TWENTY-SECOND ANNUAL REPORT

OF THE

Upper Colorado River Commission

SALT LAKE CITY, UTAH

SEPTEMBER 30, 1970

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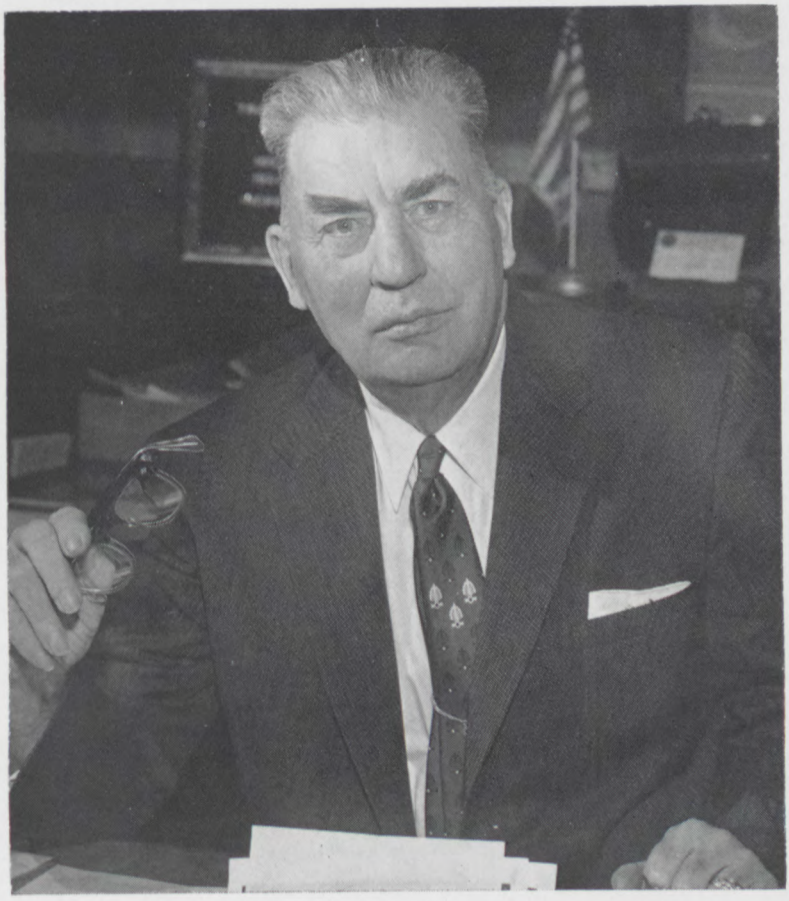
SEPTEMBER 30, 1970

IVAL V. GOSLIN
Executive Director

IN MEMORIAM

EDWIN CARL JOHNSON

January 1, 1884 - May 30, 1970



Upper Colorado River Commissioner
State of Colorado
April 1957 - February 1969

RESOLUTION

of

UPPER COLORADO RIVER COMMISSION

In Memoriam Re:

EDWIN C. JOHNSON

WHEREAS, through the death of the Honorable Edwin C. Johnson the State of Colorado and the other States of the Upper Division of the Colorado River Basin lost a most distinguished and devoted citizen; and

WHEREAS, the Honorable Edwin C. Johnson served four terms in the General Assembly of the State of Colorado, three terms as an outstanding Governor of Colorado, and faithfully served the State of Colorado as one of the most able and respected Members of the United States Senate for a period of eighteen years; and

WHEREAS, the Honorable Edwin C. Johnson was appointed Commissioner for the State of Colorado on the Upper Colorado River Commission by Governor Stephen L. R. McNichols on April 8, 1957 and served as Colorado's Commissioner until he retired in February, 1969 in order to preserve his health; and

WHEREAS, the Honorable Edwin C. Johnson throughout his long political career maintained a keen interest in all matters pertaining to the development, conservation, and utilization of the water and land resources of the Upper Colorado River Basin, was instrumental in negotiations leading to the Upper Colorado River Basin Compact that created the Upper Colorado River Commission; ably supported the enactment by the United States Congress of the Colorado River Storage Project Act; and promoted the equitable apportionment of the excess revenues derived from the sale of hydroelectric power generated by the powerplants constructed under the Colorado River Storage Project Act, making feasible the development of much of the waters of the Colorado River and its tributaries; and

WHEREAS, the Honorable Edwin C. Johnson, affectionately known to all as "Big Ed," brought to the Upper Colorado River Commission a special expertise as Commissioner and Vice-Chairman; devotedly, vigorously, and honorably performed his duties as a member of the Commission; and displayed great respect for the integrity and abilities of his fellow Commissioners, staff members,

and other interested parties with whom he was associated in Commission affairs; and

WHEREAS, after his retirement from the Commission the Honorable Edwin C. Johnson continued to his last days to exercise a continuing fight for recognition and protection of the rights of the States of the Upper Division of the Colorado River Basin to utilize their fair share of the waters of the Colorado River System; and

WHEREAS, the Honorable Edwin C. Johnson after having devoted so much of his efforts, ability, and time to the welfare of his family, his beloved State of Colorado, the Upper Colorado River Basin States, and the Nation, has been called from this world by his Supreme Maker, and his vivid personality, wonderful sense of humor, and experienced voice are sorely missed by his friends and associates:

NOW, THEREFORE, BE IT RESOLVED that the Upper Colorado River Commission at a Special Meeting held in Denver, Colorado on August 18, 1970 again expresses its appreciation of the unrelenting efforts of the Honorable Edwin C. Johnson in the protection and development of the water and related resources of the Upper Division States and extends its sympathy and understanding of their deep loss to members of his family and friends.

BE IT FURTHER RESOLVED that the Secretary of the Upper Colorado River Commission is hereby directed to forward copies of this unanimously adopted resolution to members of the family of the Honorable Edwin C. Johnson, the Governor of Colorado, and other appropriate parties, and to cause it to be published in the Commission's Twenty-Second Annual Report.

UPPER COLORADO RIVER BASIN

UPPER COLORADO RIVER
COMMISSION

25 0 25 50
SCALE OF MILES

UPPER COLORADO RIVER COMMISSION

355 South Fourth East Street
Salt Lake City, Utah 84111

October 31, 1970

Mr. President:

The Twenty-Second Annual Report of the Upper Colorado River Commission, as required by Article VIII (d) (13) of the Upper Colorado River Basin Compact, is enclosed.

The budget of the Commission is included in this report as Appendix B.

This report has also been transmitted to the Governor of each State signatory to the Upper Colorado River Basin Compact.

Respectfully yours,

Ival V. Goslin

Ival V. Goslin
Executive Director

The President
The White House
Washington, D. C. 20500

Enclosure

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I. Preface

Article VIII (d) (13) of the Upper Colorado River Basin Compact requires the Upper Colorado River Commission to "make and transmit annually to the Governors of the signatory States and the President of the United States of America, with the estimated budget, a report covering the activities of the Commission for the preceding water year."

Article VIII (1) of the By-Laws of the Commission specifies that "the Commission shall make and transmit annually on or before April 1 to the Governors of the states signatory to the Upper Colorado River Basin Compact and to the President of the United States a report covering the activities of the Commission for the water year ending the preceding September 30."

This Twenty-second Annual Report of the Upper Colorado River Commission has been compiled pursuant to the above directives.

This Annual Report includes, among other things, the following:

In Memoriam: Edwin C. Johnson;

Membership of the Commission, its Committees, Advisers, and Staff;

Roster of meetings of the Commission;

Brief discussion of the activities of the Commission;

Engineering and hydrologic data;

Pertinent legal information;

Information pertaining to Congressional legislation;

Maps of Upper Colorado River Basin;

Brief discussion of the Storage Units and participating projects of the Colorado River Storage Project and of the status of their construction or investigations;

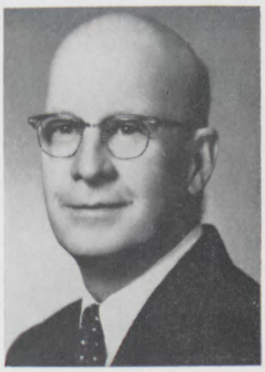
Appendices containing:

Fiscal data, such as: budget, balance sheet, statements of revenue and expense, etc.;

Long-range operating criteria for Colorado River reservoirs.

II. Commission

John A. Love
Commissioner for
Colorado



John H. Bliss
Commissioner for
New Mexico

H. P. Dugan
Chairman
Commissioner for
United States

H. T. Person
Commissioner for
Wyoming

Thorpe
Waddingham
Commissioner for
Utah

III. Officers of the Commission

Chairman, H. P. Dugan

Vice Chairman, John A. Love

Secretary, Ival V. Goslin

Treasurer, I. J. Coury

Assistant Treasurer, William F. Homer

IV. Staff

Ival V. Goslin, Executive Director

Paul L. Billhymer, General Counsel

Cecil B. Jacobson, Chief Hydraulic Engineer

Mrs. Hanna I. Wetmore, Administrative Secretary

Miss Janis Johnson, Clerk-Typist

V. Committees

The Committees of the Commission convened when required during the year.

Committees and their membership, at the date of this report, are as follows (the Chairman and the Secretary of the Commission are ex-officio members of all committees, Article V (4) of By-Laws):

STANDING COMMITTEES

Engineering Committee

Ival V. Goslin, Chairman
Clarence J. Kuiper
Laren D. Morrill
Stephen E. Reynolds
David P. Hale
Floyd A. Bishop
H. T. Person
George D. Clyde
Daniel F. Lawrence

Legal Committee

Felix L. Sparks, Chairman
Raphael J. Moses
Thomas O. Parker
Paul L. Bloom
Claud S. Mann
Dallin W. Jensen
Jack R. Gage

Budget Committee

John H. Bliss, Chairman
Felix L. Sparks
H. T. Person
Thorpe Waddingham

SPECIAL COMMITTEES

Finance Committee

Norman W. Barlow, Chairman
I. J. Coury
Bert A. Page
Felix L. Sparks

Education and Information Committee

John H. Bliss
Floyd A. Bishop
Lynn S. Ludlow

VI. Advisers to Commission

The following individuals serve as advisers to their respective Commissioners:

UNITED STATES OF AMERICA

Legal

Thomas O. Parker, Acting Regional Solicitor
U. S. Department of the Interior
Salt Lake City, Utah

Engineering

J. R. Riter
Denver, Colorado

COLORADO

Legal

Felix L. Sparks, Director
Colorado Water Conservation Board
Denver, Colorado

Raphael J. Moses, Counsel
Colorado Water Conservation Board
Boulder, Colorado

Engineering

Clarence J. Kuiper
State Engineer
Denver, Colorado

Laren D. Morrill, Deputy Director
Colorado Water Conservation Board
Denver, Colorado

NEW MEXICO

Legal

Claud S. Mann
Special Assistant Attorney General
Albuquerque, New Mexico

Paul L. Bloom
Special Assistant Attorney General
Santa Fe, New Mexico

Engineering

Stephen E. Reynolds, State Engineer
Santa Fe, New Mexico

David P. Hale, Engineer
New Mexico Interstate Stream Commission
Santa Fe, New Mexico

General

I. J. Coury, Chairman
New Mexico Interstate Stream Commission
Farmington, New Mexico

UTAH

Legal

Dallin W. Jensen, Assistant Attorney General
Salt Lake City, Utah

Engineering

George D. Clyde, Consulting Engineer
Salt Lake City, Utah

Daniel F. Lawrence, Director
Division of Water Resources
Salt Lake City, Utah

Colorado River Advisory Committee to Utah Commissioner

Hubert C. Lambert
State Engineer
Salt Lake City, Utah

Lawrence Y. Siddoway, Manager
Uintah Water Conservancy District
Vernal, Utah

Clyde E. Conover, Member
Emery County Water Conservancy District
Ferron, Utah

Clyde Ritchie, Chairman
Central Utah Water Conservancy District
Heber City, Utah

WYOMING

Legal

Jack R. Gage, Special Assistant Attorney General
Cheyenne, Wyoming

Engineering

Floyd A. Bishop, State Engineer
Cheyenne, Wyoming

H. T. Person, Upper Colorado River Commissioner
Laramie, Wyoming

Assistant Commissioners

Joe L. Budd
Big Piney, Wyoming

Norman W. Barlow
Cora, Wyoming

VII. Meetings of the Commission

During the Water Year ended September 30, 1970, the Commission met six times as follows:

Meeting No. 111	October 1, 1969	Adjourned Regular and Annual Meeting Denver, Colorado
Meeting No. 112	December 5, 1969	Special Meeting Denver, Colorado
Meeting No. 113	March 16, 1970	Regular Meeting Salt Lake City, Utah
Meeting No. 114	March 26, 1970	Adjourned Regular Meeting Denver, Colorado
Meeting No. 115	August 18, 1970	Special Meeting Denver, Colorado
Meeting No. 116	September 21, 1970	Annual Meeting Salt Lake City, Utah

VIII. Activities of the Commission

Within the scope and limitations of Article I (a) of the Upper Colorado River Basin Compact, ". . . to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of water . . ." and under the powers conferred upon the Commission by Article VIII (d) pertaining to making studies of water supplies of the Colorado River and its tributaries and the power to ". . . do all things necessary, proper or convenient in the performance of its duties . . . , either independently or in cooperation with any state or federal agency," the principal activities of the Commission have consisted of: (A) research and studies of an engineering and hydrologic nature of various phases of the water resources of the Colorado River Basin; (B) collection and compilation of documents for a legal department library relating to the utilization of waters of the Colorado River System for domestic, industrial, agricultural purposes and the generation of hydroelectric power, and legal analysis of associated laws, reports, and problems; (C) an education and information program designed to aid in securing appropriations of funds by the United States Congress for the construction, planning and investigation of storage dams, reservoirs, and water resource development projects of the Colorado River Storage Project that have been authorized for construction, and to secure the authorization by Congress for the construction of additional Storage Units and participating irrigation projects as the essential investigations and planning are completed; and (D) a legislative program consisting of the analysis and study of water resource Bills introduced in the U. S. Congress for enactment, the preparation of evidence and argument, and the presentation of testimony before Committees of the Congress.

A. ENGINEERING — HYDROLOGY

1. Type I — Comprehensive Framework Study — Upper Colorado Region

With the concurrence of Federal and State agencies, and with the approval of the Upper Colorado River Commission, the Commission's staff has assumed leadership in initiating and coordinating a comprehensive Type I Framework Study of the water and related land resources of the Upper Colorado Region which embraces the Upper Colorado River Basin. This study is one of four regional studies being made in the Pacific Southwest assigned to the Pacific Southwest Inter-Agency Committee by the Water Resources Council that was created by the Water Resources Planning Act of 1965 (79 Stat. 244). The Commission's staff works in cooperation with representatives of twenty related agencies and of the five Upper Basin States.

In organizing for this endeavor a State-Federal Interagency Group has been organized for the Upper Colorado Region with the Upper Colorado River Commission as the lead agency. This Group includes membership from each State and Federal agency. An Upper Colorado Region Staff with similar representation under the chairmanship of the Bureau of Reclamation accomplishes the bulk of the office work under the direction of the State-Federal Interagency Group.

For an effective division of labor, work groups have been organized with State and Federal representation. These work groups cover various aspects of the over-all Type I Study. Titles of the work groups are: (1) Legal and Institutional Environments, (2) Economic Base and Projections, (3) Water Resources, (4) Land Resources and Use, (5) Mineral Resources, (6) Watershed Management, (7) Flood Control, (8) Irrigation and Drainage, (9) Municipal and Industrial Water Supply, (10) Recreation, (11) Fish and Wildlife, (12) Electric Power, (13) Water Quality, Pollution, and Health Factors, (14) Public Information, and (15) Framework Plans. The Commission's General Counsel, Mr. Paul L. Billhymer, is chairman of the Legal and Institutional Environments work group. The Commission's Chief Hydraulic Engineer, Mr. Cecil B. Jacobson, has been head of the Water Resources work group.

All of the eighteen Type I Framework Studies being made of various regions of the United States are under the jurisdiction of the Water Resources Council. The Council is directed by Section 101 (a) of the Water Resources Planning Act to "maintain

a continuing study and prepare an assessment biannually — of the adequacy of supplies of water necessary to meet the water requirements in each water resource region . . ." The Upper Colorado Region State-Federal Interagency Group aids in the preparation of a draft of that portion of the National Assessment of Water and Related Land Resources pertaining to this region. Through the Pacific Southwest Inter-Agency Committee the draft is transmitted to the Water Resources Council in Washington, D.C.

Although the Water Resources Planning Act directs that there shall be prepared an assessment biannually the Office of Management and Budget of the Executive Department of the Federal Government refused to approve funds for this purpose so that a national assessment could be published in 1970. It is now anticipated that the next national assessment will not be available until about calendar year 1975.

Copies of the Type I Framework Study Report, the eighteen appendices, and an analytical summary report are now expected to be completed during the last half of calendar year 1971.

2. Other Upper Colorado River Basin Studies

Because the Colorado River Storage Project is a water resources development plan of the Upper Colorado River Basin, the Upper Colorado River Commission has determined that active participation in investigations, studies and plans related to the present and future construction and operation of water-regulating, water-diversion, power-generating, and water-utilization facilities is both necessary and expedient. The Commission has a primary duty to the four Upper Division States to do all things necessary to protect the interests of its member States in the water resources of the Colorado River and to aid the best and most expeditious development of those resources. In fulfilling this responsibility, the Commission's staff has been actively engaged during the past year in making many hydrologic and engineering studies relative to the utilization and distribution of the water resources of the Upper Colorado River Basin.

3. Long-Range Reservoir Operating Criteria

Close attention has been devoted to the study of possible effects of the "Coordinated Long-Term Operating Criteria" for upper and lower basin reservoirs published by the Secretary of the Interior in the Federal Register on June 10, 1970 (35 F.R. 8951). These "Criteria" are to be found in Appendix C of this report.

4. Forecasts of Stream Flow

*APRIL 1, 1970 FORECASTS OF APRIL-JULY INFLOWS TO LAKE POWELL**

Agency	*Acre-Feet*
Soil Conservation Service Department of Agriculture	7,214,000
U. S. Weather Bureau Department of Commerce	6,800,000
Bureau of Reclamation Department of the Interior	7,500,000

The reconstructed inflow to Lake Powell for the period April-July 1970, amounted to 8,050,000 acre-feet.**

During the April-July 1970 period storage of water in Colorado River Storage Project reservoirs above Lake Powell amounted to 1,369,000 acre-feet of which 52,000 acre-feet evaporated and 120,000 acre-feet went into bank storage.*** Excluding bank storage and evaporation Fontenelle Reservoir stored 128,000 acre-feet; Blue Mesa 413,000 acre-feet; Morrow Point 11,000 acre-feet; Flaming Gorge 381,000 acre-feet; and Navajo Reservoir 286,000 acre-feet.

Actual inflow to Lake Powell for the period April-July 1970 was 6,851,000 acre-feet.**

The virgin flow of the Colorado River at Lee Ferry for the 1970 water year amounted to 15.3 million acre-feet.****

5. Filling of Upper Basin Storage Units

In order to accomplish an initial filling of Lake Powell to the water surface elevation at which the Glen Canyon Powerplant could be put in operation, releases of water from Lake Powell were curtailed during late 1964 and early 1965. This curtailment caused a draft of Lake Mead storage water to a point below its rated power head. Power generation at Glen Canyon Dam has since been maintained at reservoir levels above minimum power head. With a favorable 1965 spring runoff, Lake Mead was restored to rated head (elevation 1122.8) in June 1965. Thereafter the level of Lake Mead has remained above rated head. The spring runoffs of 1966

*Including water to be stored upstream in other Colorado River Storage Project Reservoirs.
**Exclusive of evaporation and seepage losses.
***Including Fontenelle Reservoir on Green River in Wyoming.
****Provisional records subject to revision.

and 1967 were extremely disappointing. It was possible only to achieve a maximum level at Lake Powell of elevation 3532.85 on July 27, 1967, and a content of 8,645,000 acre-feet. Thereafter there was a draft on Lake Powell storage to maintain rated head at Lake Mead and power generation at Glen Canyon powerplant. By May 5, 1968 the water surface of Lake Powell had receded 19.5 feet to elevation 3513.30 and a content of 7,475,000 acre-feet. The spring runoffs of 1968 and 1969 were slightly improved. Near normal runoff occurred during the spring of 1970. Lake Powell rose to rated head elevation 3570 on May 29, 1969 and to elevation 3601.77, content 14,323,000 acre-feet, on July 15, 1970, or 20.6 feet above the high point of the previous year.

Lake Mead at the end of water year 1969-1970 contained 16,769,000 acre-feet* of available storage at elevation 1152.58. Lake Mead held 3.1 million acre-feet in the 30 feet above its rated head.

The gates were closed at Morrow Point reservoir on January 24, 1968. Commercial power generation is not scheduled until December 1970 due to a delay in the completion of the powerplant.

The results of the filling procedures adopted by the Secretary of the Interior at Lake Powell, Flaming Gorge, Navajo and Blue Mesa and Morrow Point Reservoirs in the Upper Colorado River Basin and at Lake Mead in the Lower Basin are illustrated in the graphs on the following pages. For reference purposes, a graph for Lake Mead has been extended back to 1935 when water was first stored behind Hoover Dam.

*Based on April 1, 1967 Capacity Table revised according to Sedimentation Survey 1963-64.

STATISTICAL DATA FOR PRINCIPAL RESERVOIRS IN COLORADO RIVER BASIN

(Units: Elevation — feet; capacity — 1,000 acre-feet)

UPPER BASIN

Colorado River Storage Project

(Total Surface Capacity)

	Flaming Gorge		Navajo		Lake Powell		Blue Mesa		Morrow Point	
	Elev.	Cap.	Elev.	Cap.	Elev.	Cap.	Elev.	Cap.	Elev.	Cap.
River elevation at dam (average tailwater)	5,603	0	5,720	0	3,138	0	7,160	0	6,775	0
Dead Storage	5,740	40	5,882.5	175	3,370	1,998	7,358	111	6,808	0
Inactive Storage (minimum power pool)	5,871	273	5,990[1]	673	3,490	6,124	7,393	192	7,100	75
Rated Head	5,946	1,102	—	—	3,570	11,426	7,438	361	7,108	80
Maximum Storage (without surcharge)	6,040	3,789	6,085	1,709	3,700	27,000	7,519	941	7,160	117

[1]Required for Navajo Indian Irrigation Project

LOWER BASIN

(Usable Surface Capacity)

	Lake Mead		Lake Mohave		Lake Havasu	
	Elev.	Capacity	Elev.	Capacity	Elev.	Capacity
River elevation at dam (average tailwater)	646	(-2,378)	506	(-8.5)	370	(-28.6)
Dead Storage	895	0	533.39	0	400	0
Inactive Storage (minimum power pool)	1,050	7,471	570	217.5	[1]440	439.4
Rated Head	1,122.8	13,633				
Maximum Storage (without surcharge)	1,221.4	26,159	647	1,809.8	450	619.4

[1] Contractual minimum for delivery to Metropolitan Water District's Colorado River Aqueduct.

