RELATED PROJECTS: DAVIS DAM

FINDING OF FEASIBILITY, APRIL 26, 1941

(H. Doc. 186, 77th Cong., 1st sess.)

BULLSHEAD (DAVIS) DAM PROJECT

LETTER FROM THE ACTING SECRETARY OF THE INTERIOR, TRANSMITTING RECLAMATION REPORT ON THE BULLSHEAD DAM PROJECT ON THE COLORADO RIVER WHERE THAT STREAM FORMS THE BOUNDARY BETWEEN ARIZONA AND NEVADA

THE SECRETARY OF THE INTERIOR,
Washington, April 26, 1941.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

MY DEAR MR. SPEAKER: There is submitted herewith the reclamation report on the Bullshead [1] Dam project on the Colorado River where that stream forms the boundary between Arizona and Nevada.

The report consists of the letter of April 7, 1941, to me from the Commissioner, Bureau of Reclamation, the engineering and economic report transmitted with that letter, and this, the finding with respect to the feasibility of the project.

The plan for the Bullshead Dam project contemplates the construction of a large dam, a power plant, transmission lines, and incidental and appurtenant works to cost approximately $41,200,000. The project will make available ultimately 225,000 kilowatts of electric energy. It will serve through regulation of the river below Boulder Dam to increase the efficiency of the Boulder Dam power plant, and to contribute to flood control, navigation improvement, irrigation and municipal water supplies, power development, reduction of silt pollution, recreation, wild waterfowl protection, and related conservation purposes. It will also prove most useful eventually in metering the water passed downstream for use beyond the boundary of the United States.

[1] On June 26, 1941 Secretary of the Interior Harold L. Ickes named Bullshead Dam "Davis Dam" in honor of Arthur Powell Davis, first Director of the Bureau of Reclamation (at that time the Reclamation Service).

The plan of operation contemplates the coordination of water releases from Bullshead Reservoir with releases from Lake Mead, the reservoir created by Boulder Dam, and the coordination of power production at the Bullshead Dam power plant with that of the Parker Dam power plant.

Demands for power are outrunning present means of meeting them in the Southwest. The Bullshead Dam project, with the Parker Dam power project and other smaller developments which may follow, will meet the situation for some years, or until the Metropolitan Water District of Southern California exercises its rights to one-half of the power from the Parker plant.

Owing to the manner in which the Bullshead Dam project fits into the plan for the development of the lower Colorado River, no allocation of costs is made to benefits other than to power. Sales of electric energy are expected to yield revenues to cover the cost of operation and maintenance of the Bullshead Dam project, and to amortize the entire cost of the project in 40 years with interest at 3 percent, thus fulfilling the requirements of the Reclamation Project Act of 1939. The power will be sold at rates comparable with those established for the Parker Dam power project, thus spreading the benefits which follow low-cost power.

I find that the Bullshead Dam project is feasible as to its construction from an engineering point of view. I find that it will benefit in many ways the region and the people of the region, and that its economic benefits exceed the annual charges. I find that repayment of the entire cost of its construction with interest at 3 percent may confidently be expected within 40 years. The Bullshead Dam project, consequently, is authorized for construction under the provisions of section 9 of the Reclamation Project Act of 1939. Construction should be begun as soon as possible in order to meet a prospective serious power deficiency.

The Director of the Bureau of the Budget has informed me that authorization of the Bullshead Dam project at this time is in accord with the program of the President.

Sincerely yours,

E. K. BURLEW,
Acting Secretary of the Interior.

UNITED STATES DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Washington, April 7, 1941.

The SECRETARY OF THE INTERIOR.

SIR: In conformity with section 15 of the Boulder Canyon Project Act (45 Stat. 1057), the Bureau of Reclamation has been conducting

extensive studies in the Colorado River Basin for the purpose of developing a comprehensive plan for the conservation and utilization of the waters of the main stream and its tributaries. The authorization contemplated that reports should be made from time to time on projects and plans.

Engineers of the Bureau of Reclamation have given special attention this past year to means of refining the general plan for development of the lower section of the Colorado River and of arranging to meet a prospective critical power shortage in the surrounding area. Demands upon the Boulder Dam power plant, even after it has been supplemented by the Parker Dam power plant and plants on the All-American Canal, will be such, owing to normal growth of load and to national-defense requirements, that an additional source of energy will be needed.

The engineering report shows that the situation can be met by construction of the Bullshead Dam project. Features of the project will be Bullshead Dam, an earth and rock-fill structure 338 feet high in the Colorado River about 67 miles below Boulder Dam; Bullshead Reservoir having a capacity of 1,600,000 acre-feet of active storage and extending to the tailrace of the Boulder Dam power plant; Bullshead Dam power plant having an initial installation of 180,000 kilowatts and an ultimate installation of 225,000 kilowatts; transmission lines interconnecting the Bullshead plant with the Parker Dam power project system and with market centers; and incidental and appurtenant works.

The Bullshead Dam project will serve important multiple purposes. Through reregulation of the flow of the main stream of the Colorado River below Boulder Dam it will contribute to flood reduction, navigation improvement, irrigation and domestic water supplies, power development, silt pollution reduction, recreation, and wild waterfowl protection, as well as other related conservation purposes. The Bullshead Dam will take its place as one of the great series of dams between the Grand Canyon and the point at which the Colorado River flows into Mexico. This series includes Boulder, Bullshead, Parker, Headgate Rock, Imperial, and Laguna Dams. The series, all Government dams, will develop this section of the river to a maximum for all purposes. Bullshead Dam will contribute in a major way to the development of the lower river for hydroelectric power. Although it serves other purposes as noted, since these purposes have been taken into consideration fully in the allocation of costs of other structures of the series, the entire cost of the Bullshead Dam project should be allocated to power. A prospective service of Bullshead Dam should be noted and emphasized. When an international agreement regarding the division of the waters of the Colorado River between the United States and Mexico is completed, the accurate

control which will be provided by Bullshead Dam will be essential to meter out the water to be passed downstream.

The creation of Bullshead Reservoir will enable the outlets at Boulder Dam to be operated for maximum power production in coordination with rapid fluctuations in the production at plants in southern California and in the demand for power in that area, which the Boulder plant principally serves. The power plant at Bullshead will be coordinated, however, with the Parker plant about 80 miles farther downstream, and will assist in serving the growing demands in southern Nevada, in western and central Arizona, and in southeastern California. The prospective power requirements of the market area are that 1,334,000,000 kilowatt-hours of energy will be needed annually in the near future. If the Bullshead Dam project is completed in 3 years, it will meet, with the Parker plant and certain small projects that may be developed, these requirements until such time as the Metropolitan Water District of Southern California exercises its right to one-half of the power from Parker Dam.

The cost of the Bullshead Dam project is estimated at $41,200,000. The cost being allocated to power, it is expected to be repaid in 40 years with interest at 3 percent under section 9 of the Reclamation Project Act of 1939 (53 Stat. 1187). The annual cost of amortizing the project on this basis will be $1,782,400 and the annual cost of operation and maintenance will be $380,000. Power rate and demand studies show that at rates comparable with those established for the Parker Dam power project, the energy from the Bullshead Dam project will yield sufficient revenue to guarantee the payment of the charges both for operation and maintenance and for amortization of the project.

