TWENTY-NINTH ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1980

YELLOWSTONE RIVER COMPACT COMMISSION

821 East Interstate Avenue
Bismarck, North Dakota

Honorable Ed Herschler
Governor of the State of Wyoming
Cheyenne, Wyoming

Honorable Thomas L. Judge
Governor of the State of Montana
Helena, Montana

Honorable Arthur A. Link
Governor of the State of North Dakota
Bismarck, North Dakota

Sirs:

Pursuant to Article III of the Yellowstone River Compact, the Commission submits the following twenty-ninth annual report of activities for the period ending September 30, 1980.

The Commission held a special meeting at Cody, Wyoming, on April 9, 1980. Mr. George L. Christopulos, Wyoming State Engineer, Mr. Gary Fritz, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, the designated representatives of their respective States, and Mr. L. Grady Moore, the designated Federal representative and chairman, were all present.

Others present were:

William Long, Deputy Wyoming State Engineer, Cheyenne, Wyoming,
Clem Lord, Interstate Streams Engineer, State Engineer's Office, Cheyenne, Wyoming,
Lou Allen, State Engineer's Office, Cheyenne, Wyoming,
Paul Kawulok, Wyoming Board of Control, Sheridan, Wyoming,
Tom King, Division Superintendent, State Engineer's Office, Riverton, Wyoming,
Dave Sprynczynatyk, State Water Commission, Bismarck, North Dakota,
Chester Blackburn, Water Commission, Ralston, Wyoming,
Lewis Frendenthal, Wyoming Water Development Commission, Thermopolis, Wyoming,
Willard C. Rhoads, Wyoming Water Development Commission, Cody, Wyoming,
Ted Meredith, Department of the Interior Field Solicitor, Billings, Montana,
Richard Moy, Department of Natural Resources and Conservation, Helena, Montana

This special meeting was called to discuss the Compact Administration Subcommittee meeting and the development of a proposal for a grant from the Old West Regional Commission.

The Commission held the annual meeting at Billings, Montana, on November 25, 1980. Mr. George L. Christopulos, Wyoming State Engineer, Mr. Gary Fritz, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, the designated representatives of their respective states, and Mr. L. Grady Moore, the designated Federal representative and chairman, were all present.

Others present were:

George M. Pike, District Chief, U.S. Geological Survey, Helena, Montana
Paul Schwieger, Office of the State Engineer, Cheyenne, Wyoming
Lou Allen, Office of the State Engineer, Cheyenne, Wyoming
Tommie J. King, Division Superintendent, Wyoming State Engineer's Office, Water Division III, Riverton, Wyoming
Paul Kawulok, Division Superintendent, Wyoming State Engineer's Office, Sheridan, Wyoming
Don MacIntyre, Chief Legal Counsel, Department of Natural Resources and Conservation, Helena, Montana
Lawrence J. Wolfe, Wyoming Attorney General's Office, Cheyenne, Wyoming
Michael Dwyer, North Dakota State Water Commission, Bismarck, North Dakota
Ted Meredith, Field Solicitor, U.S. Department of the Interior, Billings, Montana
Richard Moy, Chief of the Atmospheric Sciences Bureau, Department of Natural Resources and Conservation, Helena, Montana
Dave Kaumheimer, U.S. Fish and Wildlife Service, Billings, Montana
Allen Chronister, Montana Attorney General's Office, Helena, Montana
Michelle Johnston, U.S. Geological Survey, Compact Commission Secretary, Helena, Montana

No incidents during the year required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission feels that a program of intensive water-use regulations is not necessary. However, the attention of the Commission is continuing to focus on the need to define the detailed procedures for implementing Compact provisions previous to the time when development of water within the Yellowstone River Basin requires that these provisions be enforced.

The interest in Yellowstone River water for coal development and peripheral needs has continued to increase and it is evident that, at some yet undetermined time, the waters of the Yellowstone River system will need to be divided as allocated by Article V of the Compact.

The documentation of pre-1950 water rights has been completed in Wyoming. The 1973 Montana Water Use Act is assisting that State in its documentation, although it is still incomplete.

A problem that continues to be a major long-range concern to the Commission is the lack of proper quantification of all existing water rights. Of particular concern are the water rights of the Indian tribes and the implied Federal reserved rights. This issue is being tried in the State district court in Wyoming's Water Division III, which covers the Bighorn River Basin. The Commission believes that studies and action necessary to quantify these rights should be expedited.

The Commission feels that due to the potential for large-scale use of water associated with coal development, joint allocation and development studies should be conducted in the near future. To accomplish this in a timely manner, the Commission has applied for a grant from the Old West Regional Commission for the support of a 2-year project. The study team would work under the direction of the Commission and report quarterly on their activities.

Intake Water Company filed legal documents in U.S. District Court, Billings, Montana on October 1, 1980. The two actions are related to earlier action taken by Intake Water Company in 1973 and continued in 1977. Briefs on the current actions are to be filed in December. The suit centers around Article X of the Compact, interbasin transfer of water.

The Commission agreed to move the station Bighorn River at Bighorn upstream to a location above the confluence with Tullock Creek, beginning with the 1982 water year. The existing Bighorn station has always experienced backwater effects when flows on the Yellowstone River were large. The sum of the discharges from the new Bighorn River site and from the Tullock Creek near Bighorn site should provide a more accurate determination of flow from the Bighorn River Basin.

The budgets for fiscal years 1980 through 1982 are discussed in the following general report. The amount of funds required for future Commission activities will depend largely on the outcome of water-development plans, inflation, and the degree of water administration required.

Respectfully submitted,

George L. Christopulos
Commissioner for Wyoming

Gary Fritz
Commissioner for Montana

L. Grady Moore
Federal Representative

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ILLUSTRATION

GENERAL REPORT

Cost:

The work funded by the Commission, which to date has been primarily concerned with the collection of required hydrologic data, has been financed through cooperative arrangements whereby Montana and Wyoming each bear one-fourth of the cost and the remaining one-half is borne by the United States. The salaries and necessary expenses of the State and Federal representatives, and hydrologic data made available by other agencies, are not evaluated or considered as expenses of the Commission.

The expense of the Commission during Fiscal Year 1980 was $22,080, in accordance with the budget adopted for the year.

The budgets for Fiscal Years 1981 and 1982 were tentatively adopted subject to the availability of appropriations.

The budgets for the three fiscal years are summarized as follows:

October 1, 1979, to September 30, 1980 (Fiscal Year 1980):	
Continuation of existing stream-gaging programs	$22,080
October 1, 1980, to September 30, 1981 (Fiscal Year 1981):	
Continuation of existing stream-gaging program	24,280
October 1, 1981, to September 30, 1982 (Fiscal Year 1982):	
Estimate for continuation of existing stream-gaging program	30,800

Gaging Stations:

Gaging stations at the measuring sites specified in the Compact were continued in operation and satisfactory discharge records collected at each. Locations of gaging and reservoir stations are shown on a map of the Yellowstone River Basin at the end of the report.

During the water year ending September 30, 1980, annual streamflow was below average in all four tributaries of the Yellowstone River as given in the following table:

Measurement Point	Percent of Average
Clarks Fork Yellowstone River near Silesia, MT	94
Bighorn River at Bighorn minus Little Bighorn River near Hardin, MT Adjusted for change in contents in Bighorn Lake	77
Tongue River at Miles City, MT	48
Powder River at Locate, MT	42

Details of streamflow for Water Year 1980 and bar graphs showing comparisons with average flows during selected base periods and with the preceding year are given in appendix C.