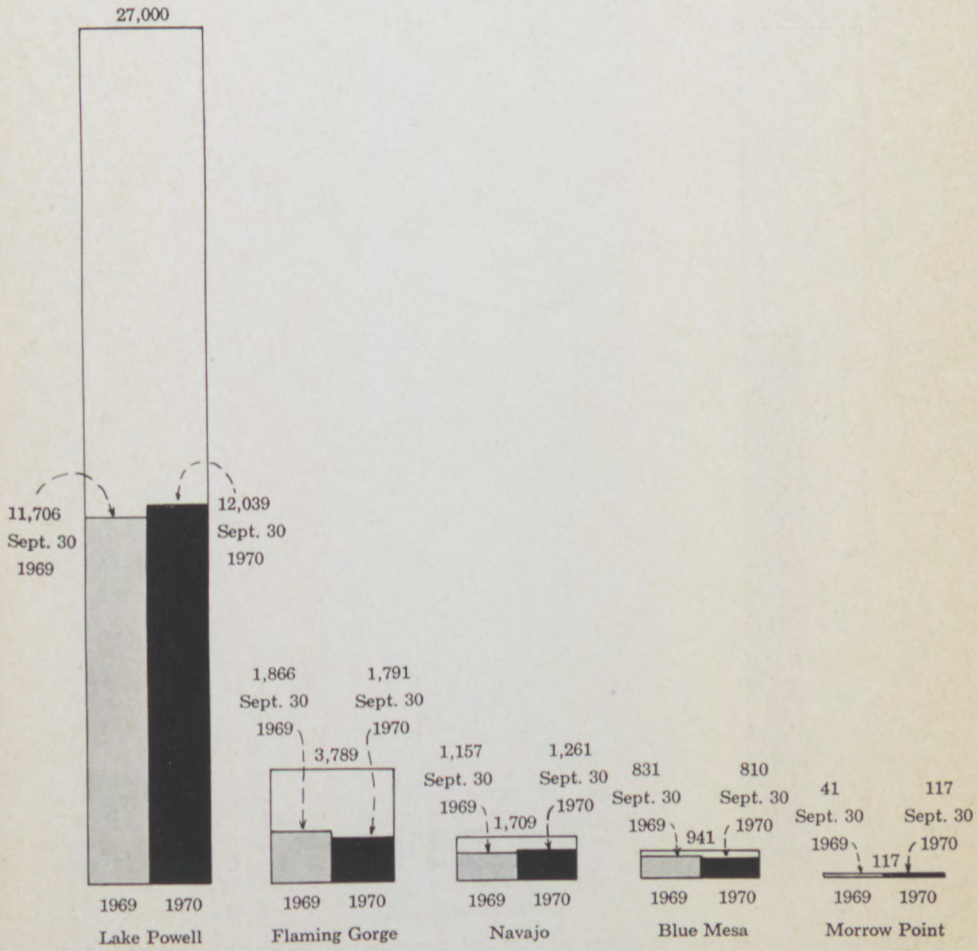
STORAGE IN PRINCIPAL RESERVOIRS AT END OF WATER YEAR

UPPER BASIN

TOTAL STORAGE CONTENTS*

(1,000 Acre-Feet)

RESERVOIR	Sept. 30 1969	Percent of Capacity	Sept. 30 1970	Percent of Capacity	Change in Contents
Lake Powell	11,706	43	12,039	45	+ 333
Flaming Gorge	1,866	49	1,791	47	— 75
Navajo	1,157	68	1,261	73	+ 64
Blue Mesa	831	88	810	86	— 21
Morrow Point	41	35	117	100	+ 76
Total	15,601	(46.5)	16,018	(47.7)	+ 377



* Excludes Bank Storage

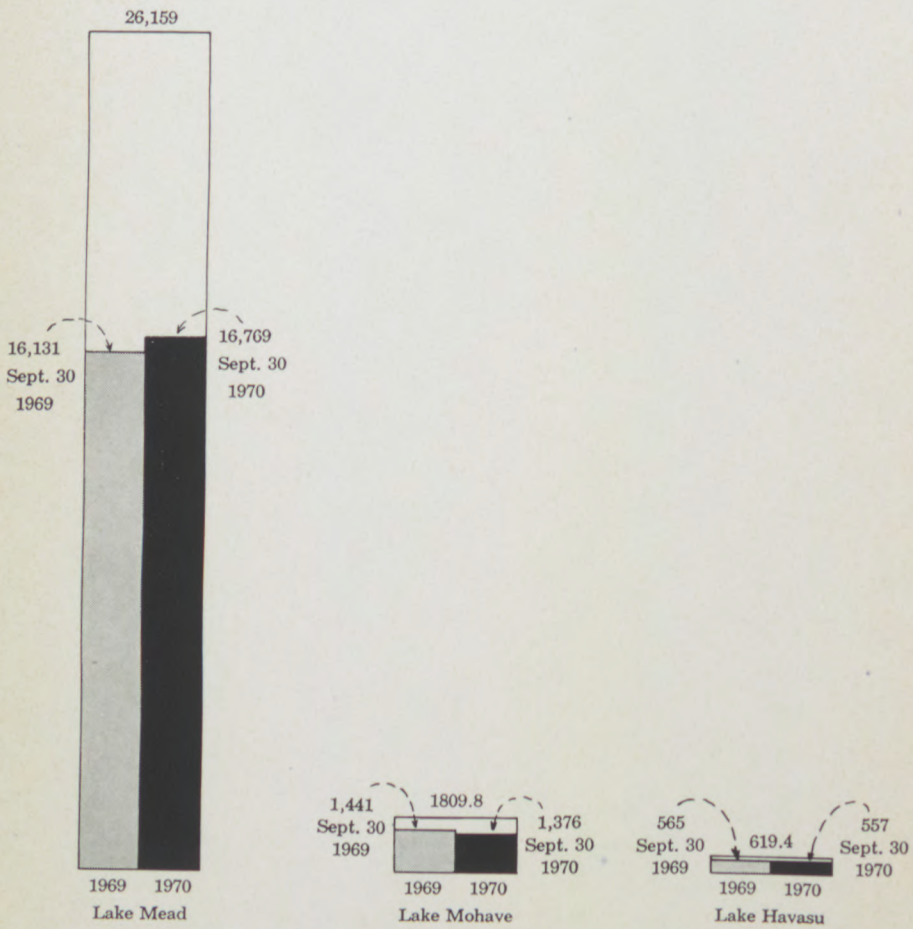
STORAGE IN PRINCIPAL RESERVOIRS AT END OF WATER YEAR

LOWER BASIN

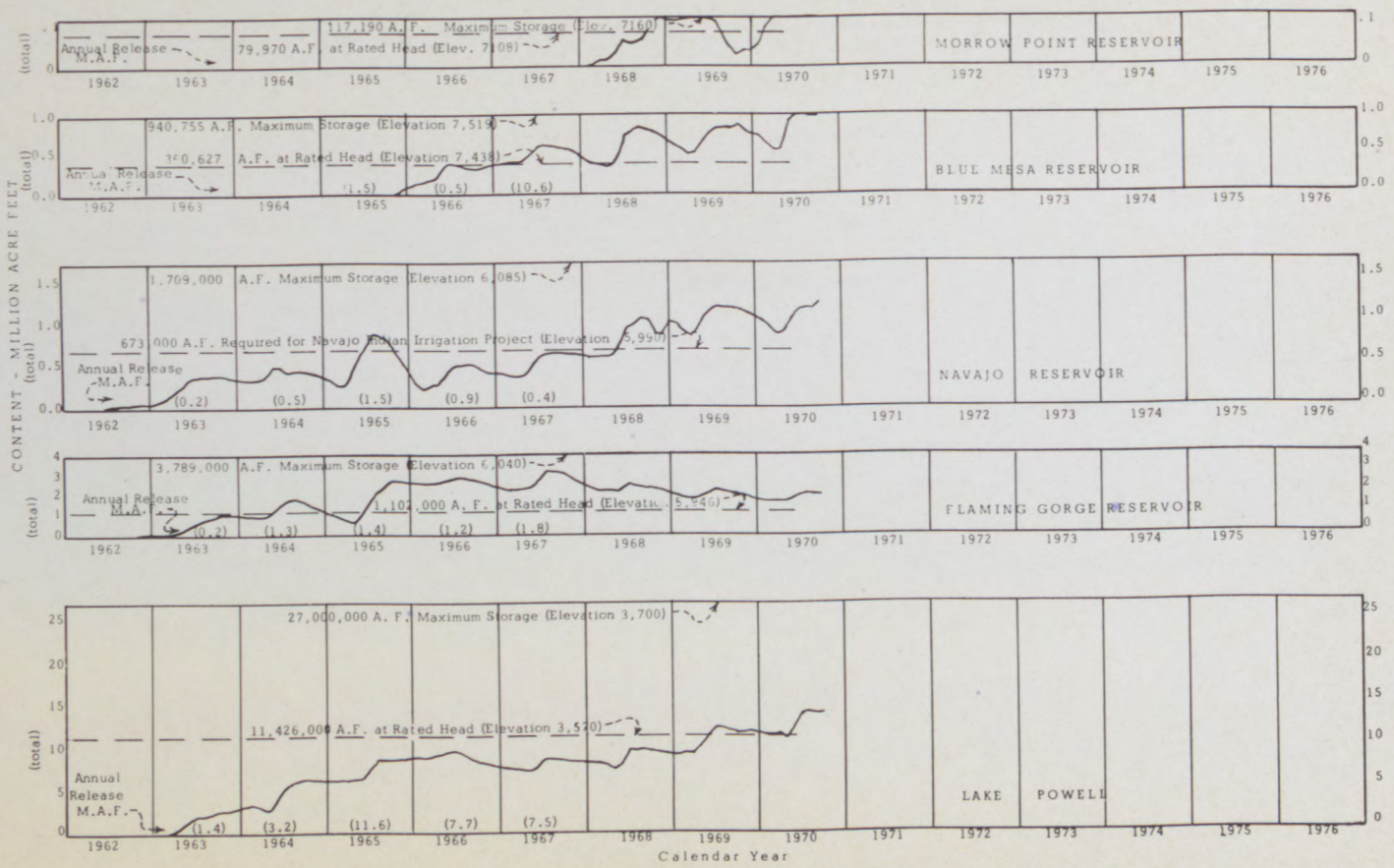
USABLE STORAGE CONTENTS

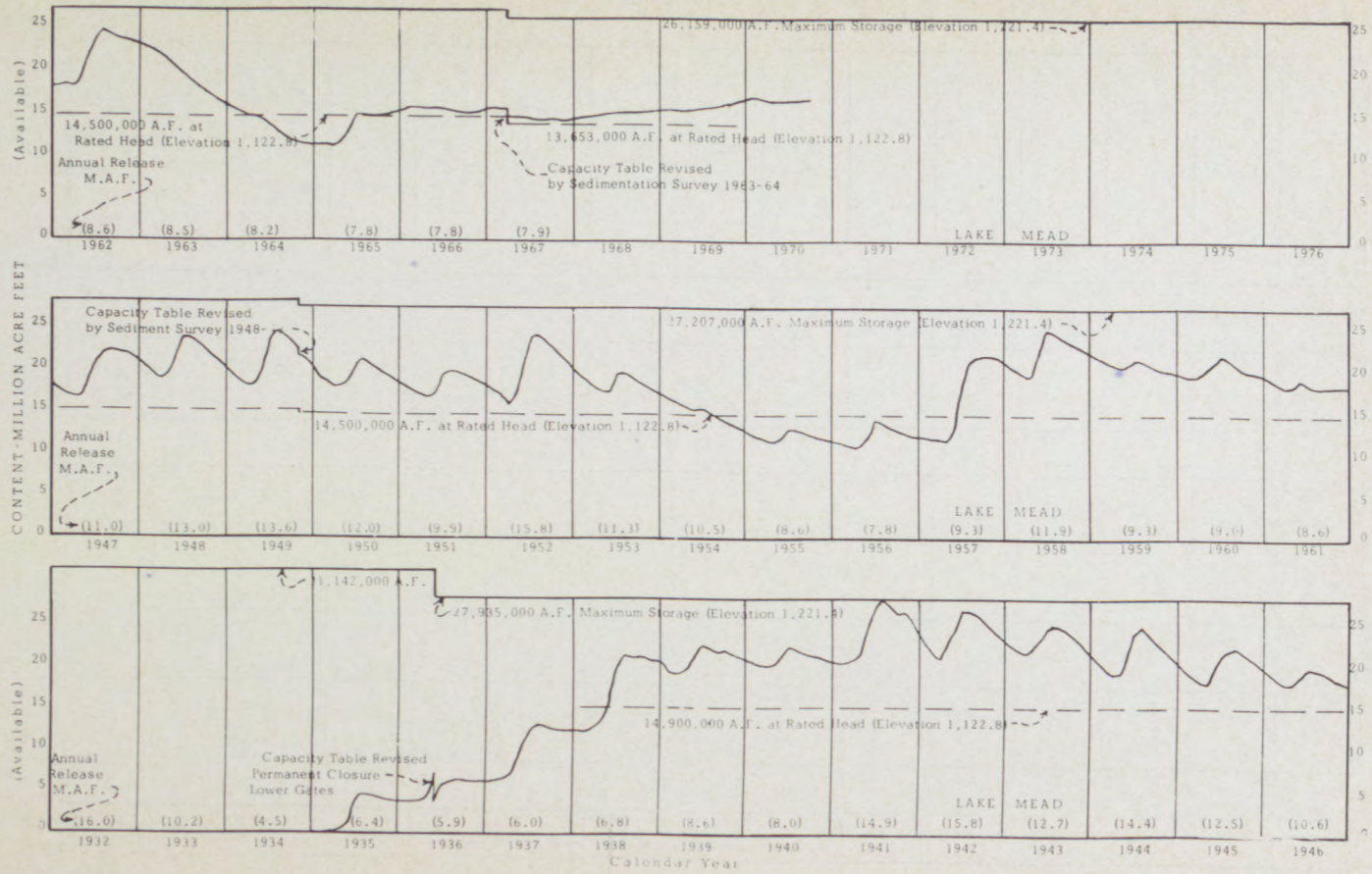
(1,000 Acre-Feet)

RESERVOIR	Sept. 30 1969	Percent of Capacity	Sept. 30 1970	Percent of Capacity	Change in Contents
Lake Mead*	16,131	62	16,769	64	+ 638
Lake Mohave	1,441	80	1,376	76	— 65
Lake Havasu	565	91	557	90	— 8
Total	18,137	(63)	18,702	(65)	+ 565



*Contents based on April 1967 revised capacity tables according to 1963-64 sedimentation survey at Lake Mead.


CONTENT - MILLION ACRE FEET
(total)
Annual Release M.A.F.
79,970 A.F.
117,190 A.F. Maximum Storage (Elev. 7160)
at Rated Head (Elev. 7108)
MORROW POINT RESERVOIR
940,755 A.F. Maximum Storage (Elevation 7,519)
360,627 A.F. at Rated Head (Elevation 7,438)
BLUE MESA RESERVOIR
1,709,000 A.F. Maximum Storage (Elevation 6,085)
673,000 A.F. Required for Navajo Indian Irrigation Project (Elevation 5,990)
NAVAJO RESERVOIR
3,789,000 A.F. Maximum Storage (Elevation 6,040)
1,102,000 A.F. at Rated Head (Elevation 5,946)
FLAMING GORGE RESERVOIR
27,000,000 A.F. Maximum Storage (Elevation 3,700)
11,426,000 A.F. at Rated Head (Elevation 3,570)
LAKE POWELL
1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976
Calendar Year


CONTENT-MILLION ACRE FEET
(Available)
26,159,000 A.F. Maximum Storage (Elevation 1,221.4)
14,500,000 A.F. at Rated Head (Elevation 1,122.8)
Annual Release M.A.F.
13,653,000 A.F. at Rated Head (Elevation 1,122.8)
Capacity Table Revised by Sedimentation Survey 1963-64
(8.6) (8.5) (8.2) (7.8) (7.8) (7.9)
1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 LAKE 1972 MEAD 1973 1974 1975 1976
Capacity Table Revised by Sediment Survey 1948-
27,207,000 A.F. Maximum Storage (Elevation 1,221.4)
14,500,000 A.F. at Rated Head (Elevation 1,122.8)
Annual Release M.A.F.
(11.0) (13.0) (13.6) (12.0) (9.9) (15.8) (11.3) (10.5) (8.6) (7.8) LAKE (9.3) MEAD (11.9) (9.3) (9.0) (8.6)
1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961
(Available)
11,142,000 A.F.
27,935,000 A.F. Maximum Storage (Elevation 1,221.4)
14,900,000 A.F. at Rated Head (Elevation 1,122.8)
Annual Release M.A.F.
Capacity Table Revised Permanent Closure Lower Gates
(16.0) (10.2) (4.5) (6.4) (5.9) (6.0) (6.8) (8.6) (8.0) (14.9) LAKE (15.8) MEAD (12.7) (14.4) (12.5) (10.6)
1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946
Calendar Year

6. Flows of Colorado River

The following two charts illustrate some of the pertinent historical facts related to the amounts of water produced by the Colorado River system above Lee Ferry, Arizona, the compact division point between the Upper and Lower Colorado River Basins. See maps on p. 3 and p. 43. The first chart is entitled COLORADO RIVER FLOW AT LEE FERRY, ARIZONA. The top of each vertical bar represents the estimated virgin flow of the river, i.e., what the flow of the river in millions of acre-feet past Lee Ferry would have been for a given year had it been undepleted by activities of man. Each vertical bar has two components. The lower black part represents the estimated or measured historic flow at Lee Ferry. The upper, lighter vertical-hatched portion represents the stream depletion, or the amount of water estimated to have been removed by man from the virgin supply upstream from Lee Ferry. Beginning in 1962, part of this depletion at Lee Ferry was caused by the retention and storage of water in storage units of the Colorado River Storage Project. The horizontal line (at approximately 15 million acre-feet) shows the long-term average virgin flow. Because the Colorado River Compact is administered on the basis of running averages covering periods of ten years, the irregular horizontal line is plotted to show the progressive 10-year average virgin flows. In only one decade (1941-1950) following 1923 has the progressive 10-year average virgin flow exceeded the long-term virgin flow.

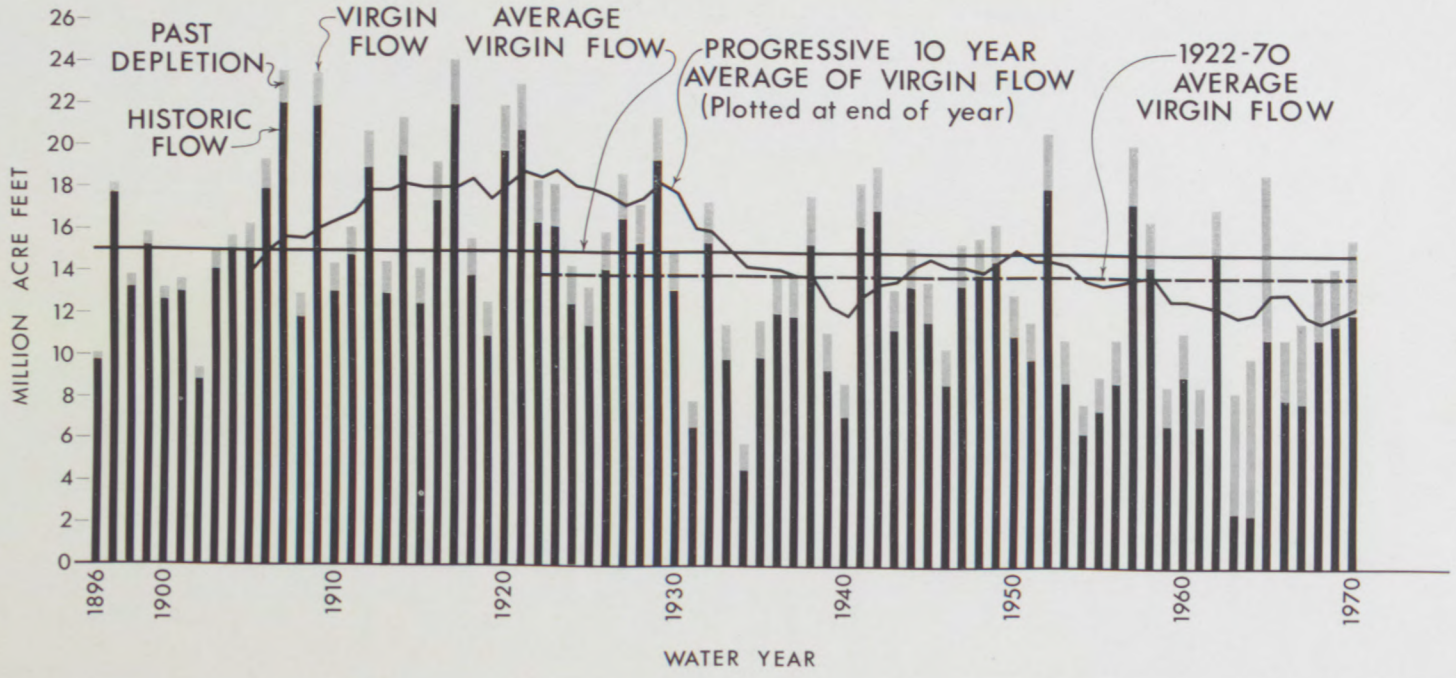
The second chart entitled LEE FERRY AVERAGE ANNUAL VIRGIN FLOW FOR SELECTED PERIODS is a pictorial representation of averages for several periods of records. The periods of water years selected were those to which reference is usually made for various purposes in documents pertaining to the Colorado River System.

