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ELEVENTH ANNUAL REPORT  
YELLOWSTONE RIVER COMPACT COMMISSION

1962

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YELLOWSTONE RIVER COMPACT COMMISSION

408 Federal Building

Helena, Montana

December 21, 1962

Honorable Jack R. Gage  
Governor of the State of Wyoming  
Cheyenne, Wyoming

Honorable Tim M. Babcock  
Governor of the State of Montana  
Helena, Montana

Honorable William L. Guy  
Governor of the State of North Dakota  
Bismarck, North Dakota

Sirs:

Pursuant to Article III of the Yellowstone River Compact, the Commission created according to the terms of said Compact, makes the following eleventh annual report on activities for the period ending September 30, 1962.

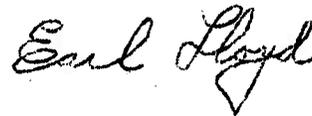
The eleventh annual meeting of the Yellowstone River Compact Commission was held in the conference room of the U. S. Bureau of Reclamation at Billings, Montana on November 28, 1962. Mr. Earl Lloyd represented Wyoming and Mr. C. S. Heidel, deputy State Engineer for Montana was designated to act for Mr. F. E. Buck, Montana State Engineer. Others in attendance were Mr. E. J. Van Camp, of Wyoming Natural Resources Board and A. S. Sollid of the U. S. Geological Survey at Billings, Montana. Mr. J. W. Ross, attorney-at-law of Fromberg, Montana appeared. Mr. Frank Stermitz, Federal representative, presided.

Stream flow was above average at all designated points of measurement for the water year as a whole. Flows of the fall and winter months were generally greater than usual. June and July flows were high and more than adequate for demands in the remainder of the water year. Storage during the water year increased by about 320,000 acre feet in the Bighorn River Basin in Wyoming.

The substantial flows of the year were indicative that the prescribed shares of Wyoming were not exceeded and no attempts at detailed administration were made. Mr. J. W. Ross told the Commission that critical situations of water supply arose on the Clark's Fork of Yellowstone River during 1961 and may be expected again with greater severity. He had no information to indicate that Wyoming has exceeded its prorata share. He stated new pumping installations have been made or are ready for installation in both states. Mr. Ross said clarification of water rights in Montana should be undertaken for proper administration of the Compact when that should become necessary and also for apportionment of limited flows in Montana. The Commission assured him of its desire to assist in matters pertinent to the Compact, but suggested the division of waters within either State was a matter of local or State control.

During the fiscal year ending June 30, 1962, the expense of the Commission was \$8,000. Contributions of \$2,000 each were made by the States of Wyoming and Montana and the Federal Government expended \$4,000. A like budget is in force for the fiscal year ending June 30, 1963. A tentative budget of \$9,000 was considered as being reasonable for each year of the succeeding biennium.

Respectfully submitted



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Earl Lloyd  
Commissioner for Wyoming



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Fred E. Buck  
Commissioner for Montana



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Frank Stermitz  
Federal Representative

## GENERAL REPORT

### Cost:

The work of the Commission is financed through annual cooperative agreements between the States of Montana and Wyoming and the United States of America. The costs considered do not include the salaries and necessary expenses of the State representatives which are borne by the respective States, nor the cost of the collection of hydrologic data now being made available through other sources. The expense of the Commission during the fiscal year ending June 30, 1962 is given:

|  | <u>Total Cost</u> | <u>Borne by<br/>United States</u> | <u>Borne by<br/>Wyoming Montana</u> |                |
|--|-------------------|-----------------------------------|-------------------------------------|----------------|
| Gaging Station operation,<br>Maintenance | \$7,000           |                                   |                                     |                |
| Data assembly and administration         | <u>1,000</u>      |                                   |                                     |                |
| Total                                    | \$8,000           | <u>\$4,000</u>                    | <u>\$2,000</u>                      | <u>\$2,000</u> |

The budget for the fiscal year ending June 30, 1963 was adopted for the above amount and the same proportionate shares. It is expected the auxiliary gage on the Bighorn River at Big Horn, Montana will be installed after delays incident to the construction of the interstate highway in this vicinity.

At the eleventh annual meeting, tentative budgets of \$9,000 were suggested for each year of the coming biennium. It is anticipated that the rising cost index, additions to data collection and items relating to administration will require this sum.

### Gaging Stations:

Discharge records were generally collected at the designated points of measurement. Supplementary data were collected on the Clark's Fork Yellowstone River near Edgar, Montana to evaluate the change in discharge below the gaging station at Edgar. The records of discharge are given in Appendix B.

The annual flows at the points of measurement ranged from 131 to 206 percent of the 1931-40 average and 145 to 1,320 percent of those for 1961. The least relative increase was on the Clark's Fork Yellowstone River and the greatest on the Powder River. Flows of the first six months of the water year were generally above average. April flows were low on some streams. Rains of June and July resulted in a sharp upturn in stream flow and a higher base flow level. The bar graphs of Appendix B illustrate the relative magnitude of the monthly and annual flows in comparison with various bases.

### Diversions:

The Commissioners for Montana and Wyoming were agreed that allocable uses under the Compact were less than the proportionate shares in either State. The Compact only provides for the allocation of water uses originating after January 1, 1950.

Mr. Buck furnished a list of reported water right filings in Montana for the period November 21, 1961 through October 31, 1962. Three previous listings are on file. Mr. Lloyd stated he would soon furnish another list to supplement the furnished listing of 1957. The printed biennial reports of the Wyoming State Engineer carry complete lists for all of Wyoming.

Storage:

In reservoirs completed after January 1, 1950:

Boysen Reservoir on the Wind River, operated by the U. S. Bureau of Reclamation, is the principal reservoir in this category. There was a net gain of 279,000 acre feet of storage during the water year. Month-end storage data are given in Appendix C.

The sealing operation of Anchor Reservoir on Owl Creek in the Bighorn River basin continued. The limited use is illustrated in the data furnished by the U. S. Bureau of Reclamation in Appendix C.