The benefits to be derived from the construction of the Bullshead Dam project far exceed the annual costs, and the project clearly meets all the requirements of the Reclamation Project Act of 1939. I recommend, therefore, that you find the project feasible, and that the finding and the report be transmitted to the Congress in compliance with the provisions of the Reclamation Project Act of 1939.

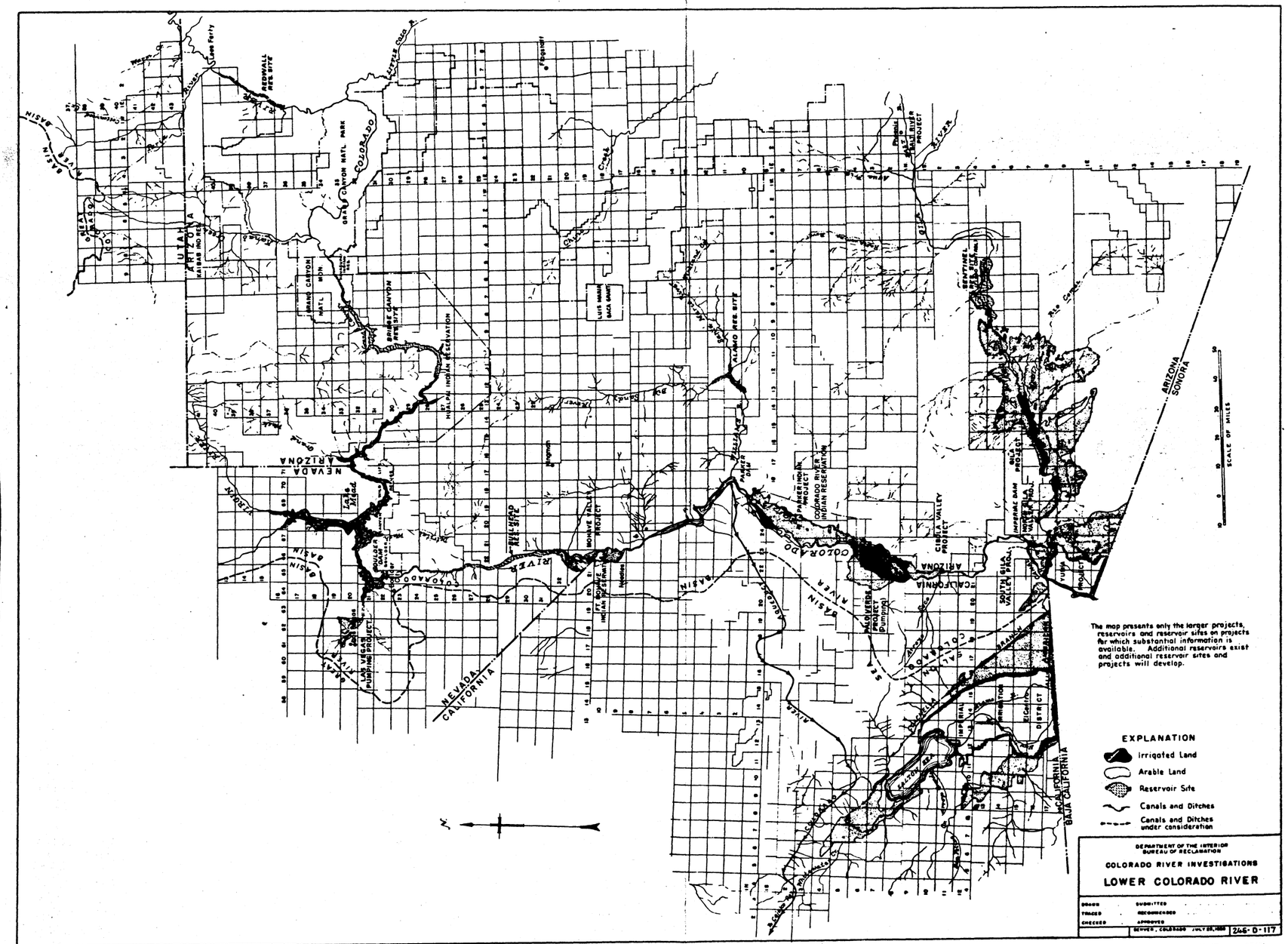
Respectfully,

JOHN C. PAGE, *Commissioner.*

REPORT ON BULLSHEAD (DAVIS) DAM PROJECT, ARIZONA-NEVADA

INTRODUCTION

The site of Bullshead Dam is approximately 67 miles downstream from Boulder Dam and about 80 miles upstream from Parker Dam on the Colorado River where that stream forms the boundary between Arizona and Nevada. It is one of a series of dam sites between the



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lower end of the Grand Canyon and the point at which the river flows from the United States into Mexico, others being Boulder Dam site, Parker Dam site, Headgate Rock Dam site, Imperial Dam site, and Laguna Dam site. Dams have been built at the Boulder, Parker, Imperial, and Laguna sites by the Bureau of Reclamation, and a dam is under construction at the Headgate Rock site by the Office of Indian Affairs, Department of the Interior.

Dams of this series will provide maximum regulation and control of the Colorado River in the lower reaches for flood reduction and control, navigation improvement, irrigation and domestic water supplies, hydroelectric power, recreation, wild waterfowl protection, pollution abatement, and related purposes.

The lower basin of the Colorado River is an area of extreme aridity, and the Colorado River is the most important irrigation stream in the Pacific Southwest. More details concerning the region and the river may be found in the reports which were made prior to the authorization of the Boulder Canyon project by the act of December 21, 1928.[2]

AUTHORITY

The investigations which resulted in this report were made pursuant to section 15 of the Boulder Canyon Project Act (45 Stat. 1057), which authorized and directed the Secretary of the Interior to make investigations and reports of the feasibility of projects for irrigation, generation of electric power, and other purposes in the States of Arizona, Nevada, Colorado, New Mexico, Utah, and Wyoming for the purposes of formulating a comprehensive scheme of control and the improvement and utilization of the waters of the Colorado River and its tributaries. This report was prepared in conformity with section 9 of the Reclamation Project Act of 1939 (53 Stat. 1187).

DESCRIPTION OF PROJECT

The Bullshead Dam project includes Bullshead Dam, Bullshead Reservoir, Bullshead power plant, transmission lines, and incidental and appurtenant works. The dam will be an earth- and rock-fill structure 338 feet high above foundation. The reservoir will have a live storage capacity of 1,600,000 acre-feet of water and will back water up to the tailrace at the Boulder Dam power plant. The power plant will utilize the 140 feet of head available between the tailrace and the Bullshead site and will have an initial capacity of 180,000 kilowatts with the installation of four 45,000-kilowatt gener-

[2] See: In 65th Cong., 1st sess., S. Doc. v. 11, No. 103, Serial No. 7265; S. Doc. No. 142, 67th Cong., 2d sess.; S. Rept. 654, pt. 1, 69th Cong., 1st sess.; H. Rept. 1657, 69th Cong., 2d sess.; H. Rept. No. 918, 70th Cong., 1st sess.; H. Doc. No. 446, 70th Cong., 2d sess.

ators and an ultimate capacity of 225,000 kilowatts. The transmissions lines, of 161,000-volt capacity, will connect with the Parker Dam plant and extend to market areas. Power from the Bullshead plant, augmented by power from the Parker plant, will serve commercial load centers at Phoenix, Tucson, and Yuma, Ariz., in the Imperial and Coachella Valleys in California, and it will serve the Gila project near Yuma.