Several important hydrologic facts are apparent from these two charts:

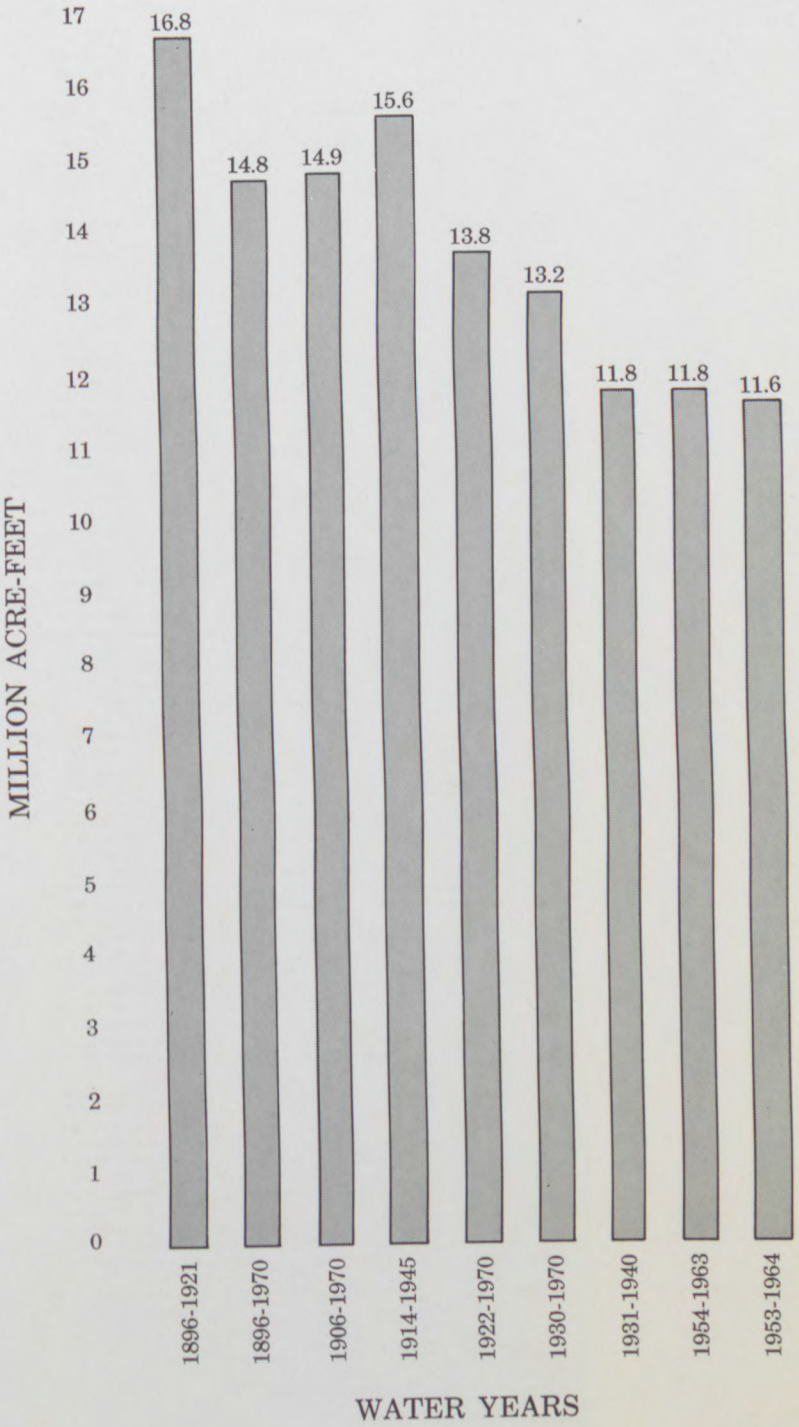
(1) For the period 1896-1921, prior to the Colorado River Compact of 1922, the average was estimated to be 16.8 million acre-feet per year, which is considerably greater than for any other period selected, including the long-term average. A stream gaging station at Lee Ferry was not installed until 1921. Therefore, the annual flows at Lee Ferry prior to the 1922 Compact are estimates based upon records obtained at other stations.

(2) A great majority of the high flows indicated were prior to 1929.

COLORADO RIVER FLOW AT LEE FERRY, ARIZONA



LEE FERRY AVERAGE ANNUAL VIRGIN FLOW FOR SELECTED PERIODS



(3) In only one decade (1941-1950) following 1923 has the progressive 10-year average virgin flow exceeded the average virgin flow. The trend for 47 years has been downward as can be seen from the first chart.

(4) For the longest period shown, 1896-1970, the estimated annual average is 14.8 million acre-feet.

(5) For the next longest period, 1906-1970, the estimated annual average virgin flow is 14.9 million acre-feet. Many of the early records for the series of years, as well as for the 1896-1970 period were based upon the estimates of flows made at other gaging stations as mentioned in (1) above. This average has the same numerical value as that used (1906-67) as the basis for justification of a water supply for the recently authorized Central Arizona Project.

(6) The average annual virgin flow for 1914-45 amounts to 15.6 million acre-feet. This is the period of record used by the negotiators of the Upper Colorado River Basin Compact of 1948.

(7) For 1922-1970, the total period since the signing of the Colorado River Compact, the annual average is 13.8 million acre-feet. Records for this series of years are based upon actual measurements of flows at Lee Ferry, the gaging station there having been installed in 1921. The general trend throughout almost this entire period has been toward a decreasing 10-year running average virgin flow.

(8) This downward trend is further demonstrated by the fact that for the 1930-1970 period the annual average had dropped to 13.2 million acre-feet.

(9) Two 10-year periods of minimum flows have occurred since 1930. These are series of years 1931-1940 and 1954-1963 for which the average annual virgin flow for *each* 10-year period amounted to only 11.8 million acre-feet.

(10) The annual average virgin flow for a 12-year period, 1953-1964, amounted to only 11.6 million acre-feet.

B. LEGAL

Since January 1969 a legal water newsletter has been issued periodically. This letter is circulated principally to the Commissioners, their advisers, and others who have requested copies. It contains concise information related to the activities of the Congress and contains summaries of legal cases covering water problems that have been decided by State and Federal appellate courts. A legal summary provides an outline of the problems presented to the courts.

The legal staff has been involved in the Type I Comprehensive Framework Study of the Upper Colorado Region. During the year much of the time of the staff has been devoted to writing the field draft of the appendix to this study report entitled "Legal and Institutional Environments Appendix." The field draft has been completed and circulated to interested entities in the Pacific Southwest Region for comments.

A consolidated supplement for "Selected Legal References" is being prepared. This supplement will make the publication current with the end of the 91st Congress, Second Session. This consolidated supplement will also incorporate supplements one, two, and three published in past years.

During the past year a number of memoranda were prepared on various legal problems that fell within the scope of the Upper Colorado River Commission's activities. There has also been a continuing program of acquisition of historical and current information that sheds light on the growing body of law known as the "law of the river," and in which members of the Commission and their legal advisers have a primary interest. This material has been added to the Commission's library for future reference by the member States.

C. EDUCATION — INFORMATION

General Cooperation

The Upper Colorado River Commission has directed its Education and Information program toward promoting interstate cooperation, harmony and united efforts; developing an understanding in other sections of the United States of the problems of the Upper Colorado River Basin; and the creation of a favorable attitude on the part of the Congress with respect to the development of the industrial and agricultural resources of the Upper Colorado River Basin.

The Commission has continued to cooperate with members of the Congressional Delegations from the Upper Colorado River Basin States and with officials of the Department of the Interior and the Bureau of Reclamation in seeking appropriations of funds by the Congress for the construction of the Storage Units and participating projects authorized for construction, as well as funds for the investigations of additional participating projects that are given priority in planning in the Colorado River Storage Project Act. As part of this cooperation the Commission's Executive Director has been in Washington, D. C. at intermittent periods acting as liaison between the Congress and States and various departments of government, supply-

ing information, arranging and taking part in Congressional hearings, and providing other assistance requested.

Relief Model

The Relief Model of the Upper Colorado River Basin and adjacent areas is available for display at conventions and other public events and has proved to be extremely interesting and instructive in promoting an understanding of the physical and hydrologic problems of the Upper Colorado River Basin and the development of its water and other natural resources. (See last page of this report.)

Motion Pictures

The motion pictures in the Commission's film library continue to be widely distributed. In addition to filling requests for the picture entitled "The Lakes Made For You" showing the recreational benefits of man-made reservoirs, hundreds of requests have also been filled for motion pictures about Glen Canyon and Flaming Gorge reservoirs and other river basin subjects by utilizing films that have been supplied to the Commission by the Bureau of Reclamation, et al. Widespread interest has been created in recent years by schools, colleges, civic clubs, etc., in the benefits of river basin development. Undoubtedly some of this increased interest can be traced to the fact that since the completion of Flaming Gorge, Glen Canyon, Blue Mesa, and Navajo dams and reservoirs the American public is becoming more aware of the national benefits of man-made bodies of water in the Colorado River Basin and elsewhere.

Library

Efforts are being continued to accumulate all types of engineering, legal, economics, and semi-technical documents related to the Colorado River Basin to comprise a well-equipped and efficiently operating permanent library. Many thousands of pages of documents have been placed on microfilm. Information in the Commission's library will be available to any of its member States on short notice should a need arise. Studies are being made and supplemented of many problems associated with the development, utilization, and conservation of water and hydro-electric resources of the Colorado River Basin.

IX. Legislation

A. GENERAL

During the 1970 water year, which terminated September 30, 1970, the Congress enacted several laws that will have significant impacts upon water resource conservation and development, not only in the Upper Colorado River Basin but in all parts of the nation. Attention is called to three of these laws, as follows:

1. National Environmental Policy Act of 1969, P.L. 91-190 (83 Stat. 852) provided for a national policy for the environment and the establishment of a Council on Environmental Quality.
2. Water Quality Improvement Act of 1970, P.L. 91-224 (84 Stat. 91) amended the Federal Water Pollution Control Act in a number of particulars.
3. P.L. 91-416 (84 Stat. 867) amended the Act of June 13, 1962 (76 Stat. 96) with respect to the Navajo Indian Irrigation Project.

B. RESERVOIR OPERATING CRITERIA

The Twenty-First Annual Report of this Commission contains a description of events during the 1969 water year relating to the formulation of reservoir operating criteria for the coordinated long-range operation of reservoirs constructed and operated under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act, as required by Section 602 of P.L. 90-537. The following discussion outlines the events during the 1970 water year.

On December 16, 1969 the Secretary of the Interior submitted a draft of *Coordinated Long-Range Operating Criteria For Colorado River Reservoirs Pursuant to the Colorado River Basin Project Act of September 30, 1968 (P.L. 90-537).*

On March 26, 1970, at its adjourned regular meeting, the Upper Colorado River Commission adopted a document that had been prepared by its Engineering and Legal Committees. This document was entitled, "Comments and Recommendations of Colorado, New Mexico, Utah, and Wyoming on the Secretary of the Interior's December 16, 1969 Proposed Long-Range Operating Criteria For Colorado River Reservoirs." These comments were divided into two major parts: (a) a recommendation that the 1962 *General Principles To Govern, and Operating Criteria For, Glen Canyon Reservoir (Lake Powell) and Lake Mead During The Lake Powell Filling Period* and particularly the charging of so-called "deficiencies" in firm

energy generation at Hoover Dam to the Upper Colorado River Basin Fund in terms of dollars, electric energy, or generating capacity should be terminated simultaneously with the adoption on July 1, 1970 of the long-range operating criteria; and (b) recommendations for modifications of the Secretary of the Interior's December 16, 1969 draft of criteria to make them more equitable and in compliance with the Congressional intent and directives of section 602 of the Colorado River Basin Project Act.

On March 31, 1970, the Governors of the four Upper Division States of the Colorado River Basin by means of the following letter transmitted the Commission's comments and recommendations to the Secretary of the Interior as the position of each of their respective States.

GOVERNORS

of

UPPER DIVISION STATES

of

COLORADO RIVER BASIN

John A. Love, Colorado
David F. Cargo, New Mexico
Calvin L. Rampton, Utah
Stanley K. Hathaway, Wyoming

March 31, 1970

Honorable Walter J. Hickel
Secretary of the Interior
Washington, D. C. 20240

Dear Mr. Secretary:

By letter of December 16, 1969 you transmitted to the Governors of the Colorado River Basin States for review a draft of "Coordinated Long-Range Operating Criteria for Colorado River Reservoirs Pursuant To The Colorado River Basin Project Act of September 30, 1968 (P.L. 90-537)." You asked each Governor for comments on the operating criteria by April 1, 1970 and stated that after their receipt, but not later than July 1, 1970, operating criteria will be adopted pursuant to Section 602 of P.L. 90-537 and published in the Federal Register. This communication is in reply to your letter and is in the nature of a joint and common response from the States of Colorado, New Mexico, Utah, and Wyoming. We are also authorized to state that it constitutes the views of the Upper Colorado River Commission.

Attached is a document entitled, "Comments and Recommendations of Colorado, New Mexico, Utah, and Wyoming on the Secretary of the Interior's December 16, 1969 Proposed Long-Range Operating Criteria For Colorado River Reservoirs." This document sets forth in detail the results of our analysis of your proposed criteria.

You will note that our comments include a recommendation that the 1962 "General Principles To Govern And Operating Criteria For Glen Canyon Reservoir (Lake Powell) and Lake Mead During The Lake Powell Filling Period" be terminated. During the months of negotiations and conferences by the Federal-State task force on the new operating criteria

directed by the Congress, representatives of your Department took the position that it was inappropriate for the task force to constitute a forum to consider the subject of termination of the 1962 filling criteria. Our representatives disagreed with that position, and we in turn disagree with your statement that, "A decision regarding termination of the filling criteria is a matter separate and apart from the issuance of operating criteria." Even a casual comparison of the 1962 reservoir filling principles and the Congressional directive contained in Section 602 of Public Law 90-537 reveals serious conflicts between the two. Equity can be done only by simultaneous action concerning both, because the two are part and parcel of the same problem.

We are pleased to learn from your letter that you are reexamining this matter and that you expect to make a decision regarding termination of the 1962 filling criteria prior to adoption of the long-range criteria directed by Congress.

There is no problem which confronts our respective States at this time of greater proportions than our future water supply. Since the Colorado River is a major source of water for each of our four States, we trust that you can understand our great concern for its future management.

We wish to thank you for the opportunity for an early review of your December 16, 1969 draft of criteria and offer the continuing services of our offices between now and July 1, 1970 in resolving any remaining questions related to this complex problem.

Sincerely yours,

John A. Love
Governor of Colorado

Calvin L. Rampton
Governor of Utah

David F. Cargo
Governor of New Mexico

Stanley K. Hathaway
Governor of Wyoming

With one exception which was desired by both the Upper and Lower Division States, the Secretary of the Interior refused to accept any substantive changes in his December 16, 1969 draft of operating criteria suggested by the member States of the Upper Colorado River Commission.

On June 8, 1970 the Secretary transmitted his "Criteria for

Coordinated Long-Range Operation of Colorado River Reservoirs" to the Governors and other interested parties in the seven Colorado River Basin States. Appendix C of this report contains a copy of the Secretary's letter and of the operating criteria.

UPPER COLORADO RIVER BASIN

COLORADO RIVER STORAGE PROJECT

UPPER COLORADO RIVER COMMISSION

X. Colorado River Storage Project and Participating Projects

A. APPROPRIATION OF FUNDS BY THE UNITED STATES CONGRESS FISCAL YEAR 1970

A large part of the actions by the Congress on the Public Works Appropriation Bill for fiscal year 1970 did not occur until after the beginning of the 1970 water year. It was not until October 2, 1969 that the House Committee on Appropriations reported H.R. 14159 to the House of Representatives. On October 8, 1969 the House passed the Bill. On November 12, 1969 the Senate approved the measure. It was not until December 3, 1969 that the House finally approved the Report of the Conference Committee. The Senate approved this report on December 4, 1969.

The finally approved Bill included more money than the President's budget request for several projects of the Colorado River Storage Project; namely, an increase of $2,000,000 for construction of the Bonneville Unit of the Central Utah Project; $110,000 for advance planning on the Dolores Project and $130,000 for advance planning on the Dallas Creek Project.

On October 15, 1969 the House and Senate approved the conference report to accompany the appropriation Bill for the Department of the Interior and Related Agencies which appropriated $5,500,000 for the Navajo Indian Irrigation project. Of this sum $3,500,000 was in the President's budget request and $2,000,000 was added by the Congress. Subsequently the President ordered a 75% reduction in spending on new construction. The Bureau of the Budget also impounded the $2,000,000 added by the Congress. Due to overhead costs of various kinds, only $470,000 of the remainder became available for actual construction work on the project.

Table X(a) illustrates a comparison of the amounts appropriated by the Congress for fiscal year 1970 for the Colorado River Storage Project and participating projects with the amounts in President Nixon's revised budget request.

The Public Works Appropriation Act for 1970 again contained

language with reference to the protection of Rainbow Bridge National Monument, as follows:

> "*Provided, that no part of the funds herein appropriated shall be available for construction or operation of facilities to prevent waters of Lake Powell from entering any national monument.*"

Table X(a)

UPPER COLORADO RIVER STORAGE PROJECT

Fiscal Year 1970 Programs

Project	*Revised Budget April 15, 1969 H. Doc. 91-100 Fiscal Year 1970*	*Appropriated Fiscal Year 1970*
Colorado River Storage Project:		
Curecanti Unit, Colorado	$ 3,500,000	$ 3,500,000
Transmission Division, Various	3,672,000	3,222,000
Participating Projects:		
Bostwick Park, Colorado	1,400,000	1,400,000
Central Utah, Bonneville Unit, Utah	8,000,000	10,000,000
Lyman, Wyoming-Utah	1,350,000	1,350,000
San Juan-Chama, Colorado-New Mexico	6,300,000	6,300,000
Drainage and Minor Construction	1,675,000	1,225,000
Advance Planning	550,000	790,000
Subtotal	$26,447,000	$27,787,000
Recreational and Fish and Wildlife Facilities:		
Bureau of Indian Affairs	700,000	650,000
National Park Service	1,350,000	1,050,000
Bureau of Sport Fisheries and Wildlife	950,000	800,000
Subtotal	$ 3,000,000	$ 2,500,000
Total, Upper Colorado River Storage Project	$29,447,000	$30,287,000
Financing:		
Construction Revenues	-450,000	
Available from prior year funds	-500,000	
Non-Federal advance	-450,000	
Initial underfinancing and undistributed reduction based on anticipated delays	-2,047,000	-2,047,000
Total	$26,000,000	$28,240,000
Navajo Indian Irrigation Project (funds appropriated to Bureau of Indian Affairs)	3,500,000	5,500,000
TOTAL CRSP 1970 Construction Program	$29,500,000	$33,740,000

B. APPROPRIATION OF FUNDS BY THE UNITED STATES CONGRESS FISCAL YEAR 1971

President Nixon's budget request for fiscal year 1971 was transmitted to the Congress on February 2, 1970. The total recommended to be appropriated to the Bureau of Reclamation for its construction program on the Colorado River Storage Project amounted to $21,180,000. From prior year and other funds $6,810,000 was supposed to be derived to account for a total program of $27,990,000. The largest item of new money requested was $10,900,000 for the Bonneville Unit of the Central Utah Project.

The President's budget request did not contain any new money for the Navajo Indian Irrigation Project. Funds from prior years were supposed to account for a program of $3,410,000 on this project for fiscal year 1971.

The Operation and Maintenance Program for the Colorado River Storage Project to be financed through the Upper Colorado River Basin Fund amounted to $8,066,000. In addition to the operation and maintenance activities on the Flaming Gorge, Glen Canyon, Navajo, and Curecanti storage units, the transmission division, and the Florida, Paonia, and Seedskadee participating projects, the 1971 program also provided for the continued purchase of power to cover requirements caused by dimunitions in energy generation and capacity impairment created at Hoover Dam powerplant as the result of operations of dams and reservoirs of the Colorado River Storage Project, and provided for quality of water studies.

The total fiscal year 1971 program of $8,066,000 will be funded by revenues received from the sale of electric energy and water.

The Upper Colorado River Commission on April 16, 1970 submitted testimony to the Subcommittee on the Department of the Interior and Related Agencies of the Committee on Appropriations of the House of Representatives in support of increased construction funds for the Navajo Indian Irrigation Project. The need for the acceleration of construction of this project was again emphasized.

Witnesses representing the Upper Colorado River Commission and various entities in its member States on May 13 and 14, 1970 testified before the Public Works Subcommittees of the House of Representatives and the Senate in support of appropriations of funds for the Colorado River Storage Project and participating projects and other water resource development projects.

On June 24, 1970 the U. S. House of Representatives passed the fiscal year 1971 Public Works Appropriation Bill, H. R. 18127. The House approved $21,515,000. The House increased the item for advance planning from $215,000 in the budget request to $785,000. The latter item includes $255,000 from 1970 budgetary reserve (Animas-La Plata Project $15,000, Dolores Project $110,000, Dallas Creek Project $130,000), an increase over the President's February 2, 1970 budget request of $315,000 (Animas-LaPlata Project $125,-000, Dolores Project $90,000, and Dallas Creek Project $100,000); $50,000 for Savery-Pot Hook Project; and $165,000 for Fruitland Mesa Project.

On August 24, 1970 the U. S. Senate passed the bill with the total amount increased to $23,430,000. Part of this increase was due to an addition of $500,000 for starting construction of the China Meadows Dam of the Lyman Project in Wyoming and $300,000 for initiating the Upalco unit of the Central Utah Project.

The Conference Committee's Report was approved by the House on September 22, 1970 and by the Senate on September 23, 1970. The Conference Committee removed the $500,000 for the China Meadows Dam and the $300,000 for the Upalco unit before approving its report.

On October 7, 1970, President Nixon signed the Public Works Appropriation Bill for fiscal year 1971 with the following statement:

> "I am today signing H.R. 18127, which makes appropriations for fiscal 1971 in a broad area of public works, including dam construction. This bill contains funds for many important purposes and projects that must be carried forward.
>
> "However, I am deeply concerned about its impact on spending in *future* years. In my proposal to the Congress last January, I requested funds for 37 projects in construction and preconstruction planning to be started by the Corps of Engineers and the Bureau of Reclamation. Seen through to completion, these new projects would cost over the years a total of $1.3 billion. The Congress increased the number of starts to 102 new projects which would ultimately cost $4.5 billion. The extra $3.2 billion is now committed by the Congress.
>
> "Many of these added starts are for projects which would benefit some particularly interested group but would be of little value to the people generally. There is too much pork in this barrel.

"It is my intention to consider all means possible to minimize the impact of these inflationary and unnecessary appropriations, including the deferment of the proposed starts and the withholding of funds. There are too many top priority demands on our resources to permit this kind of spending."

Table X(b) illustrates a general recapitulation of action by the Second Session of the 91st Congress with regard to appropriations of funds for the construction program of the Colorado River Storage Project.

Another related construction item was $20,000,000 for the Fryingpan-Arkansas Project, Colorado.

In addition, the Second Session of the 91st Congress, through its Subcommittee on the Department of the Interior and Related Agencies, enacted legislation appropriating $4,000,000 to the Bureau of Indian Affairs for construction on the Navajo Indian Irrigation Project, New Mexico.