The Commission is aware of some small reservoirs which may properly come in this category. At present their aggregate effect is considered to be insufficient to justify the collection of storage data that is not readily available.

In reservoirs existing on January 1, 1950

Compact allocations are only affected by the storage in these reservoirs as it may be used for developments completed after January 1, 1950. The extent of pertinent use is considered to be minor. The quantities in storage in the principal reservoirs in this category are given in Appendix D as a matter of hydrologic information.

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 appropriate rights existing in the States of Wyoming and Montana on January 1, 1950 are supplied, and after appropriate 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 stream flow 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 at Edgar, Montana and which is located in SW $\frac{1}{4}$  sec.24, T.4 S., R.24 E., shall temporarily be the point of measurement for the Clarks Fork, subject to whatever mutually agreeable corrections to the stream-flow records at this point as may be deemed practical to meet the terms of the Compact.

## 2. Bighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River near Custer, Montana and located near the center of sec.10, T.4 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 S $\frac{1}{2}$ , SE $\frac{1}{4}$  sec.18, 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 SE $\frac{1}{4}$  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 near Locate, Montana and located in NE $\frac{1}{4}$  sec.26, 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 specified 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 is 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, and be that of the United States Geological Survey in Helena, Montana.
- 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

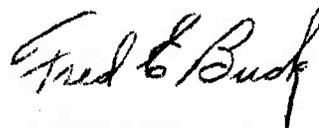
An annual meeting of the Commission shall be held on the third Tuesday of each November at some mutually agreeable point in the Yellowstone River Basin for consideration of the annual report for the water year ending the preceding September 30th, and for

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.



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Fred E. Buck  
Commissioner for Montana



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Earl Lloyd  
Commissioner for Wyoming

Attested:



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Frank Stermitz  
Federal Representative

Adopted November 17, 1953  
Amended November 16, 1959

MONTHLY SUMMARY OF DISCHARGE  
Clarks Fork Yellowstone River at Edgar, Montana

Location.--Lat 45°28'00", long 108°50'30", in SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.23, T.4 S., R.23 E., on right bank just downstream from highway bridge, half a mile east of Edgar and 6 miles upstream from Rock Creek.

Drainage area.--2,032 sq mi.

Records available.--July 1921 to September 1962. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950, available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 3,440 ft (by barometer). Prior to Sept. 18, 1940, chain gage and Sept. 18, 1940, to Aug. 31, 1953, wire-weight gage, at same site and datum.

Average discharge.--41 years, 1,034 cfs (748,600 acre-ft per year).

Extremes.--Maximum discharge during year, 7,830 cfs June 16 (gage height, 7.40 ft); minimum daily, 200 cfs Jan. 20, Feb. 23, 28.

1921-62: Maximum discharge observed, 10,900 cfs June 2, 1936 (gage height, 8.62 ft); minimum, 36 cfs Apr. 22, 1961.

Remarks.--Records excellent except those for periods of ice effect, which are poor. Upstream diversions for irrigation of about 41,500 acres, of which 840 acres lie below the station. In addition, about 6,300 acres of land lying above station are irrigated by diversions from the adjoining Rock Creek basin. Information similar to that previously given herein for Whitehorse Canal will be found on page 10.

| <u>Month</u>       | <u>Second-foot days</u> | <u>Maximum</u> | <u>Minimum</u> | <u>Mean</u> | <u>Runoff in Acre-feet</u> |
|--------------------|-------------------------|----------------|----------------|-------------|----------------------------|
| October 1961       | 25,159                  | 1,020          | 693            | 812         | 49,900                     |
| November           | 17,310                  | 780            | 440            | 577         | 34,330                     |
| December           | 12,935                  | 510            | 280            | 417         | 25,660                     |
| January 1962       | 9,825                   | 460            | 200            | 317         | 19,490                     |
| February           | 11,195                  | 800            | 200            | 400         | 22,200                     |
| March              | 11,043                  | 480            | 230            | 356         | 21,900                     |
| April              | 26,768                  | 2,040          | 335            | 892         | 53,090                     |
| May                | 54,830                  | 2,650          | 748            | 1,769       | 108,800                    |
| June               | 146,980                 | 7,210          | 2,260          | 4,899       | 291,500                    |
| July               | 66,390                  | 4,250          | 1,200          | 2,142       | 131,700                    |
| August             | 28,197                  | 1,960          | 407            | 910         | 55,930                     |
| September 1962     | <u>18,629</u>           | <u>779</u>     | <u>456</u>     | <u>621</u>  | <u>36,950</u>              |
| Water year 1961-62 | 429,261                 | 7,210          | 200            | 1,176       | 851,400                    |