Diversions:

No incidents during the year required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission believes that a program of intensive water-use regulations is not necessary.

Storage:

In reservoirs completed after January 1, 1950

Bighorn Lake, a U.S. Water and Power Resources Service project on the Bighorn River, and the largest storage project in the basin, contained 977,300 acre-feet at the beginning of the year and 1,061,000 acre-feet at the close. It fluctuated from a minimum of 752,300 acre-feet on May 8, 1980, to a maximum of 1,086,000 acre-feet on July 14, 1980. Boysen Reservoir, located on the Wind River and operated by the Water and Power Resources Service, began the year with 567,900 acre-feet in storage and ended with 607,700 acre-feet. Details regarding these reservoirs are given in appendix D. The Commission is cognizant of other reservoirs in this general group and considers their aggregate effect to be insufficient to warrant the collection of storage data at this time.

In reservoirs existing on January 1, 1950

As a matter of record and general information, month-end storage data are given in appendix E for reservoirs in existence above the points of measurement on January 1, 1950. These data are pertinent to allocation under Article V, Section C, Item 5 of the Compact.

RULES AND REGULATIONS FOR ADMINISTRATION OF THE YELLOWSTONE RIVER COMPACT

A compact, known as the Yellowstone River Compact, between the States of Wyoming, Montana, and North Dakota, having become effective on October 30, 1951, upon approval of the Congress of the United States, which apportions the waters of certain interstate tributaries of the Yellowstone River which are available after the appropriative rights existing in the States of Wyoming and Montana on January 1, 1950, are supplied, and after appropriative rights to the use of necessary supplemental water are also supplied as specified in the Compact, the following rules and regulations are adopted subject to the provisions for amendment revision or abrogation as provided herein.

Article I. Collection of Water Records

A. It shall be the joint and equal responsibility of the members of the States of Wyoming and Montana to collect, cause to be collected, or otherwise furnish records of tributary streamflow at the points of measurement specified in Article V (B) of the Compact, or as near thereto as is physically or economically feasible or justified.

1. Clarks Fork

The gaging station known as Clarks Fork near Silesia, Montana and located in NW1/4 SE1/4 sec. 1, T. 4 S., R. 23 E., shall be the point of measurement for the Clarks Fork.

2. Bighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River at Bighorn, Montana, and located in NE1/4 NE1/4 sec. 33, T. 5 N., R. 34 E., shall temporarily be the designated point of measurement on that stream. The flow of the Little Bighorn River as measured at the gaging station near Hardin, Montana, and located in SW1/4 NW1/4 sec. 20, T. 1 S., R. 34 E., shall be considered the point of measurement for that stream, except that if or when satisfactory records are not available, the records for the nearest upstream station with practical corrections for intervening inflow or diversion shall be used.

3. Tongue River

The gaging station known as the Tongue River at Miles City, Montana, and located in SE1/4 sec. 23, T. 7 N., R. 47 E., shall temporarily be the point of measurement for that stream.

4. Powder River

The gaging station known as the Powder River at Locate, Montana, and located in SE1/4 sec. 23, T. 8 N., R. 51 E., shall temporarily be the designated point of measurement for that stream.

B. Records of total annual diversion in acre-feet above the points of measurement designated in the Compact for irrigation, municipal, and industrial uses developed after January 1, 1950, shall be furnished by the members of the Commission for their respective States, at such time as the Commission deems necessary for interstate administration as provided by the terms of the Compact. Providing that if it be acceptable to the Commission, reasonable estimates thereof may be substituted.

C. Annual records of the net change in storage in all reservoirs, not excluded under Article V (E) of the Compact, above the point of measurement specified in the Compact and completed after January 1, 1950, and the annual net change in reservoirs existing prior to January 1, 1950, which is used for irrigation, municipal, and industrial purposes developed after January 1, 1950, shall be the primary responsibility of the member of the Commission in whose State such works are located; providing such data are not furnished by Federal agencies under the provisions of Article III (D) of the Compact, or collected by the Commission.

Article II. Office and Officers

A. The office of the Commission shall be located at the office of the Chairman of the Commission.

B. The Chairman of the Commission shall be the Federal representative as provided in the Compact.

C. The Secretary of the Commission shall be as provided for in Article III of these rules.

D. The credentials of each member of the Commission shall be placed on file in the office of the Commission.

Article III. Secretary

A. The Commission, subject to the approval of the Director of the United States Geological Survey, shall enter into cooperative agreements with the U.S. Geological Survey for such engineering and clerical services as may reasonably be necessary for the administration of the Compact. Said agreements shall provide that the Geological Survey shall:

1. Maintain and operate gaging stations at or near the points of measurement specified in Article V (A) of the Compact.

2. Assemble factual information on stream flow, diversion and reservoir storage for the preparation of an annual report to the Governors of the signatory States.

3. Make such investigations and reports as may be requested by the Commission in aid of its administration of the Compact.

B. Act as Secretary to the Commission.

Article IV. Budget

A. At the annual meeting of each even-numbered year or prior thereto, the Commission shall adopt a budget for operation during the ensuing biennium beginning July first. Such budget shall set forth the total cost of construction, maintenance and operation of gaging stations, the cost of engineering and clerical aid, and other necessary expenses excepting the salaries and personal expenses of the Commissioners. On odd-numbered years revisions of the budget shall be considered.

B. It shall be the obligation of the Commissioners of the States of Montana and Wyoming to endeavor to secure from the Legislature of their respective States sufficient funds with which to meet the obligations of this Compact, except insofar as provided by the Federal government.

Article V. Meetings

An annual meeting of the Commission shall be held each November at some mutually agreeable point in the

Yellowstone River Basin for consideration of the annual report for the water year ending the preceding September 30th, and for the transaction of such other business consistent with its authority; provided that by unanimous consent of the Commission the date and place of the annual meeting may be changed. Other meetings as may be deemed necessary shall be held at a time and place set by mutual agreement, for the transaction of any business consistent with its authority.

No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

Article VI. Amendments, Revisions and Abrogations.

The Rules and Regulations of the Commission may be amended or revised by a unanimous vote at any meeting of the Commission.

Gary Fritz
Commissioner for Montana

George L. Christopulos
Commissioner for Wyoming

ATTESTED:

L. Grady Moore
Federal Representative

Adopted November 17, 1953
Amended April 9, 1980

METRIC CONVERSION TABLE

The following factors may be used to convert the inch-pound units published herein to the International System (SI) of metric units. Subsequent reports will contain both the inch-pound and SI unit equivalents in the station manuscript descriptions until such time that all data will be published in SI units.

Multiply inch-pound units	By	To obtain SI units
	Length	
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
	Area	
acres	4047	square meters (m^2)
	.4047	*hectares (ha)
	.4047	square hectometer (hm^2)
	.004047	square kilometers (km^2)
square miles (mi^2)	2.590	square kilometers (km^2)
	Volume	
cfs-day (ft^3/s-day)	2447	cubic meters (m^3)
	.002447	cubic hectometers (hm^3)
acre-feet (acre-ft)	1233	cubic meters (m^3)
	.001233	cubic hectometers (hm^3)
	.000001233	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	28.32	liters per second (L/s)
	28.32	cubic decimeters per second (dm^3/s)
	.02832	cubic meters per second (m^3/s)

*The unit hectare is approved for use with the International System (SI) for a limited time. See NBS Special Bulletin 330, p. 15, 1972 edition.