WATER SUPPLY

The Bullshead Dam project will utilize the stream flow of the lower Colorado River after it has been regulated by and released from Lake Mead, the reservoir created by Boulder Dam. There are no tributaries entering the river between Boulder and Bullshead Dams. Lake Mead has a capacity of 32,359,274 acre-feet of water. It controls almost completely the main stream. Releases from Lake Mead are governed by the requirements of irrigation and domestic water users downstream, the requirements of flood control, and those of power generation. They are made in accordance with the Colorado River compact referred to in section 13 of the Boulder Canyon Project Act. The compact provides for the distribution of the waters of the Colorado River between the upper and lower basins of the river.

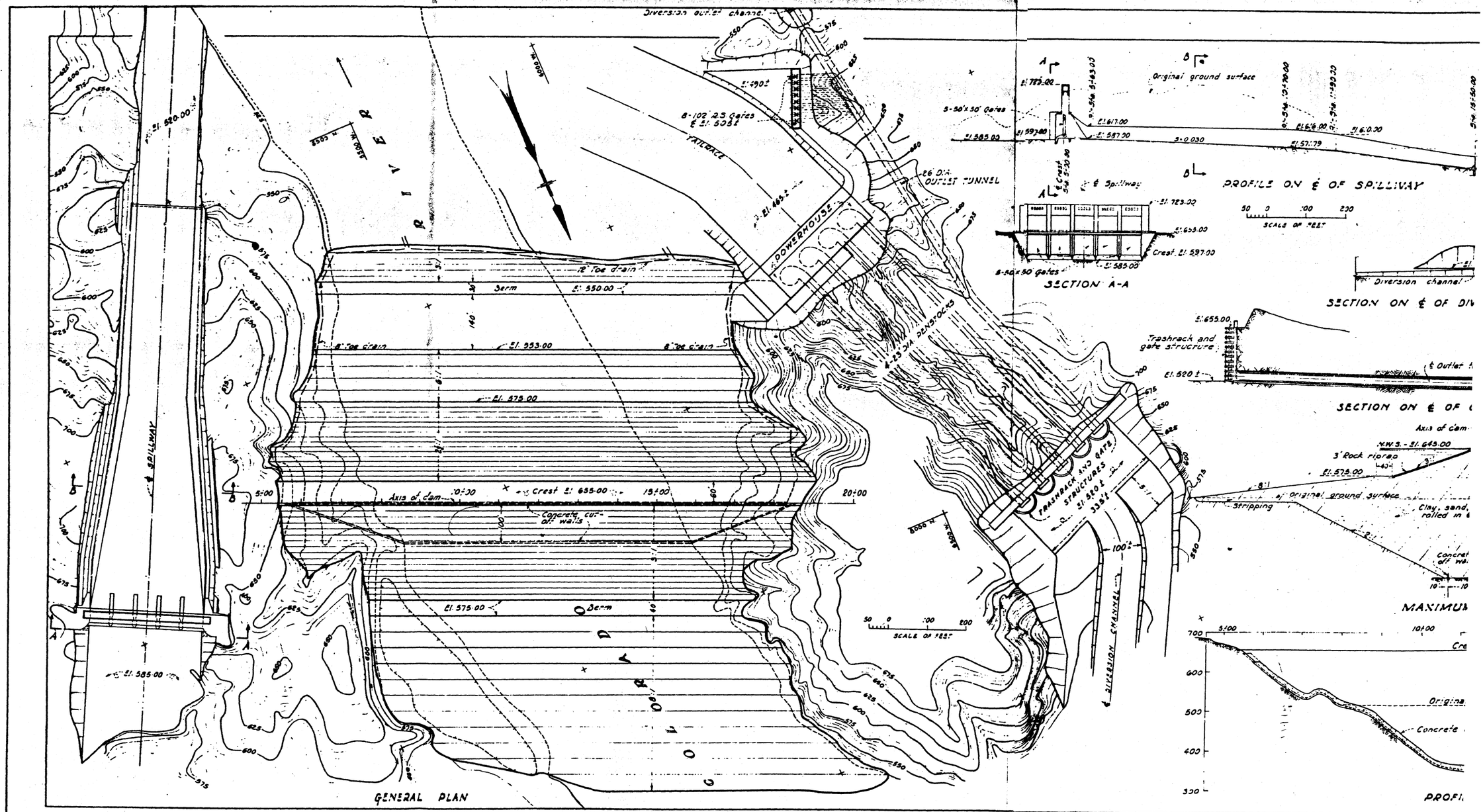
Reservoir operation studies have been made for Lake Mead based on run-off records for the 44-year period from 1897 to 1940. Irrigation diversions and the consumptive use of water in the upper basin will increase in the future until limitations provided in the Colorado River compact are reached; therefore, the water-supply studies for the Bullshead power plant are based on estimated average conditions of diversion and consumptive use as estimated for the year 1945 and for the year 1985. Table No. I which follows shows the estimated annual run-off at the Bullshead Dam site, corrected to reflect the estimated upstream use of water, in the years 1945 and 1985:

TABLE I.—*Extremes of run-off at Bullshead site*

	With 1945 conditions	With 1985 conditions
	Acre-feet	*Acre-feet*
Long-time (44-year) average	13, 200, 000	10, 000, 000
Average of low years [1]	10, 000, 000	8, 500, 000

[1] Series of years of low run-off, such as 1900 to 1905, or 1933 to 1940, inclusive, when only firm power is being produced at Boulder Dam.

In years of low run-off, the entire annual stream flow at Bullshead Dam can be used for power generation. In years of high run-off, part of the releases from Lake Mead will be made for flood-control purposes at discharges too high to be used for power generation at Bullshead Dam. The long-time average annual flow usable for power