## MONTHLY SUMMARY OF DISCHARGE

## Clarks Fork Yellowstone River at Edgar, Montana

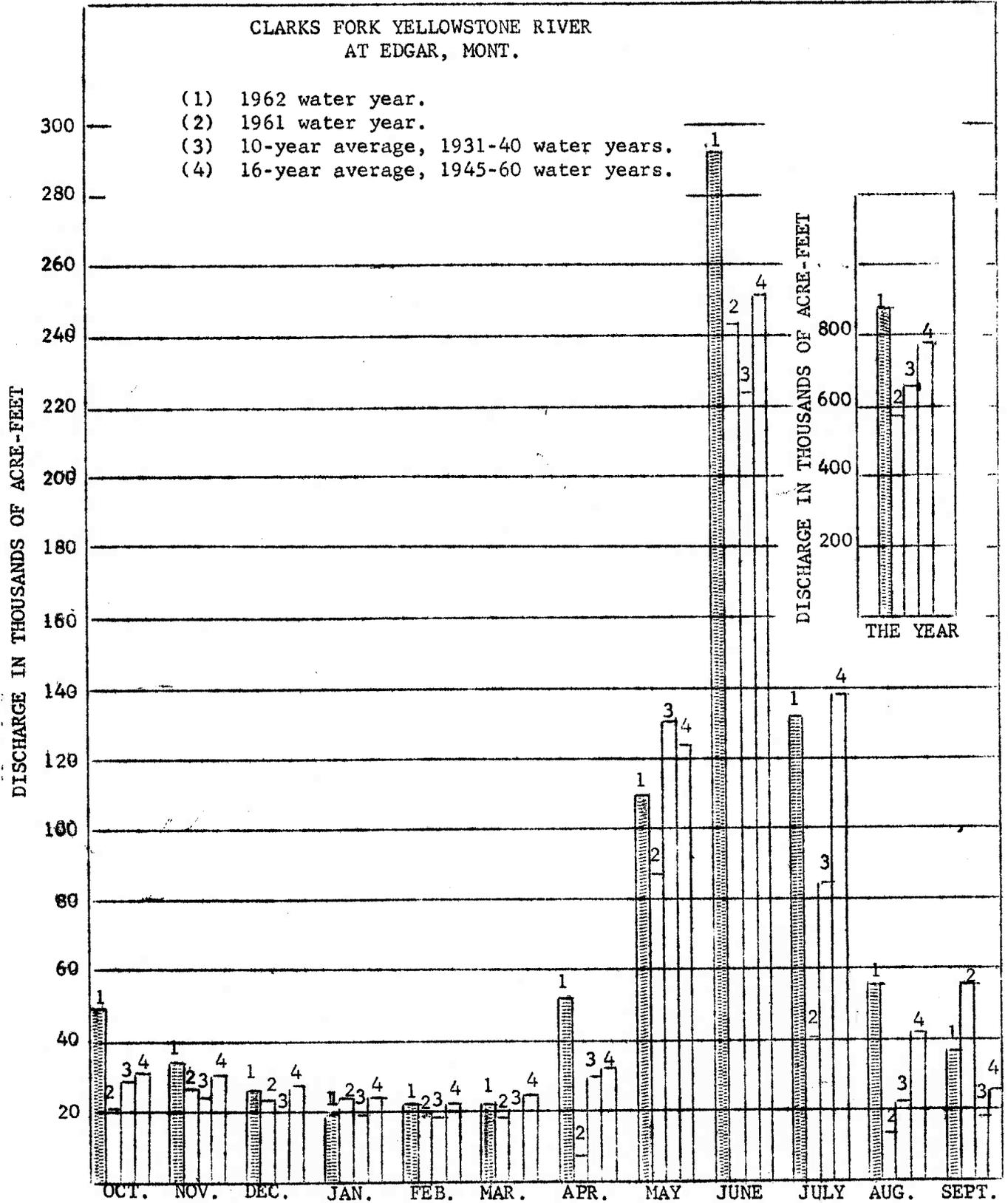
## Supplementary Data

The Compact specified the official point of measurement of the Clarks Fork Yellowstone River shall be just above the mouth of Rock Creek about 6 miles downstream from the gaging station at Edgar. The known intervening diversion is the Whitehorse Canal which begins in SW $\frac{1}{4}$  sec.1, T.4 S., R.23 E., about 4 miles downstream from the gaging station. The canal serves about 1,000 acres. Based upon periodic discharge measurements of the diversion and information on canal operation, that seasonal diversion is estimated at 6,000 acre-feet.

A cableway for discharge measurements was constructed across the Clarks Fork Yellowstone River about half a mile downstream from the Whitehorse Canal in SE $\frac{1}{4}$  sec.1, T.4 S. R.23 E. The periodic measurements of discharge of the stream at this point, those of the Whitehorse Canal and concurrent daily discharge flow at the gaging station are presented. No adjustment has been made to the mean daily flow at Edgar which could be a factor at times of significantly changing stage. The apparent inflow may generally be return flow from irrigated lands served by Rock Creek.

## Discharge in cfs at selected points

| <u>Date</u>   | <u>Clarks Fork<br/>at Edgar</u> | <u>Whitehorse<br/>Canal</u> | <u>Clarks Fork<br/>at SE<math>\frac{1}{4}</math> sec.1</u> | <u>Apparent<br/>inflow<br/>in reach</u> |
|---------------|---------------------------------|-----------------------------|--|---|
| Dec. 18, 1961 | 445                             | 0.                          | 466  | +21                                     |
| Apr. 30 1962  | 1,170                           | 0.                          | 1,160  | -10                                     |
| June 11       | 3,760                           | -                           | 3,760  | -                                       |
| June 21       | 5,880                           | 12.7                        | 5,870  | 0                                       |
| July 11       | 2,260                           | 41.6                        | 2,080  | -138                                    |
| Aug. 2        | 1,590                           | 18.8                        | 1,470  | -100                                    |
| Aug. 27       | 446                             | 19.6                        | 505  | +79                                     |
| Sept.15       | 705                             | 7.3                         | 754  | +56                                     |



Comparison of discharge during 1962 water year with 1961 water year and with average discharge for water years 1931-40 and 1945-60.

## MONTHLY SUMMARY OF DISCHARGE

## Little Bighorn River near Hardin, Montana

Location.--Lat 45°44'20", long 107°33'40", in SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.18, T.1 S., R.34 E., on right bank 425 ft upstream from highway bridge, half a mile upstream from mouth, and 2 miles east of Hardin.

Drainage area.--1,294 sq mi.

Records available.--June 1953 to September 1962, in reports of the Geological Survey and in annual reports of the Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,880 ft (by barometer). Prior to Oct. 7, 1953, wire-weight gage on bridge 425 ft downstream at different datum.

Average discharge.--9 years, 182 cfs (131,800 acre-ft per year).

Extremes.--Maximum discharge during year, 1,300 cfs June 17; maximum recorded gage height, 8.99 ft Mar. 19 (backwater from ice); minimum daily discharge, 10 cfs Dec. 12, 13.