The Public Works Appropriation Act for 1971 again contained language with reference to the protection of Rainbow Bridge National Monument, as follows:

"*Provided, that no part of the funds herein approved shall be available for construction or operation of facilities to prevent waters of Lake Powell from entering any national monument.*"

Table X(b)

COLORADO RIVER STORAGE PROJECT

Fiscal Year 1971 Appropriations

Project and State	*President's Budget February 2, 1970*	*H.R. 18127 Passed House June 24, 1970*	*H.R. 18127 Passed Senate August 24, 1970*	*Conference Rpt. Approved by House Sept. 22, 1970 Senate Sept. 23, 1970*
Colorado River Storage Project				
Curecanti Unit, Colorado	$ 2,850,000	$ 2,850,000	$ 3,000,000	$ 3,000,000
Transmission Division, Various States	2,573,000	2,163,000	2,163,000	2,163,000
Participating Projects:				
Bostwick Park, Colorado	1,214,000	1,214,000	1,214,000	1,214,000
Fruitland Mesa, Colorado	—	—	—	30,000[3]
Central Utah, Bonneville Unit, Utah	10,900,000	10,900,000	10,900,000	10,900,000
Central Utah, Jensen Unit, Utah	500,000	500,000	500,000	500,000
Central Utah, Upalco Unit, Utah	—	—	300,000	—
Lyman, Wyoming-Utah	1,453,000	1,453,000	1,953,000	1,453,000
San Juan-Chama, Colorado-New Mexico	1,272,000	1,272,000	1,747,000	1,747,000
Savery-Pot Hook, Colorado-Wyoming	—	250,000	250,000	250,000
Drainage and Minor Construction, Various States	1,154,000	1,154,000	1,154,000	1,154,000
Advance Planning, Various States	215,000	785,000	935,000[1]	905,000[4]
Initial Underfinancing, an Undistributed Reduction Based on Anticipated Delays	–1,831,000	–1,831,000	–1,831,000	–1,831,000
	20,300,000	20,710,000	22,285,000	21,485,000
Recreation, Fish & Wildlife Facilities:				
Bureau of Indian Affairs, Utah	75,000	—	—	—
National Park Service, Various States	578,000	578,000	578,000	578,000
Bureau of Sport Fisheries and Wildlife, Various States	227,000	227,000	567,000	567,000
Subtotal—Section 8 of CRSP Act	880,000	805,000	1,145,000	1,145,000
TOTAL—Colorado River Storage Project	$21,180,000	$21,515,000[2]	$23,430,000[2]	$22,630,000[2]
Financing:				
Appropriations	$21,180,000	$21,260,000	$23,175,000[2]	$22,375,000[2]
Construction Revenues	—	—	—	—
Available from Prior Year Funds	—	255,000	255,000	255,000
TOTAL	$21,180,000	$21,515,000	$23,430,000	$22,630,000

[1]The $935,000 for Advance Planning includes: Animas LaPlata $240,000, Dallas Creek $230,000, Dolores $200,000, Fruitland Mesa $165,000, San Miguel $50,000, Savery-Pot Hook $50,000.
[2]Includes $255,000 placed in budgetary reserve during fiscal year 1970 which will be released for use in fiscal year 1971.
[3]Construction on the Fruitland Mesa Project at this time is limited to the initiation of construction on replacing siphons on the Gould Canal.
[4]Includes: Animas-LaPlata $240,000, Dallas Creek $230,000, Dolores $200,000, Fruitland Mesa $135,000, San Miguel $50,000, Savery-Pot Hook $50,000.
Note 1: Another related construction item was $20,000,000 for the Fryingpan-Arkansas Project, Colorado.
Note 2: In addition to the sums listed above, the Second Session of the 91st Congress, through its Subcommittee on the Department of the Interior and Related Agencies, enacted legislation appropriating $4,000,000 to the Bureau of Indian Affairs for construction on Navajo Indian Irrigation Project, New Mexico.

C. AUTHORIZED STORAGE UNITS

(Information relative to Storage Units and Participating projects has been obtained from reports on investigations and activities of the United States Department of the Interior, Bureau of Reclamation.)

The Colorado River Storage Project was authorized for construction by the U.S. Congress in the act of April 11, 1956 (70 Stat. 105). The four storage units are comprised of Glen Canyon Dam and Lake Powell on the Colorado River in Arizona and Utah, Navajo Dam and Reservoir on the San Juan River in New Mexico and Colorado, Flaming Gorge Dam and Reservoir on the Green River in Utah and Wyoming, and the Curecanti Storage Unit on the Gunnison River in Colorado. The Curecanti Unit consists of three dams and reservoirs—Blue Mesa, Morrow Point, and Crystal. Combined, the four storage units will provide about 33,583,000 acre-feet of water storage capacity.

The authorizing act also provided for the construction of 11 participating irrigation projects. Ten additional participating projects were added by subsequent legislation.

1. Glen Canyon Storage Unit

Glen Canyon Dam and Reservoir comprises the key storage unit. It is the largest of the initial four, providing about 80 percent of both the storage and generating capacity. The 710-foot high concrete arch dam is located in northern Arizona on the Colorado River, 12.4 miles downstream from the Utah-Arizona State line and 15.3 miles upstream from Lees Ferry. (*Lees Ferry is the location of the Geological Survey gaging station and is 1 mile upstream from the compact point, Lee Ferry, which divides the Colorado River drainage into two basins.)* Glen Canyon Dam is the second tallest dam in the United States. The reservoir has a capacity of 27 million acre-feet and will extend a maximum of 186 miles upstream on the Colorado River and 71 miles up the San Juan River. The powerhouse, located at the toe of the dam, has eight generating units with a total installed capacity of 950,000 kilowatts.*

Glen Canyon Dam was completed in 1964.

Construction

Construction at Glen Canyon during 1970 was limited to improving operations, maintenance, appearance, and safety at the

*Manufacturer has increased name-plate rating from 900 MW to 950 MW as result of final in-service performance.

Includes: Animas-LaPlata $240,000, Dallas Creek $220,000, [illegible] Fryingpan-Arkansas Project, Colorado.
Note 1: Another related construction item was $20,000,000 for the Department of the Interior and Related Agencies, enacted legislation appropriating $4,000,000 to the Bureau of Indian Affairs for construction on Navajo Indian Irrigation Project, New Mexico.
Note 2: In addition to the sums listed above, the Second Session of the 91st Congress, through its Subcommittee on

dam, powerplant, and at the Government-operated community of Page, Arizona. During December 1969 a new shop and storage area were built at the east end of the powerplant service area. In summer of 1970 work was started on the hydraulic service elevator to aid in moving maintenance materials and heavy equipment between work levels in the powerplant area. Other work included drilling of drainage holes and grouting. In the city of Page, sewer lines were extended to additional commercial and residential lots; bituminous surfacing was applied to streets; concrete walks, curbs, and gutters were constructed; and painting of municipal water storage tanks was begun.

Recreation

Visitation to the Glen Canyon National Recreation Area has shown a sharp increase during the past several years—from 254,000 in 1961 to 962,940 during 1969. Through September 30 there were 714,782 visits recorded in 1970.

The National Park Service has concession-operated facilities on Lake Powell at Wahweap, Rainbow Bridge, Halls Crossing, Hite, and Bullfrog Basin, and on the Colorado River at Lees Ferry.

From 1909 through 1961 a total of 20,972 vacationers visited Rainbow Bridge. When access to the Bridge was made available by water through closure of the dam in 1963, visitation rapidly increased. In 1966 there were 20,468 visitors, or slightly less than the total of 20,972 who visited during the 53 years previous to closure of the dam. During 1967 there were 21,993 visitors; during 1968 there were 28,039; during 1969, 32,323 visits were recorded; and by September 30 of 1970 there were 34,987 visits recorded.

At the dam the Carl Hayden Visitor Center was utilized by 212,570 people through September 30, 1970. During the period January 1, 1970, through September 30, 1970, 125,762 persons participated in tours through the dam.

A total of 18 million fish—including largemouth bass, rainbow trout, Kamloop trout, kokanee salmon, and black crappie — have been planted in the lake. The annual fish harvest of the reservoir and the tailwaters is approaching 90,000.

2. Flaming Gorge Storage Unit

Flaming Gorge Dam is located on the Green River in northeastern Utah, about 40 road miles north of Vernal, Utah, and 32 river miles downstream from the Utah-Wyoming State line. The

dam is a concrete thin-arch structure rising 502 feet above bedrock. The reservoir has a capacity of 3,789,000 acre-feet and, when full, extends upstream 91 miles, or nearly to the town of Green River, Wyoming. The powerplant has an installed generating capacity of 108,000 kilowatts. The dam and powerplant were completed in 1963.

Construction

A contract was awarded during summer of 1970 to furnish and install a freight elevator in the powerplant area. The contractor has submitted construction drawings for review and should begin work soon. Bids will be taken by the Bureau of Reclamation during October 1970 for repair of bituminous surfacing at the visitors parking area adjoining the dam, the powerplant service road, and Dutch John community streets.

Recreation

Visitation at Flaming Gorge National Recreation Area continued to be high. By September 30 there were 1,052,698 recreation-days recorded in the area. During the complete year of 1969, the area sustained 1,156,000 recreation-days' use. The two visitor centers in the area have drawn large numbers of enthusiastic crowds. One of the largest single attractions in the Flaming Gorge National Recreation Area has been the self-guided tour provided by the Bureau of Reclamation through the Flaming Gorge Dam and Powerplant. By the end of September 1970 there were 55,274 visitors who had taken the tour this year.

Fishing is an important recreation activity at Flaming Gorge Reservoir and in the Green River below the dam. During 1969, there were 601,512 trout taken from the reservoir and 21,250 from the tailwaters fishery.

The U.S. Forest Service administers recreation facilities at Lucerne Valley, Antelope Flat, Buckboard Crossing, Squaw Hollow, Firehole Canyon, Dutch John Draw, Cedar Springs, and Sheep Creek. Each site has boat ramps, picnic, and campground areas. Concession facilities are available at Lucerne Valley and at Cedar Springs. In addition, several campground and overlook areas have been developed near the reservoir in the Ashley Forest.

3. Navajo Storage Unit

The 402-foot-high Navajo Dam was dedicated on September 15, 1962. Storage of water began June 27, 1962, marking the first

impounding of water in a storage unit of the Colorado River Storage Project.

Navajo Dam is located in northwestern New Mexico on the San Juan River, 34 miles east of Farmington and 3½ miles downstream from the confluence of the Los Pinos and San Juan Rivers. The dam is a zoned, earth-fill, embankment structure. The reservoir has 1,709,000 acre-feet total capacity and an active capacity of 1,036,000 acre-feet.

The major purpose of this reservoir is to regulate the flows of the San Juan River for the authorized Navajo Indian Irrigation Project near Farmington, the San Juan-Chama participating project in the Rio Grande Basin, and the Hammond participating project. Part of the water to be made available will also be used for industrial and municipal purposes in northwestern New Mexico.

Recreation

Navajo Reservoir draws visitors from many points. Visitation during 1969 totaled 517,314 people. From January 1, 1970, to September 30, 1970, 506,122 persons visited the reservoir area. Recreational areas have been developed in New Mexico on the Pine River Arm above Navajo Dam and the Sims Mesa recreation site on the opposite shore and in Colorado near Arboles in the upper portion of the lake. Basic recreation facilities at the three sites are complete. They include concrete boat ramps, visitor centers or administration buildings, picnic areas and campgrounds, modern rest rooms, parking facilities, culinary water, sewer systems, and employee residences. In addition, concessionaires at Pine River and at Arboles have developed marina facilities and have provided service, including food and trailer park accommodations, and are preparing plans for lodges, restaurants, etc. Plans are now being made to develop sanitation and picnicking facilities downstream from the dam pursuant to provisions of Public Law 89-72. This reach of the river has become one of the best stream fisheries of the Colorado River Storage Project. About 150,000 fisherman-hours were spent and 79,000 trout taken in this area during each of the past two years. Navajo Reservoir is also a popular fishery. During the 1969 season 234,275 fish were taken.

4. Curecanti Storage Unit

Curecanti Storage Unit includes three major dams and powerplants along a 40-mile canyon of the Gunnison River below Gunnison, Colorado, and upstream from the Black Canyon of the Gunnison National Monument.

Bureau of Reclamation Photo

Navajo Storage Unit, Colorado - New Mexico. Pine River recreation area on Navajo Reservoir.

Flows of the Gunnison River are now largely controlled by the 940,800-acre-foot Blue Mesa Reservoir, the largest and uppermost of the reservoirs. Water released from the Blue Mesa Reservoir through a 60,000-kilowatt-capacity powerplant at the dam receives short-term regulation at the Morrow Point Reservoir immediately downstream. Morrow Point Reservoir has a total capacity of 117,190 acre-feet and an active capacity for power production of more than 42,000 acre-feet. The powerplant capacity at Morrow Point will be 120,000 kilowatts when Crystal Dam is in operation to reregulate river flows. Crystal Powerplant will have a capacity of 28,000 kilowatts.

Construction

Blue Mesa Dam

Blue Mesa Dam and Powerplant were completed and were transferred to operation and maintenance status on April 1, 1968. The powerplant is remotely operated and controlled from the Power Operations Center at Montrose, Colorado. The two 30,000-kilowatt hydroelectric generating units in Blue Mesa Powerplant began producing commercial power during 1967.

A construction contract was awarded September 15, 1970, for a 115-kv bay at Blue Mesa switchyard in order to supply electrical energy directly to the Colorado-Ute Electric Association system. Work has started on improvement of the parking area adjacent to Blue Mesa Dam by placing a 2-inch plant mix bituminous surfacing over the existing gravel surfaces.

Ice Jam Flooding

During the past several years flooding has occurred upstream from the backwaters of Blue Mesa Reservoir during the extremely cold winter weather. The spreading waters have encroached into several resort cabins, yards of summer homes, cattle feeding lots, fields, and county roads. It is believed that this flooding has been caused by a combination of factors. At the edge of the city of Gunnison the Gunnison River has been cleaned, dredged, and straightened on several occasions in the recent past. This work confines the flow in one channel, increases the velocity of the water, and consequently, increases the scouring and bed load material that is carried downstream in greater quantities than under natural conditions. When the flowing river encounters these low velocity backwaters of the reservoir scoured materials drop and tend to raise the bottom of the channel. The construction of buildings, fences, cabins, dikes across channels, and other structures has also tended to cause

Bureau of Reclamation Photo

Blue Mesa Dam, Powerplant, and Reservoir, Curecanti Storage Unit, Colorado.

barriers to the flowing water. With time the elevated stream bed progresses upstream.

In extreme cold periods, the raised stream bed is conducive to the formation of anchor ice and also is an obstruction to floating ice, thus forming a winter dam in the river. This temporary barrier also progresses upstream with time. Under natural conditions the river channel has changed its course many times in the past by seeking the low places as gravel and sand have been moved downstream and deposited as alluvium in the valley bottom.

During the winter of 1968-1969 the Bureau of Reclamation, in cooperation with the Upper Gunnison River Water Conservancy District, and Gunnison County, accomplished limited emergency work to relieve the situation. The Corps of Engineers, *et al.*, constructed some dikes during the winter of 1969-1970. Later in 1970 the Corps of Engineers performed some clearing and snagging work in the river channel upstream from Blue Mesa Reservoir.

It appears that the only permanent solution to this problem will be the acquisition by the federal government of riparian lands subject to flooding or of flood easements covering such lands. The Department of the Interior is now pursuing this course of action with limited funds.

Morrow Point Dam

Morrow Point Reservoir has been used since 1968 for reregulating releases from Blue Mesa.

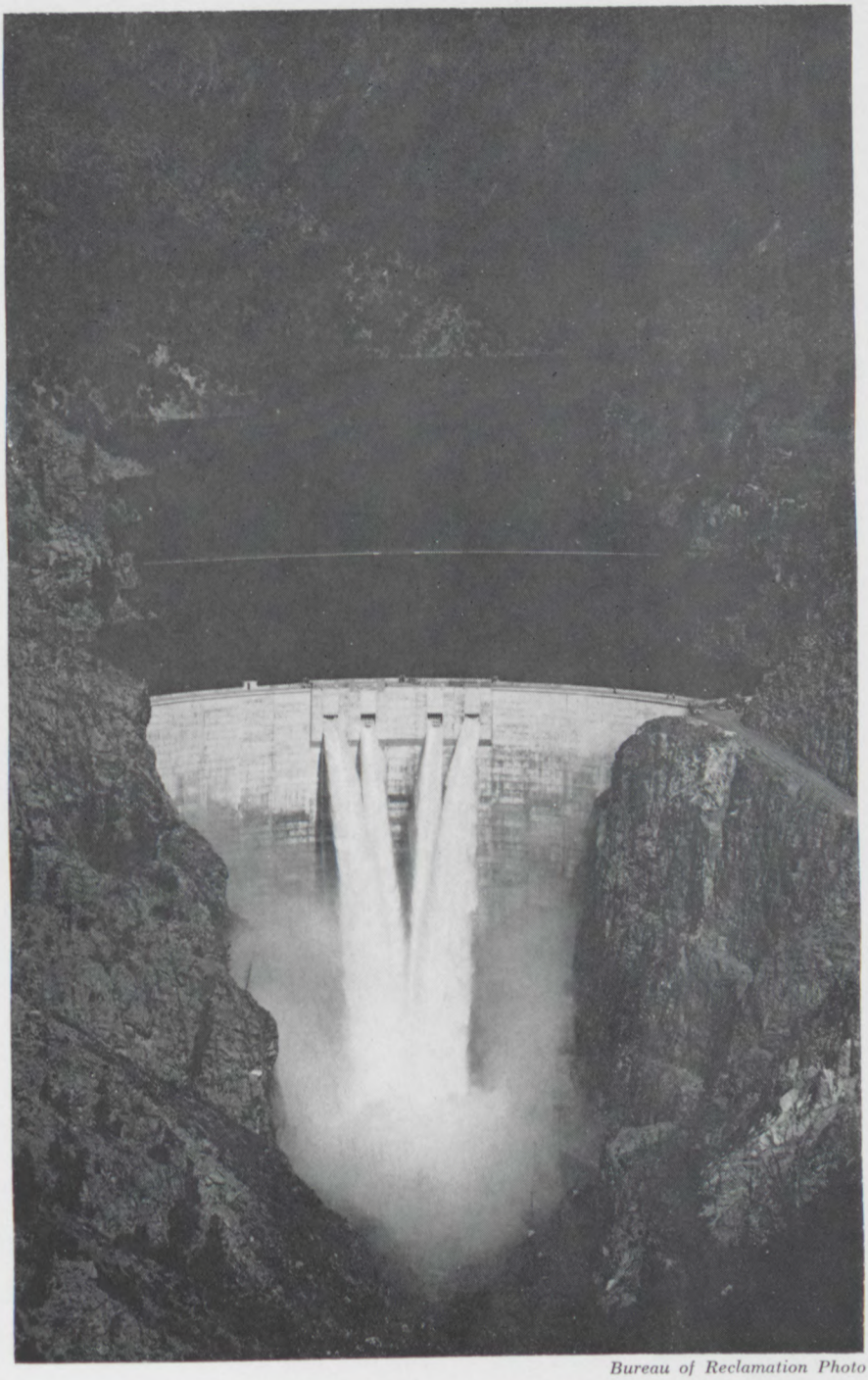
The contractor completing Morrow Point Powerplant is preparing to energize the 15-kv station service late in October, 1970, and to conduct testing operations of generating and transmission equipment later in the year. Both generating units should be on the line by January 1971. Work is progressing rapidly on the powerplant entrance structure.

Crystal Dam

An advance notice has been issued inviting prospective bidders to inspect the Crystal Dam and Powerplant construction site. Specifications are expected to be completed during December 1970 for these facilities. Contractor response has been good and representatives from several well-known firms have visited the worksite.

Recreation

The National Park Service has recreation facilities at Elk Creek adjacent to U.S. 50 on Blue Mesa Lake and at Iola across



Bureau of Reclamation Photo

Morrow Point Dam, Curecanti Storage Unit, Colorado. Waterfall from free-falling spillway is 360 feet high.

the lake. Boat ramps, parking areas, picnic, and camping facilities are available at these two sites. A visitor center has been opened at Elk Creek. Recreation use during the 1970 season to September 30 totaled 525,184 visits, a 27% increase over the same period in 1969.

Fishing is very popular. There were 165,000 fish taken from the reservoir during the 1969 recreation season.

A joint Bureau of Reclamation-National Park Service visitor center at Cimarron, Colorado—gateway to Morrow Point Dam and to Crystal Reservoir and major information center for the Curecanti Unit—is planned for construction beginning in 1971.

D. TRANSMISSION DIVISION

The Transmission Division provides facilities for the delivery of Colorado River Storage Project power to major load centers or to delivery points from which other agencies may transmit the power to load centers and to interconnect the generating plants of the Colorado River Storage Project with each other and with adjacent Federal, public, and private utility transmission systems.

Construction

Construction of the Colorado River Storage Project backbone transmission system with associated communications and control facilities is almost complete. In September 1970, a contract was awarded for construction of access roads along the Vernal-Hayden and Dinosaur-Rangely 138-kv transmission lines. A contract was also awarded in September 1970 for construction of additional facilities at the Blue Mesa switchyard, including a circuit breaker and other terminal facilities to connect with Colorado-Ute Electric Association's 115-kv line from Lake City, Colorado. Included are new steel approach towers in Colorado-Ute's line, and similar towers to replace wood approach structures in the Bureau of Reclamation's existing 115-kv lines from Curecanti and Gunnison. The new steel approach towers are designed to accord with the Federal beautification program. The connection at the Hayden Steamplant will permit wheeling by the Bureau of Colorado-Ute's power to the Blue Mesa switchyard.

The installation of four series capacitor banks was completed in 1970. Two of the capacitor banks were installed north of the Flagstaff Substation — one in each line — and the other two banks were installed north of the Pinnacle Peak Substation, one in each line. These capacitor banks increase the power capacity of the Bureau

of Reclamation's and the Arizona Public Service Company's transmission lines by improving stability and by better balancing of the power flows. Since Arizona Public Service Company shares in the benefits from the capacitor stations, the company paid for one of the Pinnacle Peak stations. The Bureau operates and maintains all four stations. The company pays the federal government for the annual expenses associated with one station at Pinnacle Peak.

Power Marketing

Generation at Colorado River Storage Project powerplants again exceeded previous production levels. Total generation was 4,287,835,000 kilowatt-hours, of which the largest amount, or 3,444,276,000 kilowatt-hours, came from Glen Canyon. The balance was supplied by Fontenelle, Flaming Gorge, and Blue Mesa.

Virtually all Colorado River Storage Project generating capacity is needed during the summer months to meet firm commitments. The four powerplants of the Storage Project were operating at full capacity to meet firm obligations, which exceeded one million kilowatts, including Hoover deficiency requirements.

The total capability of all the powerplants increased to an all-time high of 1,206,000 kilowatts as reservoirs reached their greatest storage levels. With the increase in generation, revenues also increased to over $25 million for the past 12 months, which brings the total Storage Project revenue to $98 million.