MONTHLY SUMMARY OF DISCHARGE FOR COMPACT STREAM-GAGING STATIONS

06208800 CLARKS FORK YELLOWSTONE RIVER NEAR SILESIA, MT

LOCATION.--Lat 45°30'48", long 108°49'42", in NW1/4 SE1/4 sec. 1, T. 4 S., R. 23 E., Carbon County, Hydrologic Unit 10070006, on left bank 0.5 mi (0.8 km) downstream from Whitehorse Canal intake, 1 mi (2 km) upstream from Rock Creek, 3 mi (5 km) south of Silesia, and at mile 19 (31 km).

DRAINAGE AREA.--2,093 mi^2 (5,421 km^2).

PERIOD OF RECORD.--October 1969 to current year. Records for July 1921 to September 1969 (published as Clarks Fork Yellowstone River at Edgar) at site 5 mi (8 km) upstream not equivalent owing to diversion in Whitehorse Canal during irrigation season. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Datum of gage is 3,405.79 ft (1,038.085 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers).

REMARKS.--Records good except those for winter period, which are poor. Diversion for irrigation of about 42,600 acres (172 km^2) of which 1,100 acres (4.45 km^2) lie below station. In addition, about 9,000 acres (36.4 km^2) of land above station are irrigated by diversions from the adjoining Rock Creek basin.

AVERAGE DISCHARGE.--11 years, 1,199 ft^3/s (33.96 m^3/s), 868,700 acre-ft/yr (1.07 km^3/yr).

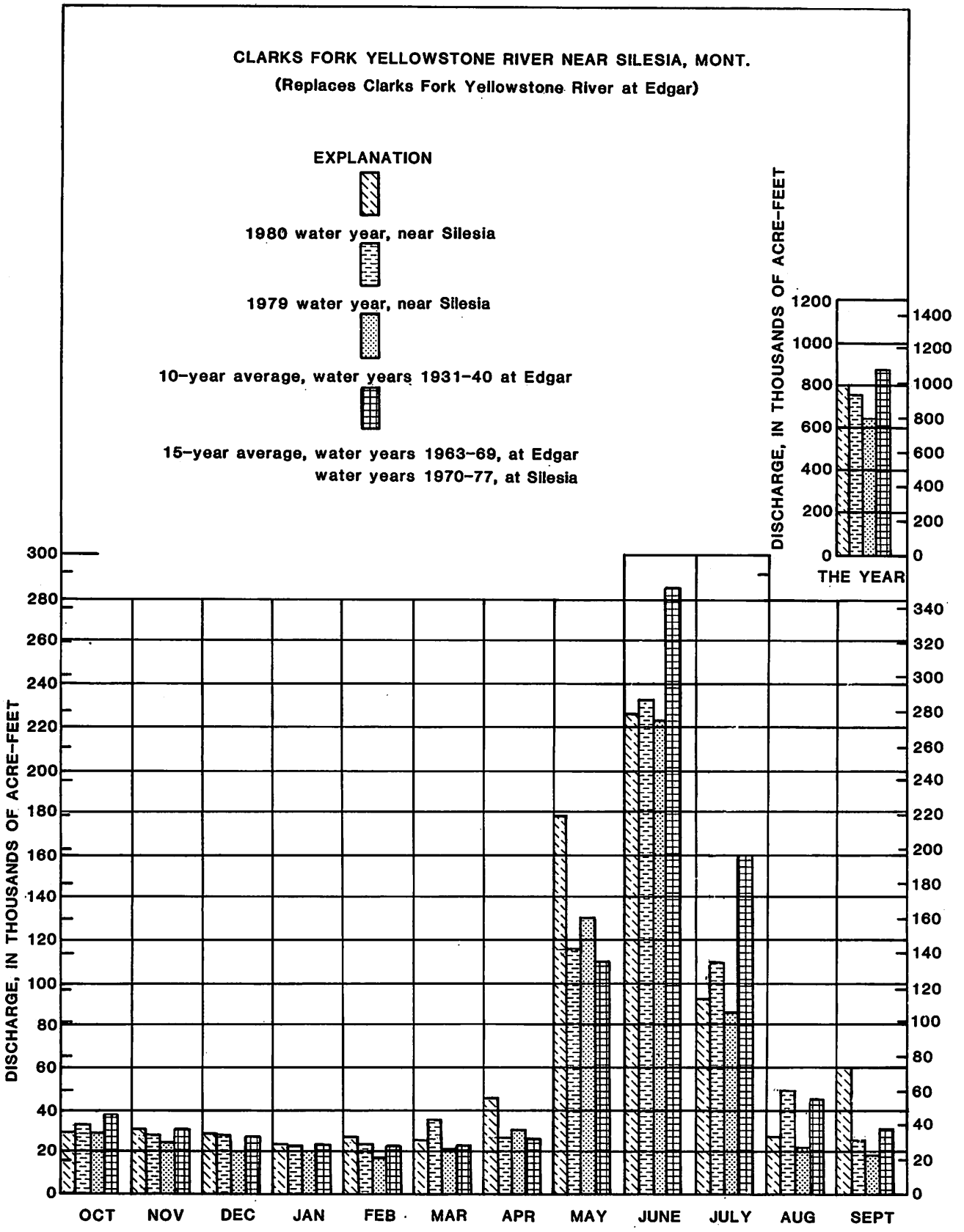
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,800 ft^3/s (334 m^3/s) June 10, 1972, gage height, 7.51 ft (2.289 m); maximum gage height, 7.82 ft (2.384 m) July 6, 1975; minimum discharge, 88 ft^3/s (2.36 m^3/s) July 21, 1977, gage height, 0.72 ft (0.219 m).

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 5,300 ft^3/s (150 m^3/s) and maximum (*):

Date	Time	Discharge (ft^3/s)	Discharge (m^3/s)	Gage height (ft)	Gage height (m)
May 23	1500	*7,560	214	*6.30	1.920
June 13	1500	5,840	165	5.41	1.649
June 22	1400	6,470	183	5.72	1.743

Minimum daily discharge, 180 ft^3/s (5.10 m^3/s) Mar. 5.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1979	14,989	484	561	368	29,730
November	15,967	532	600	460	31,670
December	14,663	473	621	240	29,080
January 1980	11,920	385	520	230	23,640
February	13,690	472	630	310	27,150
March	12,759	412	525	180	25,310
April	22,139	738	1,530	398	43,910
May	90,380	2,915	7,150	1,350	179,300
June	113,170	3,772	6,180	1,750	224,500
July	45,876	1,480	3,090	634	91,000
August	14,584	470	634	334	28,930
September 1980	30,443	1,015	1,820	471	60,380
1980 water year	400,580	1,094	7,150	180	794,600



Comparison of discharge during 1980 water year with 1979 water year near Silesia and with average discharge for water years 1931-40 and 1963-69 at Edgar and for water years 1970-77 at Silesia.

06294000 LITTLE BIGHORN RIVER NEAR HARDIN, MT

LOCATION.--Lat 45°44'08", long 107°33'27", in SE1/4 NE1/4 NE1/4 sec. 19, T. 1 S., R. 34 E., Big Horn County, Hydrologic Unit 10080016, on left bank 50 ft (15 m) downstream from bridge on Sarpy Road, 0.2 mi (0.3 km) upstream from terminal wasteway of Agency Canal, 0.6 mi (1.0 km) upstream from mouth, and 2.3 mi (3.7 km) east of Hardin.

DRAINAGE AREA.--1,294 mi^2 (3,351 km^2).

