85TH CONGRESS
2d Session

SENATE

DOCUMENT
No. 101

FINANCIAL AND ECONOMIC ANALYSIS

COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

A STUDY

PREPARED BY THE

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

FEBRUARY 1958

MAY 21, 1958.—Ordered to be printed

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S. Res. 302

IN THE SENATE OF THE UNITED STATES,
May 21, 1958.

Resolved, That a study entitled "Financial and Economic Analysis, Colorado River Storage Project and Participating Projects, February 1958", prepared by the Department of the Interior, be printed with illustrations as a Senate document, and that two thousand additional copies be printed for the use of the Committee on Interior and Insular Affairs.

Attest:

FELTON M. JOHNSTON,
Secretary.

By EMERY L. FRAZIER,
Chief Clerk.

LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., April 15, 1958.

HON. RICHARD M. NIXON,
President of the Senate,
Washington, D. C.

DEAR MR. PRESIDENT: With my letter of December 30, 1957, I transmitted to you the first annual report on the status of the Colorado River storage project and participating projects as required by section 6 of the authorizing act of April 11, 1956 (70 Stat. 105).

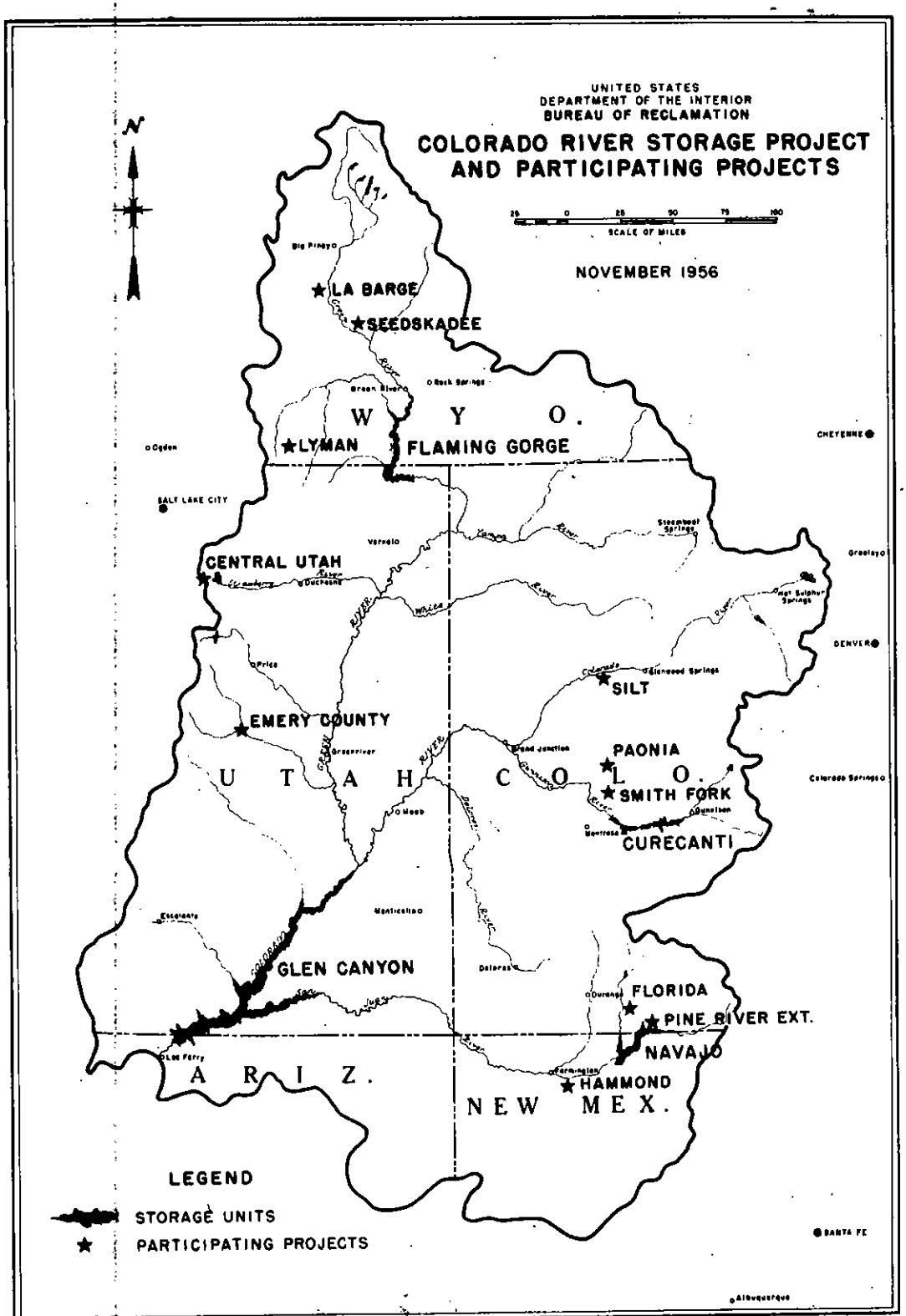
The preliminary repayment studies, referred to in that letter, have been completed and a copy of the study entitled "Financial and Economic Analysis, Colorado River Storage Project and Participating Projects, February 1958," is transmitted herewith for the information of the Congress.

This analysis is intended to be used as a reference and guide by those having responsibility for carrying out the water resource development program in the Upper Colorado River Basin.

With construction just starting on initially scheduled units, this first analysis is based largely on planning estimates with such refinements as are possible in a few instances from detailed preconstruction estimates and from bids on construction work. The analysis will be reviewed and revised periodically as detailed investigations and construction of the development progress, and as new data becomes available.

Sincerely yours,

FRED A. SEATON,
Secretary of the Interior.


UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
AND PARTICIPATING PROJECTS
SCALE OF MILES
NOVEMBER 1956
LA BARGE
SEEDSKADEE
LYMAN
FLAMING GORGE
CENTRAL UTAH
EMERY COUNTY
SILT
PAONIA
SMITH FORK
CURECANTI
GLEN CANYON
FLORIDA
PINE RIVER EXT.
NAVAJO
HAMMOND
W Y O.
U T A H
C O L O.
A R I Z.
NEW MEX.
LEGEND
STORAGE UNITS
PARTICIPATING PROJECTS
SALT LAKE CITY
DENVER
CHEYENNE
SANTA FE
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894-400-18

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Colorado River Storage Project and Participating Projects

Introduction

An extensive program for the development of water resources in the Upper Colorado River Basin was initiated by the act of April 11, 1956 (70 Stat. 105). Authorized for construction were four initial units of the Colorado River storage project on the main river or its larger tributaries, primarily for river regulation and power production. Also authorized were 11 participating projects for irrigation and other related purposes, including the partially constructed Paonia project in Colorado. The entire development is linked financially through the Upper Colorado River Basin fund which was established by the act. The largely constructed Eden project in Wyoming was also made a participant in the basin fund.

The economic and financial analysis reported in this volume is intended to be used as a reference and guide by the Bureau of Reclamation and others having responsibility in carrying out the authorized development program in the Upper Colorado River Basin. With construction just starting on initially scheduled units, this first report is based largely on planning estimates with such refinements as are possible in a few instances from detailed preconstruction estimates and from bids on construction work. The report will be revised periodically as progress is made in detailed investigations and construction and as new data become available.

The estimates of power production at the authorized storage units involve assumptions on the future depletion upstream from these units and resultant regulated annual releases. Utilization of any of the assumptions underlying the basic water supply studies does not carry with it any actual or implied finding of legal restrictions or limitations.

Water Compact and Treaty Obligations

DIVISION OF WATER

Water of the Colorado River was divided between the Upper and Lower Colorado River Basins by the Colorado River compact, which was signed in 1922 by a commissioner of each of the seven States of the river basin and by a representative of the United States and which was subsequently approved by the Congress and the President of the United States. The dividing point on the river between the upper and lower basins is at Lee Ferry near the northern border of Arizona below the mouth of the Paria River. Among other things, the compact apportions to the upper basin the beneficial consumptive

use of 7,500,000 acre-feet of water per annum. The compact provides also that

> The States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years * * *

The compact prescribes the manner in which waters of the Colorado River system may be made available to Mexico under any water rights recognized by the United States. The Mexican Treaty of 1945 provides basically for an annual delivery by the United States to Mexico of 1,500,000 acre-feet of Colorado River water. Of the many provisions in the Colorado River compact and the Mexican Treaty concerning the use of the water of the Colorado River system, those briefed above are of particular importance to the program now being initiated in the upper basin.

Water allocated to the upper basin by the Colorado River compact was further apportioned to the individual States of the upper basin by the Upper Colorado River Basin compact which was signed in 1948. Under the terms of this compact Arizona is permitted to consume 50,000 acre-feet of water annually from the upper Colorado River system and the remaining water allocated to the upper basin is apportioned to other States in the following percentages.

	Percent		*Percent*
Colorado	51.75	Utah	23.00
New Mexico	11.25	Wyoming	14.00

The upper-basin compact created the Upper Colorado River Commission, an interstate administrative agency. The commission consists of a representative of each of the States of Colorado, New Mexico, Utah, and Wyoming, and the Federal Government.

STORAGE REQUIREMENT

The flow of the Colorado River is extremely erratic, historical flow varying from 4,400,000 to 22,000,000 acre-feet annually at Lee Ferry. The extreme drought of recent years has accentuated the problems of river regulation and use. In prolonged dry periods there is not enough flow to permit the upper basin to consume its apportioned water and at the same time to meet its obligations to the lower basin and to Mexico. In wetter periods, however, flows are more than sufficient for these purposes. Large holdover storage reservoirs are thus needed to provide additional water when needed for compact fulfillment during prolonged periods of drought. Favorable opportunities for such reservoirs are provided by the deep canyons of the Colorado River and its principal tributaries in the upper basin.

Further information on the water-supply situation is presented later in this report.

PROJECT PLAN

A plan for the Colorado River storage project and an initial group of participating projects has been formulated by the Bureau of Reclamation in cooperation with other Federal agencies and with the States of the Upper Colorado River Basin. The project report prepared in 1950 and a supplemental report prepared in 1953 were printed as House Document No. 364, 83d Congress, 2d session. Reports on the participating projects in the initial group, supplemental

to the 1950 report, were also completed in 1950 and 1951. Since its introduction in the 1950 report, the project plan has been subject to modifications as shown in the 1953 supplement, in the authorizing act, and in definite plan studies.

COLORADO RIVER STORAGE PROJECT

The various dams and reservoirs of the Colorado River storage project will regulate the flow of the river, thus permitting an expansion of irrigation and other water use in the upper basin within the limits of the Colorado River compact. In most instances powerplants and switchyards will be installed at the dams and transmission lines will be provided to transmit the power to load centers. Facilities will be provided as appropriate for recreation and to mitigate losses of, and improve conditions for, the propagation of fish and wildlife. Minor flood control and other benefits, largely unevaluated at present, are anticipated from the storage project.

The Colorado River storage project as outlined in the 1950 report included 10 storage units. Four of these were authorized for construction by the act of April 11, 1956. It is anticipated that additional units will be authorized as they become needed. The four authorized units are the Glen Canyon, Flaming Gorge, Navajo, and Curecanti. Together they will provide about 34,670,000 acre-feet of reservoir capacity and about 1,167,000 kilowatts of installed generating capacity. More than three-fourths of both capacities will be provided by the Glen Canyon unit alone.

Brief descriptions of the four authorized units and their common transmission system appear below. Data on reservoir and powerplant capacities and stream depletions are summarized in the table on page 8.

Glen Canyon unit

Glen Canyon Dam will be on the Colorado River in northern Arizona, about 13 miles downstream from the Utah-Arizona State line and 16 miles upstream from Lee Ferry. It is the only one of the authorized dams that will be on the Colorado River proper.

Glen Canyon Dam will be a gravity arch concrete structure that will rise 700 feet above its foundation and 573 feet above the river. It will have a crest length of 1,500 feet. The dam will be the fourth highest in the world and second in height only to Hoover Dam in the United States. The reservoir will have a capacity of 28,040,000 acre-feet. When full, it will cover about 163,000 acres and will extend 186 miles up the Colorado River, nearly to the mouth of Green River, and 71 miles upstream on the tributary San Juan River. About 6,535,000 acre-feet of the reservoir capacity will be inactive and will be useful for sediment accumulation, to protect fish, and to provide the power head at the dam. A powerplant and switchyard will be constructed at the dam. The powerplant will include 8 generating units with a total installed capacity of 900,000 kilowatts. An access road and a bridge across the canyon about 900 feet downstream from the dam site will be constructed to Federal highway standards.

Measures will be taken to protect the Rainbow Bridge National Monument at one of the side bays of the Glen Canyon Reservoir.

Flaming Gorge unit

Flaming Gorge Dam will be on the Green River, a major tributary of the Colorado, in northeastern Utah about 6 miles south and 20 miles west of the corner common to Utah, Wyoming, and Colorado. The dam will be a concrete thin-arch structure rising about 495 feet above its foundation and about 445 feet above the river. It will have a crest length of 1,270 feet. The reservoir will have a total capacity of about 3,930,000 acre-feet and an area of about 42,000 acres. It will extend upstream 93 miles, nearly to the town of Green River, Wyo. About 330,000 acre-feet of the reservoir capacity will be inactive. The powerplant at the dam will consist of 3 generating units with a total installed capacity of 108,000 kilowatts. A switchyard will be constructed nearby.

Navaho unit

Navaho Dam will be constructed on the San Juan River in New Mexico about 34 miles east of Farmington. The dam will be an earth-fill structure about 385 feet high above the river and nearly 3,800 feet long at the crest. Navaho Reservoir will provide water for the Navaho Indian irrigation project, when that project is authorized and constructed, and also will provide water directly or indirectly for other potential projects in New Mexico. The reservoir will have a total capacity of 1,700,000 acre-feet and an inactive capacity of 672,000 acre-feet, of which about 70,000 acre-feet will be dead storage. The reservoir when full will inundate 15,300 acres and will extend approximately 34 miles up the San Juan River. Although the outlet works are such that a powerplant could be installed at a later date, no powerplant is included in the present plan. Recreational facilities will be provided at the reservoir.

Curecanti unit

The Curecanti unit will develop storage and power possibilities along part or all of a 40-mile stretch of a deep canyon section of the Gunnison River above the Black Canyon of the Gunnison National Monument and below the town of Gunnison, Colo. In order to prevent the inundation of land near the town, the authorizing legislation provides that—

> * * * the Curecanti Dam (now called Blue Mesa Dam) shall be constructed to a height which will impound not less than 940,000 acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at 7,520 feet above mean sea level. * * *

The act also requires that construction shall not be undertaken until further engineering and economic investigations have been made and until the Secretary of the Interior has certified to the Congress and the President that in his judgment the benefits of the unit will exceed its costs.

Bureau of Reclamation reconnaissance studies indicate that a favorable plan, consistent with the authorizing act, would include a series of four dams, reservoirs, powerplants, and switchyards. The developments in order moving downstream would be known as the Blue Mesa, Narrow Gauge, Morrow Point, and Crystal. Collectively, the reservoirs would have a capacity of about 1 million acre-feet. The powerplant, with an installed generating capacity of about 159,000 kilowatts, would develop a maximum of about 940 feet of static power head.

The Blue Mesa Dam, located 30 miles downstream from Gunnison, would be the largest of the series in the Curecanti unit. It would be an earth-fill structure about 350 feet high above its foundation and about 820 feet long at its crest. The reservoir would have a capacity of about 940,000 acre-feet at a high-water elevation of 7,520 feet. About 200,000 acre-feet of the reservoir capacity would be inactive. The active capacity would provide the principal seasonal river regulation for the unit powerplants. Recreational facilities would be provided at the reservoir.

Investigation and planning of the Curecanti unit are continuing in more detailed scope as required by the authorizing act.

Transmission division

The authorizing act of April 11, 1956, provides that project powerplants and transmission facilities shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates. To carry out the provisions of the law, a high-voltage transmission and grid will be constructed to interconnect the plants of the authorized units of the storage project and to effect interconnection with other existing Federal powerplants and utility systems in the area.

The transmission division includes the high-voltage lines from storage unit switchyards to substations at major load centers and points of interconnection and the substations at those points. Facilities of the transmission division will be extended as necessray to provide interconnections with future units of the storage project and with Other Federal plants and to provide for interconnection of future participating project transmission lines with the high-voltage grid. The extent and location of the high-voltage transmission grid will depend on the market area requirements for project power, the desires of power users to purchase project power, points of interconnection with other systems, and the final allotments of power to various users.

PARTICIPATING PROJECTS

Participating projects are those which will consume water of the upper Colorado River system for irrigation and other purposes and which will require assistance from power revenues of the storage project in the repayment of irrigation costs. An initial group of 11 participating projects was authorized by the act of April 11, 1956. These include the Paonia, Smith Fork, Florida, and Silt projects in Colorado; the Pine River extension in Colorado and New Mexico; the Hammond project in New Mexico; the central Utah project (initial phase) and Emery County project in Utah; and the Seedskadee, La Barge, and Lyman projects in Wyoming. The projects combined will provide water for a total of about 365,100 acres, including about 132,800 acres of full service land and about 232,300 acres of supplemental service land.

Brief descriptions of the 11 initial participating projects appear below. Data on irrigable area, reservoir storage capacity, and water supply are summarized in the table on page 8.