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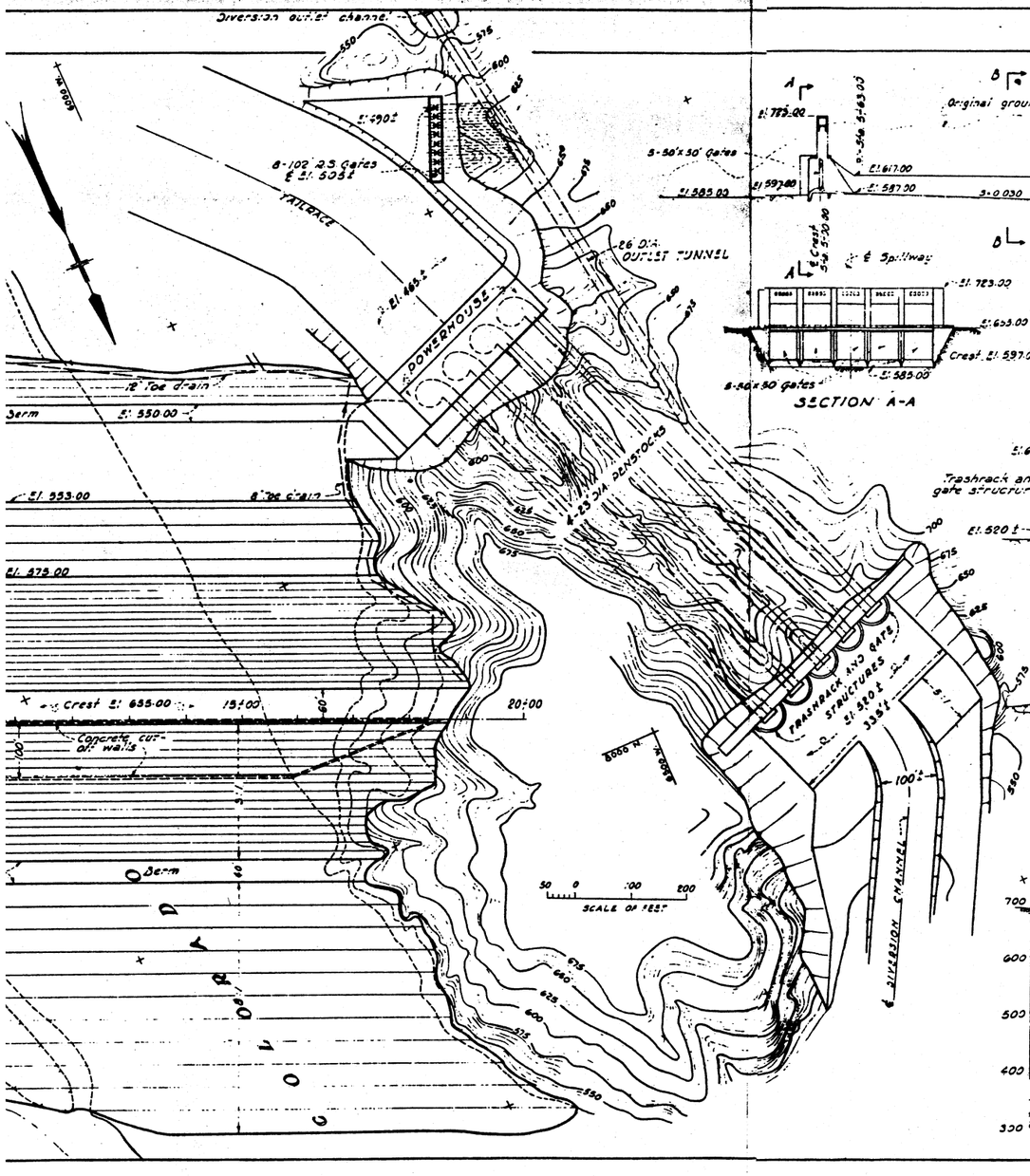

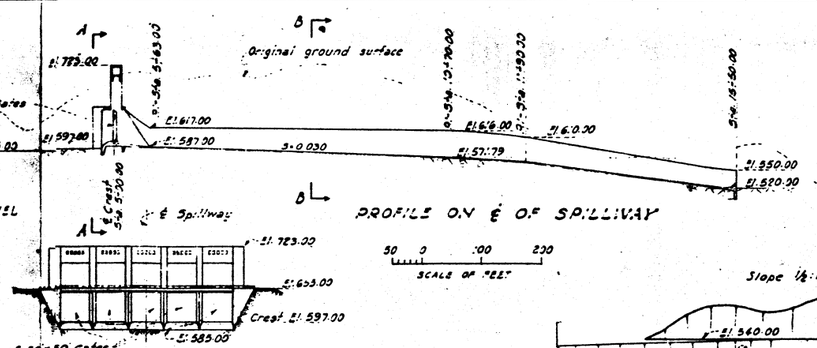

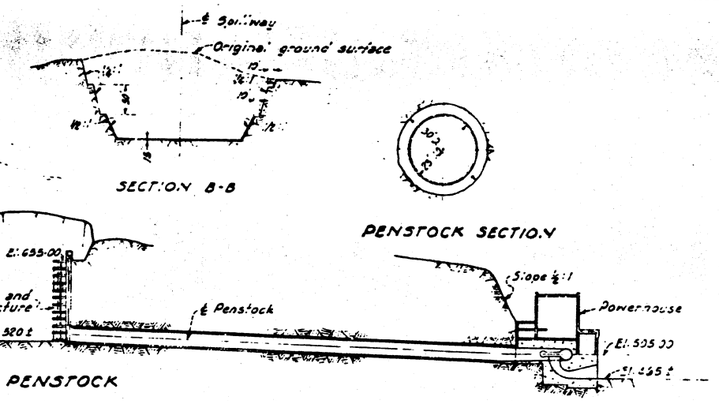

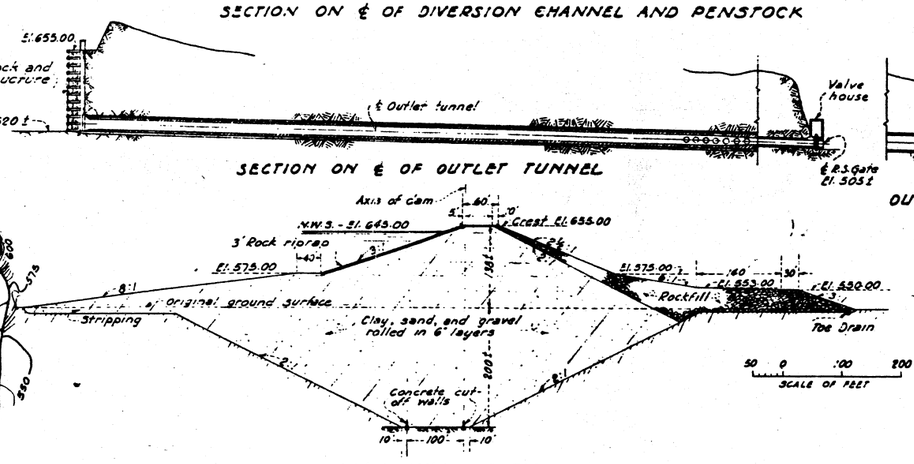

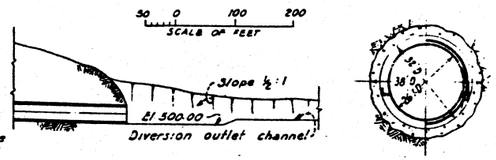

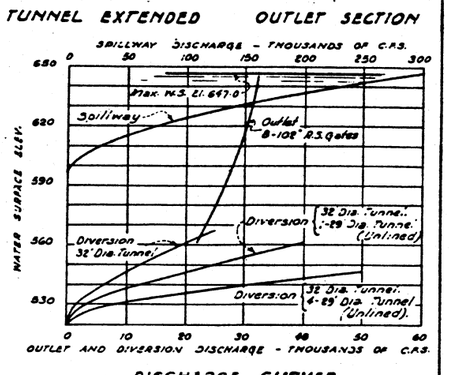

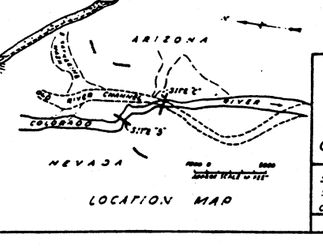

PRELIMINARY ESTIMATE DRAWING

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER INVESTIGATIONS
ARIZONA-NEVADA

BULLS HEAD DAM - SITE 'C'
GENERAL PLAN AND SECTIONS

DRAWN: M.S.P. SUBMITTED: [signature]
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CHECKED: [signature] APPROVED: [signature]
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generation is estimated at 12,500,000 acre-feet with 1945 conditions and 9,500,000 acre-feet with 1985 conditions.