PERIOD OF RECORD.--June 1953 to current year. Records since June 1953 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Datum of gage is 2,882.29 ft (878.522 m), revised, National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Oct. 7, 1953, nonrecording gage at site 0.4 mi (0.6 km) downstream. Oct. 7, 1953, to May 6, 1963, water-stage recorder at site 0.3 mi (0.5 km) downstream. May 6, 1963, to Nov. 6, 1963, nonrecording gage at site 0.4 mi (0.6 km) downstream. All at different datums. Nov. 7, 1963, to Aug. 15, 1976, water-stage recorder at site 35 ft (11 m) downstream at present datum. Aug. 15, 1976, to Sept. 30, 1978, water-stage recorders located on each bank downstream of Sarpy Road bridge and were used depending on control conditions. The left-bank gage is given in the "LOCATION" paragraph. The right-bank gage location was lat 45°44'10", long 107°33'25", in SW1/4 NW1/4 NW1/4 sec. 20, T. 1 S., R. 34 E., at approximately the same datum. Oct. 1, 1979, to Sept. 30, 1980, water-stage recorder on left bank.

REMARKS.--Records good except those for winter period, which are poor. Flow partly regulated by Willow Creek Reservoir (capacity 23,000 acre-ft, 28.4 hm^3). Diversions for irrigation of about 17,000 acres (68.8 km^2) above station. Figures of discharge given herein include flow of terminal wasteway of Agency Canal.

AVERAGE DISCHARGE.--27 years, 322 ft^3/s (9.119 m^3/s), 233,300 acre-ft/yr (288 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,600 ft^3/s (640 m^3/s), May 19, 1978, gage height, 11.20 ft (3.414 m), used gage height as obtained at bridge on Sarpy Road; maximum gage height, 11.78 ft (3.591 m) Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.20 ft^3/s (0.006 m^3/s) Aug. 7, 1961, result of discharge measurement.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,000 ft^3/s (28.8 m^3/s) Feb. 26, only peak above base of 1,000 ft^3/s (28.3 m^3/s); maximum gage height, 4.83 ft (1.472 m) Feb. 23; minimum discharge, 34 ft^3/s (0.96 m^3/s) Aug. 2, gage height, 1.59 ft (0.485 m).

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1979	4,443	143	197	106	8,810
November	4,924	164	191	136	9,770
December	5,723	185	218	110	11,350
January 1980	6,050	195	360	100	12,000
February	8,830	304	1,000	130	17,510
March	11,569	373	797	260	22,950
April	8,771	292	342	257	17,400
May	11,645	376	746	254	23,100
June	10,843	361	580	166	21,510
July	2,945	80.5	148	43	4,950
August	2,048	66.1	89	36	4,060
September 1980	2,165	72.2	88	51	4,290
1980 water year	79,506	217	1,000	36	157,700

06294700 BIGHORN RIVER AT BIGHORN, MT

LOCATION.--Lat 46°08'50", long 107°28'00", in NE1/4 NE1/4 sec. 33, T. 5 N., R. 34 E., Treasure County, Hydrologic Unit 10080015, on right bank just downstream from bridge on old U.S. Highway 10, 0.3 mi (0.5 km) downstream from bridge on Interstate Highway 94, 0.7 mi (1.1 km) upstream from mouth, 1.3 mi (2.1 km) southwest of Bighorn, and 4.4 mi (7.1 km) east of Custer.

DRAINAGE AREA.--22,885 mi^2 (59,272 km^2). Area at site used prior to Oct. 7, 1955, 22,410 mi^2 (59,042 km^2).

PERIOD OF RECORD.--May 1945 to current year. Published as "near Custer," 1945-55. Records since January 1950 available in annual reports of the Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,690 ft (820 m), by barometer. May 11 to Dec. 6, 1945, nonrecording gage, and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 mi (6 km) upstream at different datum.

REMARKS.--Records good except those for winter periods and periods of backwater in May and June, which are poor. Flow regulated by Bighorn Lake beginning November 1965 (usable capacity, 1,356,000 acre-ft, 1.67 km^3). Major regulation prior to November 1965 by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft (1.73 km^3), see appendixes D and E. Diversions for irrigation of about 465,000 acres (1,880 km^2) above station.

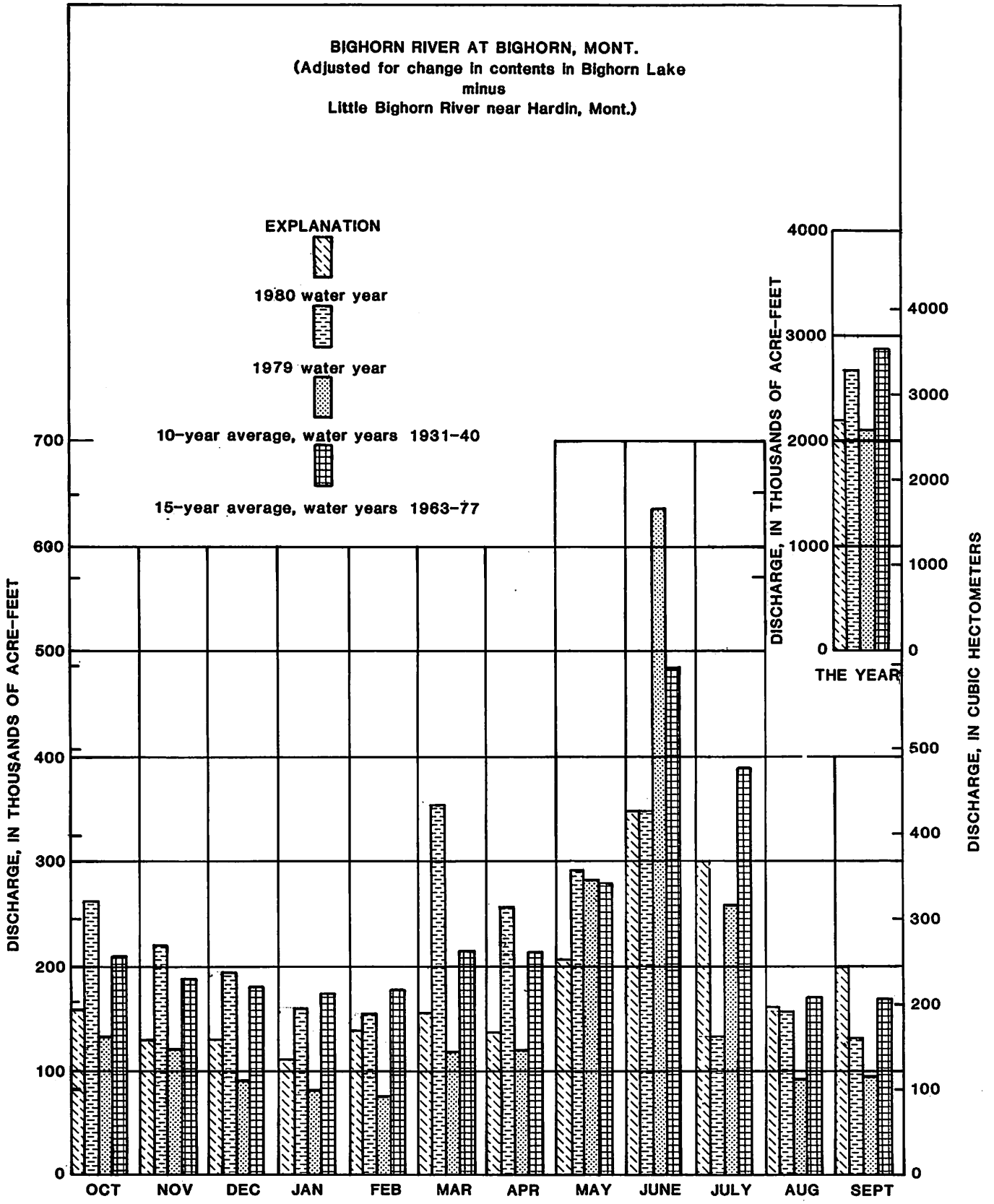
AVERAGE DISCHARGE.--35 years, 3,946 ft^3/s (111.8 m^3/s) 2,859,000 acre-ft/yr (3.53 km^3/yr), unadjusted.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 57,000 ft^3/s (1,610 m^3/s) May 20, 1978, gage height, 14.00 ft (4.267 m); maximum gage height recorded, 14.21 ft (4.331 m) Apr. 2, 1965 (ice jam); minimum discharge, about 275 ft^3/s (7.79 m^3/s) Nov. 15, 1959, result of freezeup; minimum daily, 400 ft^3/s (11.3 m^3/s) Apr. 4, 1967.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,690 ft^3/s (161 m^3/s) July 5, gage height, 4.46 ft (1.359 m); maximum gage height, 9.33 ft (2.844 m) Jan. 14 (backwater from ice jam); minimum discharge, 680 ft^3/s (19.3 m^3/s) Oct. 28.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet	Adjusted runoff, in acre-feet*
Oct. 1979	67,616	2,181	2,480	763	134,100	165,800
Nov.	60,645	2,022	2,670	763	120,300	141,300
Dec.	95,330	3,075	3,220	2,530	189,100	141,300
Jan. 1980	96,350	3,108	3,500	2,500	191,100	126,200
Feb.	104,910	3,618	4,620	3,200	208,100	153,200
Mar.	108,500	3,500	4,060	3,200	215,200	177,000
Apr.	110,240	3,675	4,620	2,240	218,700	154,600
May	73,150	2,360	3,280	1,440	145,100	233,600
June	101,590	3,386	5,590	2,650	201,500	369,900
July	139,180	4,490	5,590	2,530	276,100	307,100
Aug.	81,320	2,623	2,880	2,420	161,300	163,300
Sept. 1980	97,080	3,236	4,300	2,380	192,600	203,600
1980 water year	1,135,911	3,104	5,590	763	2,253,000	2,336,700