Paonia project

The Paonia project on the North Fork of the Gunnison River in west-central Colorado was partially constructed under the authorizing act of June 25, 1947. It was reauthorized by the act of April 11, 1956, and the entire development was linked with the basin fund as a participating project. The project will provide water to 2,200 acres of full-service land and 13,100 acres of supplemental-service land. It will provide incidental benefits to fish and wildlife, recreation, and flood control.

The Fire Mountain Canal was enlarged and partially extended under the intial authorization. Work yet to be accomplished under the 1956 reauthorization includes construction of the Paonia Reservoir on Muddy Creek to a capacity of 21,000 acre-feet, further extension of the Fire Mountain Canal, and rehabilitation of critical sections of the previously enlarged canal.

Pine River project extension

An extension will be constructed to the existing Pine River project, located in southwestern Colorado and northwestern New Mexico about 20 miles east of Durango, Colo. The extension will provide irrigation water for about 15,200 acres of full-service land, of which about 1,940 acres are within the Pine River Indian irrigation project. The extension will involve enlargement and extension of eight canals and ditches diverting from Pine River, a new diversion dam, and several small distribution laterals.

Smith Fork project

The Smith Fork project will be constructed in west-central Colorado along the Smith Fork of Gunnison River near Crawford. It will provide water for about 2,300 acres of full-service land and 8,200 acres of supplemental-service land. Recreational opportunities also will be provided. Construction features will include the Crawford Reservoir with 14,000 acre-feet of capacity, a diversion dam, feeder canals, and laterals.

Florida project

The Florida project will be constructed in southwestern Colorado on the Florida River. It will provide a full supply of water for about 6,300 acres of land and a supplemental supply for about 12,700 acres. Construction features will include the Lemon Reservoir with a capacity of about 23,000 acre-feet, a diversion dam, and distribution and drainage systems. An existing canal also will be enlarged. Operation of the project also will provide flood control and some enhancement of fish and wildlife values in the area.

Silt project

The silt project will provide water for about 1,900 acres of full-service land and 5,400 acres of supplemental-service land between Rifle and Elk Creeks in west-central Colorado. The project also will enhance fish and wildlife values in the area. Construction features will include the Rifle Gap Reservoir of 10,000-acre-foot capacity, a pumping plant, diversion dam and feeder canal, and laterals and drains. Some existing works will be rehabilitated.

Hammond project

The Hammond project in northwestern New Mexico will divert San Juan River water for irrigation of about 4,000 acres of full-service land along the river in the vicinity of Farmington and Bloomfield. Principal features of the development will be a diversion dam, distribution canal, pumping plant, and lateral and drainage systems.

Central Utah project (initial phase)

The central Utah project (initial phase) will be an extensive undertaking to develop water resources of the Uinta Basin, a segment of the Colorado River Basin in northeastern Utah. Part of the developed water will be conveyed westward for use in the Bonneville Basin in central Utah and the remainder will be used in the Uinta Basin. Reservoirs with a total capacity of about 1,663,000 acre-feet will make water available for about 28,600 acres of full-service land and about 131,800 acres of supplemental-service land. Four project powerplants will have a combined installed capacity of 61,000 kilowatts. Approximately 48,800 acre-feet of water will be provided annually for municipal, industrial and miscellaneous uses. The project will provide recreational benefits and will have value in flood and sediment control.

The potential Strawberry aqueduct will intercept flows of Rock Creek and streams west of Rock Creek. It will convey the water to the existing Strawberry Reservoir on Strawberry River which will be enlarged through donstruction of Soldier Creek Dam downstream from the present dam. The existing outlet tunnel from the reservoir will be enlarged. This tunnel conveys water westward through the Wasatch Mountain divide to the Bonneville Basin. In descending the west slope of the Wasatch Mountains, the water will pass through a series of four powerplants. In the Bonneville Basin the water will be used in an area extending from Salt Lake City south 80 miles to Nephi. Part of the use will be effected by exchanges involving the waters of Utah Lake, Provo River, and other streams. These exchanges will require construction of Bates Dam on Provo River, Hobble Creek Dam on Little Hobble Creek, and the Front Dam near Salt Lake City. Transmission lines will be constructed to serve local market areas and to interconnect with the main grid transmission system.

New project works to provide water for replacement and expanded irrigation and municipal use in the Uinta Basin will include Hanna Reservoir on the north fork of the Duchesne River, Starvation Reservoir on Strawberry River with a feeder canal from the Duchesne River, the Upalco Reservoir off-stream from Lake Fork River, the Stanaker Reservoir with feeder canal from Ashley Creek, and a service canal (Vernal unit), and Tyzack Reservoir on Brush Creek.

Emery County project

The Emery County project will be in the headwaters of the San Rafael River in east-central Utah. It will provide irrigation water for about 3,600 acres of full-service land and 20,500 acres of supplemental-service land and will provide for recreational opportunities. Joes Valley Reservoir with a total capacity of 57,000 acre-feet, a diversion dam, canal, laterals, and drains will be the principal features of the project.

Seedskadee project

The Seedskadee project will be constructed in southwestern Wyoming along the Green River below the authorized La Barge project. Principal works under the present tentative plan include a diversion dam on the river, conveyance canals, pumps, and distribution laterals. Such works will provide an irrigation water supply for about 60,700 acres of full-service land.

Modifications of the plan to provide storage and fish and wildlife facilities are being investigated. As the studies are still incomplete, however, the modifications are not included in the project data used in this report.

Lyman project

The Lyman project will be constructed in southwestern Wyoming along Blacks Fork of the Green River near the Wyoming-Utah boundary. It will supplement the irrigation water supply for about 40,600 acres of land. Bridger Reservoir will be constructed on Willow Creek to a capacity of 43,000 acre-feet. Other features will include feeder canals to the reservoir, return canals to distribute the reservoir releases, improvement of the Willow Creek channel, drainage, and improvement of the existing irrigation system.

La Barge project

The La Barge project will divert water directly from the Green River in southwestern Wyoming to provide irrigation water for about 8,000 acres of full-service land. Project works will include a diversion dam, conveyance canal, distribution laterals, and drains.

Summary of irrigation and power data: Colorado River storage project and participating projects

Units and projects	Irrigable area			Total reservoir storage capacity	Installed power-plant capacity	Average annual water supply	
	Full-service land	Supplemental service land	Total			Increase in usable irrigation supply	Increase in stream depletion
STORAGE UNITS	*Acres*	*Acres*	*Acres*	*Acre-feet*	*Kilowatts*	*Acre-feet*	*Acre-feet*
Glen Canyon				28,040,000	900,000		576,000
Flaming Gorge				3,930,000	108,000		62,000
Navaho				1,700,000			59,000
Curecanti				1,000,000	159,000		14,000
Subtotal				34,670,000	1,167,000		691,000
PARTICIPATING PROJECTS							
Paonia, Colo	2,200	13,100	15,300	21,000		20,100	9,800
Pine River extension, Colorado and New Mexico	15,200		15,200			45,450	28,300
Smith Fork, Colo	2,300	8,200	10,500	14,000		13,650	7,500
Florida, Colo	6,300	12,700	19,000	23,000		23,200	12,900
Silt, Colo	1,900	5,400	7,300	10,000		10,100	5,800
Hammond, N. Mex	4,000		4,000			18,400	9,300
Central Utah (initial phase), Utah	28,000	131,800	160,400	1,663,000	61,000	[1] 175,200	189,400
Emery County, Utah	13,600	20,500	24,100	57,000		32,400	15,500
Seedskadee, Wyo	60,700		60,700			225,800	110,400
Lyman, Wyo		40,600	40,600	43,000		82,600	
La Barge, Wyo	8,000		8,000			24,300	14,200
Subtotal	132,800	232,300	365,100	1,831,000	61,000	621,100	403,100
Total	132,800	232,300	365,100	36,501,000	1,228,000	621,100	1,094,100

[1] In addition, an average of 48,800 acre-feet annually will be made available for municipal, industrial, and miscellaneous uses under the initial phase of the central Utah project.

Project Costs and Construction Schedule

COST ESTIMATES

Construction costs

The total construction cost of the 4 initial units and transmission division of the Colorado River storage project and the 11 initial participating projects, including costs of past and future investigations, is estimated at $992,174,000. Of the total, $677,382,000 represents the cost of the storage units and transmission division and $314,792,000 the cost of the participating projects. The cost estimate is the latest official estimate of the Bureau of Reclamation and cooperating agencies. It is based generally on the price level of January 1957 except that bid prices were used where available and actual costs of past investigations and construction were used. Since the location of facilities in the transmission division has not been definitely determined, the construction cost of such facilities was estimated on the basis of an average of about $135 per kilowatt of installed powerplant generating capacity. The cost estimates will be revised periodically to include costs of completed work, changes in estimates resulting from future modifications in plans, and latest available data including bid prices.

Operation, maintenance, and replacement costs

Operation, maintenance, and replacement costs are estimated at $7,729,000 annually, including $6,282,000 for the storage units and transmission division and $1,447,000 for the participating projects. The operation and maintenance costs were estimated at price levels of the 3-year period 1954–56 and the replacement costs were based on current construction cost estimates. The estimates shown above, which were used in the repayment analysis, include replacement costs computed at 2⅞ percent interest over a 100-year period.

Summary

The table on the following page summarizes construction costs and annual operation, maintenance, and replacement costs for each storage unit, the transmission division, and each participating project. For convenience in the economic and financial analysis in later sections of the report, the table also itemizes expenditures through June 30, 1957, the costs used as a basis for the benefit-cost analysis, and the costs to be allocated.

Summary of project costs: Colorado River storage projects and participating projects

[In thousands of dollars]

Units and projects	Total construction costs [1]	Total contributed funds [2]	Costs through June 30, 1957									Total costs through June 30, 1957	Cost base for benefit-cost analysis (col. 2 minus sum of cols. 3, 4, 5, and 6)	Costs to be allocated (col. 2 minus sum of cols. 3 and 5)	Annual operation, maintenance, and replacement costs [3]
			Expended for investigations					Expended for construction							
			From reclamation fund	From Colorado River development fund	From Upper Colorado River Basin fund	From contributed funds	Total costs of past investigations	Construction appropriation	From Upper Colorado River Basin fund	From contributed funds	Total costs of past construction				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
STORAGE UNITS															
Glen Canyon	325,704	2,295	344	615		60	1,019		5,378	494	5,872	6,891	322,450	322,794	2,736
Flaming Gorge	66,591		60	86			146		597		597	743	66,445	66,505	406
Navajo	[4] 42,579		6	39			45		221		221	266	[4] 42,534	[4] 42,540	24
Curecanti	[5] 84,963		103	97	94		294					294	[5] 84,669	[5] 84,866	749
Transmission division	157,545		50	100			150		38		38	188	157,395	157,445	2,367
Subtotal	677,382	2,295	563	937	94	60	1,654		6,234	494	6,728	8,382	673,493	674,150	6,282
PARTICIPATING PROJECTS															
Paonia, Colo	7,813		8	49	185		242	1,997			1,997	2,239	7,571	7,764	23
Pine River extension, Colorado and New Mexico	5,539		54	53	48		155					155	5,384	5,498	21
Smith Fork, Colo	3,533		29	72	16		117					117	3,416	3,461	12
Florida, Colo	7,433		12	22	65		99					99	7,334	7,411	16
Silt, Colo	3,548		55	17	13		85					85	3,463	3,531	12
Hammond, N. Mex	2,441		63	8	107		178					178	2,263	2,433	18
Central Utah (initial phase) Utah	235,850	62	273	1,068	306	62	1,709					1,709	[6] 228,391	234,720	1,040
Emery County, Utah	9,913	1	13	18	10	1	42					42	9,871	9,894	40
Seedskadee, Wyo	25,470		41	410	259		710					710	24,760	25,060	183

Lyman, Wyo	11,436		52	66	1		113					113	11,323	11,376	62
La Barge, Wyo	1,816		21	65			86					86	1,730	1,751	20
Subtotal	314,792	63	621	1,342	1,010	63	3,536	1,997			1,997	5,533	305,506	312,837	1,447
Total	992,174	2,358	1,184	2,779	1,104	123	5,190	1,997	6,234	494	8,725	13,915	978,999	987,037	7,729

[1] Based on January 1957 price level except that bid prices were used where available and actual costs of past investigation and construction were used.

[2] Contributed funds, some of which have been expended to date, include $60,000 from city of Los Angeles for investigation of Glen Canyon Dam site; $1,635,000 from State of Arizona and $600,000 from Bureau of Public Roads for improvement of Glen Canyon bridge and access road to meet Federal highway standards; and $63,000 from the State of Utah and private groups for investigation of the central Utah and Emery County projects.

[3] Operation and maintenance costs are based on 1954–56 price levels and replacement costs on current prices. Figures shown include replacement costs at 2+ percent interest for use in the repayment analysis.

[4] Includes $207,000 for recreational facilities at Navajo unit.

[5] Includes $452,000 for recreational facilities at Curecanti unit.

[6] Excludes $5,750,000 for construction of certain central Utah project features to ultimate phase capacity.

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CONSTRUCTION SCHEDULE

Expenditures by the Bureau of Reclamation for advance planning and construction of the authorized storage units and participating projects are tentatively programed as shown in the schedule on the following page. Construction already has been started on the principal features of the Colorado River storage project, except those of the Curecanti unit. The first participating projects programed are the Paonia, Hammond, and Seedskadee projects and the Vernal unit of the central Utah project, all of which are scheduled for the start of construction in fiscal year 1961.

The advance planning and construction schedule has been followed in the economic and financial analysis discussed later in this report. The program as now outlined could be substantially modified, however, as actual progress will be determined by congressional appropriations. It will be desirable for work on the storage project to follow the general rate established by contracts now in force and to be awarded in fiscal year 1958. Any slowdown in the rate established would increase costs of interest during construction and in the case of the Glen Canyon and Flaming Gorge units would delay availability of power revenues to assist in repayment of irrigation costs.

WATER SUPPLY

Water supplies available for development by authorized units of the Colorado River storage project and participating projects have been estimated on the basis of recorded flows, with consideration given to downstream uses and past and anticipated upstream depletions. It is not within the scope of this report to summarize the water-supply studies made for each participating project. A brief summary of the water supply available to the Upper Colorado River Basin and units of the storage project is presented in the following paragraphs, however, in view of the importance of water supply as related to project power production and revenues.

STREAMFLOWS

Three terms are commonly used to define flows of the Colorado River. Historical flows are those which have actually occurred. Virgin flows are the estimated flows which would have occurred without man-made depletions. Present modified flows are those which would have occurred in the past had the present level of development and depletions been in full effect.

Average annual historical and present modified flows at units of the storage project have been estimated as shown in the following table.

Average annual flows for 1914–1945 period [1]

[In acre-feet]

Unit	Historical flow	Present modified flow
Glen Canyon	13,763,000	13,064,000
Flaming Gorge	1,636,000	1,615,000
Navaho	1,290,000	1,244,000
Curecanti (Morrow Point Dam site)	1,270,000	1,270,000

[1] Period adopted in negotiations for the Upper Colorado River Basin compact as representative of longtime flow conditions.

Schedule of construction and advance planning[1]
Colorado River Storage project and participating projects
(Unit--$1,000)

Units and projects	Estimated total cost	Total to June 30, 1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Balance to complete
Storage units																					
Glen Canyon	325,704	6,891	24,624	29,669	48,460	56,600	55,600	43,860	29,806	18,056	12,138										
Flaming Gorge	66,591	743	2,200	2,567	6,995	10,075	12,135	13,935	10,928	7,013											
Navajo	2/42,372	266	906	26	20	1,700	9,500	13,200	10,000	6,754											
Curecanti	3/84,511	294	69	107	35	0	0	0	0	1,400	4,765	8,000	7,300	7,990	7,350	13,400	11,242	9,084	8,200	5,275	
Transmission division	157,545	188	110	205	1,885	7,700	22,730	28,000	35,942	23,000	17,785	6,400	1,400	1,600	1,700	2,000	2,000	2,000	1,600	1,300	
Subtotal	676,723	8,382	27,909	32,574	57,395	76,075	99,965	98,995	86,676	56,223	34,688	14,400	8,700	9,590	9,050	15,400	13,242	11,284	9,800	6,575	
Participating projects																					
Paonia, Colo.	7,813	2,239	62	0	0	500	1,665	2,336	1,011												
Pine River extension, Colo. and N. Mex.	5,539	155	127	9	6	0	0	510	1,147	2,000	1,585										
Smith Fork, Colo.	3,533	117	87	2	0	0	0	737	1,091	1,347	152										
Florida, Colo.	7,433	99	84	81	6	0	0	0	0	0	750	1,700	2,400	2,313							
Silt, Colo.	3,548	85	57	28	7	0	0	0	0	0	1,000	1,773	598								
Hammond, N. Mex.	2,441	178	104	2	0	500	1,100	557													
Central Utah, Utah	235,850	1,709	448	250	318	968	2,570	2,437	2,849	6,066	7,347	11,428	12,286	13,941	15,965	21,967	23,613	21,534	9,744	9,330	71,080
(Vernal unit)	(6,956)	(432)	(100)	0	0	(500)	(2,100)	(2,100)	(1,000)	(300)	(300)	(124)									
Emery County, Utah	9,913	42	24	52	81	68	0	0	0	0	1,188	3,200	3,253	2,005							
Seedskadee, Wyo.	25,470	710	346	74		500	1,180	2,989	4,307	4,713	4,928	2,355	1,852	1,136	380						
Lyman, Wyo.	11,436	113	14	124	178	81	0	0	1,248	2,497	3,683	2,758	740								
LaBarge, Wyo.	1,816	86	5	18	80	46	0	0	0	0	0	693	700	188							
Subtotal	314,792	5,533	1,358	640	676	2,663	6,515	9,566	11,653	16,623	20,633	23,907	21,829	19,583	16,345	21,967	23,613	21,534	9,744	9,330	71,080
Total	991,515	13,915	29,267	33,214	58,071	78,738	106,480	108,561	98,329	72,846	55,321	38,307	30,529	29,173	25,395	37,367	36,855	32,618	19,544	15,905	71,080

1/ The construction program is underlined. This table presents cost figures which relate to but are not identical with the appropriation and obligation data shown in program documents.
2/ Does not include $207,000 for recreational facilities.
3/ Does not include $452,000 for recreational facilities.

