

Two Years Construction Program On Colorado River Aqueduct

Equipment and Materials Needed Are Listed Finance Corporation Reveals Study of Job

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In its announcement that it will submit a bid for \$40,000,000 of the \$220,000,000 five per cent bonds voted for construction of the Colorado River aqueduct by the Metropolitan Water District of Southern California, the Reconstruction Finance Corporation declares that the project will be "completely self-liquidating." Plans of the District for construction of the aqueduct as submitted to the Corporation and the general features of the project, are reviewed in the announcement, full text of which follows:

"The Reconstruction Finance Corporation will aid the Metropolitan Water District of Southern California to finance construction of an aqueduct system to carry water from the Colorado River to the 13 Pacific coast cities comprising the District. Announcement of the aid to the District was made on behalf of the directors of the Corporation by Harvey Couch, of Arkansas, a director, who has given especial attention to self-liquidating projects.

"The project includes a diversion dam across the Colorado River, pumping plants, storage and regulating reservoirs, distribution lines, and aqueduct 239 miles long. The cities comprising the Water District and which will use the water are: Los Angeles, Long Beach, Pasadena, Beverly Hills, Anaheim, Burbank, Compton, Glendale, San Marino, Santa Ana, Santa Monica, Torrance and Fullerton.

"The District voted a bond issue of \$220,000,000 to obtain funds to construct the aqueduct system on Sept. 29, 1931. The supreme court of California has declared the issue valid.

Project Completely Self-Liquidating

"The Reconstruction Finance Corporation, acting under the authority given it by paragraph (1) of section 201 (a) of the Emergency Relief and Construction Act of 1932, will bid upon, subject to conditions, \$40,000,000 of these 5 per cent bonds—\$20,000,000 within the first year and \$20,000,000 the second year, but prior to Jan. 23, 1934, when the authority of the Corporation to engage in such operations is terminated by law.

"The project will be completely self-liquidating. The cities of the Metropolitan Water District are to increase their water rates so that the revenue received from the sale of water will be sufficient to pay the costs of operating their individual share of the cost of the aqueduct system, the ultimate cost of which is estimated at \$283,586,000.

"The action of the Corporation makes possible the commencement of construction on this immense project in the immediate future and assures sufficient funds to carry the work forward about two years. It is believed that by the time further funds are required the Water District will be able to obtain them by the sale of its bonds in the investment market without aid from the Corporation.

"Commencement of work on this project will do much to create employment and stim-

ulate a revival of business. Engineers of the Metropolitan Water District have so far advanced with their plans and specifications that it is estimated construction can be started within from six weeks to two months from the date funds are assured.

"One thousand men probably will be employed by the end of this year and about 4,500 by July 1, 1933.

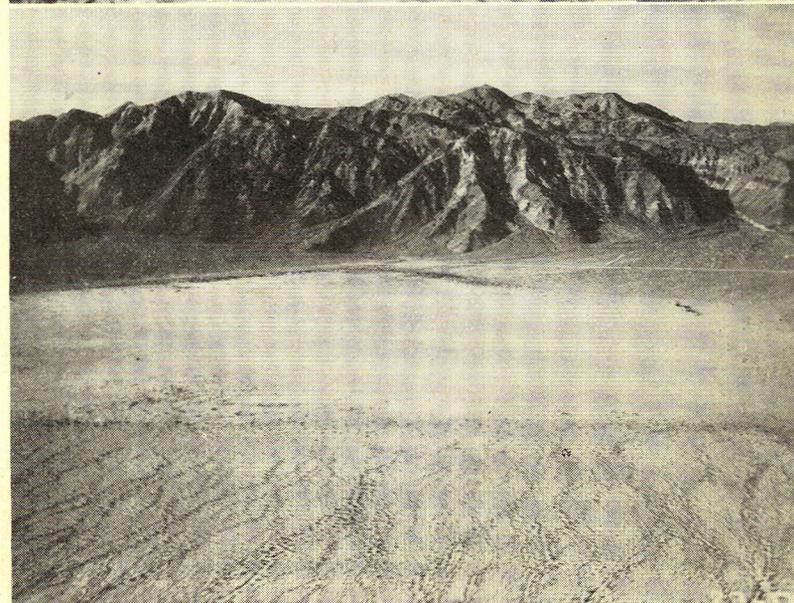
"Besides the creation of employment directly on construction work, much indirect employment will be created, for a vast amount of materials and supplies will be required. The aqueduct itself will be 239 miles long. Eighty-five miles of tunnel must be driven through the mountains and lined with concrete. The finished diameter of the bore will be about 16 feet.