The firm power production at Boulder Dam is distributed throughout the year in such a manner that it can be coordinated with the power output available at power plants in Southern California to meet the load requirements in that area. Table II shows the estimated distribution of firm power output at Boulder Dam in years of low run-off in southern California. It shows the required releases at Bullshead Dam in 1945 and 1985 to meet downstream requirements for irrigation and other requirements and the storage capacity required at Bullshead to regulate Boulder Dam releases to conform with these downstream requirements.

TABLE II.—*Storage capacity required at Bullshead*

Month	Distribution of Boulder Canyon firm output in dry years (percent)	Bullshead operation 1945 conditions			Bullshead operation 1985 conditions		
		Inflow from Lake Mead in dry years [1]	Required release for downstream irrigation, etc.[1]	Storage capacity required for regulation [1]	Inflow from Lake Mead in dry years	Required release for downstream irrigation, etc.[1]	Storage capacity required for regulation [1]
January	8.8	880	350	----	750	380	----
February	9.3	930	370	----	790	450	----
March	7.2	720	520	----	610	680	70
April	6.2	620	570	----	530	830	300
May	5.8	580	630	50	490	920	430
June	8.9	890	680	----	760	990	230
July	8.9	890	700	----	760	990	230
August	9.0	900	650	----	760	920	160
September	9.1	910	550	----	770	830	60
October	8.9	890	490	----	760	680	----
November	9.0	900	420	----	760	450	----
December	8.9	890	370	----	760	380	----
Total	100.0	10,000	6,300	50	8,500	8,500	1,480

[1] Flow units and storage units are 1,000 acre-feet.

To allow for intramonthly fluctuations in the releases from Lake Mead and Bullshead Reservoir, and for variations in these quantities from year to year, the required storage capacity fully to coordinate Boulder Dam releases with downstream irrigation requirements is estimated to be 200,000 acre-feet with 1945 run-off conditions and 1,600,000 acre-feet with 1985 conditions. Initially, the available active capacity not needed to regulate water for irrigation and other purposes could be used to regulate releases from Bullshead Reservoir as nearly as practicable in conformity with needs of the power market. Since Bullshead Reservoir will smooth the fluctuations in the releases through the Boulder Dam power plant, operation of the two plants should be coordinated to insure the production of the maximum amount of firm power output, in conformity with market requirements

from both plants. Thus the entire output from Bullshead Dam power plant in years of low run-off will be classed as firm power.

FEATURES OF BULLSHEAD DAM PROJECT

Dam.—Geological examinations were made of several dam sites. At the most favorable site the river fill is composed of sand, gravel, and silt to a maximum depth of 200 feet to bedrock. This site is adequate for the construction of the earth-fill dam herein proposed providing a cut-off trench is excavated across the river and suitable cut-off walls are placed therein, as shown on plate II.

The dam will be of the earth- and rock-fill type, 1,350 feet long at the crest and 338 feet high above the lowest foundation. The crest of the dam will be at elevation 655 feet and will have a width of 60 feet. The upstream face will be paved with rock riprap on a 3-to-1 slope down to elevation 575, the lower limit of probable wave action. The downstream face of the earth fill will have a slope of 2 to 1, and will be protected by a heavy rock fill. The total thickness of the base of the dam will be about 1,400 feet. The earth fill will consist of selected clay, sand, and gravel rolled in 6-inch layers.

A cut-off trench having a bottom width of 120 feet and 2-to-1 side slopes will be excavated in the river fill to bedrock. Two concrete cut-off walls will be constructed in the trench and up the abutments to aid in preventing seepage beneath the dam.

The spillway will be of the open-chute type cut through the left abutment of the dam and will be provided with regulating gates. The spillway capacity will be 200,000 second-feet when the water surface of the reservoir is at elevation 647, 8 feet below the top of the dam. The chute will be about 1,100 feet long and will return the flow to the river about 400 feet downstream from the toe of the dam. It will be concrete lined.

During the construction of the dam the river will be diverted through a 32-foot concrete-lined tunnel and five unlined tunnels through the right abutment of the dam. A large steel outlet pipe will be installed for permanent use in the 32-foot outlet tunnel. This will discharge through valves into the tailrace and will serve to bypass water for irrigation and other purposes when the power plant is not operating.

Additional details of the dam and appurtenant works are shown on plate II. (Note that five 29-foot unlined tunnels are to be used in place of four 30-foot tunnels as shown on the drawing.)

Reservoir.—Topographic surveys have been made of the reservoir site. Table III shows the areas and capacities of the Bullshead Reservoir at various elevations determined from the plan and profile surveys of the Colorado River made by the Geological Survey in 1902–3 and 1920, supplemented by estimates for parts of the areas where the survey data were incomplete.

TABLE III.—*Reservoir area and capacity*

Elevation	Area (acres)	Capacity (1,000 acre-feet)	Elevation	Area (acres)	Capacity (1,000 acre-feet)
525 feet	0	0	600 feet	20, 000	808
540 feet	3, 000	23	610 feet	22, 000	1, 020
550 feet	7, 000	73	620 feet	23, 000	1, 240
560 feet	12, 000	168	630 feet	25, 000	1, 480
570 feet	14, 000	298	640 feet	27, 000	1, 740
580 feet	16, 000	448	647 feet	28, 000	1, 940
590 feet	18, 000	618			

The reservoir will extend to the Boulder Dam tailrace.

Bullshead Dam power plant.—The headwater elevation at the Bullshead Dam will vary from a maximum of 647 feet, the original low-water elevation at Boulder Dam, to a minimum of 575 feet, which is the bottom of the live storage capacity required for regulation with 1985 conditions. This indicates an ultimate fluctuation of 72 feet. Initially, however, the average headwater fluctuations will probably not exceed 25 feet.

The original tailwater elevation when the Bullshead Dam is completed will be 525 feet. Some scouring in the river channel will take place after the completion of the dam. It is estimated that the static head at the plant under 1945 conditions of releases at Boulder Dam and consumptive use in the basin above Lake Mead will be 120 feet. Under the conditions of release and consumptive use as estimated for 1985 it is expected that the static head for the Bullshead plant will be 105 feet.

Bullshead Dam power plant will have an initial generating capacity of 180,000 kilowatts in four hydroelectric units. Penstocks will be installed and space provided in the powerhouse for the ultimate installation of five units of 45,000 kilowatts each.