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INTERIOR - RECLAMATION W.C. UTAH

At a point 15 miles below Glen Canyon Dam site, the Paria River contributes an average of about 25,000 acre-feet annually to the Colorado River, but the flow is erratic from year to year. For all practical purposes the flow at Glen Canyon approximates the flow at Lee Ferry, 16 miles downstream, the dividing point on the river between the upper and lower basins. The average annual virgin flow at Lee Ferry over the 1914–45 period is estimated at about 15,640,000 acre-feet.

STREAM DEPLETIONS

Annual man-made depletions in the Upper Colorado River Basin from existing developments and developments authorized prior to 1949, the year the Upper Colorado River Basin compact became effective, are estimated to average about 2,550,000 acre-feet. A number of years will be required for full development of projects authorized prior to 1949. The 2,550,000-acre-foot depletion is therefore used in this report as also applying to fiscal year 1963, when initial operation of the storage project is scheduled and is also referred to as the present depletion. On the basis of the annual depletion of 2,550,000 acre-feet, the upper basin is utilizing only about one-third of the consumptive use apportioned to it by the Colorado River compact.

As a basis for evaluating the Colorado River storage project and participating projects, a projection was made of future stream depletions estimated to occur in the upper basin during the 100-year period from fiscal year 1963 through fiscal year 2062. It was estimated that the depletions by 2062 would total about 6,191,000 acre-feet annually, consisting of 2,550,000 acre-feet from existing developments, 691,000 acre-feet from evaporation from the authorized storage units, and 2,950,000 acre-feet from new projects including the authorized participating projects and other future Federal and non-Federal developments. The 2,950,000-acre-foot depletion from new projects expressed as a weighted average amount over the 100-year period approximates 1,800,000 acre-feet, a figure used hereinafter in the project economic analysis. Assumed average depletions are summarized in the table below.

Projected depletions [1]

[In thousand acre-feet]

Fiscal year	Depletion from existing and new projects in upper basin	Average evaporation losses from storage units [2]	Total
1963	2,550	Negligible	2,550
1970	3,150	691	3,841
2020	4,750	691	5,441
2062	5,500	691	6,191

[1] Based on averages for runoff period 1914 to 1945, inclusive.
[2] Estimated average stream depletions due to evaporation from Glen Canyon, Flaming Gorge, Navaho, and Curecanti storage units.

REPLACEMENT STORAGE

The holdover reservoirs in the Upper Colorado River Basin are designed to impound water in years of high runoff and release such water during prolonged dry periods to permit the upper basin to

increase its uses and still meet its compact obligations for flows at Lee Ferry for the benefit of the lower basin and Mexico.

The estimated total active storage capacity available in fiscal year 2062 in the four authorized units after sediment encroachment is shown in the following table. This available capacity may be appropriately referred to as replacement storage capacity since it will be used, among other things, to replace to the lower basin an appropriate part of the natural streamflow consumed upstream in the upper basin during prolonged drouth periods.

Estimated active storage capacities in fiscal year 2062

[In thousand acre-feet]

Unit	Fiscal year of initial storage	Initial active active storage capacity	Sediment deposition to end of fiscal year 2062		Remaining active storage capacity in fiscal year [1] 2062
			In dead storage capacity	In active storage capacity	
Glen Canyon	1963	21,505	5,260	4,180	17,325
Flaming Gorge	1964	3,600	70	130	3,470
Navaho [1]	1964	1,028	250	80	948
Curecanti	1969	720	10	20	700
Total		26,853	5,590	4,410	22,443

[1] The storage capacity at the Navaho unit may be needed ultimately by the potential Navaho irrigation project and other local developments and hence may not be available to meet compact obligations. This situation will be reviewed when the Navaho irrigation project is authorized.

RESERVOIR OPERATIONS

Two studies were made of the coordinated operation of the four authorized units of the storage project. The first was an initial reservoir filling study to bring the reservoirs to power operating levels and to roughly determine power production potentialities to March 31, 1971. The second was a more detailed study covering coordinated reservoir operations to estimate annual power production after March 31, 1971.

The initial filling study was based on average streamflow conditions for the 32-year period 1914–45. The average flow was progressively modified throughout the filling period in accordance with the projected schedule of upstream depletions. Allowances were made for reservoir evaporation and for increases in storage at upstream reservoirs. Each reservoir was first filled to the minimum power operating level in order that power generation might be obtained as early as practicable. Thereafter additional storage was progressively accumulated at all reservoirs from available storable supplies. The filling study indiactes that Glen Canyon, the first reservoir scheduled for completion, would start filling at the beginning of fiscal year 1963. All the reservoirs would fill to reasonable operating levels by March 31, 1971, and the major part of the system power output at the three storage units would then be attained. An annual summary of the initial filling operation for the Glen Canyon Reservoir with allowance for filling of the storage project upstream reservoirs is shown on the following page.

The post-filling reservoir operation study was based on several repetitions of a runoff cycle similar to the 32-year runoff period 1914 to 1945. Data corresponding to the 32 years in sequence were inserted in the study for fiscal year 1971 through fiscal year 2002 and the process was repeated for each 32 years thereafter with proper adjustments for increased depletions. Annual releases for system

energy generation were made in varying amounts in accordance with normal operating and forecast procedures. The monthly pattern of releases for energy generation followed the pattern of energy requirements estimated for 1980 in the project power market area.[1] Additional releases made in anticipation of later spills were also utilized in the generation of energy.

Expected operation of Glen Canyon Reservoir during initial filling period

[In million acre-feet]

Year beginning Apr. 1 [1]	1914-45 average annual present modified flow at Glen Canyon Dam	Adjustments for new upstream uses		Assumed inflow to Glen Canyon Reservoir	Losses	Release from Glen Canyon Reservoir	Total storage in Glen Canyon Reservoir at end of year
		Increase in consumptive use including reservoir evaporation	Increase in storage at upstream reservoirs				
1961	13.1			13.1		13.1	0
1962	13.1	0.1		13.0		11.5	1.5
1963	13.1	.1	0.2	12.8	0.1	8.7	5.5
1964	13.1	.1	.6	12.4	.2	8.8	8.9
1965	13.1	.2	.7	12.2	.3	8.9	11.9
1966	13.1	.3	.6	12.2	.4	9.0	14.7
1967	13.1	.4	.7	12.0	.4	10.4	15.9
1968	13.1	.5	.6	12.0	.5	10.4	17.0
1969	13.1	.6	.5	12.0	.5	10.4	18.1
1970	13.1	.7	.4	12.0	.5	10.5	19.1

[1] Annual summary is based on years beginning Apr. 1 when Lake Mead and Glen Canyon Reservoir will normally be at lowest stage.

Power Production and Marketing

POWER MARKET AREA AND REQUIREMENTS

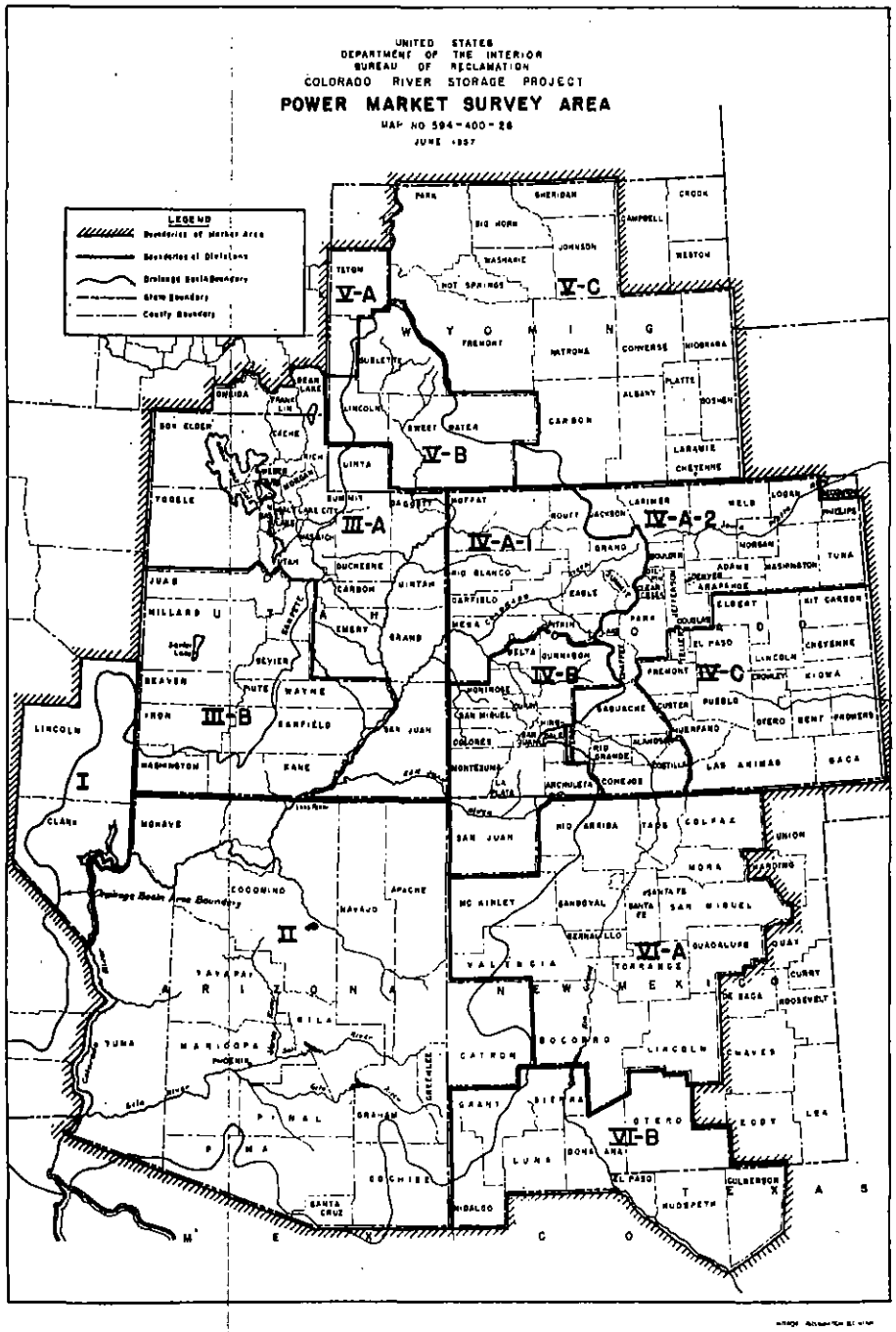
The Federal Power Commission is currently making a power market survey for the Colorado River storage project. The market area covered by the survey is shown on the map on the following page.

It is estimated that in addition to capacity and generation from existing and scheduled plans in the market area, not including scheduled plants of the Colorado River storage project, about 3,659,000 kilowatts of generating capacity and 14,313 million kilowatt-hours of generation will be needed by 1970 to meet new power requirements throughout the market area. The estimated additional requirements for 1970 and 1980 are summarized below.

Additional power and energy requirements

Division number	Principal State	1970		1980	
		Thousand kilowatts	Million kilowatt-hours	Thousand kilowatts	Million kilowatt-hours
I	Nevada	228	1,247	500	2,783
II	Arizona	954	2,871	2,606	11,770
III	Utah	930	4,612	1,881	9,942
IV	Colorado	1,146	4,708	2,638	12,134
V	Wyoming	194	674	478	2,170
VI	New Mexico	201	201	496	1,802
	Total	3,659	14,313	8,699	40,601

[1] Pattern of energy requirements was taken from preliminary data for a power market survey that is being made by the Federal Power Commission for the Colorado River storage project.


UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
POWER MARKET SURVEY AREA
MAP NO 594-400-26
JUNE 1957
LEGEND
Boundaries of Market Area
Boundaries of Divisions
Drainage Basin Boundary
State Boundary
County Boundary
V-A
V-C
V-B
III-A
IV-A-1
IV-A-2
III-B
IV-B
IV-C
I
II
VI-A
VI-B
Drainage Basin Area Boundary
WYOMING
ARIZONA
NEW MEXICO
COLORADO
UTAH
TEXAS

POWER PRODUCTION

Powerplants are presently planned at 3 of the 4 authorized units of the Colorado River storage project and at the central Utah participating project. The total installed generating capacity will be 1,228,000 kilowatts, with the installed capacity at each powerplant as tabulated on page 8. With allowances made for peak-load transmission losses, an estimated 1,109,000 kilowatts of power can be delivered to load centers.

Future power production has been estimated on the basis of coordinated reservoir operation studies as previously discussed. In accordance with the operation studies, power production will commence at the beginning of fiscal year 1965 at the Glen Canyon and Flaming Gorge units, in fiscal year 1970 at the Curecanti unit, and in fiscal year 1974 at the central Utah project. All powerplants will be completed and in full production by about the end of fiscal year 1985. The schedule of estimated energy deliverable to load centers is shown in the table below.

Estimated energy deliverable to load centers from power plants—Colorado River storage project and Central Utah project

[In million kilowatt-hours]

Fiscal year	Colorado River storage project			Central Utah project	Total		
	Glen Canyon	Flaming Gorge	Curecanti		Firm	Nonfirm	Total
1965	2,835	315	----------	----------	1,500	1,650	3,150
1966	3,032	268	----------	----------	2,950	400	3,350
1967	3,450	300	----------	----------	3,200	550	3,750
1968	3,952	298	----------	----------	3,750	500	4,250
1969	4,049	401	----------	----------	3,950	500	4,450
1970	4,079	480	241	----------	4,250	550	4,800
1971	4,066	540	294	----------	4,250	650	4,900
Average 1972-81	5,303	529	782	236	5,700	1,150	6,850
Average 1982-91	4,534	402	804	360	5,550	550	6,100
Average 1992-2001	3,412	360	718	360	4,850	0	4,850
Average 2002-11	4,825	497	866	[1] 362	5,400	1,150	6,550
Average 2012-21	4,397	440	792	362	5,200	800	6,000
After 2021 [2]	3,674	388	776	362	4,850	350	5,200

[1] Annual amounts of energy from the central Utah project are assumed to remain constant after 2001.
[2] For the Colorado River storage project, the annual amounts of energy after 2021 are assumed to be constant and equal to the 20-year average obtained by continuing the study from the year 2022 through 2041.

The average annual energy deliverable to load centers, adjusted to account for time-value considerations in determining the average equivalent energy over a 100-year period after each plant is in full production, is 5,920 million kilowatt-hours. This includes 5,558 million kilowatt-hours for the units of the Colorado River storage project and 362 million kilowatt-hours for the central Utah project. The average annual equivalent capacity for a 100-year period when adjusted in the same manner as the energy is 1,095,000 kilowatts, including 1,036,000 kilowatts for the storage project and 59,000 kilowatts for the central Utah project.

During the filling period, firm energy for each year is considered to be all the energy that can be utilized within the monthly load pattern to meet the annual load growth estimated for the power market area by the Federal Power Commission. Beginning with the post-filling operation of the reservoirs, annual firm energy has been

determined for each subsequent 10-year period to be the average annual generation for each period within the monthly load pattern estimated by the Federal Power Commission. Data from the study indicate that the installed capacity of 1,228,000 kilowatts is required in the initial decades to market power and energy at the estimated load factor for the market area of the study. When stream depletions increase in later years, project power could be marketed at lowerload factors than the area load factor. Marketing the power initially at the load factor for the area and later at lowerload factors will result in utilizing the project plants most effectively to supply the requirements of the area when operated in conjunction with other power systems.

Preliminary data from the power market survey indicate that project-produced power and energy can be readily absorbed in the market area as it becomes available from the project powerplants. The estimated requirement by 1970 for 3,659,000 kilowatts of new generating capacity and 14,313 million kilowatt-hours of generation can only be partially satisfied by the 1,109,000 kilowatts of capacity and 6,850 million kilowatt-hours of energy deliverable to load centers from the authorized units of the Colorado River storage project and the central Utah participating project.

POWER RATES

As shown in the preliminary repayment study on page 48, an average rate of 6 mills per kilowatt-hour for firm energy and 2.5 mills per kilowatt-hour for nonfirm energy will provide sufficient revenues to repay all reimbursable power costs and additional revenues to assist in repayment of irrigation costs as required by the authorizing legislation. Definite rate schedules for firm and nonfirm power and energy will be developed in accordance with departmental policy and marketing criteria when costs are more firmly established and a need for such schedules exists.