Having notified nearly all allottees that allotments not placed under contract would be rescinded, the Bureau of Reclamation proceeded to cancel over 300 megawatts of unused power allocations. These amounts were based on estimated 1967 loads. The Bureau then contracted to meet preference customers' estimated 1975-76 purchase requirements. The Bureau of Reclamation does not anticipate that power will be available for new customers. Should any of the former allottees wish to purchase firm power at a later date, contracts will be negotiated on the basis of the power still uncommitted. It is expected the Storage Project will meet present Northern Division preference customers' purchase power requirements through the summer and winter seasons of 1975-76. No withdrawal is contemplated from the Southern Division until 1976 or 1977. At the present time, the Bureau is obligated to deliver firm power in 1975-76 as follows:

Contract Rates of Delivery — Megawatts

	Summer 1975	*Winter 1975-76*
Utah	305	325
Colorado	347	355
Wyoming	98	75
New Mexico	134	156
Arizona	303	90
California	29	4
Nevada	11	6
Total	1,227	1,011

Because of uncertainties in the on-line date of Crystal Powerplant and the powerplants on the Central Utah Project and because long-range customer load estimates should be reviewed in the light of recent experience, the Bureau now plans to defer the extension of Storage Project power obligations beyond 1975-76. Amounts of power available to customers beyond 1975-76 will be determined as soon as on-line dates for new generation are firm.

Project Repayment

Power operating revenues in fiscal year 1970 paid all operating and interest costs for that year, eliminated the interest deficit remaining at the end of fiscal year 1969, and repaid $4.8 million of the principal of power construction cost. The present repayment schedule shows that the interest-bearing power investment will be repaid by the end of fiscal year 2004. By fiscal year 2007 all power, irrigation, and municipal and industrial cost allocations of the Storage Project and the power allocations of the Seekskadee Project and the Central Utah Project (initial phase) will be entirely repaid.

Starting in fiscal year 2007 it is expected revenues will be available to Upper Basin States to assist in paying for future participating projects. By the year 2059, accumulations of excess revenues to the states will be $1,331,000,000. This compares with $1,210,000,000 of assistance predicted for the Storage Project as shown in the fiscal year 1969 Thirteenth Annual Report of the Secretary of the Interior.

The increase is due primarily to the following:

1. Higher estimated power and energy generation.

2. The assumption that all energy will be sold in the future as firm.

3. Higher estimated municipal and industrial power and water revenues.

E. SALE OF MUNICIPAL AND INDUSTRIAL WATER

In October of 1969 the Secretary of the Interior executed a contract with Resources Company, Associated Southern Investment Company, and New Albion Resources Company for the sale of 102,000 acre-feet of water from Lake Powell for the Kaiparowits Powerplant in Southern Utah. Negotiations were initiated with Utah Power & Light Company during the year on a contract for the sale of 6,000 acre-feet of water from Joes Valley Reservoir of the Emery County participating irrigation project for a thermal-electric plant in Huntington Canyon, Emery County, Utah.

In January 1969, a water-use contract was executed with the Salt River Project Agricultural Improvement and Power District for a diversion of 40,000 acre-feet of water annually from Lake Powell with a water depletion limitation of 34,100 acre-feet annually. This water will be used for the Navajo Powerplant, four miles from Page, Arizona. Construction of the plant began in April 1970.

Congress enacted Public Law 90-272, March 22, 1968, approving three long-term water service contracts for 64,250 acre-feet of water annually from Navajo Reservoir. Three contracts have been executed, two of which are to provide water for thermal-electric generation.

Three short-term water service contracts for water from Navajo Reservoir were executed during 1967. Each will expire in 1972. Under these contracts a total of 1,100 acre-feet of water service is being provided annually.

Pursuant to Title III, Water Supply Act of 1958, 60,000 acre-feet of capacity in Fontenelle Reservoir were contracted in 1962 to the State of Wyoming for future municipal and industrial water uses in the State. Wyoming has granted options to corporations for the water yield from its acquired capacity in Fontenelle Reservoir.

F. SAFEGUARDING THE ENVIRONMENT

The water service contracts, grants of rights-of-way, indentures of lease, and participation agreements that are being negotiated or have been executed between the Secretary of the Interior and the various power interests contain specific language providing for water and air pollution controls as safeguards against the possible adverse effects of such plants on the environment. Language on water pollution control provides limits on, and the monitoring of, effects of plant effluents on streams within the Federal and State standards. Air pollution control language provides for (a) compli-

ance with Federal and State standards; (b) approval of designs for air pollution control equipment by the Secretary in advance of installation; (c) reports to the Secretary on operation of such equipment at least once annually; and (d) periodic review of technological advances in air pollution control equipment to insure maximum effectiveness within the limits of existing knowledge.

Presently, efforts to protect the environment are concentrated on the Navajo Powerplant, of which the United States will own 24.3 percent. This plant will provide pumping power for the Central Arizona Project.

G. AUTHORIZED PARTICIPATING PROJECTS

Twenty-one participating projects have been authorized by Congress. Eleven were authorized by the initial authorizing Act of April 11, 1956 (70 Stat. 105); two were authorized by the Act of June 13, 1962 (76 Stat. 96); three were authorized by the Act of September 2, 1964 (78 Stat. 852); and five by the Act of September 30, 1968 (82 Stat. 886). Eleven are in Colorado, three are in New Mexico, two are in Utah, three are located in Wyoming, one in both Colorado and Wyoming, and one in both Colorado and New Mexico. Participating projects consume water of the Upper Colorado River System for irrigation and municipal and industrial purposes and participate in the use of revenues in the Upper Colorado River Basin Fund to help repay the costs of irrigation features beyond the ability of the water users to repay.

The Pine River Project Extension in Colorado was deauthorized by the Colorado River Basin Project Act of September 30, 1968. Construction of the La Barge participating project in Wyoming has been indefinitely deferred.

Although the Fryingpan-Arkansas Project is not a full-fledged participating project of the Colorado River Storage Project (because it does not participate in the use of Basin Fund revenues), it could be called a "limited" participating project in the Upper Basin development plan because it does use water apportioned to the Upper Basin by the Colorado River Compact and to the State of Colorado by the Upper Colorado River Basin Compact. This project was authorized by Public Law 87-590, which was signed by the President August 16, 1962.

A brief description of each of the authorized participating projects and the present status of its construction or investigations follow:

1. COLORADO

a. Paonia Project

Paonia Dam was completed in January 1962 and was dedicated on September 29, 1962—the first participating project of the Colorado River Storage Project to be completed. Responsibility for operating and maintaining the dam was transferred to the North Fork Water Conservancy District on June 1, 1962. Recreation facilities have been constructed and are in use.

The project is located near Paonia and Hotchkiss in west-central Colorado on the North Fork of Gunnison River. Water stored in the 21,000-acre-foot capacity Paonia Reservoir is distributed to project lands through the enlarged and extended Fire Mountain Canal. Irrigation water supply is supplemented for 13,070 acres of land previously irrigated and a full water supply provided for 2,320 acres of new land. Flood damages have been reduced and fish and wildlife values enhanced.

b. Smith Fork Project

Smith Fork Project is located in Delta County, along the Smith Fork of the Gunnison River. The project was completed in the fall of 1962 and was dedicated on April 20, 1963. Principal features include Crawford Dam and Reservoir, Smith Fork Diversion Dam, Smith Fork Feeder Canal, and the Aspen Canal. Crawford Reservoir, capacity of 13,650 acre-feet, has been constructed on Iron Creek, a tributary of Smith Fork. The reservoir regulates the flow of Iron Creek and surplus flows of the Smith Fork that are conveyed to it by the Smith Fork Feeder Canal. Small quantities of reservoir storage water are released to Iron Creek and diverted by several small existing ditches. The remainder is released to the new Aspen Canal and conveyed by this canal to existing ditches for distribution. Some of the storage water releases through the Aspen Canal replace present direct flow diversions from Smith Fork, thus permitting additional direct flow diversions to be made higher on the streams through existing ditches.

Smith Fork Project provides a full water supply for irrigating 1,423 acres of new land and a supplemental supply for 8,056 acres of irrigated land located near Crawford, Colorado.

The project was transferred to the Crawford Water Conservancy District for operation and maintenance on January 1, 1964.

Recreation facilities for boating, picnicking, and camping have been developed at Crawford Reservoir, and local use of the reservoir is significant. During the 1969 season 98,529 visits were recorded.

c. Florida Project

The Florida Project is located in southwestern Colorado, southeast of Durango in the Florida River Valley and on Florida Mesa. Its principal features include Lemon Dam on the Florida River with a reservoir capacity of 40,100 acre-feet, enlargement of the existing Florida Farmers Ditch and Florida Canal, Florida Diversion Dam, and construction of the Florida laterals to serve approximately 2,210 additional acres of project lands. Flood control and fish and wildlife values are enhanced. The project includes 5,730 acres of new land and 13,720 acres of presently irrigated land needing a supplemental water supply.

All work contracted by the Bureau of Reclamation on Florida Project has been accomplished. Lemon Dam, key feature of the project, was completed and storage of water begun in November 1963. Under provisions of the Drainage and Minor Construction Act of June 13, 1956 (70 Stat. 274), the United States advanced funds to the Florida Water Conservancy District to rehabilitate four existing irrigation systems on the Florida Mesa. All work has been completed.

Water stored in the Lemon Reservoir has been available beginning with the 1965 irrigation season. Lemon Dam and Reservoir were transferred to the Florida Water Conservancy District for operation and maintenance on January 1, 1968. All conveyance and distribution facilities were transferred to the District for operation and maintenance on April 1, 1967.

Recreational use at Lemon Reservoir far exceeds estimates made before the construction of the dam and reservoir. The reservoir area sustained 44,408 visits during the 1969 season. Recreation facilities include a boat ramp, picnic areas, campgounds, parking, water, and sanitation facilities.

d. Silt Project

The Silt Project is located between Rifle and Elk Creeks near the towns of Silt and Rifle in western Colorado. An improved water supply for 4,479 acres of partially irrigated land and a full supply for 2,118 acres of new land is provided. Constructed features include Rifle Gap Dam which has created a reservoir of 13,600-acre-foot capacity, the Silt pumping plant, headworks and inlet channel, rehabiiltation of the abandoned Davie Ditch, and construction of

laterals and drains. Rifle Gap Dam is a 1,768,000-cubic yard earth- and rockfill structure, rising 120 feet above the streambed and 1,575 feet long at the crest. Storage of water was initiated in the reservoir in November 1966. The dam was accepted as complete in June 1967.

Recreation facilities include a boat ramp, picnic areas, campground, parking, water, and sanitary facilities. The area sustained 44,962 visits during the 1969 season.

e. Fryingpan-Arkansas Project

Although the Fryingpan-Arkansas Project is not a full-fledged participating project of the Colorado River Storage Project because it does not participate in the use of Upper Colorado River Basin Fund revenues, it could be called a "limited" participating project in the Upper Basin development plan because it does use water apportioned to the Upper Basin by the Colorado River Compact and to the State of Colorado by the Upper Colorado River Basin Compact. This project was authorized by Public Law 87-590, which was signed by the President August 16, 1962.

Construction of the overall project was 34 percent complete on September 30, 1970. Concrete lining of the Charles H. Boustead Tunnel is underway with completion scheduled for Spring 1971. Relocation of Colorado State Highway 96 around Pueblo Reservoir was completed and traffic routed over the new highway on August 7, 1970. A contract was awarded on June 19, 1970 for initial construction for Pueblo Dam. A contract was also awarded on August 14, 1970 for the Nast Tunnel, North Side Collection System and on August 20, 1970 for the first section of the Hunter Tunnel of the South Side Collection System. Contracts were also awarded for access roads to the North Side Collection System, road relocations in the Turquoise Lake area, sand and aggregate production for West Slope features, road surfacing and improvements in the Reudi Reservoir area, and construction of office and laboratory facilities at Pueblo Dam.

f. Bostwick Park Project

Congress authorized construction of the Bostwick Park Project in September 1964. Located in west-central Colorado, the Bostwick Park Project will provide a supplemental water supply for 4,500 acres of the presently inadequately irrigated land and a full water supply for 1,610 acres of new land. The project will also provide recreation and fish and wildlife benefits. Storage regulation of flows

Bureau of Reclamation Photo

Silver Jack Dam, Bostwick Park Project, Colorado, under construction.

of Cimarron Creek will be provided by the Silver Jack Dam, principal feature of the project. Released storage water and usable natural flows will be diverted from Cimarron Creek into the existing Cimarron Canal and conveyed 23 miles to the vicinity of the project lands where distribution will be made through existing ditches. Two laterals will be constructed to convey water to lands above those presently irrigated.

Construction

About 90 percent of the work has been accomplished for Silver Jack Dam; the contractor expects to finish this fall. The contractor is working around the clock, seven days a week, in order to complete earthwork before winter strikes the high mountain work area. Remedial work in 1969 appears to have stabilized the slide area at the right abutment of the dam. The spillway structure has been fully completed. Cimarron Creek was diverted from the gap in the dam embankment into the outlet works conduit July 25, 1970. This permitted the contractor unrestricted use of the full dam embankment area. As of September 30, 1970, about 1,030,000 cubic yards or 79 percent of the estimated 1,310,000 cubic yards of earth and rock had been placed for the dam. Installation of the control gates, outlet piping, and regulatory gates for the dam is expected to be completed during the 1970-71 winter months.

Silver Jack Dam, Bostwick Park Project, Colorado, under construction.

g. Fruitland Mesa Project

The Fruitland Mesa Project, located in west-central Colorado, was authorized by Congress in September 1964. The project will provide supplemental water for 7,010 acres of presently inadequately irrigated land and a full supply of irrigation water to 15,870 acres of land. In addition, recreation and fish and wildlife benefits will be provided. Principal project features will include the Soap Park Dam and Reservoir, the Black Mesa Conduit, the 22-mile Fruitland Canal, and two diversion dams.

Advance Planning

Advance planning studies were initiated in fiscal year 1965. The Fruitland Mesa Definite Plan Report was completed in July 1967 and has been approved by the Commissioner of Reclamation. Preconstruction activities have been in progress since issuance of the definite plan report. Collection of design data for use in preparation of specifications and estimates for Gould Canal structures and Black Mesa conduit are in progress. Additional drilling has been outlined for Soap Park Dam and for Black Mesa Tunnel.

The Fruitland Mesa repayment contract was executed June 25, 1969, and was validated by the District Court of Delta County, Colorado, on September 29, 1969. Plans are being developed for settlement of new farm units in the project area. Construction is scheduled to be initiated in fiscal year 1972 if funds become available.

h. Dallas Creek Project

Advance planning began in fiscal year 1971 with an appropriation of $130,000.

The Dallas Creek Project will develop water of the Uncompahgre River and tributaries for irrigation and municipal and industrial use. It also will provide benefits to recreation, fish and wildlife, and flood control.

Principal storage will be provided on the Uncompahgre River by a reservoir of approximately 150,000 acre-feet capacity. Flows of Cow Creek will be brought to the reservoir by feeder canal.

Selection of the site for construction of the dam will require studies and comparisons of different situations at each site, including highway and road relocations, rights-of-way, storage streamflows, pumping plants to supply water to Log Hill Mesa lands, environmental effects, and drilling and geological explorations. The $130,000 available in fiscal year 1971 is being used in part for such studies and comparisons and will enable a selection of site by the end of the fiscal year.

The smaller Dallas Divide and Sneva Reservoirs will be supplied by feeder canals from Dallas and Cow Creeks, respectively. Part of the water released from the main reservoir on Uncompahgre River will be pumped by hydraulically driven turbines to the lower lands on Log Hill Mesa. The remainder will propel the turbines and then supply existing and project rights downstream. The higher lands on Log Hill Mesa will be served by gravity releases from the Dallas Divide Reservoir.

The project will provide irrigation water for 23,620 acres, including 14,900 acres that are not now irrigated. It will provide 15,000 acre-feet annually for municipal and industrial use in the Uncompahgre Valley. The municipal water will be distributed by the Tri-County Water Conservancy District.

	Main Reservoir on Uncompahgre	Dallas Divide	Sneva
Dam type	Earth	Earth	Earth
Dam height (feet above streambed)		165	82
Crest length (feet)		4,420	1,340
Reservoir capacity (acre-feet)	150,000	17,600	825

i. Dolores Project

An appropriation of $110,000 was made available to start advance planning in fiscal year 1971.

The Dolores Project will develop water of the Dolores River for irrigation, municipal and industrial use, recreation, fish and wildlife conservation, and flood control.

Primary storage will be provided by McPhee Reservoir on the Dolores River. All project water will be released from the reservoir to the potential Dove Creek Canal which, with other project branch canals and existing systems, will deliver the water to the land. The offstream Cahone, Ruin Canyon, and Monument Creek Reservoirs will be constructed as part of the distribution system to facilitate water regulation.

The project will provide irrigation water for 61,000 acres, including 32,340 acres that are not irrigated at present. About 1,500 acres of the land are in Indian ownership. About 6,100 acre-feet of municipal and industrial water annually will be provided for the communities of Dove Creek and Cortez.

	McPhee	Cahone	Ruin Canyon	Monument Creek
Type	Earth	Earth	Earth	Earth
Height (feet above streambed)	268	75	169	107
Crest length (feet)	1,300	2,000	2,350	5,000
Reservoir capacity (acre-feet)	364,000	4,340	16,400	5,040

j. San Miguel Project

Advance planning studies are scheduled to be undertaken in fiscal year 1972..

The San Miguel Project will regulate flows of the San Miguel River for irrigation, municipal and industrial use, fish and wildlife conservation, recreation, and flood control.

Primary storage will be provided at the Saltado Reservoir on the San Miguel River. Part of the stored water will be released into the river for downstream uses, but the major part will be diverted at the reservoir outlet into the Norwood Canal, the first link in a chain of canals and reservoirs that will further control the water and convey it to places of use. This chain will include in successive order the Norwood Canal, Naturita Reservoir, Basin Canal, Radium Reservoir, and Paradox Canal. Existing irrigation reservoirs and distribution systems will be integrated with project works. Some lands above project facilities will be served by exchange.

The project will irrigate 38,950 acres, including 26,420 acres that have no present water supply. It will provide 44,000 acre-feet of water annually for municipal and industrial uses associated with the area's mineral and forest resources.

			Radium Reservoir	
	Saltado	Naturita	Radium Dam	Stone Cabin Dam
Type	Earth	Earth	Earth	Earth
Height (feet above streambed)	278	207	77	98
Crest length (feet)	1,470	2,760	3,700	575
Reservoir capacity (acre-feet)	72,600	9,200	25,600	(Same)

k. West Divide Project

Advance planning studies are scheduled to be undertaken in fiscal year 1973.

The West Divide Project is planned primarily to provide water for irrigation and for municipal and industrial use in connection with development of oil shale reserves.

Crystal River flows will be regulated at Placita Reservoir. Some reservoir releases would be made directly to the river for downstream use. Most of the releases, however, will be diverted into the Huntsman Canal, which will supply other project canals in conveying the water westward to places of use. About 17 miles of the Huntsman Canal will be in tunnel. Yank Creek Reservoir will be constructed on North Thompson Creek to meet water needs in the eastern portion of the project area.

About 39,920 acres will be irrigated, including 18,890 acres not presently irrigated. About 77,500 acre-feet of water annually will be made available in the Colorado River or in project canals for municipal and industrial uses.

	Placita Reservoir	Haystack Reservoir	Yank Creek Reservoir
Type	Earth	Earth	Earth
Height (feet above streambed)	301	132	188
Crest Length (feet)	1,630	1,350	1,540
Reservoir capacity (acre-feet)	105,660	7,590	9,210

2. COLORADO AND NEW MEXICO

a. Animas-La Plata Project

Advance planning studies began in fiscal year 1971 with funds that Colorado interests are contributing.

The Animas-La Plata Project will develop flows of the Animas and La Plata Rivers for irrigation, municipal and industrial use, recreation, and fish and wildlife conservation.

Animas River water will be regulated at a reservoir site yet to be selected. The Howardsville site, previously considered, now appears to be uneconomical because of high land prices in the reservoir area. Water will be conveyed in the Animas Diversion Canal to the La Plata River Basin. Some water will be diverted from the Animas River for municipal use at Durango, Colorado, and Aztec and Farmington, New Mexico. Part of the Durango water will replace present diversions to the city from the Florida River, permitting the replaced water to add to the supply for the Florida Project.

Water delivered to the La Plata River Basin and unused flows of the La Plata River will be regulated in the offstream Hay Gulch, Three Buttes, and Ute Meadow Reservoirs and distributed by private and project works for irrigation and for anticipated industrial uses associated with the area's extensive coal fields.

3. COLORADO AND WYOMING

a. Savery-Pot Hook Project

Construction of the Savery-Pot Hook Project as a participating project was authorized by Congress in September 1964. The project is located in Moffat County, Colorado, and Carbon County, Wyoming. Principal project features consist of two storage reservoirs — the Savery Reservoir and the Pot Hook Reservoir — and a system of canals to provide a full supply of project water to 10,940 acres of land in Colorado and 6,980 acres in Wyoming and a supplemental water supply to 3,640 acres of inadequately irrigated land in Colorado and 10,690 acres in Wyoming. The project will also provide for recreation, fish and wildlife, and flood control benefits.

Advance Planning

Advance planning studies are nearing completion. Project land classification, drainage investigations, water supply studies, and plan formulation studies are completed. On-farm development costs and farm-size studies are completed. Designs and estimates of project features are being revised and updated. The selected project plan includes a larger Pot Hook Reservoir and realigning the Pot Hook Canal at a higher elevation. Pot Hook Canal will also be extended to replace the previously planned West Side Canal extension. The Two Bar area has been eliminated from the project plan because of

poor soil quality and high cost of facilities. A definite plan report is scheduled for completion in fiscal year 1971.

4. NEW MEXICO

a. Hammond Project

The Hammond Project, located in northwestern New Mexico, was completed late in 1962 and has been operated and maintained by the Bureau of Reclamation through the 1970 irrigation season. Water has been supplied to project lands on a rental basis. The project works consist of the Hammond Diversion Dam on the San Juan River, the main gravity canal, a hydraulic turbine-driven pumping plant, three main laterals, and distribution laterals.

The water table has been elevated sufficiently in several areas to indicate a definite need for drainage. The first segment of drains, including 0.1 mile of open and 2.4 miles of closed drain has been completed. During the 1970 construction season a contract was awarded and all work completed for the Horn Canyon and Terminal Wasteways from the Main Canal, East Highline Lateral Wasteway, and lowering a segment of Horn Canyon Siphon. Collection of field data is continuing for other wasteway structures and for erosion control facilities to add necessary safeguards for operation of project facilities.

