178000	Poplar River at international boundary	USGS	2	2	2	-	2

Table 2.--Surface-water-quality stations in operation as of October 1983--Continued

Station number	Station name	Supported by	Sampling frequency				Specific conductance
			Chemical	Sediment	Temperature	Biological	
<u>Part 6--Continued</u>							
06178500	East Poplar River at international boundary	--	2	2	0	-	0
06179000	East Fork Poplar River near Scobey	--	2	2	2	-	2
06180400	West Fork Poplar River near Bredette	BIA	2	2	2	-	2
06181995	Beaver Creek at international boundary	WWT	4	4	4	-	4
06183450	Big Muddy Creek near Antelope	USGS	2	2	2	-	2
06183900	Wolf Creek near Reserve	BIA	5	-	2	-	2
06184400	Smoke Creek near Flaxville	BIA	5	-	2	-	2
06185110	Big Muddy Creek near mouth, near Culbertson	BIA	5	-	2	-	2
06185500	Missouri River near Culbertson	USGS	3	3	3	3	3
06186500	Yellowstone River at Yellowstone Lake outlet	USGS	-	-	6	-	6
06187550	Yellowstone River near Tower Junction	USGS	-	-	6	-	6
06192500	Yellowstone River near Livingston	USGS	3	3	3	3	3
06207500	Clarks Fork Yellowstone River near Belfry	WSE	2	-	2	-	2
06214500	Yellowstone River at Billings	USGS	4	4	4	4	4
06294700	Bighorn River at Bighorn	USGS	3	3	3	3	3
06294940	Sarpy Creek near Hysham	USGS	2	2	2	-	2
06294980	East Fork Armells Creek near Colstrip	MDSL	2	2	2	-	2
06294995	Armells Creek near Forsyth	MDNRC	2	2	2	-	2
06295113	Rosebud Creek at reservation boundary, near Kirby	BIA	4	4	4	-	4
06295250	Rosebud Creek near Colstrip	MDSL	4	4	4	-	4
06295380	Cow Creek near Colstrip	MDSL	2	2	2	-	0
06296003	Rosebud Creek at mouth, near Rosebud	BLM	4	4	4	-	4
06296120	Yellowstone River near Miles City	USGS	2	2	0	-	0
06306100	Squirrel Creek near Decker	MDSL	2	2	2	-	2
06306300	Tongue River at State line, near Decker	WSE, USGS	2	-	0	2	0
06307500	Tongue River at Tongue River Dam, near Decker	USGS	2	2	0	-	0
06307600	Hanging Woman Creek near Birney	MDSL	3	3	3	-	3
06307616	Tongue River at Birney Day School Bridge, near Birney	USGS	2	2	2	-	2

Table 2.--Surface-water-quality stations in operation as of October 1983--Continued

Station number	Station name	Sup-ported by	Sampling frequency				
			Chem-ical	Sedi-ment	Tem-perature	Bio-logical	Spe-cific con-ductance
<u>Part 6--Continued</u>							
06307665	Otter Creek near Otter	BLM	2	2	2	-	2
06307717	Otter Creek below Fifteenmile Creek, near Otter	MDSL	2	2	0	-	0
06307737	East Fork Otter Creek near Ashland	BLM	2	2	2	-	2
06307740	Otter Creek at Ashland	MDSL	2	2	0	-	0
06308400	Pumpkin Creek near Miles City	MDSL	4	4	4	-	4
06308500	Tongue River at Miles City	USGS, MDSL	4	0	0	4	4
06324500	Powder River at Moorhead	WSE, USGS	2	1	1	-	2
06324710	Powder River at Broadus	USGS	-	1	1	-	-
06326300	Mizpah Creek near Mizpah	BLM	4	4	4	-	4
06326500	Powder River near Locate	USGS	3	1	1	3	3
06326600	O'Fallon Creek near Ismay	USGS	4	4	4	-	4
06329200	Burns Creek near Savage	BLM	4	4	4	-	4
06329500	Yellowstone River near Sidney	USGS, USAE	3	0	6	3	3
06336500	Beaver Creek at Wibaux	USGS	2	2	2	-	2
<u>Part 12</u>							
12300110	Lake Koocanusa at international boundary	USAE	2	-	2	-	2
12301300	Tobacco River near Eureka	USAE	-	-	6	-	-
12301830	Lake Koocanusa at Tenmile Creek, near Libby	USAE	2	-	2	2	2
12301919	Lake Koocanusa at Forebay, near Libby	USAE	2	-	2	-	2
12301933	Kootenai River below Libby Dam, near Libby	USAE	2	-	2	-	2
12302055	Fisher River near Libby	USAE	-	-	6	-	-
12304500	Yaak River near Troy	USAE	-	-	6	-	-
12353000	Clark Fork below Missoula	USGS	3	3	3	3	3
12355000	Flathead River at Flathead, British Columbia	USGS	4	4	6	4	4
12355500	North Fork Flathead River near Columbia Falls	MDFWP	-	-	6	-	-
12362500	South Fork Flathead River near Columbia Falls	MDFWP	-	-	6	-	-
12363000	Flathead River at Columbia Falls	USGS	4	4	6	4	4
12370900	Teepee Creek near Polson	BIA	4	4	4	-	4