The powerhouse will be located on the Nevada side of the river just downstream from the west abutment of the dam. A forebay will be constructed on the upstream side of the abutment with trashracks and emergency slide gates serving large-diameter steel penstocks, which will be placed in the tunnels, and backfilled with concrete. Each of the penstocks connecting to the powerhouse will be equipped with a surge tank near the downstream end. The building will be a reinforced concrete structure about 515 feet long and 75 feet wide, with a transformer deck and transformer transfer track along the upstream side of the main building.

The turbines will be spaced at about 71-foot centers and will have a capacity of 60,000 horsepower each at a net head of 105 feet.

The over-all efficiency of the plant is estimated to average 70 percent. On this basis, the average annual power output is estimated in table IV to be as follows:

TABLE IV.—*Estimated electric output*

	1945 conditions	1985 conditions	Average annual output during 40-year period
Average head:			
Long-time average annual release (acre-feet)	12, 500, 000	9, 500, 000	----------
Annual release for firm power (acre-feet)	10, 000, 000	8, 500, 000	----------
Possible average annual output:			
Firm power (million kilowatt-hours)	860	640	750
Secondary power (million kilowatt-hours)	215	75	145
Total power (million kilowatt-hours)	1, 075	715	895

Transmission lines.—Transmission lines to be constructed in connection with this plant will include as principal units of the net two 161,000-volt lines to the Parker Dam power plant, one additional line from the Parker plant to Phoenix, Ariz., and one additional line from Parker power plant to the substation of the Gila project, near Yuma, Ariz.

POWER MARKET

While the discharge from the reservoir at Bullshead Dam will be coordinated with that from Lake Mead for the purpose of regulating the flow to the best advantage of downstream irrigation and other uses, the power output will be interconnected with the Parker Dam power plant. The combined output of the Bullshead and Parker plants will be used to supply a large part of the power requirements of southern Nevada, central and southwestern Arizona, the Imperial and Coachella Valleys in California, and the Gila project.

The near future annual demands for electric energy in the area to be served by the Parker and Bullshead plants are estimated at 1,334,000,000 kilowatt-hours. Contracts for the supply of part of this load from the Parker Dam power plant have already been executed. The probable distribution of the demands on the two power plants is presented near the end of this report in table VII.

The output of the Parker plant and the output from the initial installation at the Bullshead plant will be approximately 1,567,000,000 kilowatt-hours annually as compared with the estimated initial demand of 1,334,000,000 kilowatt-hours. The estimated annual output of the two plants is based on the assumption that the full capacity of the Parker Dam power plant will be available to the United States. It must be emphasized that the Metropolitan Water District of Southern California has the right to one-half of the capacity of the Parker Dam power plant when the power is needed by the district

for the purpose of pumping water into and through its Colorado River aqueduct. When the metropolitan water district exercises this right, the amount of power available to the Government will be inadequate to supply the requirements of the area to be served by the combined power systems. Thus, even with the addition of Bullshead Dam, it is clear that the prospective demand in the market area of Parker and Bullshead power plants will absorb the full output of the two plants practically from the start.

PURPOSES OF PROJECT

The Bullshead Dam project combines multiple purposes for a maximum degree of conservation of the waters of the Colorado River. It will serve navigation; flood control; river regulation for irrigation, for municipal water supply, and for metering the water which may be passed downstream for use beyond the boundary of the United States; power development; recreation; silt-pollution control; wildlife; and related purposes.

POWER DEVELOPMENT

In the preceding paragraphs of this report the ways in which the Bullshead Dam project serve in the development of hydroelectric power have been set forth and discussed. In review here it should be mentioned that the project will increase the efficiency of the Boulder Dam power plant, will develop a large block of hydroelectric power at a plant to be situated immediately below Bullshead Dam, and will improve the supply from the Parker Dam power plant and improve the service rendered the Bullshead-Parker projects market area through coordination of its energy production with that of the Parker plant.

OTHER BENEFITS

Irrigation, River regulation.—Boulder Dam is operated in such a manner that the firm power production of the Boulder power plant can be coordinated with the power output of plants in southern California, its principal market area, to meet the load requirements there, as has been noted. At certain periods the resulting reservoir releases from Lake Mead are not ideally suited to meet the irrigation requirements of the present irrigated areas and the potentially irrigable areas below Boulder Dam. The Bullshead Reservoir, of a capacity of 1,600,000 acre-feet, will make possible regulation of discharges from Lake Mead more closely to conform to downstream irrigation requirements. Such regulation will benefit 1,000,000 acres of land in the All-American Canal system, 68,000 acres of land in the Yuma project, and 500,000 acres ultimately to be developed in the Gila project. In addition, this added control of irrigation supplies will benefit such areas as that to be developed by the Office of Indian

Affairs in the Colorado River Reservation and such private developments as the Palo Verde district; and it will enable eventually the development of comparatively small areas, now desert, near to and distant from Bullshead Dam. These benefits are not ascribed to Bullshead Dam alone. They have been considered in the long-range program for the development of the Colorado River and in connection with other features of the lower Colorado River development of which Bullshead Dam is a part. No allocation of costs of the Bullshead Dam project to irrigation, therefore, is proposed.

Flood control.—No major tributary of the Colorado River enters between Boulder Dam and the Bullshead site. Lake Mead will control most floods originating in the Colorado River Basin above Boulder Dam. Bullshead Reservoir will contribute to flood reduction in the lower Colorado River Basin on those rare occasions when the spillways at Boulder Dam are called upon to bypass the peaks of extraordinary flows. It also will smooth the flow below Boulder Dam, and in such an emergency as that created by the high, flash flood of September 7, 1939, originating below Boulder Dam, the Bullshead Dam will be used in cooperation with Parker and Imperial Dams to reduce downstream peaks. No allocation of costs of the Bullshead Dam project to flood control is proposed, however.

Navigation.—While navigation of the Colorado River between Bullshead Dam and Boulder Dam will be reestablished, no allocation of cost of the Bullshead Dam to navigation is proposed.

Municipal water supply.—The Bullshead Dam project will serve only incidentally to improve municipal water supplies as it reregulates the flow of the lower river for irrigation uses. The reservoir will contribute its part toward the elimination of silt pollution; it will provide a wild waterfowl refuge on a major flyway in an area where water is scarce; it will be stocked with fish; and, like Lake Mead, it will provide fine opportunities for recreation. While these benefits are important and have received consideration in the planning of the project, no allocation of costs is proposed to municipal water supply or any of these or other miscellaneous uses.

When the waters of the Colorado River are apportioned between the United States and Mexico by international agreement, Bullshead Dam will serve an important function in providing that fine degree of control needed in effect to meter out the water in accordance with the treaty or agreement. This potential future use has been taken into consideration and is a motivating factor in proposals to build the project, though no costs have been allocated to it.