*Adjusted for change in contents in Bighorn Lake.



Comparison of discharge for 1980 water year with 1979 water year and with average discharge for water years 1931-40 and 1963-77.

06308500 TONGUE RIVER AT MILES CITY, MT

LOCATION.--Lat 46°20'44", long 105°48'10", in SE1/4 sec. 23, T. 7 N., R. 47 E., Custer County, Hydrologic Unit 10090102, on right bank 4 mi (6 km) south of Miles City and 8 mi (13 km) upstream from mouth.

DRAINAGE AREA.--5,379 mi^2 (13,932 km^2).

PERIOD OF RECORD.--April 1938 to April 1942, April 1946 to current year. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to October 1932. Monthly discharges only for some periods, published in WSP 1309. Records since January 1950 available in annual reports of Yellowstone Compact Commission.

GAGE.--Water-stage recorder. Datum of gage is 2,375.76 ft (724.132 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). April 1938 to April 1942, nonrecording gage at site 8 mi (13 km) upstream at different datum. April 1946 to Sept. 30, 1963, at datum 1.00 ft (0.305 m) higher.

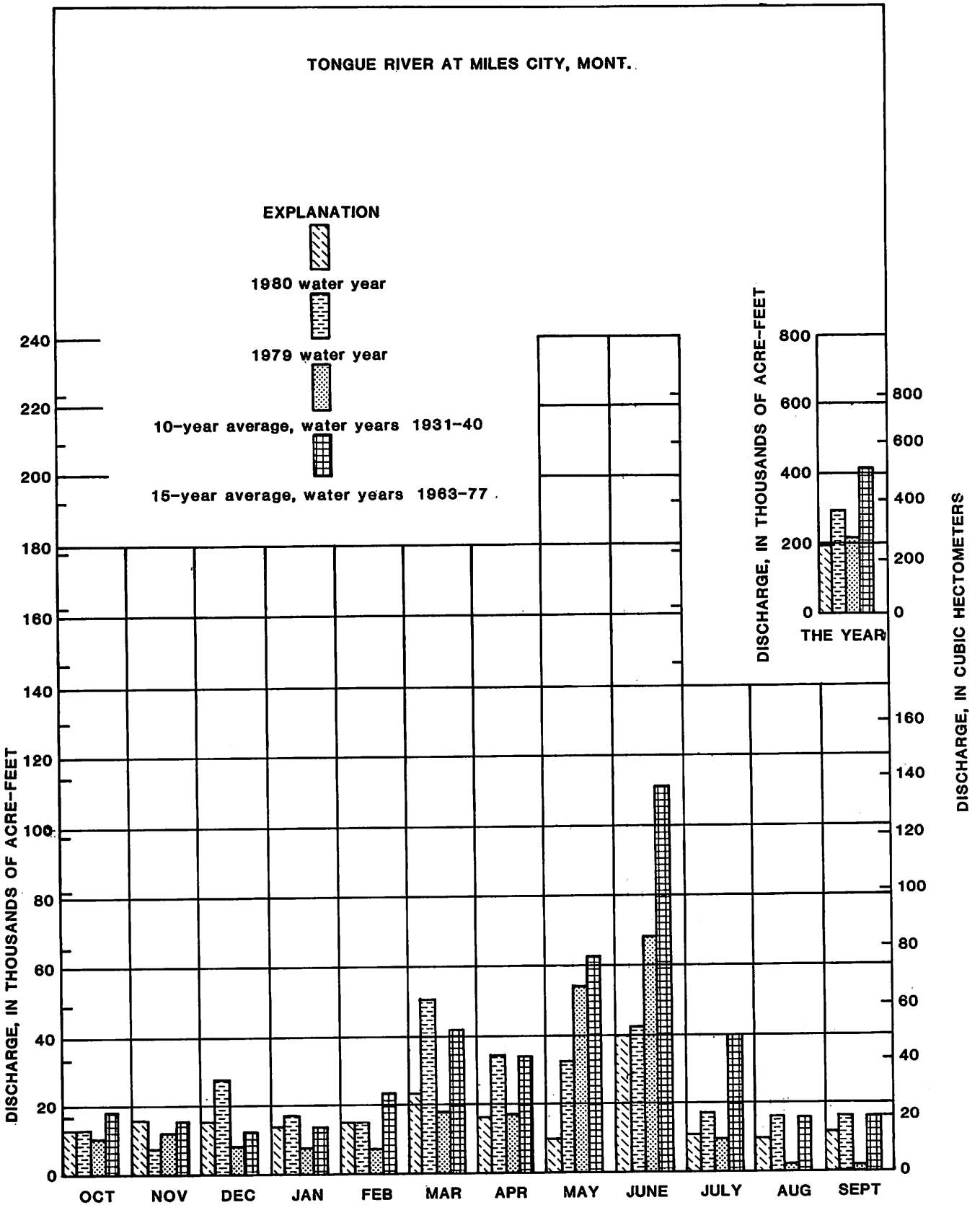
REMARKS.--Water-discharge records good except those for winter period, which are poor. Flow regulation by Tongue River Reservoir (appendix E) only, and many small reservoirs in Wyoming (combined capacity, about 15,000 acre-ft, 18.5 hm^3). Diversions for irrigation of about 90,000 acres (364 km^2) above station.

