

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
WASHINGTON

December 1, 1931.

BOULDER CANYON PROJECT—QUESTIONS AND ANSWERS

DAM:

Q. Where is the Hoover (formerly Boulder) Dam to be built?

A. In upper Black Canyon on the Colorado River about 25 miles in an air line southeast of Las Vegas, Nev., where the river forms the Arizona-Nevada State boundary.

Q. When was the name Hoover Dam adopted?

A. On September 17, 1930, at a ceremony to celebrate the beginning of work, Secretary of the Interior Wilbur named the structure to be built the Hoover Dam after President Hoover in recognition of his efforts in behalf of the project.

Q. What does the project include?

A. Construction of a dam and power plant in Black Canyon and of the All-American Canal in southern California.

Q. What are the purposes of this project?

A. Flood control and general river regulation, irrigation, silt control, power development, and domestic water supply.

Q. What will the project cost?

A. The act authorizes appropriations not to exceed \$165,000,000, divided as follows: Dam and reservoir, \$70,600,000; power development, \$38,200,000; All-American Canal, \$38,500,000; interest during construction, \$17,700,000.

Q. How high will the dam be?

A. Plans call for a maximum height of about 730 feet above foundation rock, which would raise the water surface of the river 582 feet.

Q. What type of dam is to be built?

A. The arch-gravity type, in which the water load is carried by both gravity action and horizontal arch action.

Q. What will be the length along the crest?

A. About 1,180 feet.

Q. What will be the widths up and down stream?

A. About 45 feet at the top and 650 feet at the base.

Q. What is the volume of concrete masonry?

A. About 3,400,000 cubic yards in the dam or 4,400,000 cubic yards in the dam, power plant, and appurtenant works. For comparison, the Bureau of Reclamation has placed in dams and canal structures a total of 4,776,000 cubic yards of concrete up to June 30, 1931.

Q. How much cement will be required?

A. About 5,500,000 barrels. The daily demand might tax the capacity of any one or two cement plants. This Bureau has used 4,926,000 barrels in 26 years of construction activities.

Q. What are some of the principal items of work?

A. Excavation (all classes), diversion tunnels, 2,000,000 cubic yards; excavation (common) for foundation of dam, power plant, and cofferdams, 857,000 cubic yards; rock excavation for dam foundation, 400,000 cubic yards; excavation (all classes), spillways, 1,156,000 cubic yards; earth and rock fill for cofferdams, 1,200,000 cubic yards; excavation (all classes), valve houses and intake towers, 555,000 cubic yards; drilling grout and drainage holes, 315,000 linear feet; pressure grouting, 422,000 cubic feet.

- Q. How much reinforcement steel will be used?
 A. About 35,000,000 pounds of bars and rails.
- Q. What are the estimated quantities of other principal materials?
 A. Gates and valves, 21,670,000 pounds; plate-steel conduit linings, 20,300,000 pounds; conduit lining castings, 9,570,000 pounds; pipe and fittings, 6,700,000 pounds; structural steel, 18,500,000 pounds; miscellaneous metal work, 5,300,000 pounds.
- Q. Will the Government purchase these materials?
 A. Yes. The purchasing will be handled by the Bureau of Reclamation, U. S. Customhouse, Denver, Colo.
- Q. What are the geologic conditions at the dam site?
 A. The foundation and abutments are rock of volcanic origin, geologically termed "andesite breccia," hard and very durable.
- Q. What is the depth below the river bed to foundation rock?
 A. About 140 feet.
- Q. How long will it take to build the dam, power plant, and appurtenant works?
 A. From six to seven years.
- Q. How many men will be employed?
 A. It is not anticipated that more than 3,000 men will be employed on the job at any one time.
- Q. Who are the contractors?
 A. The Six Companies, Incorporated, with headquarters at 510 Financial Center Building, San Francisco, Calif., and field office at Boulder City, Nev. F. T. Crowe is General Superintendent.
- Q. Who is construction engineer for the Bureau of Reclamation?
 A. Walker R. Young, with headquarters temporarily at Las Vegas, Nev.
- Q. What is the tentative construction program?
 A. Stripping canyon walls of loose rock, June 1, 1931, to January 1, 1932; diversion tunnels, October, 1 1931, to October 1, 1933; cofferdams, October 1, 1933, to May 1, 1934; excavation for dam, October 1, 1933, to January 1, 1935; placing concrete in dam, December 1, 1934, to August 1, 1937; spillways, December 1, 1931, to November 1, 1933; intake towers, May 1, 1933, to July 1, 1936; outlet works, September 1, 1933, to January 1, 1938; power house, September 1, 1935, to January 1, 1938.