"The longest single tunnel, the San Jacinto, will be 13 miles long. The time necessary to complete the entire project will be gov-

Aerial view of upper Parker dam site on Colorado River where water will be diverted to aqueduct Williams River entering Colorado shown in foreground.



Aerial view of the Hayfield reservoir site. One of the pump lifts on the Colorado River aqueduct will be located here.



erned by the progress of work on this tunnel. It is estimated to require about five and a half years, and it is believed the entire project can be finished in six years.

Open Canals and Conduits

"There will be about 75 miles of concrete-lined open canal through which water will flow by gravity. This part of the aqueduct will be about 10 feet deep, 22 feet wide on the bottom and 50 feet wide at the water surface.

"Another section will comprise about 55 miles of buried concrete conduit, about 16 feet in diameter. In constructing this conduit a trench first is excavated, then the conduit built and finally the trench is re-filled.

"There will also be a total of 24 miles of siphons to carry the water across valleys.

"A dam must be built across the Colorado River near Parker, Ariz., to divert water into the mouth of the aqueduct. The site of this dam is about 155 miles below the Hoover Dam and about 12 miles above the town of Parker.

"Nine storage and regulating reservoirs must be constructed along the route of the aqueduct.

Five pumping stations also will be required. The water must be elevated a total distance of 1,605 feet above the point of intake on the Colorado to pass over the highest point

the line. Power for pumping will come from the Hoover Dam.

"The aqueduct traverses mountainous and desert country, and it will be necessary to build roads, power lines, telephone lines, water lines and to construct housing for workmen.

Two Years' Construction Program

"The construction program for the first two years, for which the Corporation is prepared to provide funds, includes the following, from which possibly a better idea may be obtained as to how substantial a contribution is being made to the relief of unemployment and a revival of business:

"One hundred and ninety-six miles of permanent, graveled roads and 102 miles of secondary roads are to be built, 50,000 barrels of road oil will be required, and also about \$50,000 worth of miscellaneous materials. Grading equipment is said to be available.

"A temporary water system will require about 180 miles of pipe, weighing about 3,700 tons, 50 electric pumping units, well casing, storage tanks, booster pumps and a substantial amount of miscellaneous materials.

"A power line system comprising 323 miles of high-tension transmission line, 271 miles of distribution lines and 6 sub-

stations will require 12,000 poles, 5,000,000 pounds of copper cable, 56,000 insulators, 30 large and 400 small transformers, 600 condensers and a great amount of miscellaneous materials.

Equipment Needed for Tunnel Work

"Tunnel work will be started in 30 places and require a large amount of equipment, most of which, it is thought, will be purchased for the job. This equipment will include about 30 hoisting outfits, 100 air compressors, 300 rock drills, 40 drill sharpening outfits, 125 electric tunnel locomotives, 40 motor generator sets, 60 tunnel shovels and mucking machines, 800 mine dump cars, 10 drag-line excavators, 25 tractors, 150 trucks, 5 concrete mixing plants, 15 derricks and hoists, 150,000 feet of ventilating pipe, 1,000 tons of pipe for compressed air and water lines, 2,000 tons of steel rails, 1,500,000 feet (board measure) of cross ties and a large amount of miscellaneous material.

"About 20 camps must be built for workmen. These will require about 20,000,000 feet of lumber and a large amount of other construction materials, refrigerating plants, laundries, kitchen and dining hall equipment, and so on.

"Before work is finished, which will require at least six years, it is estimated that 10,000,000 pounds of explosives, 60,000 tons of drill steel, 400 tons of steel

of cement and several thousand tons of reinforcing steel will have been used. Besides creating employment for many men and large orders for materials and supplies in the near future, starting work on this project will mean continued employment for large numbers of men and continued requirements for large amounts of materials and supplies over the six-year period.

Estimated Cost of Project

"Engineers of the Metropolitan Water District estimate the cost of constructing the entire project as follows:

Required in the near future:	
Diversion dam	\$ 13,058,000
Main aqueduct	143,470,000
Reservoirs	17,352,000
Distribution lines	44,964,000
	\$218,844,000

Required ultimately for complete development:

Additional siphons and pumps, main aqueduct	\$ 12,888,000
Additional terminal storage reservoirs	13,320,000
Additional distribution lines	38,484,000
	\$64,692,000

\$283,536,000

"The public necessity and convenience of the citizens of Southern California will be served by an immediate start on this project. The present population of the 13 cities comprising the Metropolitan Water District of Southern California is 1,665,833, according to the 1930 census. The district is in urgent and increasing need of additional water. Daily consumption for domestic and industrial uses in 1930 was 240,000,000 gallons. In 1900 only 30,000,000 gallons a day were used.