1953-62: Maximum discharge, about 3,000 cfs Mar. 21, 1960; maximum gage height, 11.78 ft Mar. 20, 1960 (backwater from ice); minimum discharge observed, 0.2 cfs Aug. 7, 1961, result of discharge measurement.

Remarks.--Records good except those for periods of ice effect, no gage-height record, and those for period June 14-17, which are poor. Diversions for irrigation of about 17,000 acres above station. Flow partly regulated since about 1940 by Willow Creek Reservoir (capacity, 23,000 acre-ft).

| <u>Month</u>       | <u>Second-foot days</u> | <u>Maximum</u> | <u>Minimum</u> | <u>Mean</u> | <u>Runoff in Acre-feet</u> |
|--------------------|-------------------------|----------------|----------------|-------------|----------------------------|
| October 1961       | 3,499                   | 175            | 68             | 113         | 6,940                      |
| November           | 3,436                   | 167            | 55             | 115         | 6,820                      |
| December           | 2,129                   | 142            | 10             | 68.7        | 4,220                      |
| January 1962       | 2,545                   | 190            | 20             | 82.1        | 5,050                      |
| February           | 6,180                   | 360            | 65             | 221         | 12,260                     |
| March              | 6,103                   | 377            | 70             | 197         | 12,110                     |
| April              | 7,651                   | 450            | 175            | 255         | 15,180                     |
| May                | 10,767                  | 476            | 222            | 347         | 21,360                     |
| June               | 15,947                  | 1,120          | 339            | 532         | 31,630                     |
| July               | 5,099                   | 340            | 52             | 164         | 10,110                     |
| August             | 2,390                   | 157            | 38             | 77.1        | 4,740                      |
| September 1962     | <u>3,496</u>            | <u>177</u>     | <u>90</u>      | <u>117</u>  | <u>6,930</u>               |
| Water year 1961-62 | 69,242                  | 1,120          | 10             | 190         | 137,400                    |

## MONTHLY SUMMARY OF DISCHARGE

## Bighorn River at Bighorn, Montana

Location.--Lat 46°08'50", long 107°28'00" (revised), in NE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.33, T.5 N., R.34 E., on right bank just downstream from bridge on U. S. Highway 10, three-quarters of a mile upstream from mouth, 1 mile southwest of Bighorn, and 4 miles east of Custer.

Drainage area.--22,885 sq mi. At site used prior to Oct. 7, 1955, 22,410 sq mi.

Records available.--May 1945 to September 1962. Published as "near Custer", 1945-55. Records since January 1950, available in annual reports of Yellowstone River compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,690 ft (by barometer). May 11 to Dec. 6, 1945, wire-weight gage and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 miles upstream at different datum.

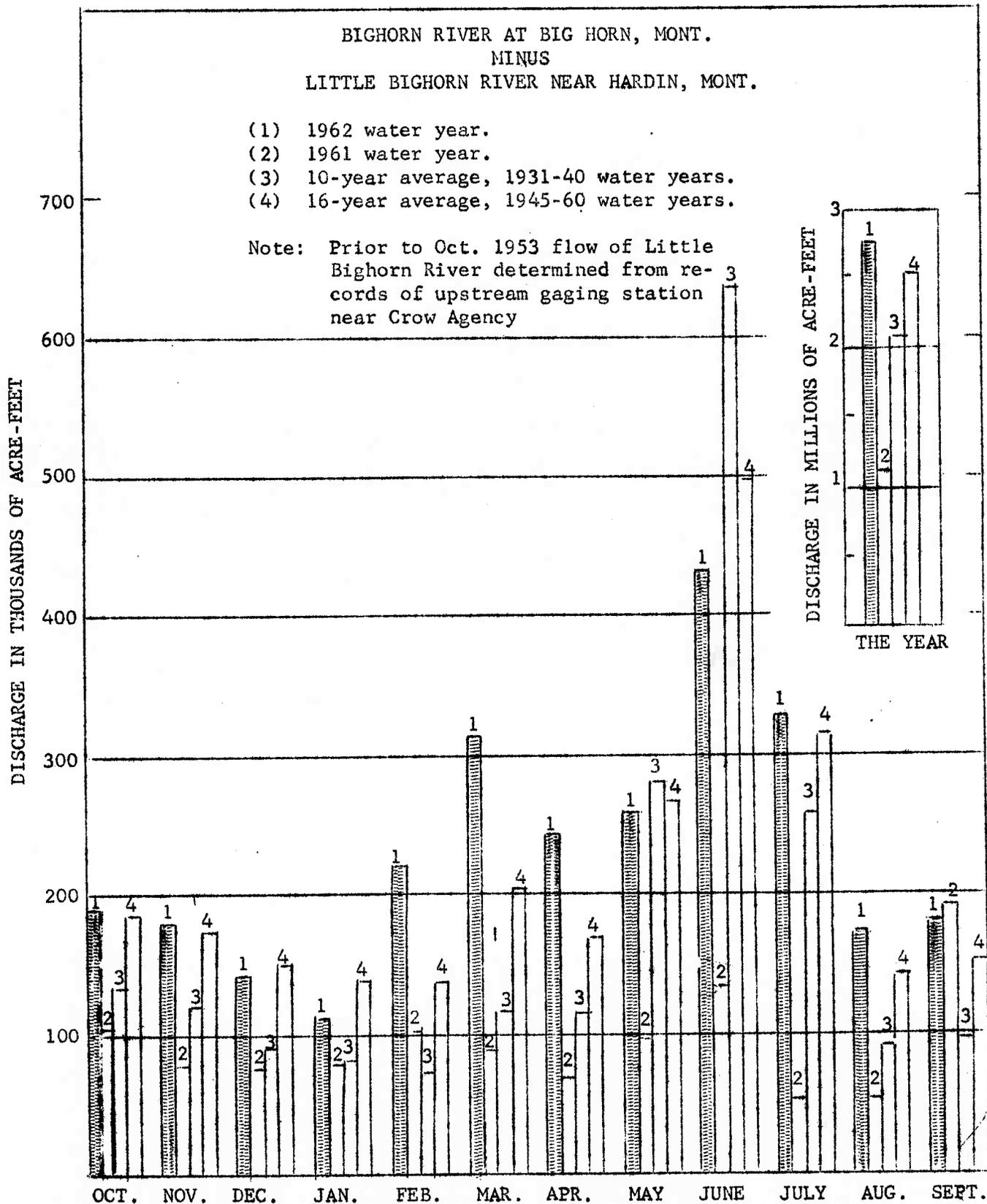
Average discharge.--17 years, 3,586 cfs (2,596,000 acre-ft per year).