RESERVOIR:

- Q. How much water will the reservoir hold?
 A. About 30,500,000 acre-feet when full. An acre-foot is the amount of water that will cover 1 acre 1 foot deep. The water in the reservoir would cover the State of Connecticut to a depth of 10 feet.
- Q. What will be the area of the reservoir?
 A. 145,000 acres or 227 square miles. For comparison, Lake Tahoe in California-Nevada, has an area of 193 square miles.
- Q. What will be the length and width of the reservoir?
 A. It is about 115 miles by river from Black Canyon to Bridge Canyon, the limit of the backwater. The reservoir will extend up the Virgin River about 35 miles. The width varies from several hundred feet in the canyons to a maximum of 8 miles.
- Q. What will be the elevation of the high-water line?
 A. 1,229 feet above sea level. It may be necessary to retain for reservoir purposes all lands below elevation 1,250.

Q. How will the reservoir capacity be utilized?

A. 9,500,000 acre-feet for flood regulation; 5,000,000 to 8,000,000 acre-feet silt pocket; 12,000,000 to 15,000,000 acre-feet active or regulation storage.

Q. How much silt will be deposited in the reservoir?

A. Estimates vary from 80,000 to 250,000 acre-feet annually under present conditions and decreasing with upstream development. It is estimated that the total silt deposits will not exceed 3,000,000 acre-feet at the end of 50 years.

Q. Will salt deposits have an injurious effect on the water?

A. While some salt from the extensive deposits in the Virgin River Valley will go into solution, the amount should not be sufficient to cause any appreciable salinity in the water.

Q. What will be the length of the shore line?

A. About 550 miles.

Q. What is the estimated annual evaporation on the reservoir?

A. 600,000 acre-feet.

Q. Are there any private lands in the reservoir site?

A. There are a number of mining claims, but most of the area is Government land. All the land is withdrawn from entry for construction purposes.

DIVERSION AND OUTLET WORKS:

Q. How will the river be diverted during dam construction?

A. By a temporary earth and rock-fill cofferdam through four 50-foot diameter concrete-lined tunnels, driven through the rock of the canyon walls, two on each side of the river.

Q. What will be the length of these tunnels?

A. The four tunnels will have a total length of about 16,300 feet or 3.1 miles.

Q. After their use for river diversion, how will the tunnels be utilized in the project scheme?

A. The two inner tunnels will be used to connect the reservoir with the penstock tunnels to the power plant and the canyon wall outlet works; and the two outer tunnels will be used for spillway outlets.

Q. What outlet works are proposed?

A. The two inner diversion tunnels and two 30-foot penstock tunnels will act as main supply tunnels for thirty-two 72-inch needle-valve outlets located in the canyon walls. All valves will receive water from four 30-foot diameter power intake towers.

Q. What are the plans for the Arizona and Nevada spillways?

A. Concrete ogee overflow crest about 700 feet long with open channel, and 50-foot diameter inclined tunnel connecting with outer diversion tunnel.

Q. What will be the capacity of the spillways?

A. Each spillway will have a maximum discharge capacity of 200,000 cubic feet per second, with a velocity in the tunnels approaching 180 feet per second.

POWER DEVELOPMENT:

Q. What will be the installed capacity of the power plant at Hoover Dam?

A. 1,000,000 or 1,200,000 horsepower, depending on the requirements of the contractors who purchase the power. For comparison, Niagara (United States) is 557,500; Conowingo 378,000 (ultimate 594,000); and Muscle Shoals 250,000 (ultimate 600,000).

Q. What is a horsepower in terms of falling water?

A. One second-foot of water falling 8.81 feet equals one horsepower, 100 per cent efficiency. A second-foot of water is 1 cubic foot passing a given point in one second of time.

Q. What will be the continuous firm power output?

A. About 663,000 horsepower, based on 83 per cent plant efficiency, and 10 per cent maximum shortage.

Q. How much electrical energy will be available yearly?

A. Four billion three hundred and thirty million kilowatt-hours on completion of the dam (1938) and this amount decreasing each year thereafter by 8,760,000 kilowatt-hours, as a result of upstream development.

Q. What is a kilowatt-hour?

A. The energy resulting from an activity of 1 kilowatt for one hour. A kilowatt is 1,000 watts. One horsepower equals 0.746 kilowatt. $663,000$ (horsepower) $\times 0.746 \times 24$ (hours) $\times 365$ (days) = 4,330,000,000 kilowatt-hours.

Q. How will the income from sale of power be used?

A. To pay all expenses of operation and maintenance of works incurred by the United States and the cost of construction of dam and power plant, with interest, within a 50-year period. Excess revenues above amortization requirements will be utilized as follows: $62\frac{1}{2}$ per cent to flood control (\$25,000,000) repayment and $18\frac{3}{4}$ per cent to Arizona and $18\frac{3}{4}$ per cent to Nevada.