AVERAGE DISCHARGE.--37 years (1938-41, 1946-80), 448 ft^3/s (12.69 m^3/s), 324,600 acre-ft/yr (400 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,300 ft^3/s (337 m^3/s) June 15, 1962, gage height, 12.33 ft (3.758 m), present datum, from rating curve extended above 5,200 ft^3/s (147 m^3/s) on basis of float measurement; maximum gage height, 13.27 ft (4.045 m), present datum, Mar. 19, 1960, Feb. 15, 1971 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,170 ft^3/s (33.1 m^3/s) June 16, gage height, 3.63 ft (1.106 m); maximum gage height, 4.12 ft (1.256 m) Dec. 7 (ice jam); minimum discharge, 59 ft^3/s (1.67 m^3/s) May 25.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1979	6,340	205	268	115	12,580
November	7,933	264	338	190	15,740
December	7,570	244	580	90	15,020
January 1980	7,140	230	280	130	14,160
February	7,270	251	500	200	14,420
March	11,774	380	580	190	23,350
April	7,780	259	404	98	15,430
May	4,612	149	271	67	9,150
June	20,218	674	1,000	265	40,100
July	5,974	193	363	119	11,850
August	4,902	158	240	90	9,720
September 1980	5,858	195	228	163	11,620
1980 water year	97,371	266	1,000	67	193,100



Comparison of discharge during 1980 water year with 1979 water year and with average discharge for water years 1931-40 and 1963-77.

06326500 POWDER RIVER AT LOCATE, MT

LOCATION.--Lat 46°25'48", long 105°18'34", in SW1/4 SW1/4 SE1/4 sec. 23, T. 8 N., R. 51 E., Custer County, Hydrologic Unit 10090209, on right bank at downstream side of bridge on Highway 12, 0.12 mi (0.19 km) west of Locate, and 25 mi (40 km) east of Miles City.

DRAINAGE AREA.--13,189 mi^2 (34,160 km^2). Drainage area at site used Oct. 1, 1977, to Mar. 21, 1978, 13,194 mi^2 (34,172 km^2).

PERIOD OF RECORD.--March 1938 to current year. Oct. 5, 1966, to Mar. 21, 1978, published as "near Locate." Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

REVISED RECORDS.--WSP 926: 1939. WSP 1309: 1938-39 (M). WSP 1729: Drainage area.

GAGE.--Water-stage recorder. Altitude of gage is 2,384.79 ft (726.884 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to July 11, 1947, non-recording gage at bridge 50 ft (15 m) upstream, and July 11, 1947, to Sept. 30, 1965, water-stage recorder at present site and datum. Oct. 1, 1965, to Oct. 4, 1966, nonrecording gage, and Oct. 5, 1966, to Mar. 21, 1978, water-stage recorder 1.5 mi (2.4 km) downstream at different datum.

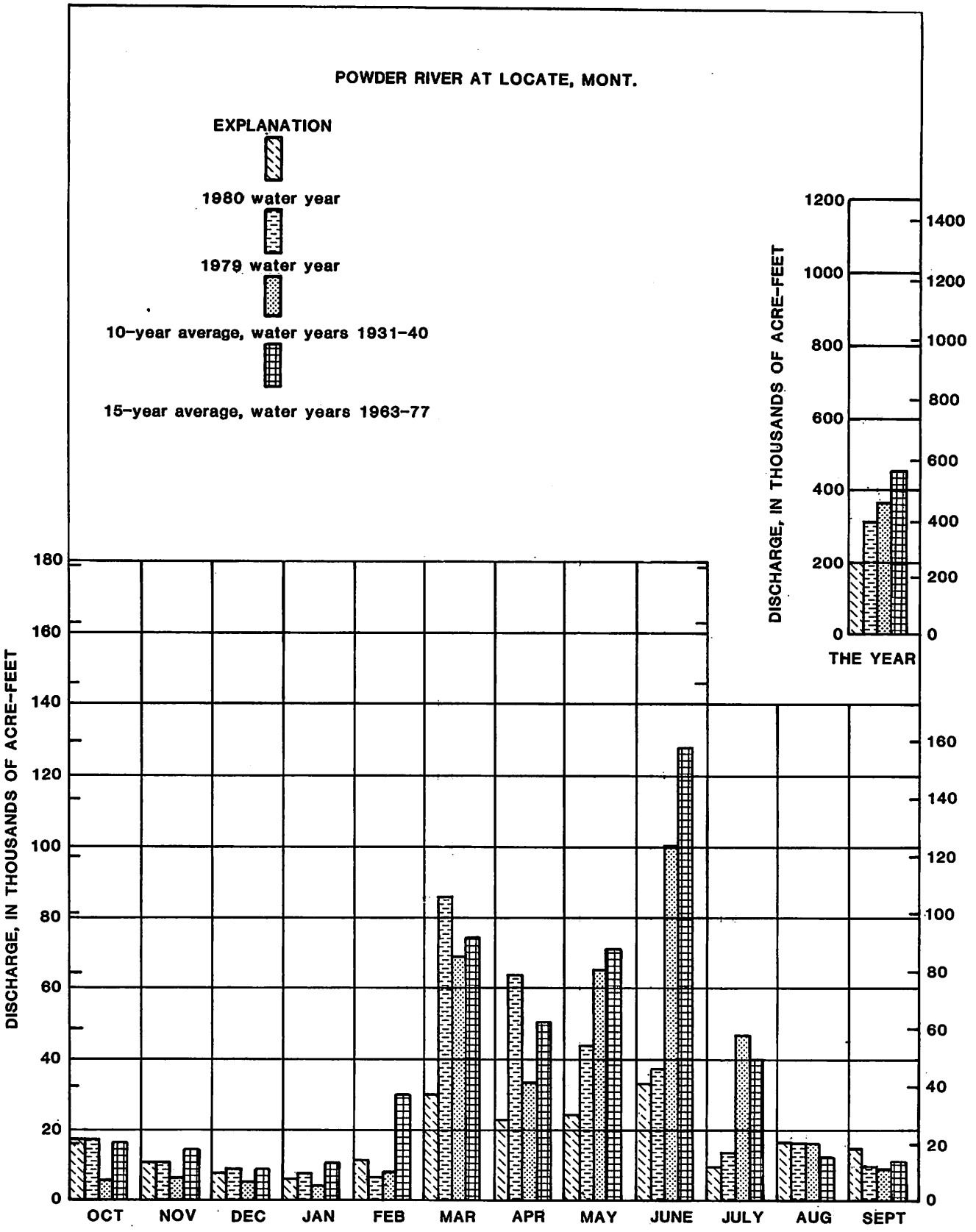
REMARKS.--Records fair except those for winter period, which are poor. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft (45.4 hm^3). Diversions for irrigation of about 74,500 acres (302 km^2) above station.

AVERAGE DISCHARGE.--42 years, 624 ft^3/s (17.67 m^3/s), 452,100 acre-ft/yr (557 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge observed, 31,000 ft^3/s (878 m^3/s) Feb. 19, 1943, maximum gage height, 12.27 ft (3.740 m) Mar. 16, 1978 (backwater from ice); no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, undetermined, May 29, no peaks above base of 5,000 ft^3/s (142 m^3/s); maximum gage height observed, 4.77 ft (1.454 m) Mar. 18 (backwater from ice jam); minimum discharge observed, 20 ft^3/s (0.57 m^3/s) July 22.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1979	5,105	165	239	88	10,130
November	5,724	191	260	70	11,350
December	3,865	125	150	80	7,670
January 1980	3,005	96.6	130	65	5,960
February	5,735	198	440	110	11,380
March	15,377	496	900	90	30,500
April	11,627	388	479	220	23,060
May	12,437	401	1,260	224	24,670
June	17,038	568	986	231	33,790
July	4,863	157	472	20	9,650
August	8,539	275	760	118	16,940
September 1980	7,426	248	348	195	14,730
1980 water year	100,741	275	1,260	20	199,800



Comparison of discharge during 1980 water year with 1979 water year and with average discharge for water years 1931-40 and 1963-77.