Extremes.--Maximum discharge during year, about 15,000 cfs Feb. 15 (gage height, 10.29 ft, backwater from ice); minimum recorded, 767 cfs Dec. 10 (gage height, 0.94 ft).

1945-62: Maximum discharge, 26,200 cfs June 24, 1947 (gage height, 8.79 ft, site and datum then in use), from rating curve extended above 12,500 cfs by logarithmic plotting; maximum gage height recorded, 10.65 ft, Mar. 20, 1947 (ice jam), site and datum then in use; minimum discharge, about 275 cfs Nov. 15, 1959, result of freezeup; minimum daily, 540 cfs July 22, 1960.

Remarks.--Records good except those for periods of ice effect or backwater from Yellowstone River, which are poor. Diversions for irrigation of about 465,000 acres above station. Major regulation by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft (see Appendices C and D).

| <u>Month</u>       | <u>Second-foot days</u> | <u>Maximum</u> | <u>Minimum</u> | <u>Mean</u> | <u>Runoff in Acre-feet</u> |
|--------------------|-------------------------|----------------|----------------|-------------|----------------------------|
| October 1961       | 99,160                  | 6,550          | 2,620          | 3,199       | 196,700                    |
| November           | 93,680                  | 3,430          | 2,720          | 3,123       | 185,800                    |
| December           | 73,790                  | 3,010          | 1,400          | 2,380       | 146,400                    |
| January 1962       | 58,800                  | 2,700          | 1,000          | 1,897       | 116,600                    |
| February           | 118,070                 | 13,000         | 1,810          | 4,217       | 234,200                    |
| March              | 165,220                 | 10,400         | 2,000          | 5,330       | 327,700                    |
| April              | 129,950                 | 6,200          | 2,630          | 4,332       | 257,800                    |
| May                | 141,460                 | 10,100         | 3,310          | 4,563       | 280,600                    |
| June               | 234,380                 | 12,600         | 3,930          | 7,813       | 464,900                    |
| July               | 171,740                 | 10,700         | 2,090          | 5,540       | 340,600                    |
| August             | 89,130                  | 5,510          | 1,870          | 2,875       | 176,800                    |
| September 1962     | 95,040                  | 3,870          | 2,720          | 3,168       | 188,500                    |
| Water year 1961-62 | 1,470,420               | 13,000         | 1,000          | 4,029       | 2,917,000                  |



Comparison of discharge during 1962 water year with 1961 water year and with average discharge for water years 1931-40 and 1945-60.

## MONTHLY SUMMARY OF DISCHARGE

## Tongue River at Miles City, Montana

Location.--Lat 46°21', long 105°48', in SE¼ sec.23, T.7 N., R.47 E., on right bank 4 miles south of Miles City and 8 miles upstream from mouth.

Drainage area.--5,379 sq mi.

Records available.--April 1938 to April 1942, April 1946 to September 1962. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to September 1932. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950, available in annual report of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,370 ft (by barometer). April 1938 to April 1942, wire-weight gage at site 8 miles upstream at different datum.

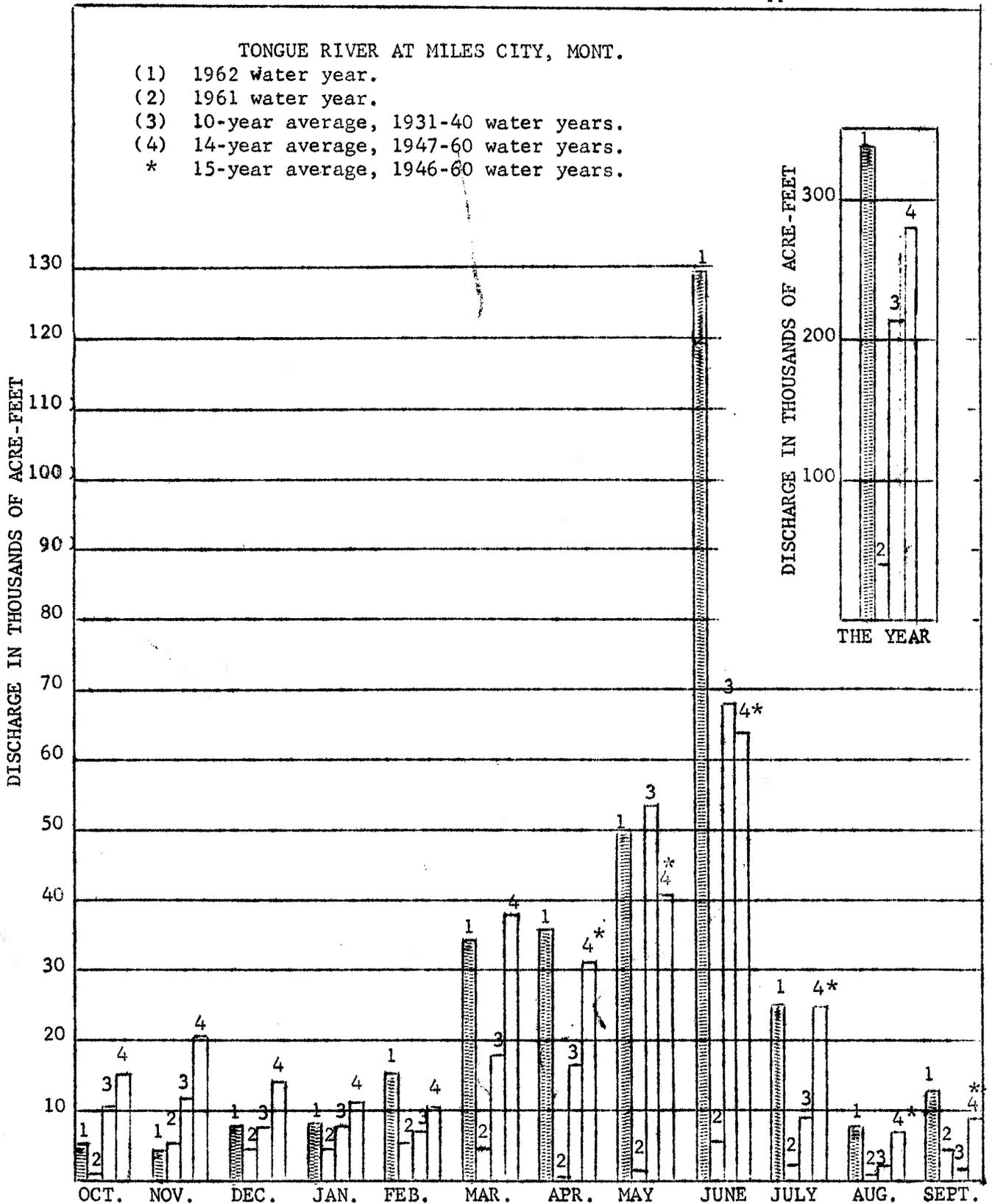
Average discharge.--19 years (1938-41, 1946-62), 347 cfs (251,200 acre-ft per year).