ESTIMATED COSTS

Construction costs.—The construction costs of the Bullshead (Davis) Dam project are estimated in table V as follows:

TABLE V.—*Costs of construction*

Bullshead Dam and Reservoir [1]	$21, 000, 000
Power plant (180,000 kilowatts) [2]	15, 500, 000
Transmission lines	2, 000, 000
Substations (at Phoenix and on the Gila project; additions to Parker switching station, etc.)	2, 700, 000
Total	41, 200, 000

[1] Includes pen stocks, trash racks, control gates, and appurtenances.
[2] Initial installation.

Operation and maintenance.—The cost of operating and maintaining the project including the cost of repairs and replacements is shown in Table VI.

TABLE VI.—*Estimated annual cost of operation and maintenance*

	Maintenance	Repairs and replacements	Total
Bullshead Dam	$25, 000	$25, 000	$50, 000
Bullshead power plant	125, 000	50, 000	175, 000
Transmission lines (400 miles)	40, 000	35, 000	75, 000
Substations (18,000 kilovolt-amperes)	15, 000	30, 000	45, 000
Total operation and maintenance and repairs and replacements			345, 000
Overhead and general expense			35, 000
Total			380, 000

Annual charges.—It is contemplated that the cost of constructing the Bullshead Dam, the power plant, and the transmission lines will be repaid to the Government in accordance with the terms of the Reclamation Project Act of 1939, the repayment period to extend over a period of 40 years with interest at 3 percent. Amortization of the cost of the project, with 3 percent interest in a 40-year period, requires an annual charge of $1,782,400. The annual operation and maintenance charge of $380,000 added to this gives a total annual charge of $2,162,400 which would be necessary to operate, maintain, and amortize the cost of the project in 40 years with interest at 3 percent.

ESTIMATED RETURNS FROM PROJECT

The Bullshead Dam power plant will be interconnected with the Parker Dam power plant and the output of the two plants will be combined for the service of the market area. Certain contracts already have been executed under which the United States furnishes power from the Parker plant. Estimates have been made of prospective-future requirements. Data relative to the power and energy require-

ments of the area and the probable revenues from fulfilling these requirements are shown in table VII which follows:

TABLE VII.—*Parker Dam power project and Bullshead (Davis) Dam project—prospective requirements and revenues*

Customer	Amount of reserved power	Estimated usage (millions of kilowatt-hours)	Readiness to serve (charge per month)	Energy rate (mills per kilowatt-hour)	Estimated annual revenue
Salt River Valley water users:					
Present	30, 000	150	$6, 250	1. 9	$360, 000
Contemplated additional	10, 000	50	2, 083	1. 9	120, 000
Central Arizona Light & Power Co	30, 000	150	6, 250	1. 9	360, 000
San Carolos Indian project	5, 000	12	2, 460	2. 0	35. 300
Tucson Gas, Electric Light & Power Co	15, 000	60	9, 300	2. 0	188, 400
Gila project pumping	214, 000	865		2. 5	2, 162, 400
Imperial irrigation district	15, 000	40	7, 500	2. 25	180. 000
Gila Valley power district	1, 000	3	750	(1)	15. 750
Yuma irrigation district	1, 000	3	750	(1)	15, 750
City of Yuma or Arizona Edison Co	3. 000	7	2, 250	(1)	42, 750
Nevada-California Electric Corporation	5, 000	12	3, 750	(1)	72, 000
Total		1, 334			3, 552, 350

[1] First 50,000 kilowatt-hours per month at 4 mills per kilowatt-hour; next 100,000 kilowatt-hours per month at 3 mills per kilowatt-hour; all over 150,000 kilowatt-hours per month at 2.25 mills per kilowatt-hour.

RATIO OF COST TO REVENUE

In comparing the cost and revenues of the Bullshead Dam project consideration must be given to the annual charges necessary to amortize the Parker Dam power project. The annual charge for the Parker Dam power project and the Bullshead Dam project are given in table VIII.

TABLE VIII.—*Parker and Bullshead (Davis) annual charges combined*

Annual cost of Parker Dam power project	$956, 800
Annual cost of Bullshead Dam project	2, 162, 400
Total	3, 119, 200

With the cost of the Bullshead Dam project allocated to power, therefore, the ratio of project cost to estimated revenue is 1:1.14.

Appendix 1215

DAVIS DAM TRANSMISSION CIRCUITS

Davis Dam transmission circuits

Circuit terminals	Ownership	Length	Operating voltage	Supporting structures	Number of 3 ϕ circuits	Conductor	Date in service
		Miles	*Kilovolts*			*Size*	
Davis-Coolidge	USBR	292	230	Steel tower	Single	795, 000 CM	Under construction.
Davis-Hoover	USBR	74	230	do	do	795, 000 CM	Do.
Davis-Parker	USBR	82	230	do	do	795, 000 CM	Do.
Davis-Kingman Line	USBR	28	69	Wood pole	do	2/0	January 1948.
Davis-Needles Line	USBR	12	69	do	do		May 20, 1946.
Major extensions from above circuits:							
Coolidge-ED–5	USBR	30	115	Wood H frame	do	336, 400 CM	Under construction.
Phoenix-Tucson No. 2	USBR	125	115	do	do	336, 400 CM	Do.
Tucson Cochise	USBR	80	115	do	do	336, 400 CM	Do.

Appendix 1216

DAVIS DAM

ALLOCATION OF ENERGY

June 23, 1948

JUNE 3, 1948.

Memorandum

To: Secretary J. A. Krug (through Division of Power).

From: Commissioner.

Subject: Proposed allocation of Davis power and energy to applicants therefor—Davis Dam project.

Following your approval on February 10, 1948, of the Interim Schedule of Rates for Wholesale Firm Power Service (Schedule R3–F3) for the Davis Dam project, Regional Director Moritz dispatched a letter to all prospective applicants for Davis power announcing your approval of the schedule of rates and requesting completion of an application form by March 31, 1948. The letter, which was dated February 27, 1948, is enclosed and marked "Exhibit A."

In response to the announcement and request, Mr. Moritz received applications for Davis power in a total amount far in excess of the 180,000 kilowatts that is expected to be available at load centers from the Davis power plant. The individual applications and a summary thereof by applicants are enclosed and marked respectively "Exhibits B and C." A summary of the applications filed, grouped by States, is shown in table 1.

TABLE 1.—*Summary of applications filed*

[Power in kilowatts and energy in millions of kilowatt-hours annually]

State	Classification of prospective customers				Total	
	Preference		Nonpreference			
	Power	Energy	Power	Energy	Power	Energy
Arizona	501, 325	2, 394	125, 500	584	626, 825	2, 978
California	222, 480	1, 149	66, 200	397	288, 680	1, 546
Nevada	60, 000	350			60, 000	350
Utah	10, 300	33			10, 300	33
Total	794, 105	3, 926	191, 700	981	985, 805	4, 907

Table 2 shows the summary of applications in table 1 after elimination of the apparent duplications.