Q. Where will the power plant be located?

A. Just below the dam, one-half on the Nevada side of the river and one-half on the Arizona side, forming a U-shaped structure?

Q. How will the water reach the turbines?

A. Through four pressure tunnels, two on each side of the river, each provided with shut-off gates and trash racks.

Q. What will be the principal machinery installation?

A. Tentative plans for a 1,000,000 horsepower installation call for twelve 85,000 horsepower hydraulic turbines, twelve 11 by 10 foot balanced valves, twelve 75,000 kilovolt-ampere generators with exciters, thirty-six 25,000 kilovolt-ampere 220,000-volt transformers, four 250-ton cranes, switchboard, and control apparatus; completely equipped machine shop.

Q. Under what heads will the turbines operate?

A. Maximum head, 582 feet; minimum head, 422 feet; average head, 520 feet.

Q. What is the estimated cost of the power development?

A. \$38,200,000, not including interest.

Q. What will be the charge for primary or firm power?

A. One and sixty-three one-hundredths mills per kilowatt-hour, delivered at transmission voltage.

Q. How much secondary or dump power will be available yearly?

A. One billion five hundred and fifty million kilowatt-hours on completion of the dam (1938) and this amount decreasing each year by 8,600,000 kilowatt-hours.

Q. What will be the charge for secondary or dump power?

A. One-half mill per kilowatt-hour, delivered at transmission voltage.

Q. Are these rates subject to adjustment?

A. At the end of 15 years from date of execution of lease and every 10 years thereafter the rates may be readjusted.

Q. How much revenue will be derived from the sale of power?

A. For the first year of operation, the income would be \$7,057,900 from the sale of 4,330,000,000 kilowatt-hours of primary energy at \$0.00163 and \$775,000 from the sale of 1,550,000,000 kilowatt-hours of secondary energy at \$0.0005.

The amount of income will decrease each year thereafter. The estimated annual income from firm energy will average about \$6,550,000 over the 50-year repayment period.

Q. Who will operate and maintain the power plant?

A. The City of Los Angeles and the Southern California Edison Company, under the general supervision of a director appointed by the Secretary of the Interior.

Q. What is the allocation of power?

A. State of Arizona, 18 per cent; State of Nevada, 18 per cent; Metropolitan Water District, 36 per cent; smaller municipalities, 6 per cent; City of Los Angeles, 13 per cent; Southern California Edison Co., 9 per cent.

Q. How is the machinery in the plant to be paid for?

A. The government will purchase and install machinery and equipment costing about \$17,700,000, and the contractors will pay in 10 equal annual installments an amount sufficient to amortize the total cost.

Q. Who will pay the cost of transmission of power?

A. The contractors who purchase the power.

WATER ALLOCATION:

Q. What is the allocation of water under the Colorado River compact?

A. Based on a mean annual run-off of 16,000,000 acre-feet, the compact allocated 7,500,000 acre-feet to the upper basin States and 7,500,000 acre-feet to the lower basin States, with the right of the latter to increase their beneficial consumptive use of such water by 1,000,000 acre-feet per annum.

Q. How much of the water allocated to the lower basin States does California get?

A. California has agreed that the aggregate annual consumptive use of the river water shall not exceed 4,400,000 acre-feet of the 7,500,000 allocated to the lower basin by Article III(a) of the compact. In addition California can use one-half of the surplus waters available above the 7,500,000 acre-feet allocated.

Q. How much water is allocated to Nevada and Arizona?

A. The Boulder Canyon Project Act authorizes Arizona, California, and Nevada to enter into an agreement which shall provide that Nevada gets 300,000 acre-feet and Arizona 2,800,000 acre-feet for exclusive beneficial consumptive use; also, that Arizona may annually use one-half of the surplus water unapportioned by the compact and in addition shall have the exclusive beneficial consumptive use of the Gila River and its tributaries within the State. Such an agreement has not yet been made.

RIVER FLOW:

Q. What has been the greatest measured discharge of the Colorado River?

A. Two hundred thousand cubic feet per second measured at Yuma, Ariz.

Q. Have there been any larger floods?

A. A maximum flood of 300,000 cubic feet per second is believed to have been the flow for a short period in 1884.

Q. What has been the smallest measured discharge?

A. Sixty-six cubic feet per second, measured at Yuma, Ariz.

Q. What is the discharge at the dam site?

A. The average is 22,000 cubic feet per second, with an average annual run-off of 15,700,000 acre-feet.

Q. What will be the maximum flood discharge after completion of the project?

A. The largest flood since 1900 would be held to 48,000 cubic feet per second at the dam and 35,000 cubic feet per second in the delta region. An 1884 flood would be reduced to an outflow of 75,000 cubic feet per second.