Extremes.--Maximum discharge during year, 13,300 cfs June 15 (gage height, 11.33 ft); from rating curve extended above 3,200 cfs on basis of float measurement; minimum daily, 15 cfs Nov. 17.

1938-42, 1946-62: Maximum discharge, that of June 15, 1962; maximum gage height, 12.27 ft Mar. 19, 1960 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

Remarks.--Records good except those for periods of ice effect, which are poor. Diversions for irrigation of about 90,000 acres above station. Flow regulated by Tongue River Reservoir (Appendix C) and many small reservoirs (combined capacity, about 15,000 acre-ft).

| <u>Month</u>       | <u>Second-foot days</u> | <u>Maximum</u> | <u>Minimum</u> | <u>Mean</u> | <u>Runoff in Acre-feet</u> |
|--------------------|-------------------------|----------------|----------------|-------------|----------------------------|
| October 1961       | 2,475                   | 139            | 45             | 79.8        | 4,910                      |
| November           | 2,375                   | 199            | 15             | 79.2        | 4,710                      |
| December           | 4,121                   | 180            | 90             | 133         | 8,170                      |
| January 1962       | 4,215                   | 220            | 85             | 136         | 8,360                      |
| February           | 7,650                   | 460            | 180            | 273         | 15,170                     |
| March              | 17,563                  | 1,600          | 290            | 567         | 34,840                     |
| April              | 18,503                  | 1,140          | 274            | 617         | 36,700                     |
| May                | 24,961                  | 1,540          | 191            | 805         | 49,510                     |
| June               | 65,293                  | 9,290          | 833            | 2,176       | 129,500                    |
| July               | 12,707                  | 1,610          | 73             | 410         | 25,200                     |
| August             | 4,060                   | 220            | 35             | 131         | 8,050                      |
| September 1962     | 6,698                   | 270            | 155            | 223         | 13,290                     |
| Water year 1961-62 | 170,621                 | 9,290          | 15             | 467         | 338,400                    |



Comparison of discharge during 1962 water year with 1961 water year and with average discharge for water years 1931-40 and 1947-60.

## MONTHLY SUMMARY OF DISCHARGE

## Powder River near Locate, Montana

Location.--Lat 46°26', long 105°18', in NE¼ sec.26, T.8 N., R.51 E., on right bank 50 ft downstream from bridge on U. S. Highway 12 at present site of Locate (5 miles west of former site of Locate), 3 miles upstream from Locate Creek, and 25 miles east of Miles City.

Drainage area.--13,189 sq mi.

Records available.--March 1938 to September 1962. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder and wire-weight gage. Altitude of gage is 2,400 ft (by barometer). Prior to July 11, 1947, wire-weight gage at bridge 50 ft upstream at same datum.