Summary of Procedures for Economic and Financial Analysis

Procedures adopted for the economic and financial analysis of the Colorado River storage project and participating projects are consistent with present policies of the Bureau of Reclamation and with the provisions of the project authorizing act of April 11, 1956. Salient information concerning the procedures is listed below.

(1) Analyses were made of the storage project units and participating projects in the following combinations:

(*a*) The four storage units were analyzed separately and jointly for benefit-cost comparisons and jointly for cost allocations and repayment.

(*b*) The 11 participating projects were each analyzed separately.

(*c*) The 4 storage units and 11 participating projects were analyzed jointly to show the overall expenditure and repayment requirements.

(2) Construction cost estimates are the latest official estimates of the Bureau of Reclamation and cooperating agencies and are based on the January 1957 price level except that bid prices are used where

available and actual costs of past investigations and construction are included.

(3) Operation and maintenance cost estimates are based on 1954–56 price levels. Replacement costs are based on current construction cost estimates.

(4) A 100-year period is used in the benefit-cost and cost-allocation analyses.

(5) Water supply, power production, and related studies are based on the assumption that average annual stream depletions from projects in the upper basin will increase from an average of 2,550,000 acre-feet at present to an average of 5,500,000 acre-feet by the end of the 100-year period from fiscal year 1963 through fiscal year 2062. In addition depletions due to evaporation losses from the 4 authorized storage units are estimated to average 691,000 acre-feet at the end of the 100-year period.

(6) Benefits for use in the benefit-cost and cost-allocation analyses are determined for all project purposes in accordance with existing procedures of the Bureau of Reclamation. Irrigation benefits are evaluated as direct, indirect, and public and are based on anticipated agricultural conditions without and with the development. Benefits from power and municipal and industrial water are based on the cost of the most economical single-purpose alternative that is likely to be developed in the absence of the project and that would provide benefits comparable to those of the project. Flood control, recreation, and fish and wildlife benefits are evaluated by the Corps of Engineers, National Park Service, and Fish and Wildlife Service, respectively.

(7) A 2½-percent interest rate is used in the benefit-cost and cost-allocation analyses, except that an interest rate of 6¼ percent for private financing is used in estimating alternative power costs and annual power benefits.

(8) Taxes are included in the estimated cost of the most economical alternative for project power in evaluating power benefits. Accordingly an amount equal to the taxes is included in the cost of project power in benefit-cost comparisons. No provision for payment of a tax equivalent is made in power repayment studies.

(9) All costs of past investigations and construction costs paid from contributed funds are excluded from the benefit-cost analysis. Contributed funds and expenditures from the Colorado River development fund are excluded from the cost allocation and repayment analyses.

(10) In the benefit-cost analysis a share of the cost of the storage project is apportioned to irrigation and other water-consuming uses initiated subsequent to 1949, the year the Upper Colorado River Basin compact became effective.

(11) Costs are allocated by the separable cost-remaining benefits method except that only separable costs are allocated to recreation and fish and wildlife.

(12) Repayment of all reimbursable costs of units and participating projects is based on a 50-year period following completion of each unit, project, or separable feature thereof, with appropriate development periods in the case of irrigation. The exceptions to this are in the repayment of the Pabnia and Eden projects for which repayment

periods of 68 and 60 years, respectively, have been authorized. The costs allocated to flood control, recreation, and fish and wildlife are nonreimbursable. Irrigation costs are repayable without interest. Costs allocated to power and municipal and industrial use, including interest during construction, are repayable with interest. In this study an interest rate of 2⅞ percent is used in the repayment calculations in all instances where costs are repayable with interest. This rate has been officially determined in the manner prescribed by law as applicable to the Glen Canyon, Flaming Gorge, and Navaho units. An official determination of rates applicable to the Curecanti unit and to participating projects has not yet been made.

(13) Average rates of 6 mills per kilowatt-hour for firm energy and 2.5 mills per kilowatt-hour for nonfirm energy are used in this analysis. These rates are estimated to be required to return enough revenue to pay, under the provisions of the authorizing act, the following construction costs in addition to the annual operating costs:

(*a*) Costs allocated to power with interest.

(*b*) Storage unit costs allocated to irrigation without interest.

(*c*) Costs of participating projects that are allocated to irrigation and that are beyond the repayment ability of the irrigators, without interest.

(14) Anticipated revenue collections from conservancy-type districts are included as participating project revenues.

Benefit-Cost Analysis

The economic desirability of developing the Colorado River storage project and participating projects was measured by a comparison of anticipated benefits from a national standpoint and the Federal costs of development. Both benefits and costs were converted to average annual equivalent values at 2½ percent interest over a 100-year period beginning with the initial operation of each individual storage unit and participating project.

BENEFITS

The benefit-cost comparisons were based on consideration of all benefits from the authorized developments that could be evaluated in monetary terms, including substantial benefits from irrigation and power and smaller amounts of benefits from municipal and industrial water, flood control, fish and wildlife conservation, recreation, and other project services.

Irrigation benefits

Irrigation benefits are estimated to average $15,464,000 annually over the 100-year period of analysis. About $6,712,000 represents storage benefits assignable to future participating projects, and about $8,752,000 represents benefits estimated for the 11 initial participating projects.

The irrigation benefit used in the cost allocation of the storage project is $9 million annually. This estimate is the sum of the $6,712,000 for future participating projects and $2,288,000 representing the value of regulatory storage to the 11 participating projects.

Benefit-cost comparison for Colorado River Storage project and participating projects
(50-year period of analysis with 2 1/2 percent interest rate)
(Unit—$1,000)

Units and projects	Economic costs: Investment: Construction costs exclusive of contributed funds and costs of past investigations	Investment: Interest during construction at 2 1/2 percent	Investment: Total	Investment: Annual equivalent of total	Annual operation, maintenance, and replacement costs	Assigned annual costs of replacement storage 1/	Annual tax revenues foregone because of public power investment	Total annual equivalent costs	Annual benefits: Irrigation 2/: Direct	Irrigation 2/: Indirect	Irrigation 2/: Public	Irrigation 2/: Total	Power	Municipal and industrial water	Flood control	Fish and wildlife	Recreation	Sedimentation control	Total	Benefit-cost ratios: Direct benefits	Benefit-cost ratios: Total benefits
Storage units 3/																					
Glen Canyon	453,189	32,866	486,055	17,137	3,994		6,885	28,016				3,930	31,957						35,887		1.3:1
Flaming Gorge	77,230	4,796	82,026	2,892	550		824	4,266				1,170	3,559						4,729		1.1:1
Navajo	42,534	2,403	44,937	1,584	25			1,609				4/1,400			31		130		1,561		1.0:1
Curecanti	100,540	4,694	105,234	3,710	969		1,216	5,895				212	5,683				86		5,981		1.0:1
Subtotal	673,493	44,759	718,252	25,323	5,538		8,925	39,786				5/6,712	41,199		31		216		48,158		1.2:1
Participating projects																					
Paonia, Colo.	7,571	289	7,860	277	23	20		320	335	336		671			2	4	3		680	1.1:1	2.2:1
Pine River extension, Colo. and N. Mex.	5,384	359	5,743	202	21	56		279	244	207	124	575				-2	3		573	.9:1	2.1:1
Smith Fork, Colo.	3,416	141	3,557	125	12	16		153	110	45		155							158	.7:1	1.0:1
Florida, Colo.	7,334	314	7,648	270	16	26		312	178	134	45	357			6	6			369	.6:1	1.2:1
Silt, Colo.	3,463	134	3,597	127	12	12		151	114	76	17	207				2			209	.8:1	1.4:1
Hammond, N. Mex.	2,263	62	2,325	82	18	18		118	102	93	32	227							227	.9:1	1.9:1
Central Utah (initial phase), Utah	6/228,391	11,384	239,775	8,454	1,040	378	502	10,374	2,165	1,255	909	4,329	2,423	1,437	85		428	2	8,704	.6:1	.8:1
Emery County, Utah	9,871	297	10,168	359	40	32		431	282	123	42	447				-1	48		494	.8:1	1.1:1
Seedskadee, Wyo.	24,760	1,230	25,990	916	183	220		1,319	694	721	354	1,769				-10			1,759	.5:1	1.3:1
Lyman, Wyo.	11,323	475	11,798	416	62			478	281	77	37	395				-4			391	.6:1	.8:1
La Barge, Wyo.	1,730	48	1,778	63	20	28		111	84	104	45	233							233	.8:1	2.1:1
Subtotal	305,506	14,733	320,239	11,291	1,447	806	502	14,048	4,589	3,171	1,605	9,365	2,423	1,437	93	-5	482	2	13,797	.6:1	1.0:1
Total	978,999	59,492	1,038,491	36,614	6,985	806	9,308	53,832	4,589	3,171	1,605	16,077	42,812	1,437	124	-5	698	2	61,955		1.1:1

1/ Estimated at $2 per acre-foot of increased stream depletion.
2/ No adjustment made for development period.
3/ Costs of Transmission division have been prorated among the units of the storage project.
4/ Benefits from the Navajo Indian irrigation project have been assigned to the Navajo unit in the proportion that the cost of the Navajo Reservoir bears to the total cost of the Navajo project including Navajo Reservoir.
5/ Storage benefits assignable to future participating projects.
6/ Excludes $5,750,000 for construction of certain Central Utah project features to ultimate phase capacity.

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Benefit-cost comparison for Colorado River Storage project and participating projects
(100-year period of analysis with 2 1/2 percent interest rate)
(Unit--$1,000)

Units and projects	Economic costs: Investment: Construction costs exclusive of contributed funds and costs of past investigations	Investment: Interest during construction at 2 1/2 percent	Investment: Total	Annual equivalent of total	Annual operation, maintenance, and replacement costs	Assigned annual costs of replacement storage 1/	Annual tax revenues foregone because of public power investment	Total annual equivalent costs	Annual benefits: Irrigation 2/: Direct	Irrigation 2/: Indirect	Irrigation 2/: Public	Irrigation 2/: Total	Power	Municipal and industrial water	Flood control	Fish and wildlife	Recreation	Sedimentation control	Total	Benefit-cost ratios: Direct benefits	Benefit-cost ratios: Total benefits
Storage units 3/																					
Glen Canyon	453,189	32,866	486,055	13,275	4,893		6,775	24,943				3,930	31,216						35,146		1.4:1
Flaming Gorge	77,230	4,796	82,026	2,240	590		816	3,646				1,170	3,510						4,680		1.3:1
Navajo	42,534	2,403	44,937	1,227	25			1,252				4/1,400			31		130		1,561		1.2:1
Curecanti	100,540	4,694	105,234	2,874	1,027		1,215	5,116				212	5,663				86		5,875		1.1:1
Subtotal	673,493	44,759	718,252	19,616	6,535		8,806	34,957				5/6,712	40,389		31		216		47,262		1.4:1
Participating projects																					
Paonia, Colo.	7,571	289	7,860	215	23	20		258	318	322		640			2	4	3		649	1.3:1	2.5:1
Pine River extension, Colo. and N. Mex.	5,384	359	5,743	157	21	56		234	216	183	110	509				-2			507	.9:1	2.2:1
Smith Fork, Colo.	3,416	141	3,557	97	12	16		125	107	43		150					3		153	.9:1	1.2:1
Florida, Colo.	7,334	314	7,648	209	16	26		251	170	128	43	341			6	6			353	.7:1	1.4:1
Silt, Colo.	3,463	134	3,597	98	12	12		122	109	73	16	198				2			200	.9:1	1.6:1
Hammond, N. Mex.	2,263	62	2,325	64	18	18		100	91	83	28	202							202	.9:1	2.0:1
Central Utah (initial phase), Utah	6/228,391	11,384	239,775	6,546	1,040	378	502	8,469	2,063	1,196	866	4,125	2,423	1,437	85		428	2	8,500	.8:1	1.0:1
Emery County, Utah	9,871	297	10,168	278	40	32		350	269	117	40	426				-1	48		473	.9:1	1.3:1
Seedskadee, Wyo.	24,760	1,230	25,990	710	183	220		1,113	615	639	313	1,567				-10			1,557	.5:1	1.4:1
Lyman, Wyo.	11,323	475	11,798	322	62			384	277	75	36	388				-4			384	.7:1	1.0:1
La Barge, Wyo.	1,730	48	1,778	49	20	28		97	74	92	40	206							206	.8:1	2.1:1
Subtotal	305,506	14,733	320,239	8,738	1,447	806	502	11,503	4,309	2,951	1,492	8,752	2,423	1,437	93	-5	482	2	13,184	.8:1	1.1:1
Total	978,999	59,492	1,038,491	28,354	7,982	806	9,308	46,460	4,309	2,951	1,492	7/15,464	42,812	1,437	124	-5	698	2	60,446		1.3:1

1/ Estimated at $2 per acre-foot of increased stream depletion.
2/ Adjusted for development period.
3/ Costs of Transmission division have been prorated among the units of the storage project.
4/ Benefits from the Navajo Indian irrigation project have been assigned to the Navajo unit in the proportion that the cost of the Navajo Reservoir bears to the total cost of the Navajo project including Navajo Reservoir.
5/ Storage benefits assignable to future participating projects.
6/ Excludes $5,750,000 for construction of certain Central Utah project features to ultimate phase capacity.
7/ Includes storage benefit of $6,712,000 for future projects and $2,288,000 included in the benefits of the 11 participating projects.

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The irrigation benefit from participating projects includes direct, indirect, and public benefits. About $4,309,000 of the total represents direct benefits, measured by the increase in net farm income that will be realized with project development. Approximately $2,951,000 represents indirect benefits, measured by the increased profits of businesses handling, processing, and marketing products from the developments and of enterprises supplying goods and services to project farms. The remaining $1,492,000 will be of a public nature realized from the increase or improvement in community facilities and services and stabilization of the local and regional economy.

Benefits from irrigation were evaluated on the basis of average long-term projected price levels.

Power benefits

Total power benefits for the storage project and participating projects are estimated at an average of $42,812,000 annually. These benefits are taken as the average annual value of the total estimated cost of obtaining equivalent power from the most economical alternative source likely to be developed in the absence of the storage project and participating projects. Steam-electric plans constructed and operated by private utilities are considered to be the most likely alternative source. The private plants and necessary transmission lines would be located throughout the market area so as to provide the most economical means of serving the load centers with the necessary power. The plants generally would be large, modern, three-unit installations having a high efficiency and being strategically located with respect to fuel supply. The average cost of alternative steam-electric power and energy delivered to representative load centers throughout the market area is estimated to be $24.50 a year per kilowatt of dependable capacity (including $8.50 per year for taxes) and 2.7 mills per kilowatt-hour for energy. The average annual benefits as shown above result from applying these unit costs to the average annual equivalent amounts of capacity and energy estimated at 1,095,000 kilowatts and 5,920 million kilowatt-hours for the storage project and central Utah project.

The total cost of the most economical alternative source of equivalent power or power benefits for the Colorado River storage project is estimated at $40,389,000 annually as shown under "Cost allocations." The total cost of the most economical alternative source of equivalent power or power benefits for the central Utah project is estimated at $2,423,000 annually.

Municipal and industrial water benefits

Benefits from municipal and industrial water in present evaluations are confined to those that will result from the central Utah project and are estimated to average $1,437,000 annually. This estimate is based on the average annual equivalent cost of obtaining a comparable water supply from the most economical alternative single-purpose means of development.

Flood-control benefits

Preliminary appraisals by the Corps of Engineers indicate that the reduction in flood damage that will result from operation of the authorized project developments will average $124,000 annually. The benefits are equal to the different between the flood damage that is expected to occur with and without the project. The corps will further evaluate flood-control benefits in connection with definite plan studies.

Fish and wildlife benefits

Effects of participating projects on fish and wildlife resources, both beneficial and adverse, have been partially evaluated by the Fish and Wildlife Service. The total adverse effects for the projects studied were found to exceed the total benefits by an average of $5,000 annually. No evaluation, however, has been made of the effects of the storage units on fish and wildlife. The example of Lake Mead suggests that the net benefits of the large storage reservoirs may be substantial. Further evaluation of fish and wildlife benefits will be made as a part of pre-construction surveys.

Recreational benefits

The National Park Service estimates the recreational benefits of the authorized projects and units studied to date at $698,000 annually. The estimate is generally based on the service's judgment that annual benefits of the specific (Federal and non-Federal) recreational facilities included in preliminary plans are at least equal to the annual equivalent cost of constructing, operating, and maintaining the facilities and that a like benefit value will accrue from the recreational use of dams and reservoirs. The evaluation of recreational benefits will be continued in preconstruction surveys.

Other benefits

A number of minor benefits in addition to those mentioned may be expected from project development. The only one so far evaluated is a sediment control benefit in connection with a potential reservoir of the central Utah project which, according to an estimate by the Bureau of Indian Affairs, will have a value of $2,000 annually in preventing sedimentation of Indian irrigation canals.