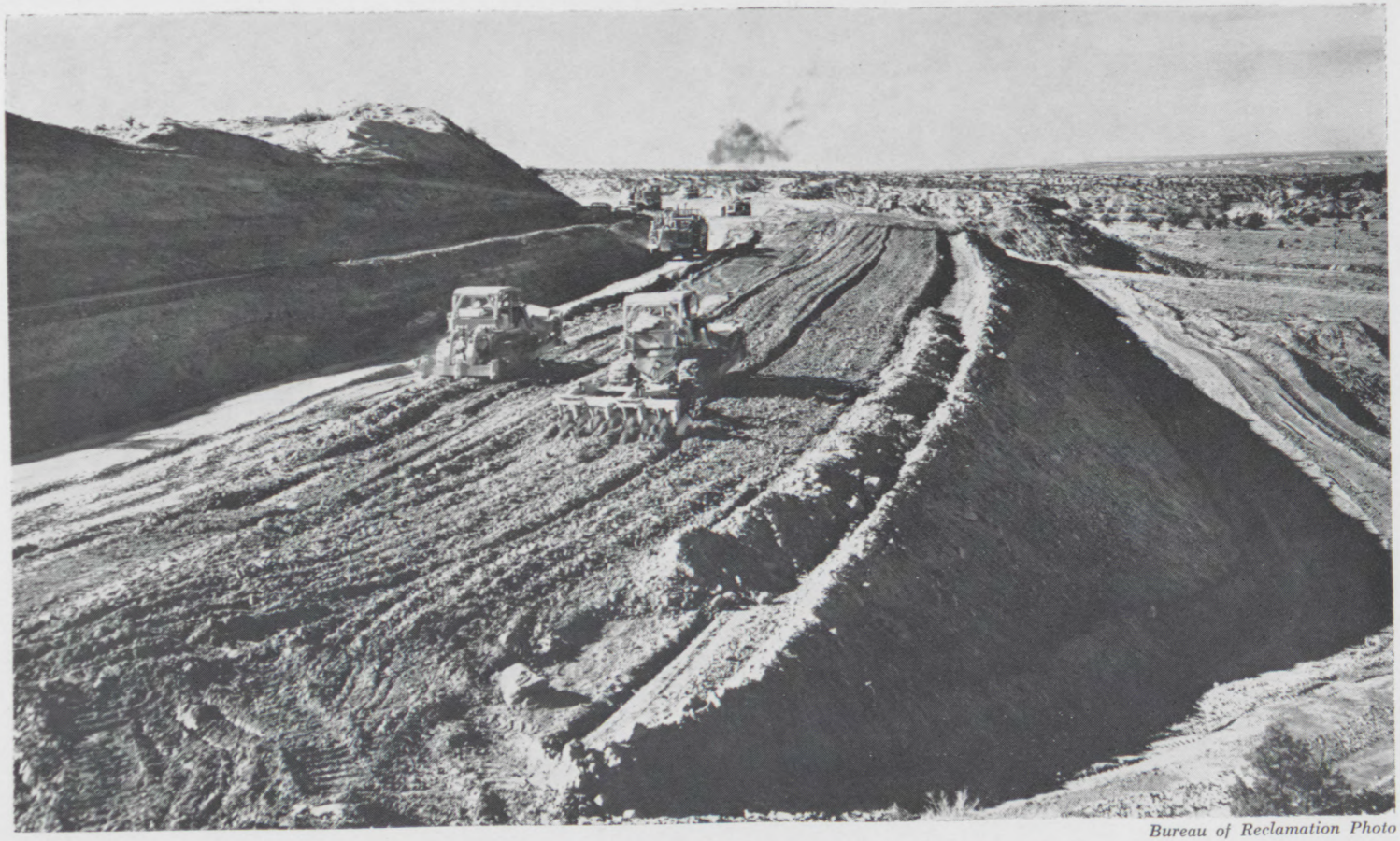
The project will provide irrigation water for 3,933 acres, of which approximately 2,095 acres are now irrigated. Project lands are divided into 62 farms (23 full-time and 39 part-time).

b. Navajo Indian Irrigation Project

The Navajo Indian Irrigation Project was authorized for construction by Public Law 87-483 of the 87th Congress as a Bureau of Indian Affairs project. The bill was signed into law by the President on June 13, 1962. The project, authorized as a participating project of the Colorado River Storage Project, is being constructed by the Bureau of Reclamation for the principal purpose of furnishing irrigation water to approximately 110,630 acres of land. An average annual diversion of 508,000 acre-feet of water will be required from Navajo Reservoir for delivery to project lands.

Location

The project lands proposed for irrigation are situated on an elevated plain south of the San Juan River in San Juan County, in northwestern New Mexico. The project lands range in elevation from



Bureau of Reclamation Photo

Construction of main canal, Navajo Indian Irrigation Project, New Mexico.

5,580 feet to 6,450 feet and lie from 200 to 1,000 feet above the river. The project area has a temperate and semi-arid climate with a frost-free growing season of about 160 days. The annual average precipitation is only about eight inches with about half of this amount occurring as rainfall during the growing season. Irrigation is necessary for successful crop production in the San Juan River Basin. The irrigable lands in the project are well suited to the cultivation and production of adapted crops. Under irrigation, it is expected that the lands will be devoted primarily to alfalfa, corn, beans, and irrigated pasture, with some acreage devoted to orchards and vegetables. All of the lands in the project are presently undeveloped and, due to the lack of moisture, are used only for grazing.

Project Plan

The proposed plan of development of the Navajo Indian Irrigation Project depends upon the construction of facilities to provide a water supply for the irrigation of lands to be developed solely for Indian use as a fulfillment of a national obligation to the Navajo Tribe. The project area will include some off-reservation lands, the acquisition of which, for inclusion in the reservation, is provided in the legislation. The project works will consist of a canal system, laterals, pumping plants, a small powerplant, and additional related facilities as may be required.

The project is adapted to serve municipal and industrial water users as well as its primary purpose of irrigation. The officials of the State of New Mexico anticipate that a relatively large municipal and industrial water demand will develop in the San Juan River Basin. The authorizing Act provides for such purposes over and above that needed for irrigation on the Navajo Indian Irrigation Project.

The Bureau of Reclamation is responsible for the design and construction of irrigation facilities to the turnouts to the individual farm units. The development of the farm units rests with the Bureau of Indian Affairs and the Navajo Tribe. Such work would include the farm distribution system, land leveling, farm drainage, and construction of improvements.

Cost and Repayment

The total estimated construction cost for the project is $206,000,000 (P. L. 91-416). The costs associated with the development of farm units are not considered a part of the construction cost for which the Bureau of Reclamation has the responsibility.

The authorizing act provides that the cost allocated to Indian,

tribal, or restricted lands served by the project, and beyond the capability of such lands to repay, shall be nonreimbursable. This is in recognition of the fact that assistance to the Navajo Indians is the overall responsibility of the entire nation.

Construction

Approximately 32.2 miles of Main Canal are required to convey the water supply from Navajo Reservoir to the initial lands to be served. Under the present construction schedule, it is anticipated that approximately 10,000 acres will be developed for irrigation annually after delivery of water is made to the first lands to be served.

To complete the project works, as currently planned, will require the construction of approximately 600 miles of open canal and laterals, 9.0 miles of siphons, and 13.1 miles of tunnel to convey the water to the project lands. It will also require construction of a power plant and required pumping plants to serve lands situated above the Main Canal. Cutter Dam will be constructed to take advantage of the economic benefits afforded by utilizing a natural channel for a reach of the Main Canal. Gallegos Dam, an earthfill dam, will be constructed to create a pump-storage reservoir that will be filled by pumping during the off-irrigation season. This reservoir will provide an additional water supply which can be used during the peak irrigation requirement months of June and July. As construction of the canal system progresses, farm units will be developed for irrigation.

Economic Benefits

The Navajo Indian population has grown to over 90,000 persons, and is increasing at such a rate that it is estimated it will equal 300,000 in the year 2000. It is therefore necessary that such measures as the Navajo Indian Irrigation Project must be undertaken to keep pace with this population growth.

The project will provide irrigation benefits that will give the Navajo people a better standard of living. It will provide a means of self-support for 850 families on the farm units and create employment for an additional 1700 families. It is estimated the project will provide a substantial part of the livelihood for about 17,000 of the Navajo people directly from the on-farm operations. Approximately 16,000 additional people would obtain a substantial part of their livelihood from the agriculturally oriented industries required by development of the project.

Construction of the project can be expected to generate about 8,400 man-years of on-site work and to require an equivalent of more than 12,000 man-years of work in other areas throughout the country in providing the necessary services, materials, and equipment. An additional stimulus to the economy is roughly equivalent to another 27,000 man-years of employment that will result from the increased demands by on- and off-site workers for such items as clothing, food, furniture, gasoline, and other consumer goods.

To satisfy the needs of the farm families that will occupy the project lands will require the construction of schools, housing, farm buildings, roads, fences, and utility installations. There will also be increasing demands for such equipment as farm machinery, trucks, and automobiles.

The development of the project will have an uplifting economic impact on the livelihood of the Navajo tribe. The project will be a major factor in the transition of the traditionally pastoral Navajos from a simple subsistence economy of raising sheep to participating in the agricultural economy of the nation.

Progress Limited in 1970

Due to the failure of the Executive Department of the Federal Government to approve the appropriation of Federal funds in sufficient amounts, construction progress on this project has been unreasonably slow for the past eight years.

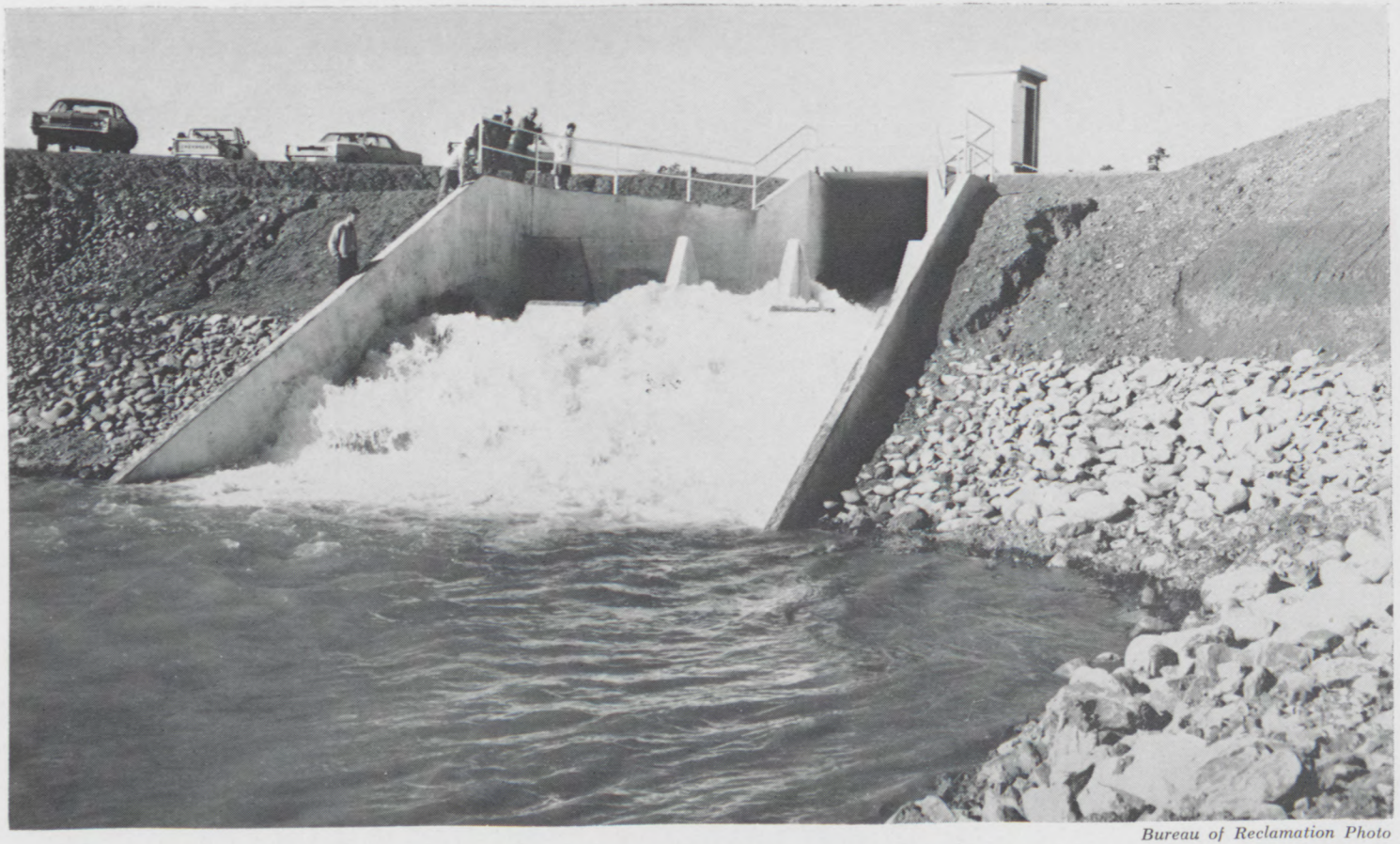
At the beginning of this report year, October 1, 1969, there were no construction contracts in force. Two major contract awards for work were made prior to October 1, 1970.

On April 2, 1970, a contract in the amount of $2,031,037 was awarded for 2.5 miles of concrete-lined main canal, and two concrete siphons, 17.5 feet in diameter and totaling 700 feet in length. By September 30, 1970, the contractor had completed 20 percent of the work.

A contract was awarded on September 3, 1970, in the amount of $2,385,665 for the construction of Cutter Dam. The earthfill dam will be about 90 feet high and 950 feet long. On September 30, 1970, the contractor has earned $85,000, or about four percent of the contract amount.

c. San Juan-Chama Project

The San Juan-Chama Project was authorized as a participating



Bureau of Reclamation Photo

Azotea Tunnel Outlet Works, San Juan-Chama Project, New Mexico, first diversion of about 180 second feet of water.

project of the Colorado River Storage Project by Public Law 87-483, signed June 13, 1962 (76 Stat. 96).

Location

The project is designed to make possible an average annual diversion of 110,000 acre-feet of water from the upper tributaries of the San Juan River in the Upper Colorado River Basin, through the Continental Divide, for utilization in the Rio Grande Basin, New Mexico. The imported waters are to be used to provide an irrigation water supply for 39,300 acres of land in the Rio Grande Basin. These lands in the Cerro, Taos, Llano, and Pojoaque tributary irrigation units consist of 22,800 acres presently irrigated and 16,500 acres presently dry land. A supplemental water supply will also be provided for irrigation of 81,600 acres in the Middle Rio Grande Conservancy District.

Initial authorization is limited to the plans for diverting and regulating the project water and for furnishing water to the city of Albuquerque and for irrigation.

Project Plan

Principal construction features include three diversion dams, three feeder conduits, three tunnels, two river siphons, and one storage dam and reservoir.

Blanco Diversion Dam on Rio Blanco will divert water to the Blanco feeder conduit. The Blanco feeder conduit is to consist of a closed conduit of 520 cubic feet per second capacity conveying water from Blanco Diversion Dam to Blanco Tunnel. Blanco Tunnel is planned as a concrete-lined structure with 520 cubic feet per second capacity to carry water 8.6 miles from Rio Blanco to Little Navajo River. Little Navajo River siphon, a concrete siphon with a capacity of 520 cubic feet per second, will carry water under Little Navajo River to the Oso Tunnel. The Little Oso Diversion Dam on the Little Navajo River upstream from the Little Navajo River siphon will divert water from the Little Navajo River through the Little Oso feeder conduit, a closed conduit with a capacity of 150 cubic feet per second, to the entrance to the Oso Tunnel.

The Oso Tunnel will be a concrete-lined structure with a capacity of 550 cubic feet per second and a length of 5.22 miles, from Little Navajo River to Navajo River. The 550-cubic-foot-per-second Navajo River siphon is to carry water under the Navajo River where the Oso Diversion Dam diverts water to the Oso feeder conduit. This

conduit, with a capacity of 650 cubic feet per second, will run from Oso Diversion Dam to Azotea Tunnel.

The 12.8-mile-long concrete-lined Azotea Tunnel will convey water from Navajo River to Azotea Creek in Rio Grande Basin. These imported waters will flow down Azotea and Willow Creeks 11.78 river miles to Heron Reservoir.

The regulating and storage reservoir will be formed by Heron Dam on Willow Creek just above the point where Willow Creek enters the Chama River. The dam will be an earthfill structure about 265 feet high and will form the reservoir with a capacity of about 400,000 acre-feet, with a surface area of about 6,000 acres. The spillway will have a capacity of 450 cubic feet per second, and the outlet works will have a capacity of 4,220 cubic feet per second.

Construction is also to include the enlargement of the outlet of the existing El Vado Dam so that releases from Heron Reservoir can be bypassed through El Vado Reservoir as desired.

Benefits

The project will provide a dependable municipal and industrial water supply for the city of Albuquerque, supplemental irrigation water for the Middle Rio Grande Conservancy District, and an additional supply of irrigation water for the Cerro, Taos, Llano, and Pojoaque tributary units. Substantial fish and wildlife and recreational benefits will be created by the project, particularly Heron Reservoir.

Progress in 1970

On October 1, 1969, the Bureau of Reclamation had four major construction contracts in force. No additional contracts were awarded the following year.

The contract for Azotea Tunnel and appurtenant structures was about 88 percent complete at the beginning of the report year. The contract was awarded April 22, 1964, in the amount of $13,791,000. The tunnel is 10.8 feet interior diameter, and over 67,000 feet long. The contractor finished the lining of 51,400 feet in 1969, using over 20,000 cubic yards of concrete. All of the work was completed on November 11, 1970.

The construction of Heron Dam and the relocation of State Highway 95 was 60 percent complete as of October 1, 1969. The contract was awarded on September 8, 1967, in the amount of $8,597,550. The earth and rockfill dam will have a crest length of

1,250 feet and stand 265 feet about the streambed. A dike of similar construction will be 2,370 feet long and stand 78 feet maximum height. At the beginning of the report year, the dike was nearly completed as were outlet works in the dam and the road relocation. The dam itself had risen but 25 feet out of the river. On September 30, 1970 all work was completed except the earth dam which had attained 100 feet in height from placement of over 2.3 million cubic yards of material. The contractor was forced to stop all operations in early November due to winter weather. Work will resume in April or May 1971.

On October 1, 1969, the contract for Willow Creek channelization and structures was approximately 45 percent complete. The contract was awarded on March 20, 1969, in the amount of $496,841. Accomplishments during the year consisted of the placement of 55,000 cubic yards of riprap and bedding material, and the placement of about 1,000 cubic yards of concrete in structures. The contract was completed on August 2, 1970.

The last contract in force on October 1, 1969 was for clearing of all trees and brush from the proposed Heron Reservoir. The contract was awarded on May 2, 1969, in the amount of $89,640. The clearing was completed on July 16, 1970.

5. UTAH

a. Central Utah Project (Initial Phase)

The Central Utah Project (Initial Phase) will provide water for irrigation, municipal and industrial use, and power generation. Benefits also will be realized in the fields of outdoor recreation, fish and wildlife conservation, flood control, water quality control, and area redevelopment. The Initial Phase consists of four units. Largest of these is the Bonneville Unit which involves diversion of water from the Uinta Basin to the Bonneville Basin and associated developments in both basins. The other three units — the Vernal, Upalco, and Jensen — provide for local development in the Uinta Basin.

In view of increased municipal and industrial water demands in Salt Lake County, the Bureau of Reclamation has rescheduled construction so that water deliveries could be started as early as 1973. The Bureau of Reclamation studies show that through joint use of present and new water conveyance features, available sources of water can meet the public water supply needs of Salt Lake County, including Salt Lake City, until about 1990.

Under the Bonneville Unit the Strawberry Aqueduct (now under construction) will intercept flows of Uintah Mountain streams

as far east as Rock Creek and convey the water to the existing Strawberry Reservoir which will be enlarged by construction of Soldier Creek Dam. Stored water will be released through the Wasatch Mountains to the Central Utah area. Through various exchanges and by the construction of new facilities, the water will be made available to an area extending from Salt Lake City about 75 miles south to the city of Nephi. Starvation Reservoir on Strawberry River with a feeder canal from Duchesne River will develop water for use in the Uintah Basin.

Under present plans 36,000 acre-feet of water annually will be diverted to the Sevier River Basin for supplemental irrigation in that area.

To convey water to the Sevier River Basin, a 29-mile canal from near the Nephi area to the existing Sevier Bridge Reservoir on the Sevier River will be built. Irrigation on the Sevier River Basin will be accomplished both by exchange of water with upstream reservoirs and by direct irrigation from the Sevier Bridge Reservoir.

The Central Utah Water Conservancy District signed a repayment contract in 1965.

i. Vernal Unit

The Vernal Unit, near Vernal, Utah, was the first unit of the Initial Phase of the Central Utah Project to be constructed. Project features include Steinaker Reservoir, offstream from Ashley Creek with a capacity of 38,200 acre-feet; Fort Thornburgh Diversion Dam; Steinaker Feeder Canal; and Steinaker Service Canal. Construction started in 1959 and was completed by 1962. The Vernal Unit, through storage of waters diverted from Ashley Creek, assures farmers an adequate, year-round supply of water; augments municipal water supply for three communities in Ashley Valley—Vernal, Maeser, and Naples—and provides recreation and fishing at Steinaker Reservoir.

Water storage and distribution facilities have been completed and turned over to the water users for operation and maintenance. Drainage construction has been initiated and a closed pilot drain completed. Work has been nearly finished under a $48,626 contract awarded in June 1970 for a 1.5-mile closed drain. Design data are being assembled for a 5.4-mile system of buried pipe drains to serve a second drainage deficient area.

ii. Bonneville Unit

The Starvation Diversion and Storage Complex has been completed. The new reservoir filled to 60 percent of its 167,300-acre-foot capacity by the end of the 1970 snowmelt runoff season. Utah Department of Highways opened the relocated segment of U. S. Highway No. 40 for traffic late in 1969 and completed application of seal coat materials to the roadway during the 1970 summer season.

The contractor for the 4.1-mile-long Water Hollow Tunnel (part of the Strawberry Aqueduct) holed through during March 1970. Tunnel lining operations were started in June 1970 and the contractor expects to have concrete lining operations completed early in 1971.

Concrete and dam embankment operations have been finished for the Bottle Hollow Dams and Dike and inlet channel. The contractor will complete placement of riprap protection and construction cleanup by the November 12, 1970, contract completion date.

On September 24, 1970, Burgess Construction Company of Fairbanks, Alaska, submitted a low bid of $9,873,924 for constructing Soldier Creek Dam and about 7 miles of access road. The construction award is expected to be made early in October 1970. Soldier Creek Damsite is located on Strawberry River about 6 miles below the existing Strawberry Dam. It will rise 250 feet above the streambed, contain nearly 3,020,000 cubic yards of earth and rock and have a crest length of about 1,290 feet. Upon completion, Soldier Creek Dam will enlarge the capacity of the existing Strawberry Reservoir from 283,000 acre-feet to 1,106,500 acre-feet. The water surface level will be about 45 feet higher than that in the existing reservoir and the old Strawberry Dam will be completely inundated. Design of the new dam incorporates a high and a low outlet through which downstream releases can be made for the most advantageous temperature for the downstream fishery. Utah Department of Highways recently awarded a $1,122,928 contract to Strong Company, Springville, Utah, for relocating a 4-mile segment of U.S. Highway from the enlarged Strawberry Reservoir area. The Department of Highways will administer this contract under terms of a relocation agreement.