MONTHLY SUMMARY OF CONTENTS FOR COMPACT RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

06258900 BOYSEN RESERVOIR, WY

LOCATION.--Lat 43°25'00", long 108°10'37", in NW1/4 NW1/4 sec. 16, T. 5 N., R. 6 E., Fremont County, at dam on Wind River, 13 mi (21 km) north of Shoshoni, Wyoming.

DRAINAGE AREA.--7,700 mi^2 (19,943 km^2).

PERIOD OF RECORD.--October 1951 to current year (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is referenced to National Geodetic Vertical Datum of 1929 (levels by U.S. Water and Power Resources Service).

REMARKS.--Reservoir is formed by rock-fill dam completed in October 1951. Storage began Oct. 11, 1951. Usable capacity, 742,100 acre-ft (915 hm^3) between elevation 4,657.00 ft (1,419.454 m), invert of penstock pipe, and 4,725.00 ft (1,440.180 m), top of spillway gate. Dead storage, 59,880 acre-ft (73.8 hm^3) below elevation 4,657.00 ft (1,419.454 m). Prior to Jan. 1, 1966, usable capacity was 757,800 acre-ft (934 hm^3) and dead storage was 62,000 acre-ft (76.4 hm^3), at same elevations. Crest of dam is at elevation 4,758 ft (1,450 m). Figures given herein represent usable contents. Water used for irrigation, flood control, and power development.

COOPERATION.--Records furnished by U.S. Water and Power Resources Service.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 862,500 acre-ft (1,060 hm^3) July 6, 7, 1967, elevation, 4,730.83 ft (1,441.957 m); minimum daily since normal use of water started, 189,800 acre-ft (234 hm^3) Mar. 18, 19, 1956, elevation, 4,684.18 ft (1,427.738 m), capacity table then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 780,500 acre-ft (962 hm^3) July 5, elevation, 4,726.92 ft (1,440.765 m); minimum daily, 461,800 acre-ft (569 hm^3) Apr. 22, elevation, 4,708.43 ft (1,435.129 m).

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1979	4,715.32	567,900	
October 31	4,715.70	574,200	+6,300
November 30	4,715.17	565,500	-8,700
December 31	4,713.95	545,700	-19,800
January 31, 1980	4,712.48	522,600	-23,100
February 29	4,711.35	505,200	-17,400
March 31	4,710.10	486,400	-18,800
April 30	4,708.57	463,800	-22,600
May 31	4,718.93	629,400	+165,600
June 30	4,726.26	767,200	+137,800
July 31	4,723.35	710,300	-56,900
August 31	4,720.23	652,600	-57,700
September 30, 1980	4,717.68	607,700	-44,900
1980 water year			+39,800

* Does not include dead storage of 59,880 acre-feet (73.8 hm^3).

06260300 ANCHOR RESERVOIR, WY

LOCATION.--Lat 43°39'50", long 108°49'27", in sec. 26, T. 43 N., R. 100 W., Hot Springs County, at dam on South Fork Owl Creek, 2 mi (3 km) downstream from Middle Fork, 3 mi (5 km) southeast of Anchor, and 32 mi (51 km) west of Thermopolis.

DRAINAGE AREA.--125 mi^2 (324 km^2), approximately.

PERIOD OF RECORD.--November 1960 to current year (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is referenced to National Geodetic Vertical Datum of 1929 (U.S. Water and Power Resources Service benchmark).

REMARKS.--Reservoir is formed by concrete arch dam completed in 1960. Usable capacity, 17,170 acre-ft (21.2 hm^3) between elevation 6,343.75 ft (1,933.575 m), invert of river outlet, and 6,441.00 ft (1,963.217 m), spillway crest, not including 68 acre-ft (83,800 m^3) below elevation 6,343.75 ft (1,933.575 m). Prior to Oct. 1, 1971, usable capacity was 17,280 acre-ft (21.3 hm^3) not including 149 acre-ft (184,000 m^3) below the invert. Figures given herein represent usable contents. Water is used for irrigation of land in Owl Creek basin.

COOPERATION.--Records furnished by U.S. Water and Power Resources Services.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 9,250 acre-ft (11.4 hm^3) July 4, 1967 (elevation, 6,418.52 ft or 1,956.365 m); no storage on many days each year.

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 5,460 acre-ft (6.73 hm^3) June 25, (elevation, 6,403.71 ft or 1,951.851 m); no storage on many days.

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1979	-	0	0
October 31	-	0	0
November 30	-	0	0
December 31	-	0	0
January 31, 1980	-	0	0
February 29	-	0	0
March 31	-	0	0
April 30	6,356.00	225[1]	+225
May 31	6,393.53	3,320	+3,095
June 30	6,399.85	4,370	+1,050
July 31	-	0	-4,370
August 31	-	0	0
September 30, 1980	-	0	0
1980 water year			0

*Does not include dead storage of 68 acre-feet (83,800 m^3).

[1]Estimate

06286400 BIGHORN LAKE NEAR ST. XAVIER, MT

LOCATION.--Lat 45°18'27", long 107°57'26", in SW1/4 SE1/4 sec. 18, T. 6 S., R. 31 E., Big Horn County, Hydrologic Unit 10080010, in block 13 of Yellowtail Dam on Bighorn River, 1.3 mi (2.1 km) upstream from Grapevine Creek, 15.5 mi (24.9 km) southeast of St. Xavier, and at mile 81.0 (130.3 km).

DRAINAGE AREA.--19,626 mi^2 (50,831 km^2).

PERIOD OF RECORD.--November 1965 to current year (monthend contents only). Prior to October 1969, published as "Yellowtail Reservoir."

GAGE.--Water-stage recorder in powerhouse control room. Datum of gage is referenced to National Geodetic Vertical Datum of 1929 (levels by U.S. Water and Power Resources Service).

REMARKS.--Reservoir is formed by thin concrete-arch dam; construction began in 1961; completed in 1967. Storage began Nov. 3, 1965. Usable capacity, 1,356,000 acre-ft (1.67 km^3) between elevation 3,296.50 ft (1,004.773 m), river outlet invert, and 3,657.00 ft (1,114.654 m), top of flood control. Elevation of spillway crest, 3,593.00 ft (1,095.146 m). Normal maximum operating level, 1,097,000 acre-ft (1.35 km^3), elevation, 3,640.00 ft (1,109.472 m). Minimum operating level, 483,400 acre-ft (596 hm^3), elevation 3,547.00 ft (1,081.126 m). Dead storage, 18,970 acre-ft (23.4 hm^3) below elevation 3,296.50 ft (1,004.773 m). Figures given herein represent usable contents. Water is used for power production, flood control, irrigation, and recreation.

COOPERATION.--Elevations and capacity table furnished by U.S Water and Power Resources Service.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 1,346,000 acre-ft (1.66 km^3) July 6, 1967, elevation, 3,656.43 ft (1,114.480 m); minimum since first filling, 660,700 acre-ft (815 hm^3) Mar. 11, 1970, elevation, 3,584.45 ft (1,092.540 m).

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 1,086,000 acre-ft (1.32 km^3) July 14, elevation, 3,639.16 ft (1,109.216 m); minimum daily 752,300 acre-ft (928 hm^3) May 8, elevation, 3,599.97 ft (1,097.271 m).