AVERAGE ANNUAL EQUIVALENT COSTS

Determination of costs

For comparison with the average annual benefits, an estimate was made of the average annual equivalent Federal cost of development. This cost includes the Federal investment amortized over the 100-year period of analysis at 2½ percent interest and annual operation, maintenance, and replacement costs. Construction costs used in the benefit-cost analysis do not include past investigation costs since these do not bear on the advisability of future expenditures. Also they do not include contributed funds for the Glen Canyon bridge and highway nor costs of constructing certain central Utah project features to ultimate phase capacity since no evaluations have been made of benefits from such expenditures. Interest on expenditures during the construction period is added to construction costs. An amount

equivalent to taxes on an alternative private power development is also included as an economic cost of developments involving power production. Also included for participating projects is each project's pro rata share of the cost of regulatory facilities of the Colorado River storage project for reasons explained below.

Storage project costs assigned to participating projects

Reservoirs of the Colorado River storage project, as explained under "Water Supply," will provide replacement water for the lower basin and Mexico in prolonged drought periods in order to permit continued expansion of water-consuming uses in the upper basin. A portion of the cost of the storage reservoirs may therefore appropriately be assigned to the water-consuming uses of participating projects in the benefit-cost analysis. Under the authorized repayment plan, however, all of the reimbursable storage costs will be rapaid from power revenues.

Since the amount of replacement storage required is a direct function of increases in stream depletion, it is equitable to assign the allocated costs of replacement storage to each participating project in proportion to the amount of stream depletion that it will cause. In a later section of this report, a total cost of $122,086,000 on a present worth basis for units of the storage project is allocated to irrigation. This allocation, prorated to an average increase in consumptive use of 1,800,000 acre-feet annually over the 100-year period of analysis, amounts to about $70 per acre-foot. On an annual equivalent basis it is about $2 per acre-foot of depletion.

BENEFIT-COST SUMMARY

Benefit-cost comparisons have been made for each unit of the Colorado River storage project, the combined storage units, each participating project, and for the storage project and participating projects combined. Comparisons have been made for a 100-year period of analysis in accordance with Bureau of Reclamation policy and for a 50-year period in response to requests from the Bureau of the Budget. For both periods of analysis comparisons have been made for total benefits (direct, indirect, and public) and where possible for direct benefits only. Results of the comparisons are shown in the tables facing page 21.

The benefit-cost analysis for the 100-year period, with consideration given to all the benefits, is believed to be the most equitable measure of economic justification. Use of the 100-year period of study is more realistic than a 50-year period since the major features have been designed and are being constructed to last well beyond 100 years. Recognition of all benefits is desirable because direct benefits do not fully measure the significance of the project. Operation of the storage units and participating projects will be interrelated in stream regulation, power production, and power transmission. Consequently, the benefits of storage are recognized in the analysis of the participating projects, and a corresponding assignment of costs for stream depletion is made as discussed above. Because of the interdependence of storage works and local facilities for use of water, a

benefit-cost ratio for an individual storage unit or participating project is necessarily arbitrary and is less significant than a ratio of total benefits to total costs for the authorized features.

In the analysis for the 100-year period and with consideration given to all the anticipated benefits, the Colorado River storage project and participating projects combined have benefits in excess of costs and each individual storage unit and participating project has benefits equal to or greater than the costs. The overall project benefit-cost ratio is 1.3 to 1.

Cost Allocations

Preliminary allocations have been made of the estimated costs of the Colorado River storage project and participating projects as a basis for determining reimbursable costs by purposes and for making repayment studies. Costs of the four units of the storage project have been allocated as a single project cost and have been apportioned to irrigation and other water-consuming uses, power, flood control, and recreation. Costs of each participating project have been separately allocated to the same purposes as the storage project costs and also on some instances to municipal and industrial water and to fish and wildlife. The allocations are of necessity preliminary in nature since they are based on estimated costs and project plans that may be modified in definite plan studies.

Procedures used in allocations of the storage project costs are discussed in the following sections and the resulting allocations are summarized in the table on page 29. Allocations of cost of participating projects also are summarized in the table on pages 30 and 31. Procedures used in making the participating project allocations are similar to those for the storage project.

Derivation of storage project cost allocations

Storage project costs used as a basis for the allocations include construction costs, interest during construction, and operation, maintenance, and replacement costs. Costs of past investigations financed from the reimbursable Reclamation and Upper Colorado River Basin funds were included in the construction costs, but those financed from the nonreimbursable Colorado River development fund and contributed funds were excluded. Also excluded were costs of construction financed from contributed funds.

Method of allocation

Only separable costs of recreational facilities were allocated to recreation. Remaining costs were then allocated to irrigation, power, and flood control by the separable cost-remaining benefits method. Under this method the separable costs of each purpose were allocated to that purpose and the sum of the separable costs for all purposes was subtracted from the total project costs to obtain remaining joint costs. The remaining joint costs were then allocated to the various project purposes in proportion to the remaining benefits of the purposes in excess of their separable costs. Thus the total allocation to each purpose is equal to or greater than the separable cost of including that purpose in the project and is not more than either the benefits or the cost of the most economical single-purpose alternative. Under this method

the costs of facilities serving more than one purpose are allocated to the various purposes in a manner that permits each purpose to share in the economy of the multiple-purpose development.

In the allocation procedure all benefits and costs including interest during construction were converted to present values at the beginning of the 100-year period of analysis at an interest rate of 2½ percent. The total allocations made on this basis were then converted to appropriate capital and annual amounts. The amount of interest during construction was then converted to reflect a 2⅞-percent rate to determine the amount of interest during construction to be reimbursed.

Separable and joint costs

The separable costs for each purpose of the multiple-purpose project are defined as the difference between the cost of the multiple-purpose project and the cost of the project with the purpose omitted. Thus the separable costs for each purpose include the costs of those project facilities used solely by that purpose plus the difference in costs of the joint use facilities that would change in size or design with the purpose omitted. Separable costs were determined by assuming each purpose in turn as the last purpose added to the multiple-purpose project. The remaining joint costs are the total project costs less the sum of the separable costs for the various purposes. The estimated separable costs of power, irrigation, flood control, and recreation for the four units of the storage project and the remaining joint costs for the project are shown in the following table.

Determination of separable and remaining joint costs—Colorado River storage project

[In thousands of dollars]

Unit and item	Construction costs [1]	Interest during construction at 2½ percent	Annual costs: Operation and maintenance costs	Annual costs: Replacement costs	Annual costs: Total
Multiple-purpose project cost					
Glen Canyon	$322,794	$27,898	$1,648	$1,179	$2,827
Dam and reservoir	204,666	17,575	530	44	574
Powerplants and switchyards	118,128	10,323	1,118	1,135	2,253
Flaming Gorge	66,505	4,592	233	185	418
Dam and reservoir	49,618	3,421	66	10	76
Powerplants and switchyards	16,887	1,141	167	175	342
Navaho	42,540	2,403	16	9	25
Dam and reservoir	42,333	2,403	16	9	25
Recreational facilities	207				
Curecanti	84,866	4,051	385	391	776
Dam and reservoir	45,307	2,147	37	41	78
Powerplants and switchyards	39,017	1,904	348	350	698
Recreational facilities	452				
Transmission division	157,445	5,845	884	1,605	2,489
Total	674,150	44,759	3,166	3,369	6,535
Multiple-purpose project with power omitted					
Glen Canyon Dam and Reservoir	$195,000	$16,471	$482	$41	$523
Flaming Gorge Dam and Reservoir	46,300	2,850	58	10	68
Navaho—					
Dam and Reservoir	42,333	2,403	16	9	25
Recreational facilities	207				
Curecanti—					
Dam and Reservoir	16,700	878	12	10	22
Recreational facilities	452				
Total	300,992	22,602	568	70	638
Separable power costs	373,158	22,157	2,598	3,299	5,897
Multiple-purpose project with irrigation omitted					
Glen Canyon	$322,794	$27,898	$1,648	$1,179	$2,827
Flaming Gorge	66,505	4,592	233	185	418
Navaho—recreation	207				
Curecanti	84,866	4,051	385	391	776
Transmission division	157,445	5,845	884	1,605	2,489
Total	631,817	42,356	3,150	3,360	6,510
Separable irrigation costs [2]	42,333	2,403	16	9	25
Multiple-purpose project with recreation omitted					
Glen Canyon	$322,794	$27,898	$1,648	$1,179	$2,827
Flaming Gorge	66,505	4,592	233	185	418
Navaho	42,333	2,403	16	9	25
Curecanti	84,414	4,051	385	391	776
Transmission division	157,445	5,845	884	1,605	2,489
Total	673,491	44,759	3,166	3,369	6,535
Separable recreational costs	659				
Recapitulation					
All units:					
Total costs	$674,150	$44,759	$3,166	$3,369	$6,535
Less total separable costs	416,150	24,560	2,614	3,308	5,922
Remaining joint costs	258,000	20,199	552	61	613

[1] Excludes nonreimbursable costs of past investigation paid from Colorado River development fund and contributed funds. Also excludes money contributed for construction.

[2] Includes flood-control costs on San Juan River and therefore considered as a dual cost in cost-allocation table.

Justifiable irrigation expenditure

The justifiable irrigation expenditure for the Colorado River storage project is limited to the maximum benefits that could be attributed to the storage water replacement function or the costs of the most economical alternative single-purpose replacement storage, whichever is the lesser. The alternative single-purpose costs were found to be substantially less than the benefits and thus were taken as the justifiable expenditure. Both the benefits and the alternative costs are discussed in the following sections.

Benefits.—The maximum benefits that could be attributed to the water replacement function of the storage project are taken as the benefits in excess of local construction and operating costs of future water-consuming projects in the upper basin over the 100-year period of analysis. Consideration was given only to the benefits and costs associated with irrigation, municipal, and industrial use. The excess of the benefits over costs for the 100-year period was estimated by projection of the excess benefits anticipated for the 11 initial participating projects. The projections were made on the basis of the average value of excess benefits per acre-foot of stream depletion. In order to arrive at a conservative estimate, however, the excess benefit value determined for the initial participating projects was slightly lowered when related to other future projects. Also the computations were based on the weighted average increase in stream depletions of 1,800,000 acre-feet over the 100-year period rather than the projected total increase of 2,950,000 acre-feet by the end of the period. Derivation of the excess benefits is summarized in the following table.

Excess annual benefits of initial participating projects and projection for future water-consuming projects [1]

[In thousands]

Participating projects	Annual benefits	Annual costs	Annual benefits in excess of costs	Increased annual stream depletion (acre-feet)	Average excess benefits per acre-foot of stream depletion
Paonia	$640	$236	$404	10	$40
Pine River extension	509	178	331	28	12
Smith Fork	150	110	40	8	5
Florida	341	221	120	13	9
Silt	198	111	87	6	15
Hammond	202	84	118	9	13
Central Utah	5,562	5,317	245	189	1
Emery County	426	298	128	16	8
Seedskadee	1,567	893	674	110	6
Lyman	383	384	4	0	0
La Barge	206	69	137	14	10
Subtotal	10,189	7,901	2,288	403	6
Total projected average including future projects for 100-year period			9,000	1,800	5

[1] Includes only those benefits associated with irrigation, municipal, and industrial water.

As shown in the table, the estimate of total excess benefits for the 100-year period of analysis amounts to an average of $9 million annually. The present worth of this annual amount over a 100-year period at 2½ percent interest is about $330 million.

Alternative single-purpose costs.—The alternative single-purpose irrigation costs of the Colorado River Storage project were estimated

as the costs of providing replacement storage for irrigation and other upstream water-consuming uses equivalent to that at the Glen Canyon, Flaming Gorge, Curecanti, and Navajo units.

After allowances are made for sediment deposition to year 2062 and minimum operating levels for power production, the multiple-purpose reservoirs at Glen Canyon, Flaming Gorge, Curecanti, and Navajo units will have about 22,443,000 acre-feet of active storage capacity. The single-purpose alternative must have an equivalent amount of active storage capacity, without any specific reservation of dead storage to maintain a minimum power pool, after making allowances for evaporation losses and sediment deposition to year 2062. The lowest cost single-purpose alternative was found to consist of the Cross Mountain, Flaming Gorge, Dewey, and Navajo Reservoirs. To assure the initial filling of such alternative reservoirs during the present period of incomplete water use in the Colorado River Basin, they would need to be constructed under the same schedule as the authorized multiple-purpose reservoirs.

The lowest cost single-purpose replacement storage alternative was selected by reconnaissance analyses using available data on the various large reservoir sites in the upper basin. The estimated capacities and construction costs of the selected alternative system of reservoirs are shown in the table on the following page.

Justifiable power expenditure

The justifiable expenditure for power is taken as the cost of the most economical single-purpose alternative power development described on page 29. As previously explained, this same cost is taken as a measure of the project power benefit. The total annual costs of the alternative development were estimated on the basis of private financing including taxes and interest at the rate of 6¼ percent. The estimated costs are summarized below.

Item	Average annual equivalent of total cost	Present worth [1]
Cost excluding taxes	$31,583,000	$1,156,380,000
Taxes	8,806,000	322,423,000
Total	40,389,000	1,478,803,000

[1] Computed over a 100-year period with interest at rate of 2⅛ percent.

Estimated cost of single-purpose storage alternative—Colorado River storage project

	Cross Mountain Dam and Reservoir	Flaming Gorge Dam and Reservoir	Dewey Dam and Reservoir	Navajo Dam and Reservoir	Total
Initial active storage capacity	5,200,000	3,930,000	9,500,000	1,028,000	19,658,000
Active capacity remaining in year 2062	5,160,000	3,730,000	8,000,000	948,000	17,838,000
Construction cost	$20,265,000	$48,446,000	$92,350,000	$42,333,000	$203,394,000
Interest during construction [1]	1,139,000	3,246,000	7,389,000	2,403,000	14,177,000
Net investment by year completed	21,404,000	51,692,000	99,739,000	44,736,000	217,571,000
Annual operation, maintenance, and replacement costs	104,000	77,000	193,000	25,000	399,000
Present worth of operation, maintenance, and replacement costs	3,808,000	2,819,000	7,066,000	915,000	14,608,000
Present worth of total cost	25,212,000	54,511,000	106,805,000	45,651,000	232,179,000

[1] Computed at an interest rate of 2⅛ percent.

Justifiable flood-control expenditure

Flood control benefits, as estimated by the Corps of Engineers, were used as the justifiable flood-control expenditure. These have been evaluated only for the Navaho unit and are estimated at $1,135,000 as the present worth of $31,000 annually over 100 years at 2½ percent interest. No estimate was made of the cost of the cheapest alternative means of providing flood control for consideration as the justifiable flood-control expenditure as the cost of such an alternative would far exceed the anticipated flood-control benefits.

RESULTS OF ALLOCATIONS—STORAGE PROJECT AND PARTICIPATING PROJECTS

A summary of the derivation of the allocations made for the storage project is shown in the following table. Results of the allocations made for the storage project and for the participating projects are summarized on pages 30 and 31.

Derivation of cost allocations—Colorado River storage project [1] *(separable costs-remaining benefits method)*

[In thousands of dollars]

	Irrigation	Power	Flood control	Subtotal	Recreation	Total
1. Benefits [2]	330,000	1,478,803	1,135	1,809,938	-------	----------
2. Alternative single-purpose cost [3]	232,179	1,478,803	(4)	----------	-------	----------
3. Justifiable expenditure	232,179	1,478,803	1,135	1,712,117	-------	----------
4. Initially separable costs [3]	---------	933,651	--------	933,651	659	934,310
(a) Construction costs	---------	373,158	--------	373,158	659	373,817
(b) Interest during construction	---------	22,157	--------	22,157	-------	22,157
(c) Operation, maintenance, and replacement costs	---------	215,913	--------	215,913	-------	215,913
(d) Taxes foregone	---------	322,423	--------	322,423	-------	322,423
5. Remaining benefits before dual costs	232,179	545,152	1,135	778,466	-------	----------
6. Allocated dual costs [3]	45,422	----------	229	45,651	-------	45,651
(a) Construction costs	42,121	----------	212	42,333	-------	42,333
(b) Interest during construction	2,391	----------	12	2,403	-------	2,403
(c) Operation, maintenance, and replacement costs	910	----------	5	915	-------	915
7. Remaining benefits	186,757	545,152	906	732,815	-------	----------
8. Allocated joint costs [3]	70,664	223,979	--------	300,643	-------	300,643
(a) Construction costs	65,790	192,210	--------	258,000	-------	258,000
(b) Interest during construction	5,151	15,048	--------	20,199	-------	20,199
(c) Operation, maintenance, and replacement costs	5,723	16,721	--------	22,444	-------	22,444
9. Total allocation [3]	122,086	1,157,630	229	1,279,945	659	1,280,604
(a) Construction costs	107,911	565,368	212	673,491	659	674,150
(b) Interest during construction	7,542	37,205	12	44,759	-------	44,759
(c) Operation, maintenance, and replacement costs	6,633	232,634	5	239,272	-------	239,272
(d) Taxes foregone	---------	322,423	--------	322,423	-------	322,423
10. Construction costs:						
(a) Excluding interest during construction	107,911	565,368	212	673,491	659	674,150
(b) Including interest during construction at 2½ percent	115,453	602,573	224	718,250	659	718,909
(c) Including reimbursable interest during construction at 2⅛ percent	107,911	609,277	212	717,400	659	718,059
11. Annual operation, maintenance, and replacement costs:						
(a) Based on 2¼ percent	181	6,354	0	6,535	-------	6,535
(b) Based on 2⅛ percent	174	6,108	0	6,282	-------	6,282

[1] No cost has been allocated to fish and wildlife because studies of this function have not been completed. Future studies may result in allocations to this and other functions not presently included.
[2] Present worth of annual benefits over 100 years at 2½ percent interest.
[3] Include construction costs with exception of expenditures from contributed funds and Colorado River Development Fund, interest during construction at 2½ percent, operation, maintenance, and replacement costs, and taxes foregone when appropriate. Figures for operation, maintenance, and replacement costs and taxes foregone are present values computed for a 100-year period at 2½ percent.
[4] Greater than benefits.