A contract was awarded September 28, 1970, for constructing the Currant Creek Field Station from which construction forces will direct work for Currant Creek Dam and the Currant and Lay-

Bureau of Reclamation Photo

Starvation Dam and Reservoir, Bonneville Unit, Central Utah Project.

out Tunnels. Bids will be taken October 15, 1970 for constructing the latter tunnels, diversions, and appurtenant structures.

Preconstruction activities are continuing for Currant Creek Dam, Vat tunnel and other Strawberry Aqueduct features that will divert and transport water to the enlarged Strawberry Reservoir. Work is also proceeding on preparation of designs for the first two reaches of the Jordan Aqueduct.

Advance Planning

iii. Upalco Unit

The Upalco Unit Definite Plan Report, completed in May 1968, has been approved by the Commissioner of Reclamation. Start of construction is scheduled for fiscal year 1973, if funds become available.

The plan of development for the Upalco Unit as now proposed will develop waters of Lake Fork and Yellowstone Rivers for irrigation, recreation, fish and wildlife, and flood control. Storage regulation will be provided at Taskeech Reservoir on Lake Fork below Moon Lake Reservoir. Total capacity of Taskeech Reservoir would be 78,400 acre-feet. Surplus flows of Yellowstone River will be diverted at the Bonita Diversion Dam and conveyed 8.5 miles in the 250-second-foot Taskeech Feeder Canal. Irrigation supplies will be released from the reservoir to Lake Fork River and distributed from the river through existing canal systems and through the 3.6-mile, 50-second-foot Taskeech Service Canal that will extend to Yellowstone River. The project will provide a supplemental irrigation supply to 27,540 acres of non-Indian lands and 15,070 acres of Indian lands.

Part of the storage in Taskeech Reservoir will replace irrigation storage presently provided in Twin Potts Reservoir and 14 upstream mountain lakes and thus permit water levels in these facilities to be stabilized for fish and wildlife and recreation.

Advance Planning

iv. Jensen Unit

The Jensen Unit Definite Plan Report is being revised, primarily for addition of information on the project's effects on environment. The project located along the Green River in Uintah County east of Vernal, will develop flows of the Green River to provide irrigation water for 4,080 acres, of which 3,640 acres would receive supplemental water supplies. The project would also furnish 18,000

acre-feet annually of municipal and industrial water supply for use in the vicinity of Vernal and provide flood control and fish and wildlife benefits.

Project commitments would be met by storage releases from the Tyzack Dam and Reservoir to be constructed on Big Brush Creek with a storage capacity of 26,000 acre-feet, the 35-second-foot Tyzack Pumping Plant which empties into the 4.1-mile Tyzack Aqueduct, and the Burns Pumping Plant on the Green River.

b. Emery County Project

Emery County Project provides supplemental water for 18,004 acres of land and a full supply for 771 acres in Emery County in east-central Utah near the towns of Huntington, Castle Dale, and Orangeville. Principal components of the project include Joes Valley Dam and Reservoir on Cottonwood Creek with a storage capacity of 62,500 acre-feet, the Swasey Diversion Dam located about 10 miles downstream from Joes Valley, the 16-mile Cottonwood-Huntington Canal heading at the Swasey Diversion Dam, the Huntington North Dam and Reservoir with a capacity of 5,420 acre-feet, and the 3½-mile Huntington North Service Canal. Laterals and drains will be constructed as required. Recreation facilities are provided at the project storage sites. The Emery County Project was completed in June 1966.

Construction

New work items undertaken during the past year have included constructing the 15 c.f.s. City Ditch Turnout from Cottonwood Creek-Huntington Canal and a contract for placing buried membrane lining in seven segments of the canal and construction of a farm bridge over the canal. The membrane lining and bridge construction will be undertaken at the close of the 1970 irrigation season.

Contruction of project drainage facilities will be carried on as funds permit.

6. WYOMING

a. Lyman Project

The Lyman Project is located in Uinta County in southwestern Wyoming near the town of Lyman. The project will deliver supplemental water to 42,674 acres of presently irrigated lands. Two dams—the Meeks Cabin and China Meadows—will be built

Bureau of Reclamation Photo

Meeks Cabin Dam and Reservoir, Lyman Project, Wyoming, under construction.

by the Bureau of Reclamation and will comprise the principal features of the project.

Construction

Meeks Cabin Dam was completed during September 1970. On September 14, 1970, additional stressing was noted in concrete at the juncture of the outlet works conduit and chute section. The design of the outlet works piping is being modified to allow for future lateral movement. At the end of the report period the prime contractor was performing backfill grouting in the conduit and sealing the conduit joints. Installation of the control gates, 62-inch outlet pipe, and regulatory gates will get underway later in the fall.

Construction of China Meadows Dam and Reservoir is being deferred due to present money limitations.

Recreation facilities will be provided at the reservoirs.

b. Seedskadee Project

The planned Seedskadee Project will provide for the irrigation of 58,775 acres of dry arable land along both side of the Green River in an area extending from 14 to 50 miles northwest of Green River, Wyoming. It will also provide water for future municipal and industrial needs.

Under this plan Fontenelle Dam and Reservoir on Green River will be used both for storage (to a total capacity of 345,000 acre-feet) and as a means of diverting water from the river. The 10,000-kilowatt powerplant at the toe of the dam began operation in May 1968. Development of a wildlife refuge downstream from Fontenelle Dam is proceeding as an adjunct to the project under Section 8 of the Colorado River Storage Project Act.

About 100 miles of canals and 160 miles of laterals will be constructed in the distribution system to convey water from the reservoir to farm units.

Construction

Fontenelle Dam was completed during April 1964 and storage of water initiated. Construction of water distribution facilities continues to be deferred pending completion of a project reevalution report.

The present Seedskadee Project program centers on the Development Farm, which is completing its sixth full year of operation.

The farm is being operated by the University of Wyoming under the general supervision of an advisory committee. Studies on the farm will provide valuable and needed information on water management practices, crop production, and livestock-handling techniques and their relationship to optimum size of family farm units for the Seedskadee Project lands. Detailed records are being kept as a basis for initiation of hydrologic and agricultural economic studies in the development and plan report of the Seedskadee Project. Current information from records kept will be summarized by the University in collaboration with the Bureau. The Seedskadee Development Farm is scheduled to operate at least one more season as a study farm. Crop yields attained indicate the soils are productive under proper management, but crop diversification and production are limited by the altitude and short growing season in the area.

Recreation

Recreation facilities provided at Fontenelle Reservoir include a boat ramp, parking areas, campground, picnic sites, water, contact station, and comfort stations.

c. Eden Project

The Eden Project is located in Sweetwater County, southwestern Wyoming, about 45 miles north of Rock Springs. Major physical features consist of the Big Sandy Reservoir (39,700 acre-feet) and the Eden Reservoir (7,500 acre-feet). There are 113 miles of canals and laterals to serve the project. The present project area under water right is 17,088 acres.

Contruction started in 1950 and was completed in 1960. First water was available through Bureau-constructed works in 1953. By contract dated June 8, 1950, the Eden Valley Irrigation and Drainage District assumed responsibility for repayment of construction cost of $75 an acre over a 60-year period with the remaining costs to be repaid from revenues of the Colorado River Storage Project. Operation and maintenance was turned over to the water users on January 1, 1970.

Short water supplies in some years, short growing season, limited crop production, general economic conditions, and farm management have been factors limiting farm income.

The Farmers Home Administration, Agricultural Stabilization and Conservation Service, the Soil Conservation Service, and the

Bureau of Reclamation have been active in improving adverse project conditions.

As a step in alleviating water shortages on the Eden Project, several canals have been lined.

Construction contracts amounting to $325,000 were awarded during the summer of 1970 for additional improvements to project water conveyance and delivery systems. Work to be accomplished includes placing compacted earth lining in 7 miles of laterals serving the Farson area, and 5.6 miles in the Eden area; constructing 0.2 miles of new laterals in the Farson area; enlarging 2.3 miles of laterals; enlarging turnout structures; installing check drops, siphons, division boxes, turnouts, and wasteways; and installing new culverts and drain inlets. Construction activities did not get into full swing until late in the fall of 1970 when irrigation demands lessened sufficiently to permit work on existing irrigation facilities. This work is scheduled for completion prior to the summer of 1971.

Drainage construction has also been carried on as funds permitted. A total of 20.2 miles of deep drains and approximately 30 miles of surface drains had been provided by the end of the 1970 irrigation season. Investigations are continuing to determine the need for providing additional drainage through either deepening existing drains or constructing new facilities.

H. POTENTIAL PARTICIPATING PROJECTS

In carrying out further investigations of projects under Federal Reclamation Laws in the Upper Colorado River Basin, the Secretary of the Interior is directed to give priority to completion of planning reports on a number of potential projects.

The Bureau of Reclamation, so far as limited funds and personnel will permit, is continuing its studies on these projects. Considerable progress in investigations has been accomplished during the past year.

I. FEASIBILTY INVESTIGATIONS COLORADO

a. Yellow Jacket Project

A proposed feasibility report on the Yellow Jacket Project is under review. The present plan for the project includes storage regulation at Lost Park and Ripple Reservoirs in the White River drainage for development of lands in the White River Basin. The project

would also include a small portion of the lands in the Axial Basin in the vicinity of Milk Creek which would be served from surplus flows of Milk Creek with storage provided at Thornburgh Reservoir. The project would provide a supplemental irrigation supply to 3,700 acres of land and a full supply to 19,900 acres of land. The remaining Axial Basin lands would be included in the Lower Yampa Project (Juniper Project). The project would also develop a municipal and industrial water supply and provide recreation and fish and wildlife benefits.

b. Battlement Mesa Project

A proposed feasibility report on the Battlement Mesa Project is under review. The project would develop the flows of Buzzard Creek to provide supplemental irrigation water to 3,130 acres of land and a full water supply to 6,340 acres of land, develop 3,000 acre-feet of municipal and industrial water, and provide benefits to recreation and fish and wildlife. Owens and Buzzard Creek Reservoirs would be constructed on Buzzard Creek to regulate and store excess flows of the stream. Irrigation water released from the reservoirs would be distributed through a system of project facilities, including the Harrison, Brush Creek, and Colorado Canals, the Cheney Lateral, and a series of smaller laterals branching from the main canals.

c. Bluestone Project

A proposed report is scheduled for completion in fiscal year 1971. This will summarize results of feasibility studies for the Bluestone Project and of reconnaissance studies for a potential project extension. The project would provide a supplemental irrigation supply to 1,880 acres of land, a full supply to 750 acres of land, and 61,000 acre-feet for municipal and industrial use. The extension would involve the construction of Una Reservoir, a major storage feature on the Colorado River, to provide hydroelectric power, municipal and industrial water, recreation, fish and wildlife, flood control, and river regulation.

d. Grand Mesa Project

Feasibility investigations are well advanced. Preparation of feasibility designs and estimates for most project features are in progress. Completion of a proposed feasibility report is scheduled for fiscal year 1971.

e. Upper Gunnison Project

Land classification and drainage field work and engineering surveys are completed. Agricultural economic surveys, plan formulation studies, and water supply studies are in progress. Completion of a proposed feasibility report is scheduled for fiscal year 1971.

f. Basalt Project

Detailed land classification and drainage field work has been completed. Other phases of the feasibility investigations are proceeding satisfactorily. The feasibility investigations have been expanded to include studies of Ashcroft Reservoir or an alternative storage site on Castle Creek as a means of providing municipal water supplies for the city of Aspen, Colorado. Completion of a proposed feasibility report is scheduled for fiscal year 1972.

g. Lower Yampa Project

Feasibility investigations were initiated in fiscal year 1969. Land classification, drainage, and plan formulation studies are in progress. The proposed feasibility report is scheduled for completion in fiscal year 1974. This project was formerly identified as the Juniper and Great Northern Projects.

UTAH

a. Central Utah Project (Ultimate Phase), Uintah Unit

The Uintah Unit was conditionally authorized by the Colorado River Basin Project Act. Construction is contingent upon completion and submission to Congress of a feasibility report along with certification by the Secretary that the Unit is economically justified and financially feasible.

The project would develop the flows of the Uinta and Whiterocks Rivers to provide supplemental irrigation water to 45,150 acres of land and a full supply to 7,820 acres of new land, develop 1,000 acre-feet of municipal and industrial water, and provide benefits to recreation, fish and wildlife, and flood control.

Uinta and Whiterocks Reservoirs would be constructed on Uinta and Whiterocks Rivers, respectively, to regulate and store surplus flows for project use. Project water would be delivered through present distribution systems requiring some rehabilitation. Stabilization of 13 upstream reservoirs will provide exchange water

for irrigation as well as provide recreation and fish and wildlife benefits.

b. Central Utah Project (Ultimate Phase), Ute Indian Unit

Feasibility investigations are currently in progress on the Ute Indian Unit. The Ute Indian Unit would develop Colorado River water for irrigation, municipal and industrial use, and power production. The Unit would serve both Indian and non-Indian lands in the Uinta Basin. Municipal and industrial water would be developed for use in the Uinta Basin to facilitate development of vast deposits of phosphate, oil shale, minerals, and other natural resources. Water would also be diverted from the Uinta Basin to the Bonneville Basin to help satisfy the expanding water requirements of the Wasatch Front area.

Under the Colorado River Basin Project Act a planning report must be completed on or before December 31, 1974, to enable the United States of America to meet the commitments heretofore made to the Ute Indian Tribe of the Uintah and Ouray Indian Reservation under an agreement dated September 20, 1965.

2. RECONNAISSANCE INVESTIGATIONS

UTAH

a. Paria-San Rafael Investigations

Reconnaissance investigations were initiated in fiscal year 1969 with funds contributed by the State of Utah. The study area includes the San Rafael, Dirty Devil, Escalante, and Paria River Basins. The study will provide a general appraisal of the overall water and related resources and development potentials of the area. A reconnaissance report is scheduled to be completed in fiscal year 1972.

WYOMING

a. Green River Project

Reconnaissance investigations initiated in fiscal year 1968 are progressing satisfactorily consisting of plan formulation studies, preparation of reconnaissance water supply studies, agricultural economic surveys, preparation of designs and estimates, and cooperation with other agencies. Alternative plans of development to supply municipal and industrial water for in-basin uses, export municipal and industrial water to North Platte River Basin, and provide water for lands west and/or east of Green River are under consideration. A reconnaissance report is scheduled to be completed in fiscal year 1971.

I. RESERVOIR OPERATIONS

The 1970 snowmelt runoff in the Upper Colorado River Basin during the period April through July totalled 8,220,000 acre-feet which is less than one percent below the long-term average. Runoff for the total water year ending September 30, 1970, was 12.5 million acre-feet which was disposed of as follows:

	Acre-Feet
Net Storage Increase	2,600,000
Bank Storage	1,000,000
Evaporation	300,000
Releases to Lower Basin	8,600,000
Total	12,500,000

All of the Upper Basin Reservoirs had a net gain in storage during water year 1970 except Fontenelle and Flaming Gorge from which 40,000 and 35,000 acre-feet respectively were moved downstream. Most of the system gain or about 2,300,000 acre-feet was in Lake Powell. During the same 12-month period, Lake Mead gained about 600,000 acre-feet of storage.

Lake Powell reached an all-time high water surface elevation of 3,602 feet on July 15, 1970, with storage of 12,325,000 acre-feet. The lake is expected to recede slightly before spring runoff starts in 1971.

About 8.6 million acre-feet of water were released to the Lower Basin during water year 1970. For the next two years, annual releases should be about 8.8 million acre-feet each year in order to deliver 75 million acre-feet to the Lower Basin in the 1963-72 decade (to fulfill a compact commitment). This particular 10-year period is especially critical because of the small releases during the first two years when minimum power pools were being developed in Lake Powell and Flaming Gorge Reservoir. The entire release will be used to generate power for customers in both the Upper and Lower Basins.

The water surface of Flaming Gorge Reservoir on the Green River receded slightly from its seasonal high at elevation 5984 feet with storage of 1,876,000 acre-feet to an end-of-year elevation of 5980 feet. The April through July spring runoff above the reservoir was about 985,000 acre-feet, or 85 percent of normal. Scheduled power releases should draw the reservoir down to near elevation 5979 feet with storage of about 1,755,000 acre-feet by the time of spring runoff in 1971.

Fontenelle Reservoir on the upper part of the Green River in Wyoming had been drawn down from a seasonal high water surface elevation of 6501 feet with storage of 309,000 acre-feet on July 23, 1970, to elevation 6493 feet with storage of 246,000 acre-feet by the end of the water year. During the coming winter the reservoir will be drawn down to approximately elevation 6482 feet. In future years the reservoir will normally fill each spring to elevation 6506 feet and be drawn down to between elevation 6480 and 6485 feet late each winter. Within this type of fluctuation, all purposes of the project will be served and minimum amounts of water will bypass the powerplant.

The water surface level of Navajo Reservoir on the San Juan River reached an all-time high elevation of 6054 feet with storage of 1,266,000 acre-feet on September 23, 1970. The reservoir should recede to elevation 6010 by the end of March 1971 to permit extension of a boat ramp. The snowmelt runoff above Navajo Reservoir during 1970 was only about 446,000 acre-feet or 53 percent of the long-term average.

On the Gunnison River, Blue Mesa Reservoir filled for the first time with a storage content of 831,000 acre-feet and a water surface elevation of 7519.6 feet. Blue Mesa will be drawn down to elevation 6456 feet by the end of March 1971. Some releases were made in addition to the amount of water that would go through the powerplant in order to reduce the magnitude of the peak inflow and to control flooding downstream. The 1970 snowmelt runoff above Blue Mesa was 967,000 acre-feet or about 123 percent of normal.

Morrow Point Reservoir, which is located immediately downstream from Blue Mesa Dam, filled and occasionally spilled during the summer. Operation of Morrow Point Powerplant is currently scheduled to begin early in 1971.

J. ATMOSPHERIC WATER RESOURCES PROGRAM IN THE UPPER COLORADO RIVER BASIN

Scientific investigation into atmospheric water resources continues in the mountains of the Upper Basin States. The scope of the investigation has been enlarged from purely experimental studies by adding a pilot-type project.

Small scale cloud-seeding experiments are being conducted by the University of Wyoming in the Bridger Range of the Wind River Mountains in western Wyoming.

Quite important to the Reclamation program are winter seeding experiments conducted by Colorado State University at Climax, Colorado, under a grant from the National Science Foundation. These experiments have been conducted for 10 years and are again scheduled for the winter of 1970-71. These experiments are designed to show the quantitative change in precipitation by seeding and to determine criteria for optimum seeding conditions. In the past these experiments have been based on ground seeding. This year there will be more seeding with aircraft and pyrotechnics.

The Colorado River Basin Pilot Project in the San Juan Mountains of southwestern Colorado is the last development step before possible fullscale seeding operations in the Upper Colorado River Basin. The prime objective of the project is to provide sound evaluation of precipitation increases from operational-type cloud seeding over large areas. Preliminary meteorological measurements and project design studies were made in the project area during the winter of 1968-69. Equipment and instrumentation, except silver-iodide generators, were tested during the winter of 1969-70. The silver-iodide generators were installed during the summer of 1970 and seeding will begin this (1970-71) winter. There are about 90 days of snowfall in the area per year. About 40 of these days are suitable for seeding, and about 20 will be seeded. Randomized seeding during each season, using 24-hour periods will be followed. The periods will be from 10:00 a.m. one day to 10:00 a.m. the following day.

This area is a high-production snowpack location which contributes substantially to the flow of the Colorado River and some of its major tributaries, including the Gunnison, San Miguel, Dolores, and San Juan Rivers. Most of the seeding and target areas are sparsely populated, above 9,500 feet elevation, and virtually all are Government owned.

The cloud-seeding operations will be conducted from the control center at Durango, Colorado. The Durango center will also continually appraise avalanche conditions and total snowpack depth in order to suspend seeding operations, as required. Storms which forecasts indicate may be severe in nature will not be seeded.

The responsibility for evaluating seeding results and other factors will be that of a separate, unbiased scientific contractor to be selected at a future date.

Ecological studies of effects of the pilot cloud-seeding project have been contracted to the University of Colorado, Fort Lewis College, and Colorado State University.

XI. Findings of Fact

No findings of fact pursuant to Article VIII of the Upper Colorado River Basin Compact have been made by the Upper Colorado River Commission. No part of this Annual Report is to be construed as a finding of fact by the Commission.

XII. Acknowledgments

The Upper Colorado River Commission wishes to acknowledge the united actions of the Governors of Colorado, New Mexico, Utah and Wyoming on the fundamental issues involved in the development of the water and land resources of the Upper Colorado River Basin and for their interest in and support of the Upper Colorado River Commission.

The Commission especially wishes to give recognition to the difficult and able work of the members of the United States Congress from the Upper Division States of the Colorado River Basin and to acknowledge with appreciation the assistance it has received from agencies of the Executive Branch of the Federal Government: the Department of the Interior, Bureau of Reclamation, Geological Survey, Bureau of Indian Affairs, and the Department of Agriculture.

Officers and personnel of many state agencies having their primary interests in various phases of water resources have also aided materially with cooperative efforts and information.

At a Special Meeting held in Denver, Colorado on August 18, 1970, the Commission unanimously adopted resolutions of thanks to Mr. J. Stuart McMaster, retired, Regional Solicitor of the Department of the Interior and legal adviser to the Commissioner representing the United States of America on the Upper Colorado River Commission and to Mr. J. R. Riter, hydrologist for the Bureau of Reclamation and engineering adviser to the Commissioner for the United States. A copy of each of these resolutions is published herein.

RESOLUTION OF THANKS

to

J. STUART McMASTER

WHEREAS, J. Stuart McMaster served with distinction in various capacities in the legal divisions of the Bureau of Reclamation, the U.S. Department of the Interior, and in recent years as Regional Solicitor of the Department of the Interior at Salt Lake City, Utah; and

WHEREAS, J. Stuart McMaster served for many years as legal adviser to the Commissioner representing the United States of America on the Upper Colorado River Commission; and

WHEREAS, J. Stuart McMaster devoted his exceptional ability, his fair judgment, and his energy to legal problems confronted in the development, utilization, and conservation of water, hydroelectric power, and land resources of the Colorado River Basin; and

WHEREAS, J. Stuart McMaster, by his exceptional devotion to duty, exercise of good judgment, and understanding of his fellow men, has earned the strong respect and affection of all members of the Upper Colorado River Commission, its advisers and staff; and

WHEREAS, J. Stuart McMaster has retired from the position of Regional Solicitor for the Department of the Interior to heed a call from the Church of Jesus Christ of Latter-day Saints to become President of its Kansas-Missouri Mission:

NOW, THEREFORE, BE IT RESOLVED that the Upper Colorado River Commission at a Special Meeting held in Denver, Colorado on August 18, 1970 expresses its thanks and appreciation to Mr. J. Stuart McMaster for his faithful services, his outstanding cooperation, and his untiring efforts in seeking solutions to the many complex legal problems that have confronted this Commission and its Members during his tenure as counsel to the Commissioner for the United States, and sincerely wishes him the best of health, success, and happiness in all of his future endeavors.