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1979	3,629.24	977,300	
October 31	3,632.40	1,009,000	+31,700
November 30	3,634.37	1,030,000	+21,000
December 31	3,629.74	982,200	-47,800
January 31, 1980	3,622.59	917,300	-64,900
February 29	3,615.64	862,400	-54,900
March 31	3,610.70	824,200	-38,200
April 30	3,601.17	760,100	-64,100
May 31	3,614.16	848,600	+88,500
June 30	3,633.10	1,017,000	+168,400
July 31	3,635.90	1,048,000	+31,000
August 31	3,636.17	1,051,000	+3,000
September 30, 1980	3,637.06	1,061,000	+10,000
1980 water year			+83,700

* Does not include dead storage of 18,970 acre-feet (23.4 hm^3).

MONTHLY SUMMARY OF CONTENTS FOR COMPACT RESERVOIRS IN EXISTENCE ON JANUARY 1, 1950

The extent, if any, of the use of reservoirs in this category which may be subject to Compact allocations was not determined. As a matter of hydrologic interest the monthend contents in acre-feet of four reservoirs are given. The first three reservoirs are in the Bighorn River basin, Wyoming, and data on contents were furnished by the U.S. Water and Power Resources Service. Tongue River Reservoir in Montana is operated under the supervision of the Water Resources Division of the Montana Department of Natural Resources and Conservation, which agency furnished operating data.

Contents, in acre-feet

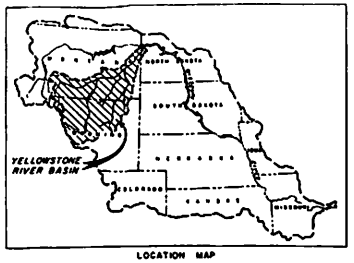
Month	06224500 a/Bull Lake	b/Pilot Butte Reservoir	06281500 c/Buffalo Bill Reservoir	06307000 d/Tongue River Reservoir
September 30, 1979. . .	73,580	8,420	242,800	15,000
October 31.	74,800	7,760	213,500	16,220
November 30	75,710	7,480	212,600	15,550
December 31	76,030	7,300	211,100	13,600
January 31, 1980. . . .	77,270	7,120	212,100	15,000
February 29	77,940	6,950	214,400	18,760
March 31.	78,640	11,800	216,800	31,470
April 30.	81,140	27,150	230,900	34,600
May 31.	114,600	28,850	323,100	55,800
June 30	145,200	28,080	440,200	58,550
July 31	137,100	26,140	399,200	36,000
August 31	101,800	18,500	319,400	17,300
September 30, 1980. . .	66,270	13,290	313,600	9,060
Change in contents during water year. .	-7,310	+4,870	+70,800	-5,940

a/ Usable contents, from revised capacity table effective October 1, 1965. Dead storage is 722 acre-ft (890,000 m^3).

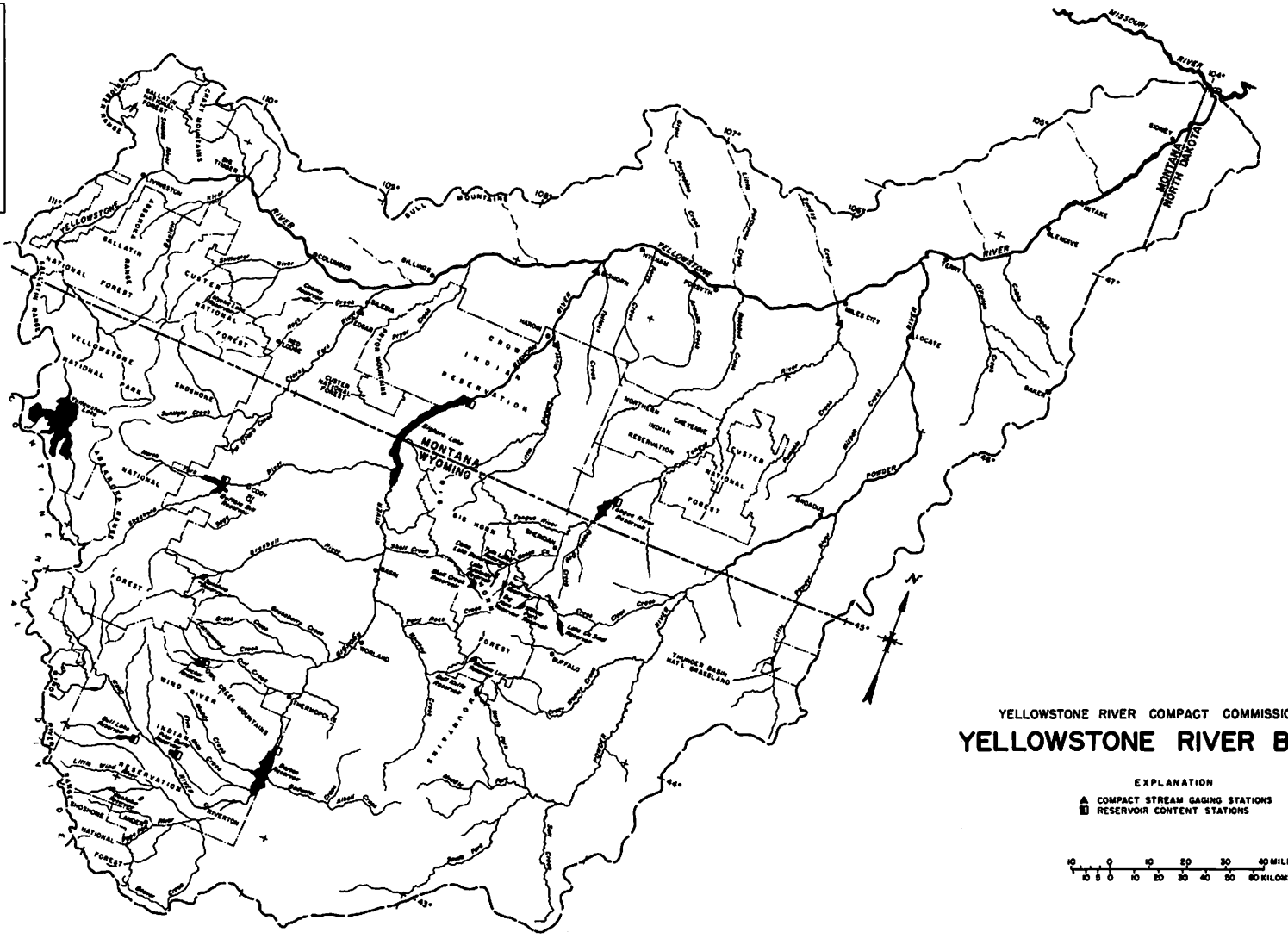
b/ Usable contents. Dead storage is 5,360 acre-ft (6.61 hm^3).

c/ Usable contents, from revised capacity table based on survey of 1959. Contents prior to October 1960 based on survey of 1941. Dead storage is negligible.

d/ Usable contents. Dead storage is 1,400 acre-ft (1.73 hm^3). Contents based upon sedimentation surveys of October 1948.



LOCATION MAP



YELLOWSTONE RIVER COMPACT COMMISSION

YELLOWSTONE RIVER BASIN

EXPLANATION

▲ COMPACT STREAM GAGING STATIONS
▣ RESERVOIR CONTENT STATIONS

10 0 10 20 30 40 MILES
10 5 0 10 20 30 40 50 60 KILOMETERS

MAP SHOWING LOCATIONS OF COMPACT STREAM-GAGING AND RESERVOIR-CONTENT STATIONS