TABLE 2.—*Summary of applications after elimination of apparent duplications*

[Power in kilowatts and energy in millions of kilowatt-hours annually]

State	Classification of prospective customers				Total	
	Preference		Nonpreference			
	Power	Energy	Power	Energy	Power	Energy
Arizona	300, 280	1, 193	22, 500	101	322, 780	1, 294
California	222, 480	1, 149	66, 200	397	288, 680	1, 546
Nevada	60, 000	350			60, 000	350
Utah	10, 300	33			10, 300	33
Total	593, 060	2, 725	88, 700	498	681, 760	3, 223

In view of the applications for Davis power far exceeding the amount which will be available, the power allotment of Davis capacity becomes a difficult problem. In considering this problem the Bureau has used the following priorities:

(*a*) Fulfillment of commitments for power from other Colorado River sources in present contracts for Parker power.

(*b*) Federal agencies within the Department of the Interior.

(*c*) Other Federal agencies.

(*d*) Certain small contractors which have preference under reclamation law and also are now served directly by the Parker power system.

(*e*) Other applicants which have preference under reclamation law.

(*f*) All other applicants.

Using these priorities and limiting allotments to applicants which could be either served directly by the Parker-Davis transmission system, which has been described to the Congress in requests for appropriations, or applicants in the State of California which manifestly could make transmission arrangements with other agencies, the Bureau has prepared and recommends the allotment shown in table 3.

TABLE 3.—*Allocation of Davis power (kilowatts)*

(*a*) Fulfillment of commitments in contracts for Parker power:	
Gila project	2, 500
Bagdad Copper Corp. (contract I2r–13919)	4, 000
Colorado River Indian irrigation project (contract Ilr–1398)	2, 000
Imperial Irrigation District (contract I2r–11729)	15, 000
San Carlos Indian irrigation project (contract Ilr–1329)	5, 000
Tucson Gas, Electric Light & Power Co. (contract I2r–11533)	15, 000
Subtotal	43, 500

TABLE 3.—*Allocation of Davis power (kilowatts)*—Continued

(*b*) Federal agencies within the Department of the Interior:	
San Carlos Indian irrigation project	9, 000
(*c*) Other Federal agencies:	
Army Engineer Board, Imperial Dam, Arizona	3, 000
Army Air Force stations, California	15, 000
Veterans' Administration Center, Whipple, Ariz	225
(*d*) Certain small contractors which have preference under reclamation law and also are now served directly by the Parker power system:	
Gila Valley Power District	2, 000
Yuma Irrigation District	1, 500
(*e*) Other applicants which have preference under reclamation law:	
State of Nevada through its Colorado River Commission	[1] 45, 000
Imperial Irrigation District	[2] 15, 000
State of Arizona through the Arizona Power Authority	[3] 45, 775
Total	180, 000

[1] To be temporarily sold by the Bureau of Reclamation, as explained in the text.
[2] Subject to recapture by the Bureau if and when the Imperial Irrigation District places the proposed Pilot Knob power plant in operation.
[3] Includes 14,000 kilowatts subject to withdrawal by the Bureau upon 2 years' notice for use in the operation of the Gila project.

After providing for the immediate requirements for operation of the pumping plants of the Gila project, the requirements of applicants having rights to power from other sources in contracts for Parker power to the extent of the commitments in such contracts, and the applications of the San Carlos Indian irrigation project, the Army Engineer Board, the Veterans' Administration center, and two districts now being served by the Parker power system, aggregating in total 59,225 kilowatts, there remains 120,775 kilowatts for allotment to other applicants. Of this amount, 45,000 kilowatts is recommended for the State of Nevada (Nevada has applied for 60,000 kilowatts or one-third of all Davis power), and 30,000 kilowatts is recommended for customers in the State of California. All of the remaining 45,775 kilowatts is recommended to be allotted to the State of Arizona because the most desperate need for power in the Davis market area, which has been described to the Congress as central and southern Arizona, southern Nevada, and southern California, is in Arizona.

It is understood that the State of Nevada does not contemplate immediate need for Davis power but is conducting a campaign for introduction of additional industries in the basic magnesium plant predicated on the availability of Davis power to supplement its power from Hoover Dam. In view of this situation, it is recommended that the allocation to the State of Nevada be temporarily sold by the Bureau to the municipalities of Los Angeles, Burbank, Glendale, and Pasadena subject to withdrawal by the State of Nevada upon 1 year's notice in such increments as the State may desire. Such power would be apportioned among the four California municipalities in the ratio of the amounts requested by those municipalities and withdrawals would be made in the same proportion.

One-half of the 30,000 kilowatts allotted for use in the State of California is recommended for the Imperial Irrigation District, a preference customer. Since the capacity of the proposed Pilot Knob power plant and the plants at the drops on the All-American Canal plus 15,000 kilowatts of Davis power under the commitment in the district's contract for Parker power would make ample hydroelectric capacity available to the district, it is recommended that the 15,000 kilowatts of Davis power over and above the 15,000-kilowatt Parker contract commitment be subject to recapture by the Bureau if and when the district places the proposed Pilot Knob power plant in operation.

The Arizona Power Authority has been allotted all of the 45,775 kilowatts recommended for Arizona to be made available to other applicants which have preference under reclamation law. After elimination of apparent duplication, such other preference applicants have applied to the Bureau for 228,000 kilowatts of Davis power. The authority is in a better position than the Bureau to apportion such 45,775 kilowatts among all such applicants because the authority can supplement Davis power and energy with its Hoover Dam energy for which it has not yet exercised its right to take. Such allotment of the entire amount to the authority was recommended to you by the Arizona Electric Coordinating Committee in its letter of March 26, 1948, and such allotment has been advocated by representatives of the Rural Electrification Administration. It will be the Bureau's proposal in contracting with the authority to require it to observe the preferences established in reclamation law in the resale of Davis power. It must be pointed out, however, that the preference provisions governing disposition of power by the authority (sec. 6 (b) of the Arizona Power Authority Act, as amended) are not in all respects identical with the preference provisions of the reclamation law, although the authority is itself a preference customer under reclamation law. Accordingly, without an amendment to its act, the authority could lawfully follow the preference provisions of reclamation law only to the extent that such law is consistent with the authority's powers under its own act.

In order to assure the use in Arizona of Davis power which will be required for the operation of the pumping plants of the Gila project as its development proceeds but which is not required at the present stage of development of the project, such increased requirements of the project for Davis power have been included in the 45,775 kilowatts allotted to the Arizona Power Authority. However, it is recommended that 14,000 kilowatts of the 45,775 kilowatts be subject to withdrawal by the Bureau upon 2 years' notice in such increments as are required for use in the operation of the Gila project.

A detailed analysis of the applications granted or rejected, including the amounts thereof and the reasons therefor, is enclosed and marked "Exhibit D."

It is recommended that you approve the allotment of Davis power shown in table 3 subject to the negotiation of acceptable contracts. Upon receipt of such approval the Bureau will immediately undertake negotiation of such contracts.

(Sgd.) MICHAEL W. STRAUS.

Enclosure 308.

I concur June 16, 1948.

[s] WALTON SEYMOUR,
Director, Division of Power.

I concur June 17, 1948.

[s] W. E. W.
[s] O. L. C.

Approved: June 23, 1948.

[s] J. A. KRUG,
Secretary of the Interior.

Copy for Division of Power.
cc—Reg. Dir., Boulder City, Nev.
Reg. Csl., Los Angeles, Calif.

(Exhibits "A" through "D" omitted to conserve space)