Summary of allocated costs [1]*—Colorado River storage project and participating projects*

[In thousands of dollars]

Storage project and participating projects	Irrigation	Power	Municipal and industrial water	Flood control	Subtotal	Recreation	Fish and wildlife [2]	Other	Total
Storage project:									
Construction costs	$107,911	$565,368		$212	$673,491	$659			$674,150
Reimbursable interest during construction		43,909			43,909				43,909
Operation, maintenance, and replacement costs	174	6,108			6,282				6,282
Participating projects:									
Paonia, Colo.:									
Construction costs	7,684			72	7,756	8			7,764
Operation, maintenance, and replacement costs	22				22	1			23
Pine River extension, Colorado and New Mexico:									
Construction costs	5,486				5,486				5,486
Operation, maintenance, and replacement costs	21				21				21
Smith Fork, Colo.:									
Construction costs	3,437				3,437	24			3,461
Operation, maintenance, and replacement costs	12				12				12
Florida, Colo.:									
Construction costs	7,234			125	7,359		$52		7,411
Operation, maintenance, and replacement costs	16				16				16
Silt, Colo.:									
Construction costs	3,531				3,531				3,531
Operation, maintenance, and replacement costs	12				12				12
Hammond, N. Mex.:									
Construction costs	2,433				2,433				2,433
Operation, maintenance, and replacement costs	18				18				18
Central Utah (initial phase), Utah:									
Construction costs	131,242	49,048	$44,419	2,232	226,941	1,552	477	[3] $5,750	234,720
Reimbursable interest during construction		3,062	2,456		5,518				5,518
Operation, maintenance, and replacement costs	240	490	53		783	187	70		1,040
Emery County, Utah:									
Construction costs	9,704				9,704	190			9,894
Operation, maintenance, and replacement costs	25				25	15			40
Seedskadee, Wyo.:									
Construction costs	25,060				25,060				25,060
Operation, maintenance, and replacement costs	183				183				183
Lyman, Wyo.:									
Construction costs	11,376				11,376				11,376
Operation, maintenance, and replacement costs	62				62				62
LaBarge, Wyo.:									
Construction costs	1,751				1,751				1,751
Operation, maintenance, and replacement costs	20				20				20

Subtotal, participating projects:									
Construction costs	208,938	49,048	44,419	2,429	304,834	1,774	529	5,750	312,887
Reimbursable interest during construction		3,062	2,456		5,518				5,518
Operation, maintenance, and replacement costs	631	490	53		1,174	203	70		1,447
Total, storage project and participating projects:									
Construction costs	316,849	614,416	44,419	2,641	978,325	2,433	529	5,750	987,037
Reimbursable interest during construction		46,971	2,456		49,427				49,427
Operation, maintenance, and replacement costs	805	6,598	53		7,456	203	70		7,729

[1] Allocated construction costs exclude expenditures from contributed funds and Colorado River Development Fund. Interest during construction and replacement costs are based on interest at rate of 2⅞ percent.

[2] The fish and wildlife allocation is incomplete because no appraisal of fish and wildlife benefits from the storage project has been made and benefits from the participating projects have been only partially evaluated.

[3] Estimated cost of constructing certain features to ultimate phase capacity.

PROJECT REPAYMENT

A repayment analysis of the Colorado River storage project and participating projects has been made to demonstrate how repayment of reimbursable construction costs of the project, including interest during construction, can be accomplished in accordance with the provisions of the authorizing legislation. Costs allocated to recreation and to fish and wildlife are made nonreimbursable by the authorizing act. Costs allocated to flood control are also nonreimbursable. Costs allocated to irrigation, power, and municipal and industrial water use, which represent more than 99 percent of the project cost after deductions are made for contributed funds and nonreimbursable investigation expenditures, are reimbursable.

Reimbursable costs except as noted below will be repaid in a period of not more than 50 years from the date of completion of the respective storage units, participating projects, or separable features thereof, following in the case of irrigation a suitable development period of not more than 10 years. Irrigation-water users will repay in accordance with their estimated ability for a period of 50 years except as otherwise provided by separate authorization acts for the Eden and Paonia projects. Project repayment contracts will be executed with conservancy-type districts which have the capacity to levy assessments upon all taxable real property located within their boundaries to assist in paying project costs. Municipal and industrial water users will repay with interest at 2⅞ percent the full cost allocated to municipal and industrial water. Power will be sold at rates at which all costs allocated to power will be repaid with interest at 2⅞ percent and revenues will be provided to assist in the repayment of irrigation costs.

UPPER COLORADO RIVER BASIN FUND

All revenues collected in the operation of the Colorado River storage project and participating projects will be credited to and disbursed from the Upper Colorado River Basin fund as provided by the project authorizing act. Accounting records for the basin fund will be maintained to show (1) source of revenue and (2) the application of total revenues received into the fund. Surplus revenues in the basin fund, as defined in section 5 (e) of the act of April 11, 1956, will be used to repay irrigation costs of participating projects that are beyond the repayment ability of the project irrigators. Surplus revenues remaining in the basin fund from participating projects will be apportioned to the State in which such participating project is located and surplus revenues from the storage units will be apportioned by States as shown below.

	Percent		*Percent*
Colorado	46.0	Wyoming	15.5
Utah	21.5	New Mexico	17.0

In accordance with the foregoing procedures, disbursements from the basin fund for the storage project or for participating projects will be made generally in the following order:

(1) Payment of operation, maintenance, replacement, and emergency costs for project facilities.

(2) Payment of interest on the unpaid balance of construction costs allocated to power and municipal and industrial water.
(3) Repayment of reimbursable construction costs.

SUMMARY OF COSTS AND REPAYMENT

Tentative construction cost allocations and estimated repayment under the procedures previously discussed are summarized in the table facing page 34. Following that summary six different repayment schedules are presented. The first (p. 35) is a repayment schedule for all power costs, including those of the storage project and central Utah project, and for irrigation costs of the storage project. It shows how power revenues will repay all reimbursable costs of the storage project and power costs of the central Utah project and establishes revenues available to assist in the repayment of irrigation costs of participating projects. The next four schedules (pp. 36 to 39) demonstrate repayment of irrigation costs of participating projects segregated by the States of Colorado, New Mexico, Utah, and Wyoming, respectively. The last schedule is a summary of power, municipal and industrial water, and irrigation repayment for all authorized units of the storage project and all participating projects, as well as the Eden project in Wyoming.

The repayment tables and schedules indicate that all costs allocated to power for both the storage project and participating projects, amounting to $661,387,000 including interest during construction, can be repaid with interest within a period of 50 years following completion of each of the separable power features. Power costs according to present schedules would be fully repaid in year 2008. Costs of the storage units allocated to irrigation, amounting to $107,911,000, would be repaid from power revenues in 5 years or in the 43d year (2012) following completion of the irrigation investment at the different units. Costs allocated to municipal and industrial water, amounting to $46,875,000 including interest during construction, would be repaid with interest in 50 years following completion of appurtenant facilities. The municipal and industrial water development is presently scheduled in three blocks with repayment being completed in years 2014, 2023, and 2031. Costs of the 11 participating projects and the Eden project allocated to irrigation, totaling $217,129,000 plus $5,750,000 allocated to the ultimate phase of the central Utah project, would be repaid within a 50-year period following the development periods, except that authorized periods of 68 years and 60 years would be used for the Paonia and Eden projects, respectively. The last payment would be made in year 2049, the 90th year of the combined operation of all storage units, the participating projects, and Eden project. The irrigation repayment would be made by the irrigators and from power revenues and conservancy district taxes as illustrated in the summary table. In repayment studies for participating projects, drafts on power revenues in the basin fund at no time exceeded scheduled revenues apportioned to the State in which the respective projects are located. Repayment of reimbursable project costs was accomplished prior to the dates on which final payments are due and interest-bearing and non-interest-bearing costs, to the extent practicable, were paid concurrently.

Summary of cost allocations and repayment—Colorado River storage project and participating projects

[In thousands of dollars]

Item	Allocated construction costs of storage units and participating projects	Reimbursable interest during construction for storage units and participating projects	Eden project construction costs	Total repayment for storage units, participating projects, and Eden project
Reimbursable costs:				
Irrigation	316,849		8,191	325,040
From water users				(31,012)
From power revenues				(284,985)
From conservancy districts				(8,443)
Power	614,416	46,971		661,387
Municipal and industrial use	44,419	2,456		46,875
Ultimate phase, central Utah project	5,750			5,750
Subtotal	981,434	49,427	8,191	1,039,052
Nonreimbursable costs:				
Flood control	2,641			
Recreation	2,433			
Fish and wildlife	529			
Subtotal	5,603			
Total allocated costs	987,037			
Plus expenditures from Colorado River development fund	2,779			
Contributed funds	2,358			
Total project costs	992,174			
Earned surplus through 2049	775,528			

Year of study	Fiscal year	Deliverable energy		Gross revenues			Operation, maintenance, and replacement costs 1/	Net power revenues	Electric plant in service at end of year	Interest on unpaid power investment at 2/7/8%	Repayment of power investment	Unpaid balance of power investment	Allowable unpaid balance of power investment	Power revenues used to repay irrigation investment of storage project	Irrigation plant of storage project in service at end of year	Unpaid balance of irrigation investment of storage project	Allowable unpaid balance of irrigation investment of storage project	Remaining net power revenues of Central Utah project apportioned to Utah	Remaining net power revenues of Colorado River Storage units apportioned to					Total power revenues available for irrigation repayment assistance	Year of study
		Firm	Nonfirm	From firm energy at 6 mills a kw.-hr.	From nonfirm energy at 2.5 mills a kw.-hr.	Total													Colorado 46%	Utah 21.5%	New Mexico 17%	Wyoming 15.5%	Total 24		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	1959																								0
1	60																								1
2	61																								2
3	62																								3
4	63								201,043			201,043	201,043		63,158	63,158	63,158								4
5	64								378,820	5,780	3,565	375,255	378,820		105,279	105,279	105,279								5
6	65	1,500	1,650	9,000	4,125	13,125	3,780	9,345	501,087	10,789	2,807	494,715	501,087		105,279	105,279	105,279								6
7	66	2,950	400	17,700	1,000	18,700	5,104	13,596	506,155	14,233	1,165	498,618	506,155		105,279	105,279	105,279								7
8	67	3,200	550	19,200	1,375	20,575	5,187	15,388	506,155	14,335	4,228	494,390	506,155		105,279	105,279	105,279								8
9	68	3,750	500	22,500	1,250	23,750	5,187	18,563	537,408	14,214	5,531	520,112	537,408		107,911	107,911	107,911								9
10	69	3,950	500	23,700	1,250	24,950	5,205	19,745	537,408	14,951	6,383	513,729	537,408												10
11	70	4,250	550	25,500	1,375	26,875	5,539	21,336	537,408	14,770	6,816	506,913	537,408												11
12	1971	4,250	650	25,500	1,625	27,125	5,539	21,586	537,408	14,574	16,962	489,951	537,408												12
13	72	5,700	1,150	34,200	2,875	37,075	5,539	31,536	622,604	14,086	16,939	558,208	625,654												13
14	73						6,050	31,025	625,654	16,048	14,577	546,681	647,987												14
15	74						6,450	30,625	647,987	15,717	14,888	554,126	650,187												15
16	75						6,470	30,605	650,187	15,931	14,402	541,924	651,787												16
17	76						6,742	30,333	651,787	15,580	14,723	528,801	653,387												17
18	77						6,772	30,303	653,387	15,203	15,100	515,301	654,987												18
19	78								654,987	14,815	15,488	501,413	656,587												19
20	79								656,587	14,416	15,887	487,126	658,187												20
21	80								658,187	14,005	16,298	472,428	659,787												21
22	1981	5,700	1,150	34,200	2,875	37,075		30,303	659,787	13,582	14,321	459,707	660,787												22
23	82	5,550	550	33,300	1,375	34,675		27,903	660,787	13,217	14,686	446,021	661,387												23
24	83								661,387	12,823	15,080	431,541													24
25	84									12,407	15,496	416,045													25
26	85									11,961	15,942	400,103													26
27	86									11,503	16,400	383,703													27
28	87									11,031	16,872	366,831													28
29	88									10,546	17,357	349,474													29
30	89									10,047	17,856	331,618													30
31	90									9,534	18,369	313,249													31
32	1991	5,550	550	33,300	1,375	34,675		27,903		9,006	13,322	299,927													32
33	92	4,850	0	29,100	0	29,100		22,328		8,623	13,705	286,222													33
34	93									8,229	14,099	272,123													34
35	94									7,824	14,504	257,619													35
36	95									7,407	14,921	242,698													36
37	96									6,978	15,350	227,348													37
38	97									6,536	15,792	211,556													38
39	98									6,082	16,246	195,310													39
40	99									5,615	16,713	178,597													40
41	2000									5,135	17,193	161,404													41
42	2001	4,850	0	29,100	0	29,100		22,328		4,640	23,863	137,541													42
43	02	5,400	1,150	32,400	2,875	35,275		28,503		3,954	24,549	112,992													43
44	03									3,249	25,254	87,738													44
45	04									2,522	25,981	61,757													45
46	05									1,776	26,727	35,030													46
47	06									1,007	27,496	7,534		0		107,911									47
48	07									217	7,534	0		20,752		87,159									48
49	08													28,503		58,656									49
50	09													28,503		30,153									50
51	10													28,503		1,650									51
52	2011	5,400	1,150	32,400	2,875	35,275		28,503						1,650		0									52
53	12	5,200	800	31,200	2,000	33,200		26,428											11,398	5,327	4,212	3,841	24,778	24,778	53
54	13												661,387				107,911	1,675	11,386	5,322	4,208	3,837	24,753	26,428	54
55	14												460,344				44,753								55
56	15												282,567				2,632								56
57	16												160,300				2,632								57
58	17												155,232				2,632								58
59	18												155,232				2,632								59
60	19												123,979				0								60
61	20												123,979												61
62	2021	5,200	800	31,200	2,000	33,200		26,428					123,979						11,386	5,322	4,208	3,837	24,753	26,428	62
63	22	4,850	350	29,100	875	29,975		23,203					123,979						9,903	4,628	3,660	3,337	21,528	23,203	63
64	23												38,783												64
65	24												35,733												65
66	25												13,400												66
67	26												11,200												67
68	27												9,600												68
69	28												8,000												69
70	29												6,400												70
71	30												4,800												71
72	31												3,200												72
73	32												1,600												73
74	33												600												74
75	34												0												75
76	35																								76
77	36																								77
78	37																								78
79	38																								79
80	39																								80
81	40																								81
82	41																								82
83	42																								83
84	43																								84
85	44																								85
86	45																								86
87	46																								87
88	47																								88
89	48																								89
90	49	4,850	350	29,100	875	29,975	6,772	23,203	661,387										9,903	4,628	3,660	3,337	21,528	23,203	90
	Total	426,650	51,100	2,559,900	127,750	2,687,650	561,148	2,126,502	661,387	444,890	661,387			107,911	107,911			1,675	91,156	182,809	144,564	131,810	850,339	912,314	

1/ Includes all operation, maintenance, and replacement costs of storage project and operation, maintenance, and replacement costs of Central Utah project allocated to power.