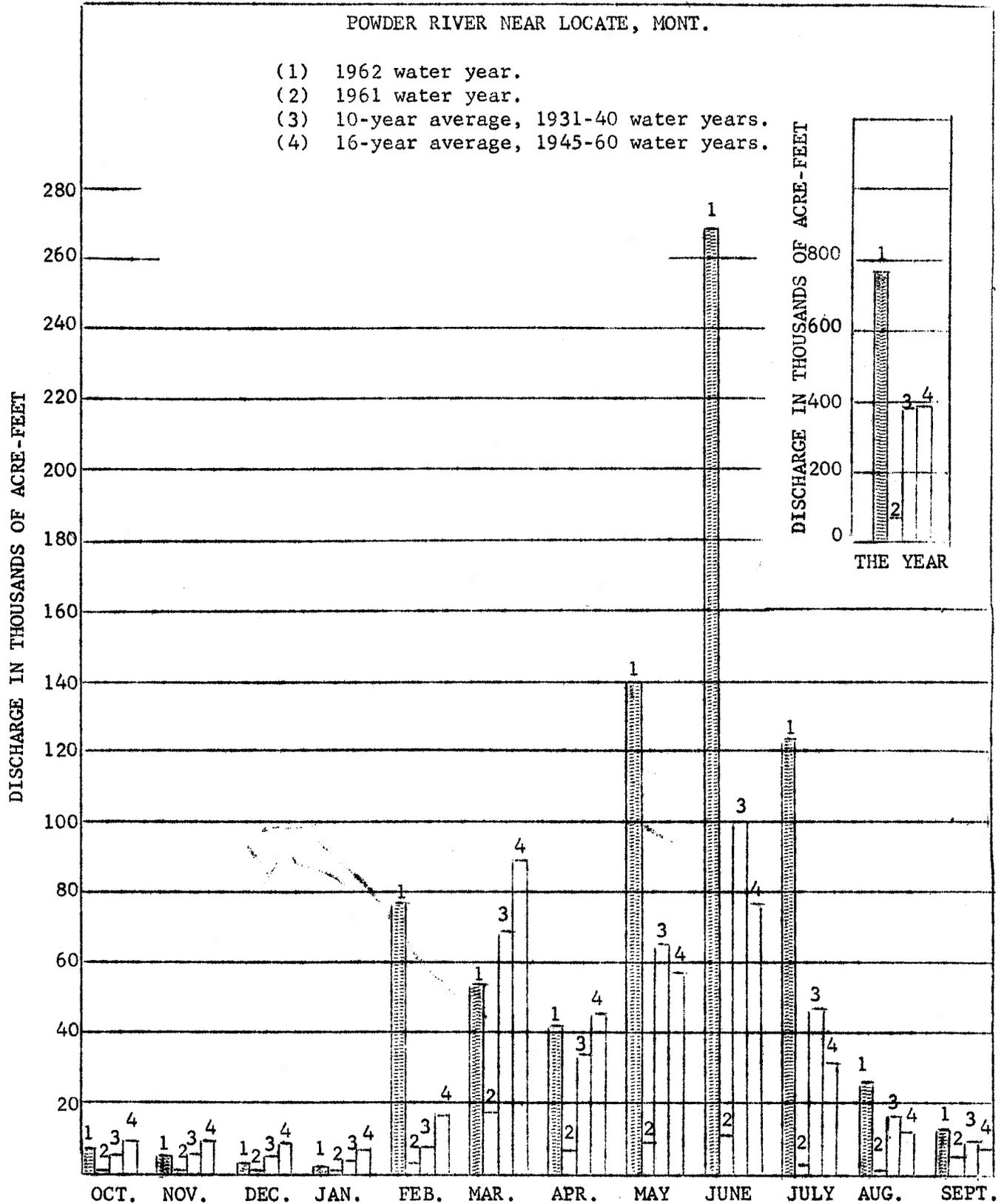
Average discharge.--24 years, 590 cfs (427,100 acre-ft per year).

Extremes.--Maximum discharge during year, 19,400 cfs June 20 (gage height, 8.75 ft); minimum daily, 4 cfs Dec. 28.

1938-62: Maximum discharge observed, 31,000 cfs Feb. 19, 1943 (gage height, 11.23 ft), from rating curve extended above 17,000 cfs; no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

Remarks.--Records fair except those for periods of ice effect or no gage-height record, which are poor. Diversions for irrigation of about 52,000 acres above station. Some regulation by tributary reservoirs with combined usable capacity of 36,800 acre-ft.

| <u>Month</u>       | <u>Second-foot days</u> | <u>Maximum</u> | <u>Minimum</u> | <u>Mean</u> | <u>Runoff in Acre-ft</u> |
|--------------------|-------------------------|----------------|----------------|-------------|--------------------------|
| October 1961       | 3,628                   | 301            | 58             | 117         | 7,200                    |
| November           | 2,680                   | 150            | 60             | 89.3        | 5,320                    |
| December           | 1,559                   | 150            | 4              | 50.3        | 3,090                    |
| January 1962       | 990                     | 100            | 5              | 31.9        | 1,960                    |
| February           | 38,905                  | 10,000         | 45             | 1,389       | 77,170                   |
| March              | 26,990                  | 3,800          | 95             | 871         | 53,530                   |
| April              | 21,115                  | 1,530          | 383            | 704         | 41,880                   |
| May                | 70,538                  | 9,780          | 572            | 2,275       | 139,900                  |
| June               | 135,540                 | 15,000         | 1,640          | 4,518       | 268,800                  |
| July               | 62,136                  | 11,200         | 505            | 2,004       | 123,200                  |
| August             | 13,187                  | 1,170          | 161            | 425         | 26,160                   |
| September 1962     | <u>6,500</u>            | <u>723</u>     | <u>117</u>     | <u>217</u>  | <u>12,890</u>            |
| Water year 1961-62 | 383,768                 | 15,000         | 4              | 1,051       | 761,100                  |



Comparison of discharge for 1962 water year with 1961 water year and with average discharge for water years 1931-40 and 1945-60.

## RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

## BOYSEN RESERVOIR

Water-stage recorder at dam on Wind River, about 21 miles south of Thermopolis, Wyoming. Reservoir formed by earth-fill dam, construction of which began in 1947. Storage began October 11, 1951. Dead storage, 62,000 acre-feet at elevation 4657.0. Usable contents, 758,000 acre-feet at elevation 4725.0 (top of gates). Crest of dam at elevation 4758.

Records given herein represent usable contents. Water is used for irrigation and power development. Allocation for flood control provided. Date furnished by U. S. Bureau of Reclamation.

Extremes.--Maximum usable contents during year, 757,400 acre-feet Aug. 2, 3 (elevation, 4,724.98 ft); minimum, 319,100 acre-feet Apr. 19 (elevation, 4,696.73 ft).