Table 2.--Surface-water-quality stations in operation as of October 1983--Continued

Station number	Station name	Sampling frequency					Specific conductance
		Funding	Chemical	Sediment	Temperature	Biological	
<u>Part 12--Continued</u>							
12374250	Mill Creek above Bassoo Creek, near Niarada	BIA	4	4	4	-	4
12374800	Cromwell Creek near Niarada	BIA	4	4	4	-	4
12375900	South Fork Crow Creek near Ronan	BIA	4	4	4	-	4
12377150	Mission Creek above reservoir, near St. Ignatius	BIA	4	4	4	-	4
12381400	South Fork Jocko River near Arlee	BIA	4	4	4	-	4
12383500	Big Knife Creek near Arlee	BIA	4	4	4	-	4
12387450	Valley Creek near Arlee	BIA	4	4	4	-	4
12388400	Revais Creek below West Fork, near Dixon	BIA	4	4	4	-	4
12388650	Camas Creek near Hot Springs	BIA	4	4	4	-	4
12388700	Flathead River at Perma	BIA	4	4	4	-	4

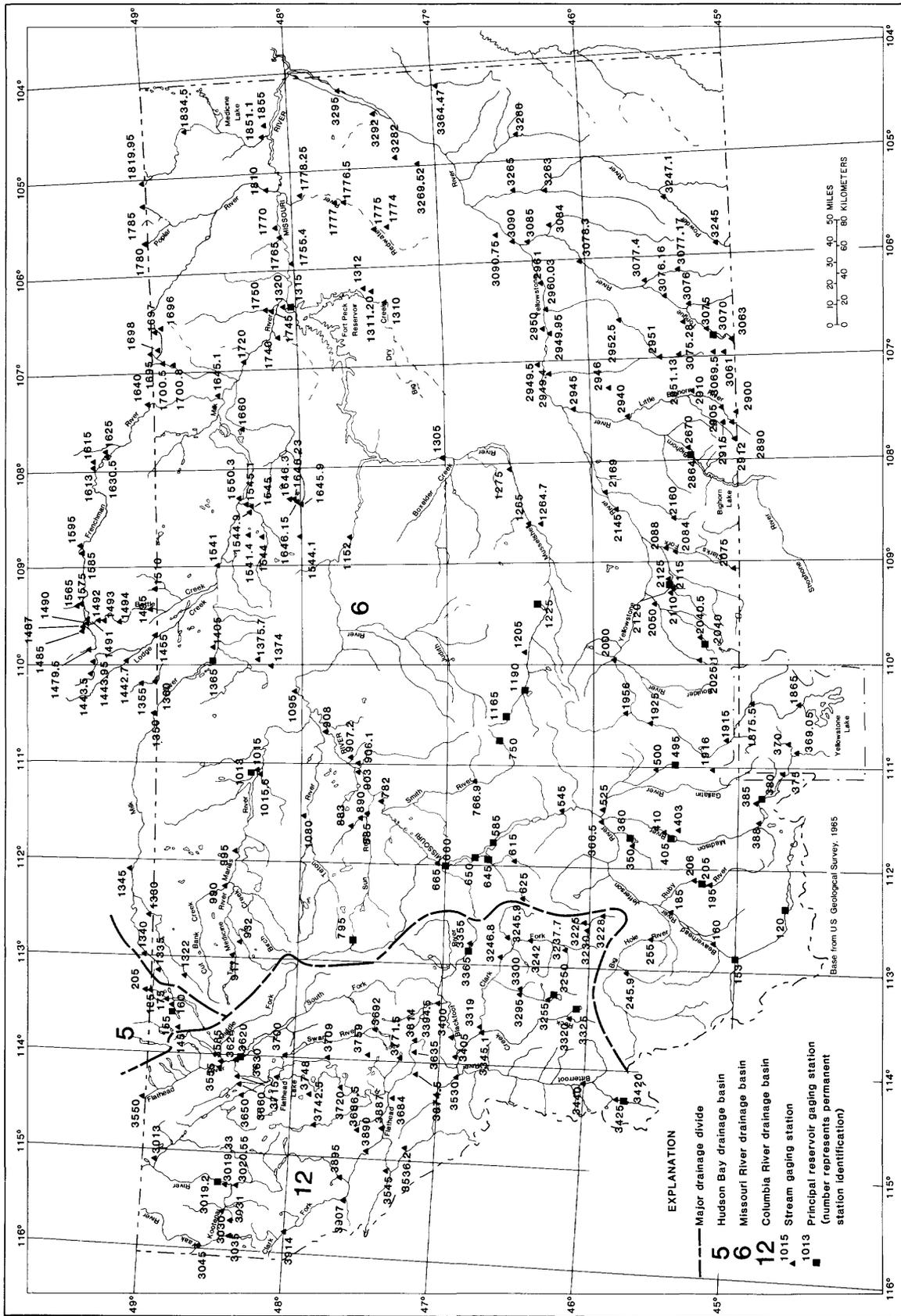


Figure 2.--Location of surface-water gaging stations, October 1983.