Year of study	Fiscal year	Repayment of irrigation costs: Apportionment of power revenues to State	By irrigators	By apportioned power revenues	Irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Repayment of irrigation costs: By irrigators	By apportioned power revenues	Irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Repayment of irrigation costs: By irrigators	By apportioned power revenues	Irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Repayment of irrigation costs: By irrigators	By apportioned power revenues	Irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Apportioned power revenues: Irrigation repayment	Cumulative surplus	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	1959																													0
1	60																													1
2	61																													2
3	62																													3
4	63																													4
5	64									7,684	7,684	2,684																		5
6	65							0			7,684																			6
7	66							0			7,684				5,212	5,212	5,212								3,437	3,437	3,437			7
8	67							0			7,684		0							3,531	3,531	3,531	0			3,437				8
9	68							24			7,660		0										0			3,437				9
10	69				7,234	7,234	7,234	24			7,636		0					0					19			3,418				10
11	70		0					24			7,612		0					0												11
12	1971		0					25			7,587		0					0								3,399				12
13	72		0					24			7,563		0					0								3,380				13
14	73		0					24			7,539		0					0			3,531					3,361				14
15	74		0			7,234		25			7,514		0					18			3,513					3,342				15
16	75		31			7,203		34			7,480		0								3,495					3,323				16
17	76					7,172		34			7,446		0			5,212					3,477					3,304				17
18	77					7,141		34			7,412		19			5,193					3,459					3,285				18
19	78					7,110		34			7,378		19			5,174					3,441					3,266				19
20	79					7,079		35			7,343		19			5,155					3,423					3,247				20
21	80					7,048		34			7,309		19			5,136					3,405					3,228				21
22	1981					7,017		34			7,275		19			5,117					3,387					3,209				22
23	82					6,986		34			7,241		19			5,098					3,369					3,190				23
24	83					6,955		34			7,207		19			5,079					3,351					3,171				24
25	84					6,924		35			7,172		57			5,042					3,333					3,152				25
26	85					6,893		34			7,138					5,005					3,315					3,133				26
27	86					6,862		34			7,104					4,968					3,297					3,114				27
28	87					6,831		34			7,070					4,931					3,279					3,095				28
29	88					6,800		34			7,036					4,894					3,261					3,076				29
30	89					6,769		35			7,001					4,857					3,243					3,057				30
31	90					6,738		34			6,967					4,820					3,225					3,038				31
32	1991					6,707		34			6,933					4,783					3,207					3,019				32
33	92					6,676		34			6,899					4,746					3,189					3,000				33
34	93					6,645		34			6,865					4,709					3,171					2,981				34
35	94					6,614		35			6,830					4,672					3,153					2,962				35
36	95					6,583		34			6,796					4,635					3,135					2,943				36
37	96					6,552		34			6,762					4,598					3,117					2,924				37
38	97					6,521		34			6,728					4,561					3,099					2,905				38
39	98					6,490		34			6,694					4,524					3,081					2,886				39
40	99					6,459		35			6,659					4,487					3,063					2,867				40
41	00					6,428		34			6,625					4,450					3,045					2,848				41
42	2001					6,397		34			6,591					4,413					3,027					2,829				42
43	02					6,366		34			6,557					4,376					3,009					2,810				43
44	03					6,335		34			6,523					4,339					2,991					2,791				44
45	04					6,304		35			6,488					4,302					2,973					2,772				45
46	05					6,273		34			6,454					4,265					2,955					2,753				46
47	06					6,242		34			6,420					4,228					2,937					2,734				47
48	07					6,211		34			6,386					4,191					2,919					2,715				48
49	08					6,180		34			6,352					4,154					2,901					2,696				49
50	09					6,149		35			6,317					4,117					2,883					2,677				50
51	10					6,118		34			6,283					4,080					2,865					2,658				51
52	2011			0		6,087		34	0		6,249		0			4,043					2,847					2,639				52
53	12	11,398		5,684		372		34	5,364		851		350			3,656			0		2,829			0		2,620		11,398		53
54	13	11,386		0		341		34	0		817		3,138			481			2,631		180			2,487		114		8,256	3,130	54
55	14					310		35			782		0			444			0		162			0		95			14,516	55
56	15					279		34			748					407					144					76			25,902	56
57	16					248		34			714					370					126					57			37,288	57
58	17					217		34			680					333					108					38			48,674	58
59	18					186		34			646					296					90					19	3,437		60,060	59
60	19					155		35			611					259					72		19			0	0		71,446	60
61	20					124		34			577					222					54		0						82,832	61
62	2021	11,386				93		34			543					185					36								94,218	62
63	22	9,903				62		34			509					148					18	3,531							104,121	63
64	23					31	7,234	34			475					111		18			0	0							114,024	64
65	24		31			0	0	35			440					74		0										123,927	65
66	25		0					34			406					37	5,212											133,830	66
67	26							34			372		37			0	0											143,733	67
68	27							34			338		0															153,636	68
69	28							34			304																	163,539	69
70	29							35			269																	173,442	70
71	30							34			235																	183,345	71
72	2031							34			201																	193,248	72
73	32							34			167																	203,151	73
74	33							34			133																	213,054	74
75	34							35			98	7,684																222,957	75
76	35							28			70	1,670																232,860	76
77	36							10			60																	242,763	77
78	37							10			50																	252,666	78
79	38							10			40																	262,569	79
80	39							10			30																	272,472	80
81	40							10			20																	282,375	81
82	2041							10			10	1,670																292,278	82
83	42							10			0	0																302,181	83
84	43							0																				312,084	84
85	44																											321,987	85
86	45																											331,890	86
87	46																											341,793	87
88	47																											351,696	88
89	48																											361,599	89
90	49	9,903			7,234					7,684					5,212					3,531					3,437				371,502	90
Total		391,156	1,550	5,684	7,234			2,320	5,364	7,684			1,724	3,488	5,212			900	2,631	3,531			550	2,487	3,437			19,654	371,502	

1/ Represents 95 percent of the project which is estimated to be in Colorado. The remaining 5 percent is in New Mexico.

2/ Repayments in some years arbitrarily increased by $1,000 to adjust for rounding off of amounts of less than $500 in other years.

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INTERIOR - BUREAU OF RECLAMATION, SLC, UTAH

(Unit--$1,000)

Year of study	Fiscal year	Demand project: Apportionment of power revenues to State	Demand project: Repayment of irrigation costs: By irrigators	Demand project: Repayment of irrigation costs: By apportioned power revenues	Demand project: Irrigation plant: In service at end of year	Demand project: Irrigation plant: Unpaid balance	Demand project: Irrigation plant: Allowable unpaid balance	Pine River project extension/: Repayment of irrigation costs: By irrigators	Pine River project extension/: Repayment of irrigation costs: By apportioned power revenues	Pine River project extension/: Irrigation plant: In service at end of year	Pine River project extension/: Irrigation plant: Unpaid balance	Pine River project extension/: Irrigation plant: Allowable unpaid balance	With summary of application of apportioned power revenues: Irrigation repayment	With summary of application of apportioned power revenues: Cumulative surplus	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1959														0
1	60														1
2	61														2
3	62														3
4	63				2,433	2,433	2,433								4
5	64		0												5
6	65		0												6
7	66		0							274	274	274			7
8	67		0					0							8
9	68		0					0							9
10	69		0					0							10
11	70		0					0							11
12	1971		0					0							12
13	72		0					0							13
14	73		0			2,433		0							14
15	74		6			2,427		0							15
16	75					2,421		1							16
17	76					2,415		1			274				17
18	77					2,409		1			273				18
19	78					2,403		1			272				19
20	79					2,397		1			271				20
21	80					2,391		1			270				21
22	1981					2,385		1			269				22
23	82					2,379		1			268				23
24	83					2,373		1			267				24
25	84					2,367		2			265				25
26	85					2,361		4			263				26
27	86					2,355					261				27
28	87					2,349					259				28
29	88					2,343					257				29
30	89					2,337					255				30
31	90					2,331					253				31
32	1991					2,325					251				32
33	92					2,319					249				33
34	93					2,313					247				34
35	94					2,307					245				35
36	95					2,301					243				36
37	96					2,295					241				37
38	97					2,289					239				38
39	98					2,283					237				39
40	99					2,277					235				40
41	2000					2,271					233				41
42	2001					2,265					231				42
43	02					2,259					229				43
44	03					2,253					227				44
45	04					2,247					225				45
46	05					2,241					223				46
47	06					2,235					221				47
48	07					2,229					219				48
49	08					2,223					217				49
50	09					2,217					215				50
51	10					2,211					213				51
52	2011	0		0		2,205			0		211		0	0	52
53	12	4,212		2,133		66			181		28		2,314	1,898	53
54	13	4,208		0		60			0		26		0	6,106	54
55	14					54					24			10,314	55
56	15					48					22			14,522	56
57	16					42					20			18,730	57
58	17					36					18			22,938	58
59	18					30					16			27,146	59
60	19					24					14			31,354	60
61	20					18					12			35,562	61
62	2021	4,208				12					10			39,770	62
63	22	3,660				6	2,433				8			43,430	63
64	23		6			0	0				6			47,090	64
65	24		0								4			50,750	65
66	25										2	274		54,410	66
67	26							2			0	0		58,070	67
68	27							0						61,730	68
69	28													65,390	69
70	29													69,050	70
71	30													72,710	71
72	2031													76,370	72
73	32													80,030	73
74	33													83,690	74
75	34													87,350	75
76	35													91,010	76
77	36													94,670	77
78	37													98,330	78
79	38													101,990	79
80	39													105,650	80
81	40													109,310	81
82	2041													112,970	82
83	42													116,630	83
84	43													120,290	84
85	44													123,950	85
86	45													127,610	86
87	46													131,270	87
88	47													134,930	88
89	48													138,590	89
90	2049	3,660			2,433					274				142,250	90
	Total	144,564	300	2,133	2,433			95	181	274			2,314	142,250	

1/ Represents 5 percent of the project which is estimated to be in New Mexico. The remaining 95 percent is estimated to be in Colorado.

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Year of study	Fiscal year	Apportionment of storage unit power revenues	Net power revenues from Central Utah project	Vernal unit of Central Utah project: Repayment of irrigation costs: By irrigators	Vernal unit of Central Utah project: Repayment of irrigation costs: By apportioned storage unit power revenues	Vernal unit of Central Utah project: Irrigation plant: In service at end of year	Vernal unit of Central Utah project: Irrigation plant: Unpaid balance	Vernal unit of Central Utah project: Irrigation plant: Allowable unpaid balance	Remainder of Central Utah project: Repayment of irrigation costs: Total	Remainder of Central Utah project: Repayment of irrigation costs: By irrigators[1]	Remainder of Central Utah project: Repayment of irrigation costs: By Conservancy District	Remainder of Central Utah project: Repayment of irrigation costs: By apportioned storage unit power revenues	Remainder of Central Utah project: Repayment of irrigation costs: By Central Utah project power revenues	Remainder of Central Utah project: Irrigation plant: In service at end of year	Remainder of Central Utah project: Irrigation plant: Unpaid balance	Remainder of Central Utah project: Irrigation plant: Allowable unpaid balance	Emery County project: Repayment of irrigation costs: By irrigators	Emery County project: Repayment of irrigation costs: By apportioned power revenues	Emery County project: Irrigation plant: In service at end of year	Emery County project: Irrigation plant: Unpaid balance	Emery County project: Irrigation plant: Allowable unpaid balance	Summary of application of storage unit power revenues: Irrigation repayment	Summary of application of storage unit power revenues: Cumulative surplus	Cumulative surplus power revenues of Central Utah project	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	1959																								0
1	60																								1
2	61																								2
3	62																								3
4	63																								4
5	64					6,192	6,192	6,192																	5
6	65			0			6,192																		6
7	66			0			6,192																		7
8	67			0			6,192								3,680	3,680	3,680								8
9	68			30			6,162			0					3,680	3,680	3,680								9
10	69						6,132			0					3,680	3,680	3,680								10
11	70						6,102		26	26					5,403	5,403	5,403			9,704	9,704	9,704			11
12	1971						6,072		177	26	151				37,078	37,052	37,078	0							12
13	72						6,042		177	26					37,078	36,875	37,078	0							13
14	73						6,012		269	118					37,078	36,698	37,078	0							14
15	74						5,982		269	118					54,294	53,645	54,294	0							15
16	75						5,952		277	126						53,376		74			9,704				16
17	76						5,922		277	126						53,099					9,630				17
18	77						5,892		296	145						52,822					9,556				18
19	78						5,862		296	145					54,294	52,526	54,294				9,482				19
20	79						5,832		305	154	151				2/84,305	82,241	84,305				9,408				20
21	80						5,802		341	155	186				84,305	81,936	84,305				9,334				21
22	1981						5,772		341	155					84,305	81,595	84,305				9,260				22
23	82						5,742		340	154					109,087	105,036	109,087				9,186				23
24	83						5,712		341	155					117,826	114,435	117,826				9,112				24
25	84						5,682		340	154						114,094					9,038				25
26	85						5,652		341	155						113,754					8,964				26
27	86						5,622		349	163						113,413					8,890				27
28	87						5,592		381	195						113,064					8,816				28
29	88						5,562		381	195						112,683					8,742				29
30	89						5,532		399	213	186				117,826	112,302	117,826				8,668				30
31	90						5,502		440	213	227				130,800	124,877	130,800				8,594				31
32	1991						5,472		440	213						124,437					8,520				32
33	92						5,442		440	213						123,997					8,446				33
34	93						5,412		453	226						123,557					8,372				34
35	94						5,382		453							123,104					8,298				35
36	95						5,352		453							122,651					8,224				36
37	96						5,322		453							122,198					8,150				37
38	97						5,292		453							121,745					8,076				38
39	98						5,262		453							121,296					8,002				39
40	99						5,232		453	226	227					120,839					7,928				40
41	2000						5,202		523	258	265					120,386					7,854				41
42	2001						5,172		523	258						119,863					7,780				42
43	02						5,142		523	258						119,340					7,706				43
44	03						5,112		523	258						118,817					7,632				44
45	04						5,082		522	257						118,294					7,558				45
46	05						5,052		523	258						117,772					7,484				46
47	06						5,022		522	257						117,249					7,410				47
48	07						4,992		523	258						116,727					7,336				48
49	08						4,962		522	257						116,204					7,262				49
50	09						4,932		523	258	265					115,682					7,188				50
51	10						4,902		561	257	304					115,159					7,114				51
52	2011	0			0		4,872		258	258		0				114,598					7,040				52
53	12	5,327			4,692		150		892	257		635	0			114,340					6,966				53
54	13	5,322	1,675		0		180		7,255	258		5,322	1,675			113,448					6,892	5,327			54
55	14						90		7,254	257						106,193					6,818	5,322			55
56	15						60		7,255	258						98,939					6,744				56
57	16						30	6,192	7,254	257						91,684					6,670				57
58	17			30			0	0	7,255	258						84,430					6,596				58
59	18			0					7,254	257						77,175					6,522				59
60	19								7,255	258						69,921	130,800				6,448				60
61	20								7,228	231		5,322				62,666	127,120				6,374				61
62	2021	5,322							6,203	232		4,296				55,438	127,120				6,300				62
63	22	4,628							1,907	232						49,235	127,120		1,026		5,200	5,322			63
64	23								1,814	139						47,328	95,445		4,628		498	4,628			64
65	24								1,814	139						45,514	95,445		350		74	350	4,278		65
66	25								1,807	132						43,700	93,722	74			0	9,704	8,906		66
67	26								1,807	132						41,893	93,722	0				0	13,534		67
68	27								1,787	112						40,086	82,636						18,162		68
69	28								1,788	113						38,299	82,636						22,790		69
70	29								1,778	103						36,511	76,506						27,418		70
71	30								1,778	103						34,733							32,046		71
72	2031								1,778	103						32,955							36,674		72
73	32								1,777	102						31,177							41,306		73
74	33								1,778	103						29,400							45,930		74
75	34								1,778	103						27,622							50,558		75
76	35								1,778	103						25,844	76,506						55,186		76
77	36								1,769	94						24,066	68,158						59,814		77
78	37								1,738	63						22,297	43,376						64,442		78
79	38								1,737	62						20,559	43,376						69,070		79
80	39								1,720	45						18,822	21,713						73,698		80
81	40								1,720	45						17,102	21,713						78,326		81
82	2041								1,720	45						15,382	21,713						82,954		82
83	42								1,720	45						13,662	21,713						87,582		83
84	43								1,706	31						11,942	12,974						92,210		84
85	44								1,706	31						10,236							96,838		85
86	45								1,706	31						8,530							101,466		86
87	46								1,706	31						6,824							106,094		87
88	47								1,706	31						5,118							110,722		88
89	48								1,706	31						3,412							115,350		89
90	49	4,628	1,675			6,192			1,706	31			1,675	130,800	1,706	12,974				9,704			119,978		90
	Total	182,809	26,826	1,500	4,692	6,192	-	-	130,800	12,875	8,443	47,507	61,975	130,800	-	-	3,700	6,004	9,704	-	-	58,203	124,606	0	

1/ Adjustments of $1,000 made in certain years to compensate for rounding off of annual amounts of less than $500.
2/ Includes $5,750,000 allocated to ultimate phase.