1953-62: Maximum usable contents, 857,400 acre-feet, July 5, 1957 (elevation, 4,729.85 ft); minimum, 189,800 acre-ft March 18, 19, 1956 (elevation, 4,684.18 ft).

| <u>Month</u>       | <u>Water-Surface<br/>elevation<br/>in feet</u> | <u>*Contents<br/>in<br/>Acre-feet</u> | <u>Change in contents<br/>during month<br/>in acre-feet</u> |
|--------------------|--|---------------------------------------|---|
| September 30, 1961 | 4,703.45                                       | 403,100                               |   |
| October 31         | 4,704.10                                       | 412,000                               | +8,900  |
| November 30        | 4,703.49                                       | 403,600                               | -8,400  |
| December 31        | 4,701.55                                       | 377,900                               | -25,700   |
| January 31, 1962   | 4,700.17                                       | 360,300                               | -17,600   |
| February 28        | 4,703.32                                       | 401,300                               | +41,000   |
| March 31           | 4,698.17                                       | 336,000                               | -65,300   |
| April 30           | 4,697.88                                       | 332,500                               | -3,500  |
| May 31             | 4,702.03                                       | 384,100                               | +51,600   |
| June 30            | 4,720.55                                       | 673,600                               | +289,500  |
| July 31            | 4,724.92                                       | 756,200                               | +82,600   |
| August 31          | 4,722.71                                       | 713,600                               | -42,600   |
| September 30, 1962 | 4,721.02                                       | 682,200                               | <u>-31,400</u>  |
| Water year 1961-62 |  |                                       | +279,100  |

\* Does not include dead storage of 62,000 acre-feet.

## RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

## ANCHOR RESERVOIR

Water-stage recorder at dam on South Fork Owl Creek, 31 miles west of Thermopolis, Wyoming. Reservoir formed by thin concrete arch dam, construction of which began in 1957. Closure of dam made November 21, 1960. Temporary outlet at elevation 6,304.30 ft still in use. Lowest permanent outlet sill at elevation 6,343.75 ft, total contents, 148 acre-feet. Total contents, 17,420 acre-feet at upper active capacity level of 6,441 ft. Crest of dam at elevation 6,452.5 ft.

Records given in this report are total contents to reflect storage changes below normal dead storage level. Water is to be used for irrigation. Data furnished by U. S. Bureau of Reclamation.

| <u>Month</u>       | <u>Water-Surface<br/>elevation<br/>in feet</u> | <u>*Contents<br/>in<br/>acre-feet</u> | <u>Change in contents<br/>during month<br/>in acre-feet</u> |
|--------------------|--|---------------------------------------|---|
| September 30, 1961 | 6,339.00                                       | 89                                    |   |
| October 31         | 6,347.85                                       | 215                                   | +126  |
| November 30        | 6,344.88                                       | 163                                   | -52   |
| December 31, 1961  | 6,335.00                                       | 55                                    | -108  |
| January 31, 1962   | 6,332.09                                       | 40                                    | -15   |
| February 28        | 6,343.61                                       | 146                                   | +106  |
| March 31           | 6,353.19                                       | 339                                   | +193  |
| April 30           | 6,354.50                                       | 375                                   | +36   |
| May 31             | 6,304.30                                       | 0                                     | -375  |
| June 30            | 6,357.03                                       | 454                                   | +454  |
| July 31            | 6,340.00                                       | 98                                    | -356  |
| August 31          | 6,304.30                                       | 0                                     | -98   |
| September 30, 1962 | 6,304.30                                       | 0                                     | 0   |
| Water year 1961-62 |  |                                       | -89   |

\* Includes dead storage

## 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 month-end contents in acre-feet of four reservoirs are given. The first three reservoirs are in the Bighorn River Basin in Wyoming and data on contents were furnished by the U. S. Bureau of Reclamation. Tongue River Reservoir in Montana is operated under the supervision of the Montana State Water Conservation Board which agency furnished operating data.

Revisions.--Data received subsequent to publication of the Tenth Annual Report, reveals some interpolated month-end contents for Tongue River Reservoir are incorrect in the 1961 report. A revised yearly table is given herewith:

|                    |        |                                   |         |
|--------------------|--------|-----------------------------------|---------|
| September 30, 1960 | 800    | April 30, 1961                    | 22,600  |
| October 31         | 1,000  | May 31                            | 40,700  |
| November 30        | 4,100  | June 30                           | 50,400  |
| December 31, 1960  | 7,200  | July 31                           | 35,700  |
| January 31, 1961   | 9,800  | August 31                         | 22,400  |
| February 28        | 16,500 | September 30, 1961                | 20,400  |
| March 31           | 22,600 | Change in contents<br>during year | +19,600 |

## Contents in Acre-feet

|                                   | <u>Bull Lake</u> | <u>Pilot Butte<br/>Reservoir</u> | <u>a/ Buffalo Bill<br/>Reservoir</u> | <u>b/ Tongue River<br/>c/ Reservoir</u> |
|-----------------------------------|------------------|----------------------------------|--------------------------------------|---|
| September 30, 1961                | 89,800           | 4,600                            | 285,200                              | 20,400                                  |
| October 31                        | 94,500           | 6,200                            | 294,400                              | 30,700                                  |
| November 30                       | 97,500           | 6,200                            | 282,200                              | 39,000                                  |
| December 31, 1961                 | 95,600           | 8,900                            | 255,400                              | 39,900                                  |
| January 31, 1962                  | 88,700           | 10,600                           | 228,500                              | 41,100                                  |
| February 28                       | 85,600           | 12,700                           | 204,300                              | 48,600                                  |
| March 31                          | 78,000           | 23,700                           | 176,200                              | 47,300                                  |
| April 30                          | 84,100           | 28,400                           | 212,800                              | 40,600                                  |
| May 31                            | 107,500          | 28,700                           | 249,200                              | 46,500                                  |
| June 30                           | 151,000          | 27,600                           | 443,600                              | 46,900                                  |
| July 31                           | 151,600          | 19,700                           | 420,300                              | 47,400                                  |
| August 31                         | 139,700          | 5,200                            | 369,100                              | 33,000                                  |
| September 30, 1962                | 109,400          | 5,000                            | 319,000                              | 27,000                                  |
| Change in contents<br>during year | +19,600          | +400                             | +33,800                              | +6,600                                  |

a/ Revised capacity table based on survey of 1959; contents prior to October 1960, based on survey of 1941.

b/ Contents based upon sedimentation surveys of October, 1948.

c/ Contents for April, May, June, and July interpolated from readings made near end of month. Contents for February, August, and September 1962, estimated.