"The district's population, it has been estimated, will increase to 2,500,000 by 1940 and will reach 5,300,000 by 1980, provided sufficient water is available. It has been estimated that by 1940 a daily water supply of 400,000,000 gallons must be available, and that by 1980 a supply of 990,000,000 gallons a day will be required.

District Water Supply

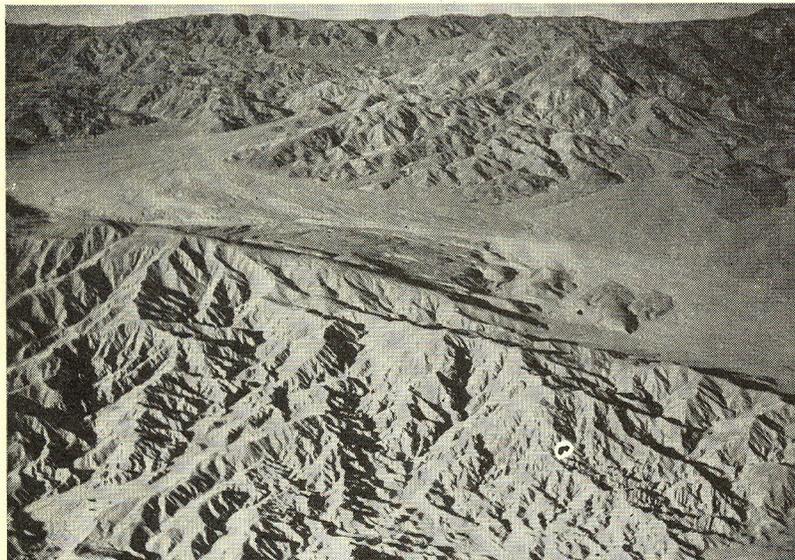
"At present the District secures its water partly from surface and partly from underground sources. The underground water is pumped and long continued pumping has steadily lowered the water level and decreased the underground supply. Most of the surface water comes through the 250 mile Owen River aqueduct. The total dependable supply at present is 286,000,000 gallons a day. Daily consumption in 1930 was 240,000,000 gallons a day. This margin of supply over consumption is too small for safety or growth of population.

"Thorough study of all surface and underground supplies in the vicinity of the district revealed that the only source of supply adequate for the district's increasing future needs was the Colorado River. To conserve and store the extremely fluctuating flood waters of the Colorado, the Hoover Dam is being built by the United States. The district has acquired the 'right' to take 1,500 cubic feet per second or about 1,000,000,000 gallons daily from the river. It has contracted to pay the United States 25 cents per acre foot for the actual amount used.

Four Pumping Lifts

"The water impounded by the Hoover Dam passes, when released, through the generating plant at the dam and flows downstream 155 miles where it is diverted by a second dam, which is part of the project now being fi-

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Aerial view of the Indio hills and Little San Bernardino Mountains through which Colorado River aqueduct will pass.



Aerial view of west slope of San Jacinto mountains near the west portal of the San Jacinto tunnel of the aqueduct.

nanced, into the mouth of the aqueduct.

"Immediately after entering the aqueduct the water is lifted by pumps a distance of 294 feet into a reservoir, from which it is immediately pumped upward again another 297 feet into a second reservoir. It passes from the second reservoir into the aqueduct and runs by gravity about 65 miles, passing, on the way, through the first syphon, into the third pumping station, where it is boosted up 137 feet higher.

Leaving the third pumping station, the water runs downhill through about 43 miles of aqueduct and a second syphon into the fourth pumping station which boosts it up 415 feet more. From that height it runs by gravity through about 10 miles of aqueduct, including the third syphon, into the third reservoir.

"The fifth pumping station takes the water from this reservoir and lifts it 460 feet more to the highest point on the line, which is 1,790 feet above sea level and 1,340 feet above the point where it entered the aqueduct at the Colorado River. On account of the down-

grade between pumping stations the water must actually be lifted a total distance of 1,605 feet by the five stations.

"From the highest point on the line the water runs down hill about 120 miles to the last reservoir, the Cajalco, which is at an elevation of 1,400 feet. On the way the aqueduct crosses several valleys through syphons.

"Leaving the Cajalco reservoir, the water goes into the distribution system to the cities comprising the Water District. When the Cajalco reservoir is full some electrical power will be developed by the flow of water from it.

"Power to operate the five pumping stations will come from the Hoover Dam. The District has contracted with the United States for this power, at the rate of \$0.00163 per kilowatt hour for firm electrical energy and \$0.005 per kilowatt hour for secondary electrical energy. Firm electrical energy is energy that is continuously available for 24 hours a day, while secondary energy is available intermittently."