REPAYMENT SCHEDULES FOR IRRIGATION COSTS OF PARTICIPATING PROJECTS IN WYOMING AND EDEN PROJECT

(Unit--$1,000)

Year of study	Fiscal year	Apportionment of power revenues to State	La Barge project: Repayment of irrigation costs: By irrigators	La Barge project: Repayment of irrigation costs: By apportioned power revenues	La Barge project: Irrigation plant: In service at end of year	La Barge project: Irrigation plant: Unpaid balance	La Barge project: Irrigation plant: Allowable unpaid balance	Lyman project: Repayment of irrigation costs: By irrigators	Lyman project: Repayment of irrigation costs: By apportioned power revenues	Lyman project: Irrigation plant: In service at end of year	Lyman project: Irrigation plant: Unpaid balance	Lyman project: Irrigation plant: Allowable unpaid balance	Seedskadee project: Repayment of irrigation costs: By irrigators	Seedskadee project: Repayment of irrigation costs: By apportioned power revenues	Seedskadee project: Irrigation plant: In service at end of year	Seedskadee project: Irrigation plant: Unpaid balance	Seedskadee project: Irrigation plant: Allowable unpaid balance	Eden project: Repayment of irrigation costs: By irrigators 1/	Eden project: Repayment of irrigation costs: By apportioned power revenues	Eden project: Irrigation plant: In service at end of year	Eden project: Irrigation plant: Unpaid balance	Eden project: Irrigation plant: Allowable unpaid balance	Summary of application of apportioned power revenues: Irrigation repayment	Summary of application of apportioned power revenues: Cumulative surplus	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	1959																			1,278	1,278	1,278			0
1	60																	0		1,278	1,278	1,278			1
2	61																	0		8,191	8,191	8,191			2
3	62																	0			8,191				3
4	63																	0			8,191				4
5	64																	0			8,191				5
6	65														2,887	2,887	2,887	0			8,191				6
7	66												0		2,887	2,887	2,887	9			8,182				7
8	67												0		12,637	12,637	12,637	14			8,168				8
9	68									11,376	11,376	11,376	0		18,061	18,061	18,061	14			8,154				9
10	69				1,751	1,751	1,751	0					0		25,060	25,060	25,060	25			8,129				10
11	70		0					0					0								8,104				11
12	1971		0					0					0								8,079				12
13	72		0					0					0								8,054				13
14	73		0					0			11,376		0								8,029				14
15	74		0					30			11,346		0								8,004				15
16	75		0								11,316		0			25,060					7,979				16
17	76		0								11,286		13			25,047					7,954				17
18	77		0								11,256		13			25,034					7,929				18
19	78		0								11,226		22			25,012					7,904				19
20	79		0			1,751					11,196		39			24,973					7,879				20
21	80		5			1,746					11,166		40			24,924					7,854				21
22	1981					1,741					11,136					24,875					7,829				22
23	82					1,736					11,106					24,826					7,804				23
24	83					1,731					11,076					24,777					7,779				24
25	84					1,726					11,046					24,728					7,754				25
26	85					1,721					11,016					24,679					7,729				26
27	86					1,716					10,986					24,630					7,704				27
28	87					1,711					10,956					24,581					7,679				28
29	88					1,706					10,926					24,532					7,654				29
30	89					1,701					10,896					24,483					7,629				30
31	90					1,696					10,866					24,434					7,604				31
32	1991					1,691					10,836					24,385					7,579				32
33	92					1,686					10,806					24,336					7,554				33
34	93					1,681					10,776					24,287					7,529				34
35	94					1,676					10,746					24,238					7,504				35
36	95					1,671					10,716					24,189					7,479				36
37	96					1,666					10,686					24,140					7,454				37
38	97					1,661					10,656					24,091					7,429				38
39	98					1,656					10,626					24,042					7,404				39
40	99					1,651					10,596					23,993					7,379				40
41	2000					1,646					10,566					23,944					7,354				41
42	2001					1,641					10,536					23,895					7,329				42
43	02					1,636					10,506					23,846					7,304				43
44	03					1,631					10,476					23,797					7,279				44
45	04					1,626					10,446					23,748					7,254				45
46	05					1,621					10,416					23,699					7,229				46
47	06					1,616					10,386					23,650					7,204				47
48	07					1,611					10,356					23,601					7,179				48
49	08					1,606					10,326					23,552					7,154				49
50	09					1,601					10,296					23,503					7,129				50
51	10					1,596					10,266					23,454					7,104				51
52	2011					1,591			0		10,236					23,405					7,079	0			52
53	12	3,841				1,586			3,841		6,365					23,356					7,054	3,841			53
54	13	3,837				1,581			3,837		2,498					23,307			0		7,029	3,837			54
55	14					1,576			2,198		270					23,258			1,639		5,365	3,837			55
56	15					1,571			0		240			0		23,209			3,837		1,503	3,837			56
57	16			1,501		65					210			1,121		22,039			1,215		263	3,837			57
58	17			0		60					180			3,837		18,153			0		238	3,837			58
59	18					55					150			3,837		14,267					213	3,837			59
60	19					50					120			3,837		10,381					188	3,837			60
61	20					45					90			3,837		6,495					163	3,837			61
62	2021	3,837				40					60			3,837		2,609					138	3,837	0		62
63	22	3,337				35					30	11,376		2,304		256					113	2,304	1,033		63
64	23					30		30			0	0		0		207					88	0	4,370		64
65	24					25		0								158	25,060				63	8,191	7,707		65
66	25					20							49			109	22,173	25			38	5,139	11,044		66
67	26					15							36			73	22,173	16			22	3,861	14,381		67
68	27					10							36			37	12,423	11			11	3,861	17,718		68
69	28					5	1,751						27			10	6,999	11			0	0	21,055		69
70	29		5			0	0						10			0	0	0					24,392		70
71	30		0																				27,729		71
72	2031																						31,066		72
73	32																						34,403		73
74	33																						37,740		74
75	34																						41,077		75
76	35																						44,414		76
77	36																						47,751		77
78	37																						51,088		78
79	38																						54,425		79
80	39																						57,762		80
81	40																						61,099		81
82	2041																						64,436		82
83	42																						67,773		83
84	43																						71,110		84
85	44																						74,447		85
86	45																						77,784		86
87	46																						81,121		87
88	47																						84,458		88
89	48																						87,795		89
90	49	3,337			1,751					11,376					25,060					8,191			91,132		90
	Total	131,810	250	1,501	1,751			1,500	9,876	11,376			2,450	22,610	25,060			1,500	6,691	8,191			40,678	91,132	

1/ Not paid into basin fund because of separate authorization.

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INTERIOR - BUREAU OF RECLAMATION SLC UTAH

SUMMARY DEPARTMENT SCHEDULE--AUTHORIZED STORAGE PROJECT UNITS AND PARTICIPATING PROJECTS INCLUDING BEER PROJECT

(Unit--$1,000)

Year of study	Fiscal year	Net power revenues from storage project units and Central Utah project	Application of net power revenues: To interest	To power investment	To irrigation investment of storage project units	Apportioned to States	Electric plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Storage project irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Net revenues from municipal and industrial water	Application of net revenues from municipal and industrial water: To interest	To municipal and industrial investment	Municipal and industrial plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Revenues applied to repayment of irrigation investment of participating projects: Total	From irrigators	From Conservancy District tax	From Central Utah project power	From storage project power	Irrigation plant of participating projects: Investment	Unpaid balance	Allowable unpaid balance	Total revenues	Project plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Unused revenues: From storage project power	From Central Utah project power	From municipal and industrial use	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
0	1959																							1,278	1,278	1,278		1,278	1,278	1,278				0
1	60																							1,278	1,278	1,278		1,278	1,278	1,278				1
2	61																							8,191	8,191	8,191		8,191	8,191	8,191				2
3	62																							8,191	8,191	8,191		8,191	8,191	8,191				3
4	63																							8,191	8,191	8,191		8,191	8,191	8,191				4
5	64																							10,624	10,624	10,624		10,624	10,624	10,624				5
6	65	9,345	5,780	3,565			201,043	201,043	201,043	63,158	63,158	63,158	18	18	0	619	619	619						24,500	24,500	24,500		289,320	289,320	289,320				6
7	66	13,556	10,789	2,807			378,820	375,245	378,820	105,279	105,279	105,279	18	18	0	619	619	619	9	9				24,387	24,387	24,387	9,363	509,105	505,540	509,105				7
8	67	15,388	11,223	1,165			501,087	491,715	501,087				1,709	1,298	411	45,177	45,177	45,177	11	11				39,590	39,581	39,590	13,623	644,975	640,594	644,975				8
9	68	18,563	11,335	4,228			506,155	498,618	506,155				1,733	1,291	442				68	68				49,717	49,710	49,710	15,430	661,793	654,733	661,793				9
10	69	19,745	11,214	5,531			506,155	498,350	506,155	105,279	105,279	105,279		1,275	438				79	79				70,071	69,980	70,071	18,649	682,124	670,968	682,124				10
11	70	21,136	11,953	6,383			537,408	523,112	537,408	107,911	107,911	107,911		1,262	451				121	121				97,482	97,312	97,482	19,842	743,420	725,592	743,420				11
12	1971	21,586	12,770	6,816			537,408	506,913	537,408					1,236	465				276	276				129,157	128,857	129,157	21,850	775,095	751,122	775,095				12
13	72	31,536	14,574	16,962			537,408	485,951	537,408					1,298	411	619	619	619	275	124	151			129,157	128,312	129,157	31,829	775,095	726,793	775,095				13
14	73	31,025	14,086	16,939			622,604	558,298	622,604				18	18	0	45,177	45,177	45,177	367	216				146,373	145,251	146,373	31,810	922,065	856,157	922,065				14
15	74	30,625	14,048	16,577			625,691	526,681	625,691				1,709	1,298	411				422	271					144,739		32,756	925,115	824,097	925,115				15
16	75	30,605	15,717	14,888			647,987	594,126	647,987				1,733	1,291	442				544	393					144,195		32,862	967,448	890,976	967,448				16
17	76	30,333	15,931	14,402			650,187	541,524	650,187					1,275	438				557	406					143,638		32,603	969,648	837,179	969,648				17
18	77	30,303	15,580	14,723			651,787	538,301	651,787					1,262	451				566	445				146,373	143,082	146,373	32,612	951,248	823,209	951,248				18
19	78		15,803	15,100			653,387	515,301	653,387					1,236	477				695	491				126,384	172,448	176,384	32,621	987,859	798,650	982,859				19
20	79		14,815	15,488			656,987	504,113	656,987					1,222	491				681	491	151			176,384	171,816	176,384	32,648	984,459	823,653	984,459				20
21	80		14,416	15,887			656,987	487,126	656,987										682	496	106			176,384	171,436	176,384	32,698	986,059	808,293	986,059				21
22	1981	30,303	14,005	16,298			658,187	472,828	658,187				1,713	1,208	505	46,875	43,214	46,875	682	496				202,766	196,234	271,166	32,698	1,011,139	815,788	1,011,139				22
23	82	27,903	13,582	14,321			659,787	459,707	659,787				1,777	1,242	535		42,680		681	495				209,905	203,292	209,905	30,361	1,028,478	813,550	1,024,478				23
24	83		13,217	14,686			660,787	446,021	660,787				1,777	1,227	550		42,130		682	496					202,610		30,362	1,025,478	798,672	1,025,478				24
25	84		12,823	15,080			661,387	431,541	661,387				1,777	1,211	566		41,564		701	515					201,909		30,381	1,026,078	782,925	1,026,078				25
26	85		12,407	15,496				416,045					1,781	1,195	576		40,978		701	515					201,208		30,385	1,026,078	766,142	1,026,078				26
27	86		11,961	15,942				400,103						1,177	604		40,374		709	523					200,499		30,393	1,026,078	748,887	1,026,078				27
28	87		11,503	16,400				383,703						1,161	620		39,751		711	555					199,758		30,425	1,026,078	731,126	1,026,078				28
29	88		11,031	16,872				366,831						1,143	638		39,116		711	555				209,905	199,017	209,905	30,425	1,026,078	712,875	1,026,078				29
30	89		10,546	17,357				349,474						1,125	656		38,460		760	574	186			222,879	211,231	222,879	30,444	1,039,052	707,076	1,039,052				30
31	90		10,047	17,856				331,618						1,106	675		37,785		800	573	227				210,441		30,444		687,715					31
32	1991	27,903	9,534	18,369				313,249						1,086	695		37,090		800	573					209,631		30,444		667,887					32
33	92	22,328	9,006	13,322				299,927						1,066	715		36,375		800	573					208,831		21,909		651,044					33
34	93		8,623	13,705				286,222						1,045	736		35,639		813	586					208,018		28,927		637,790					34
35	94		8,295	14,099				272,123					1,781	1,025	756		34,883		811	587					207,204		21,923		622,121					35
36	95		7,891	14,504				257,619					1,785	1,003	782		34,101		813	586					206,391		28,926		606,022					36
37	96		7,407	14,971				242,648						981	804		33,297		813	586					205,578		28,926		589,482					37
38	97		6,578	15,350				227,298						957	828		32,469		813	586					204,765		28,926		572,493					38
39	98		6,536	15,792				211,506						934	851		31,618		813	586					203,952		21,926		555,037					39
40	99		6,062	16,246				195,310						909	876		30,742		814	587	227				203,138		21,927		537,101					40
41	2000		5,615	16,713				178,597						884	901		29,841		883	618	265				202,295		21,926		518,604					41
42	2001	22,328	5,135	17,193				161,404						857	928		28,913		883	618					201,372		21,926		499,800					42
43	02	28,503	4,640	23,863				137,541						832	953		27,960		883	618					200,409		31,171		473,901					43
44	03		3,921	24,549				112,992						804	981		26,979		883	618					199,606		31,171		447,488					44
45	04		3,249	25,254				87,738					1,785	776	1,009		25,970		883	618					198,723		31,171		420,342					45
46	05		2,522	25,981				61,757					1,789	747	1,042		24,928		883	618					197,840		31,175		392,636					46
47	06		1,776	26,727				35,030						715	1,074		23,854		882	617					196,958		31,174		363,753					47
48	07		1,007	27,496				7,534			107,911			685	1,104		22,750		883	618					196,075		31,175		334,270					48
49	08		217	7,534	20,756			0			87,159			654	1,135		21,615		882	617					195,193		31,174		303,967					49
50	09				28,503						58,656			621	1,168		20,447		884	619	265				194,309		31,176		273,112					50
51	10				28,503						30,153			587	1,202		19,245		221	617	204				193,388		31,213		242,786					51
52	2011	28,503			28,503						1,650			553	1,236		18,009		618	618					192,770		30,910		212,199					52
53	12	26,428			1,650	24,778					0			517	1,272		16,737		617	617					192,153		28,834		208,890					53
54	13					26,428			661,387			107,911		481	1,308		15,429	46,875	25,173	618		1,675	22,880		165,980		28,835		187,609	1,039,052	1,858	1,898	7,338	54
55	14								460,324			44,753	1,785	443	1,346		14,083	46,256	15,708	618			17,415		147,272		28,835		181,355	774,232	15,594	15,594		55
56	15								282,567			2,632	1,781	405	1,350		12,733		11,452	618			9,159		135,820		28,827		148,553	594,495	15,620			56
57	16								160,300					366	1,388		11,345		11,451	617					134,369	222,879	28,826		135,714	474,188	15,621			57
58	17								155,232					327	1,427		9,918		11,452	618					132,917	216,687	28,827		122,835	462,928	15,621			58
59	18								155,232					286	1,466		8,452		11,421	587					101,496	216,687	28,796		109,938	462,928	15,623			59
60	19								123,979					243	1,510		6,942		11,423	589					90,073	209,570	28,798		97,015	379,805	15,622			60
61	20								123,979					200	1,556		5,386		11,426	592					78,647	209,570	28,751		84,083	379,805	15,619			61
62	2021	26,428				26,428			123,979					155	1,598		3,788		11,377	543					67,220	209,570	28,758		71,108	379,805	15,622	15,594		62
63	22	23,203				23,203			123,979					108	1,645		2,143	46,256	11,377	543			9,159		55,843	177,995	25,527		58,046	348,170	14,524	14,556		63
64	23								38,783					62	1,690		453	1,668	9,057	450			6,932		46,886	160,595	25,431		47,139	203,095	21,207	21,178		64
65	24								35,733					13	51		402		2,422	397			350		44,464	141,698	25,381		44,866	179,325	23,245	21,528		65
66	25								13,400					12	53		349		1,959	284					42,505	135,955	25,268		42,852	151,053	23,244		1,717	66
67	26								11,200					10	54		295		1,937	262					40,568	118,105	25,246		40,853	131,003	23,245		1,717	67
68	27								9,600					9	56		239		1,871	198					38,695	106,355	25,182		38,934	119,653	23,244		1,716	68
69	28								8,000					7	57		182		1,865	190					36,830	92,540	25,174		31,932	102,638	23,245		1,717	69
70	29								6,400					5	59		123		1,828	153					35,002	84,190	25,177		35,125	92,288	23,245		1,717	70
71	30								4,800					4	61		62	1,698	1,812	137					33,190		25,252		33,252	90,645	23,244		1,716	71
72	2031								3,200					2	62		0	0	1,812	137					31,378		25,121		31,378	87,390	23,245		1,717	72
73	32								1,600					0	0				1,811	136					29,567		25,120		29,567	85,790	23,309		1,781	73
74	33								600										1,812	137					27,755		25,121		27,755	84,790				74
75	34								0										1,811	136					25,943		25,120		25,822	84,790				75
76	35																		1,806	131					28,136	69,828	25,115		28,136	69,828				76
77	36																		1,779	104					22,357	45,046	25,088		22,357	45,046				77
78	37																		1,748	73					20,609	45,046	25,057		20,609	45,046				78
79	38																		1,747	72					18,862	23,383	25,056		18,862	23,383				79
80	39																		1,730	55					17,132	23,383	25,039		17,132	23,383				80
81	40																		1,730	55					15,402	23,383	25,039		15,402	23,383				81
82	2041																		1,730	55					13,672	23,383	25,039		13,672	23,383				82
83	42																		1,730	55					11,942	12,974	25,039		11,942	12,974				83
84	43																		1,706	31					10,236		25,015		10,236					84
85	44																		1,706	31					8,530		25,015		8,530					85
86	45																		1,706	31					6,824		25,015		6,824					86
87	46																		1,706	31					5,118		25,015		5,118					87
88	47																		1,706	31					3,412		25,015		3,412					88
89	48																		1,706	31					1,706	12,974	25,015		1,706	12,974				89
90	2049	23,203				23,203	661,387			107,911			1,781			46,875			1,706	31					0	0	25,015	1,039,052	0	0	23,309	21,528		1,781	90
	Total	2,126,592	444,890	661,387	157,911	912,314	661,387			107,911			135,078	42,165	46,875	46,875	0	0	222,879	11,612	8,143	61,975	120,849	222,879	0	0	0	2,301,635	1,039,052	0	0	775,526	725,590	0	135,078	

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BUREAU -- RECLAMATION SLC UTAH