BE IT FURTHER RESOLVED that the Secretary of the Upper Colorado River Commission is hereby directed to transmit a copy of this resolution to the Secretary of the Interior and to Mr. J. Stuart McMaster.

RESOLUTION OF THANKS

to

J. R. RITER

WHEREAS, J. R. Riter served for many years in various engineering capacities within the Bureau of Reclamation, Department of the Interior; and

WHEREAS, J. R. Riter served as one of the engineering advisers to the Federal representative on the Upper Colorado River Basin Compact Commission and to the Commissioner for the United States on the Upper Colorado River Commission; and

WHEREAS, J. R. Riter throughout his long career devoted his engineering talent and energy to the study of the water resources of the river systems of the seventeen Western States leading to the development and conservation of the water resources under numerous Federal reclamation projects; and

WHEREAS, J. R. Riter through his devotion to duty became highly respected by members of the Upper Colorado River Commission; and

WHEREAS, J. R. Riter has retired from the Bureau of Reclamation:

NOW, THEREFORE, BE IT RESOLVED by the Upper Colorado River Commission that said Commission desires to express its thanks and appreciation to Mr. J. R. Riter for his faithful services and untiring efforts in seeking solutions to the many complicated hydrological problems that have confronted this Commission during his tenure as adviser to the United States Commissioner, and said Commission sincerely wishes him the best of continued health and happiness in his future endeavors:

BE IT FURTHER RESOLVED that the Secretary of the Upper Colorado River Commission is hereby directed to forward a copy of this resolution to the Commissioner of Reclamation and to Mr. J. R. Riter.

Appendices

APPENDIX A

Report of Auditor

REPORT OF EXAMINATION

Upper Colorado River Commission

SALT LAKE CITY, UTAH

June 30, 1970

McNULTY, CHADWICK & STEINKIRCHNER
CERTIFIED PUBLIC ACCOUNTANTS
200 NORTH SIXTH STREET
GRAND JUNCTION, COLORADO
81501

Upper Colorado River Commission
Salt Lake City
Utah

Gentlemen:

We have examined the balance sheets of the General Fund and the Property and Equipment Fund of the Upper Colorado River Commission as of June 30, 1970 and the related Statement of Revenue and Expense — General Fund for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records as we considered necessary under the circumstances.

In our opinion, the accompanying balance sheets and statement of revenue and expense present fairly the financial position of the Upper Colorado River Commission at June 30, 1970 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

McNULTY, CHADWICK & STEINKIRCHNER
Certified Public Accountants

BALANCE SHEET — GENERAL FUND

UPPER COLORADO RIVER COMMISSION

June 30, 1970

ASSETS

CASH		
Office cash fund		$ 25.00
Cash on deposit with First Security Bank of Utah, N.A.:		
Demand deposit	$ 3,713.97	
Time certificates	88,500.00	92,213.97
OTHER ASSETS		
Returnable deposit—United Air Lines	$ 425.00	
Pension trust insurance premiums to be withheld from employees	418.98	843.98
PREPAID EXPENSE		
Unexpired insurance premiums	$ 536.16	
Prepaid pension trust insurance premiums	3,662.65	
Prepaid office expense	830.77	5,029.58
TOTAL ASSETS		$98,112.53

LIABILITIES, RESERVES AND FUND BALANCE

ACCOUNTS PAYABLE		
For supplies and expenses		$ 239.85
RESERVE		
For fiscal year 1971 assessments received in advance		12,375.00
UNAPPROPRIATED FUND BALANCE		
Balance July 1, 1969	$70,481.78	
Add excess of revenue over expenses for fiscal year ended June 30, 1970	20,015.90	
	$90,497.68	
Less appropriation for fiscal year ended June 30, 1970	5,000.00	
Balance June 30, 1970		85,497.68
TOTAL LIABILITIES, RESERVES AND FUND BALANCE		$98,112.53

Note — The accompanying Notes to Financial Statements — General Fund are an integral part of this statement.

BALANCE SHEET — PROPERTY AND EQUIPMENT FUND

UPPER COLORADO RIVER COMMISSION

June 30, 1970

ASSETS

PROPERTY AND EQUIPMENT — at cost	
Land and land improvements	$ 26,366.00
Building	47,627.24
Furniture and fixtures	18,157.62
Library	4,623.40
Automobile	4,820.70
Engineering equipment	3,409.07
Motion picture film — at nominal value	3.00
Upper Colorado River Basin relief model	5,937.77
TOTAL ASSETS	$110,944.80

FUND BALANCE

INVESTMENT IN PROPERTY AND EQUIPMENT			
Balance July 1, 1969			$109,198.48
Transactions for the fiscal year ended June 30, 1970:			
Additions:			
Capital outlay expenditures — General Fund		$3,834.74	
Correction to prior year furniture and fixture inventories		21.27	
		$3,856.01	
Retirements:			
Remove excess of book cost over trade-in allowance on automobile and two typewriters	$1,968.80		
Cost of two fans sold	73.50		
Cost of property items scrapped	67.39	2,109.69	
NET INCREASE IN FUND BALANCE			1,746.32
FUND BALANCE JUNE 30, 1970			$110,944.80

NOTES TO FINANCIAL STATEMENTS — GENERAL FUND

UPPER COLORADO RIVER COMMISSION

June 30, 1970

Note 1 — At June 30, 1970, unrecorded liability of the Commission to its full time employees for accrued annual leave amounted to $4,721.41. According to Commission policy (effective July 1, 1960), each employee is expected to take annual leave of 15 days each calendar year during which period of time regular salary payments are continued. Employees may accumulate a maximum of 30 days annual leave.

Note 2 — The Commission created the Upper Colorado River Commission Pension Trust effective October 1, 1965. The purpose of this trust is to purchase insurance policies which will provide retirement income and life insurance for qualified employees of the Commission. The Commision is required to pay the premiums on the policies one year in advance, in October of each year, and amounts equivalent to 3% of the base pay is withheld from the pay checks of the participating employees during the ensuing twelve month period to cover the employee's share of the premium cost.

STATEMENT OF REVENUE AND EXPENSE — GENERAL FUND

UPPER COLORADO RIVER COMMISSION

For the fiscal year ended June 30, 1970

	Budget	Actual	Actual Over (Under) Budget
REVENUE			
Assessments	$110,000.00	$110,000.00	$ —0—
Interest earned on time deposit	—0—	4,587.50	4,587.50
Appropriation from fund balance	5,000.00	5,000.00	—0—
Sale of two fans	—0—	15.00	15.00
TOTAL REVENUE	$115,000.00	$119,602.50	$ 4,602.50
EXPENSE			
Personal services:			
Administrative salaries	$ 26,250.00	$ 26,208.00	$ (42.00)
Engineering salaries	15,700.00	14,296.05	(1,403.95)
Attorney's salary	15,700.00	15,672.00	(28.00)
Clerical salaries	4,400.00	639.40	(3,760.60)
Janitor	1,500.00	1,188.00	(312.00)
F.I.C.A. Tax	1,700.00	1,446.91	(253.09)
Pension Fund	17,000.00	15,109.24	(1,890.76)
	$ 82,250.00	$ 74,559.60	$ (7,690.40)
Current expenses:			
Reporting	$ 1,050.00	$ 437.50	$ (612.50)
Telephone and telegrams	2,800.00	2,488.71	(311.29)
Office supplies and postage	3,100.00	2,350.56	(749.44)
Insurance and bonds	1,000.00	1,003.63	3.63
Accounting	750.00	750.00	—0—
Secretarial service	400.00	—0—	(400.00)
Engineering supplies and services	600.00	222.09	(377.91)
Printing	2,600.00	1,999.85	(600.15)
Library supplies and expense	850.00	553.10	(296.90)
Meeting expense	300.00	30.78	(269.22)
Utilities	1,300.00	1,039.44	(260.56)
Building repair and maintenance	500.00	175.76	(324.24)
Miscellaneous	350.00	329.58	(20.42)
	$ 15,600.00	$ 11,381.00	$ (4,219.00)
Capital outlay	$ 4,150.00	$ 3,834.74	$ (315.26)
Education and information	1,000.00	297.29	(702.71)
Travel	12,000.00	9,513.97	(2,486.03)
	$ 17,150.00	$ 13,646.00	$ (3,504.00)
TOTAL EXPENSE	$115,000.00	$ 99,586.60	$(15,413.40)
EXCESS OF REVENUE OVER EXPENSE		$ 20,015.90	$ 20,015.90

Note — The accompanying Notes to Financial Statements — General Fund are an integral part of this statement.

Supplementary Data

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS — GENERAL FUND

UPPER COLORADO RIVER COMMISSION

For the fiscal year ended June 30, 1970

Balance of cash and demand deposit at July 1, 1969		$ 77,600.67
Cash receipts:		
Assessments for fiscal year 1970	$97,625.00	
Assessments for fiscal year 1971	12,375.00	
Interest earned on time deposit	4,587.50	
Sale of two fans	15.00	114,602.50
		$192,203.17
Cash disbursements:		
Personal services	$74,450.96	
Current expenses	11,790.53	
Capital outlay	3,834.74	
Education and information	307.79	
Travel	9,580.18	99,964.20
Balance of cash and demand deposit at June 30, 1970		$ 92,238.97

INSURANCE COVERAGE

UPPER COLORADO RIVER COMMISSION

June 30, 1970

	Coverage	
	Type	Amount (in dollars)
Treasurer	Fidelity bond	$ 40,000
Assistant Treasurer	Fidelity bond	$ 40,000
Automobile	Comprehensive	Actual cash value
	Liability:	
	Each person	$300,000
	Each accident	$500,000
	Property damage	$ 50,000
	Medical	$ 5,000
	Collision and upset	$100 deductible
	Uninsured tourists	10/20,000
Employees	Workmen's compensation	Statutory
Office contents	Fire and comprehensive	$ 50,000
Office premises	Liability	$300,000
Building	Special multi-peril	$ 60,000-A

Note A — 90% co-insurance clause

APPENDIX B

UPPER COLORADO RIVER COMMISSION

BUDGET

Fiscal Year Ending June 30, 1972

PERSONAL SERVICES		
Administratives Salaries (including Administrative Secretary)	$29,600	
Legal	17,300	
Engineering	17,300	
Clerical - Secretary	3,100*	
Janitor	1,500	
Pension Trust	17,000	
Social Security	2,000	
		$ 87,800
*Part-time		
TRAVEL		$ 13,000
CURRENT EXPENSE		
Reporting and accounting	$ 2,000	
Telephone and telegraph	3,000	
Insurance and bond premiums	1,100	
Printing	2,600	
Secretarial Services	400	
Engineering Supplies and Services	500	
Office Supplies and Postage	3,500	
Library and Miscellaneous	1,250	
Meeting expense	400	
Utilities	1,350	
Building Repair and Maintenance	600	
		$ 16,700
CAPITAL OUTLAY		$ 3,375
EDUCATION AND INFORMATION		$ 1,125
TOTAL ESTIMATED EXPENSE Fiscal Year July 1, 1971 through June 30, 1972		$122,000
To be funded from surplus		$ 12,000
Total Assessments for Fiscal Year 1972		$110,000

APPENDIX C

UNITED STATES DEPARTMENT OF THE INTERIOR

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20240

June 8, 1970

Dear Governor .....:*

Enclosed is a copy of the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs" which I have adopted and which is being published in the *Federal Register* in accordance with Section 602 of the Colorado River Basin Project Act of September 30, 1968, Public Law 90-537 (82 Stat. 885).

The adopted criteria represent largely the contributions of a task group of State and Federal representatives which held five meetings from July through November 1969. The valuable input of information furnished by your representatives and our various contractors for water and power is appreciated.

Comments from the Upper and Lower Division States concerning the proposed operating criteria enclosed with my letter dated December 16, 1969, also have been helpful in preparing the adopted criteria. A detailed explanation of decisions on each of the suggestions and recommendations is being furnished to your representatives and others who participated in the various task force meetings.

In that letter you were advised that we expected to make a decision prior to July 1, 1970, regarding the proposed termination of the "General Principles to Govern, and Operating Criteria for, Glen Canyon Reservoir (Lake Powell) and Lake Mead During the Lake Powell Filling Period."

The avenue available to me for such a termination is provided in the option of Principle No. 2 of the Filling Criteria, which reads:

> ". . . If, in the judgment of the Secretary, the contents of Lake Powell and Lake Mead warrant such action, and after consultation with appropriate interests of the Upper Colorado River Basin and the Lower Colorado River Basin, the Secretary may declare that in not less than 1 year from and after the date of such declaration these principles and criteria are no longer applicable."

*The above letter was sent to the Governor of each of the seven Colorado River Basin States.

All of the comments submitted which relate to my exercise of this option have been carefully reviewed, and in my judgment the contents of Lake Powell and Lake Mead do not warrant termination of the Filling Criteria at this time.

The major objection expressed by Upper Basin interests to continuing the Filling Criteria has been the use of Colorado River Storage Project (CRSP) generated energy to replace Hoover deficiencies and the resultant impact upon the Upper Colorado River Basin Fund. Under current water and power marketing conditions, all CRSP generation is required to meet firm energy obligations of the United States and all energy needed to satisfy Hoover deficiencies must be purchased. Except for minor variations, this operating condition is expected to continue.

The net result is that increased revenues will accrue to the Upper Colorado River Basin Fund from power sales, and money expended from that fund to replace Hoover deficiencies will be reimbursed from the Colorado River Development Fund pursuant to Section 502, Public Law 90-537.

In accordance with the provisions of the Filling Criteria, the modification thereof dated May 11, 1964, and consistent with said Section 502, the Upper Colorado River Basin Fund will not be reimbursed for costs incurred in connection with impairment of capacity and energy resulting from the drawdown of Lake Mead below elevation 1,123 feet incident to the attainment of minimum power pool in Lake Powell. Neither will there be reimbursement for energy furnished from CRSP generation utilized in meeting energy deficiencies and impairments in Hoover generation.

I know of your vital interest in these matters. The efforts of you and your representatives have assisted us in making decisions which we believe are in the best interest of the entire Colorado River Basin.

Sincerely yours,

(signed) WALTER J. HICKEL

Secretary of the Interior

Enclosure

CRITERIA FOR COORDINATED LONG-RANGE OPERATION OF COLORADO RIVER RESERVOIRS PURSUANT TO THE COLORADO RIVER BASIN PROJECT ACT OF SEPTEMBER 30, 1968 (P. L. 90-537)

These Operating Criteria are promulgated in compliance with Section 602 of Public Law 90-537. They are to control the coordinated long-range operation of the storage reservoirs in the Colorado River Basin constructed under the authority of the Colorado River Storage Project Act (hereinafter "Upper Basin Storage Reservoirs") and the Boulder Canyon Project Act (Lake Mead). The Operating Criteria will be administered consistent with applicable Federal laws, the Mexican Water Treaty, interstate compacts, and decrees relating to the use of the waters of the Colorado River.

The Secretary of the Interior (hereinafter the "Secretary") may modify the Operating Criteria from time to time in accordance with Section 602(b) of P. L. 90-537. The Secretary will sponsor a formal review of the Operating Criteria at least every 5 years, with participation by State representatives as each Governor may designate and such other parties and agencies as the Secretary may deem appropriate.

I. ANNUAL REPORT

(1) On January 1, 1972, and on January 1 of each year thereafter, the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected plan of operation for the current year.

(2) The plan of operation shall include such detailed rules and quantities as may be necessary and consistent with the criteria contained herein, and shall reflect appropriate consideration of the uses of the reservoirs for all purposes, including flood control, river regulations, beneficial consumptive uses, power production, water quality control, recreation, enhancement of fish and wildlife, and other environmental factors. The projected plan of operation may be revised to reflect the current hydrologic conditions, and the Congress and the Governors of the Colorado River Basin States shall be advised of any changes by June of each year.

II. OPERATION OF UPPER BASIN RESERVOIRS

(1) The annual plan of operation shall include a determination by the Secretary of the quantity of water considered necessary as

of September 30 of that year to be in storage as required by Section 602(a) of P.L. 90-537 (hereinafter "602(a) Storage"). The quantity of 602(a) Storage shall be determined by the Secretary after consideration of all applicable laws and relevant factors, including, but not limited to, the following:

(a) Historic streamflows;

(b) The most critical period of record;

(c) Probabilities of water supply;

(d) Estimated future depletions in the upper basin, including the effects of recurrence of critical periods of water supply;

(e) The "Report of the Committee on Probabilities and Test Studies to the Task Force on Operating Criteria for the Colorado River," dated October 30, 1969, and such additional studies as the Secretary deems necessary;

(f) The necessity to assure that upper basin consumptive uses not be impaired because of failure to store sufficient water to assure deliveries under Section 602(a)(1) and (2) of P. L. 90-537.

(2) If, in the plan of operation, either:

(a) the Upper Basin Storage Reservoirs active storage forecast for September 30 of the current year is less than the quantity of 602(a) Storage determined by the Secretary under Article II(1) hereof, for that date; or

(b) The Lake Powell active storage forecast for that date is less than the Lake Mead active storage forecast for that date;

the objective shall be to maintain a minimum release of water from Lake Powell of 8.23 million acre-feet for that year. However, for the years ending September 30, 1971 and 1972, the release may be greater than 8.23 million acre-feet if necessary to deliver 75,000,000 acre-feet at Lee Ferry for the 10-year period ending September 30, 1972.

(3) If, in the plan of operation, the Upper Basin Storage Reservoirs active storage forecast for September 30 of the current water year is greater than the quantity of 602(a) Storage determination for that date, water shall be released annually from Lake Powell at a rate greater than 8.23 million acre-feet per year to the extent necessary to accomplish any or all of the following objectives:

(a) to the extent it can be reasonably applied in the States of the Lower Division to the uses specified in Article III(e) of the

Colorado River Compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead,

(b) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and

(c) to avoid anticipated spills from Lake Powell.

(4) In the application of Article II(3)(b) herein, the annual release will be made to the extent that it can be passed through Glen Canyon Powerplant when operated at the available capability of the powerplant. Any water thus retained in Lake Powell to avoid bypass of water at the Glen Canyon Powerplant will be released through the Glen Canyon Powerplant as soon as practicable to equalize the active storage in Lake Powell and Lake Mead.

(5) Releases from Lake Powell pursuant to these criteria shall not prejudice the position of either the upper or lower basin interests with respect to required deliveries at Lee Ferry pursuant to the Colorado River Compact.

III. OPERATION OF LAKE MEAD

(1) Water released from Lake Powell, plus the tributary inflows between Lake Powell and Lake Mead, shall be regulated in Lake Mead and either pumped from Lake Mead or released to the Colorado River to meet requirements as follows:

(a) Mexican Treaty obligations;

(b) Reasonable consumptive use requirements of mainstream users in the Lower Basin;

(c) Net river losses;

(d) Net reservoir losses;

(e) Regulatory wastes.

(2) Until such time as mainstream water is delivered by means of the Central Arizona Project, the consumptive use requirements of Article III(1)(b) of these Operating Criteria will be met.

(3) After commencement of delivery of mainstream water by means of the Central Arizona Project, the consumptive use requirements of Article III(1)(b) of these Operating Criteria will be met to the following extent:

(a) *Normal:* The annual pumping and release from Lake Mead will be sufficient to satisfy 7,500,000 acre-feet of annual con-

sumptive use in accordance with the decree in *Arizona* v. *California*, 376 U.S. 340 (1964).

(b) *Surplus:* The Secretary shall determine from time to time when water in quantities greater than "Normal" is available for either pumping or release from Lake Mead pursuant to Article II(B)(2) of the decree in *Arizona* v. *California* after consideration of all relevant factors, including, but not limited to, the following:

(i) the requirements stated in Article III(1) of the Operating Criteria;

(ii) requests for water by holders of water delivery contracts with the United States, and of other rights recognized in the decree in *Arizona* v. *California;*

(iii) actual and forecast quantities of active storage in Lake Mead and the Upper Basin Storage Reservoirs; and

(iv) estimated net inflow to Lake Mead.

(c) *Shortage:* The Secretary shall determine from time to time when insufficient mainstream water is available to satisfy annual consumptive use requirements of 7,500,000 acre-feet after consideration of all relevant factors, including, but not limited to, the following:

(i) the requirements stated in Article III(1) of these Operating Criteria;

(ii) actual and forecast quantities of active storage in Lake Mead;

(iii) estimate of net inflow to Lake Mead for the current year;

(iv) historic streamflows, including the most critical period of record;

(v) priorities set forth in Article II(a) of the decree in *Arizona* v. *California;* and

(vi) the purposes stated in Article I(1) of these Operating Criteria.

The shortage provisions of Article II(B)(3) of the decree in *Arizona* v. *California* shall thereupon become effective and consumptive uses from the mainstream shall be restricted to the extent determined by the Secretary to be required by Section 301(b) of Public Law 90-537.

IV. DEFINITIONS

(1) In addition to the definitions in Section 606 of P. L. 90-537, the following shall also apply:

(a) "Spills," as used in Article II(3)(c) herein, means water released from Lake Powell which cannot be utilized for project purposes, including, but not limited to, the generation of power and energy.

(b) "Surplus," as used in Article III(3)(b) herein, is water which can be used to meet consumptive use demands in the three Lower Division States in excess of 7,500,000 acre-feet annually. The term "surplus" as used in these Operating Criteria is not to be construed as applied to, being interpretive of, or in any manner having reference to the term "surplus" in the Colorado River Compact.

(c) "Net inflow to Lake Mead," as used in Article III(3)(b)(iv) and (c)(iii) herein, represents the annual inflow to Lake Mead in excess of losses from Lake Mead.

(d) "Available capability," as used in Articles II(4) herein, means that portion of the total capacity of the powerplant that is physically available for generation.

The relief model of the Upper Colorado River Basin, pictured above, was constructed by the Upper Colorado River Commission in cooperation with the Babson Institute of Business Administration. This model shows the topographic features of the area and indicates location of major units of the Colorado River Storage Project and Participating Projects. It is used by the Commission in work connected with administration of Upper Basin activities and is available for display at conventions and other public events.

UPPER COLORADO RIVER COMMISSION

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