IRRIGABLE AREAS:

Q. How much irrigable land is there below the Boulder Canyon reservoir, in the United States?

A. About 2,100,000 acres, according to preliminary estimates.

Q. How is this area divided between the States?

A. Arizona 900,000 acres, California 1,200,000 acres, and Nevada 15,000 acres. These are gross areas and may be materially changed when irrigable area surveys are made.

Q. What are some of the possible projects in Arizona?

A. The Parker-Gila Valley project with a gross area of more than 600,000 acres in the southwestern part of the State, an investigation of which was authorized by Congress under the act. The Parker project of about 116,000 acres near Parker, Mohave Valley, with an irrigable area of 33,000 acres near Needles, Calif., and the Cibola Valley of 16,000 acres in Yuma County. The Yuma project adjacent to the city of Yuma is an active Federal project, with about 55,000 acres irrigated at the present time, and a total ultimate irrigable area of 112,000 acres, including about 45,000 acres of undeveloped mesa lands.

Q. What are the principal California projects which may be benefited?

A. The Imperial Valley has a present irrigable area of 522,000 acres and about 850,000 acres of valley and adjacent mesa lands can be irrigated under the All-American Canal. The Coachella Valley near Indio has an irrigable area of 150,000 acres, which can be served by a branch of the All-American Canal. There are 79,000 acres in the Palo Verde Valley project near Blythe.

Q. Where is the irrigable acreage in Nevada?

A. Cottonwood Island, on the Colorado River, located due west of Chloride, Ariz. has an area of 3,000 acres. The State engineer plans to develop additional areas by pumping.

Q. What is the approximate classification of the irrigable lands?

A. Public, 44 per cent; private, 40 per cent; State, 1 per cent; railroad, 2 per cent; Indian, 8 per cent; and entered, 5 per cent.

BOULDER CITY:

Q. Where is the new town on the Boulder Canyon project located?

A. The location is about 6 miles west of the dam site, at the summit and near the terminus of the Union Pacific section of the branch railroad.

Q. Has the town been named?

A. Yes, it has been given the name of Boulder City by Secretary Wilbur.

Q. What about a water supply?

A. Water is pumped from the Colorado River to the town, a distance of 6 miles, with a total lift of about 2,000 feet. The intake is about 3,500 feet downstream from the dam site on the Nevada side. The water first goes to a presedimentation basin 100 feet above river level, then to a 100,000-gallon tank at Boulder City, from there to a purification plant, and finally to a 2,000,000-gallon storage tank.

Q. What other improvements are necessary?

A. A sewerage system and electrical distribution system are being installed. Sidewalks and curbs are being provided and streets surfaced and paved.

Q. What is the building program?

A. Government employees, principally engineers, inspectors, and clerks will require an office building, dormitory, and a number of houses for living quarters. The Government will also erect a post office building, school, and garage.

Q. Will employees of the contractors on the dam and power plant live in the town?

A. Yes. A portion of the town has been set aside for the contractors' use. The contractors arrange for the housing of their workmen, with construction subject to Government approval. They are building mess halls, dormitories, hospital, clubhouse, commissary, machine shop, storehouses, garage, laundry, and employees' cottages.

Q. Who owns the lands in the town site?

A. The Government owns the land, which is vacant public land and under first form withdrawal. It is also included in a Federal reservation.

Q. How can one obtain a town lot for business purposes?

A. The land is leased for a 10-year term ending June 30, 1941, to those awarded business permits, the Government to retain ownership and supervisory control. Continuation of the leases is contingent upon compliance with the terms of the contract. A model town is the objective.

Q. What will be the population?

A. From 3,000 to 4,000 during the construction period, according to present estimates.

Q. Will this town be permanent?

A. It will no doubt be permanent, because the 730-foot dam and 115-mile lake will be a great attraction for tourists. There are also many scenic wonders close by to attract visitors, including three national parks—Grand Canyon, Zion, and Bryce Canyon. A sizable force will also be required for operation of the reservoir and power plant.

Q. What are the immediate plans for the town?

A. Contracts have been let for buildings, waterworks, sewerage system, street surfacing, sidewalks, and curbs. A highway and railroad from the town to the dam site are completed.

Q. How much money is being expended at Boulder City?

A. It is estimated that it will cost the Government about \$2,000,000 to build the town.

Q. What provisions are made for erecting buildings suited to the climatic conditions in that section?

A. A city planner, who is well acquainted with the type of building construction required, designed the town plan. All Government buildings will be of the Spanish type of architecture. The Bureau of Reclamation encountered somewhat similar climatic conditions on the Yuma and Salt River projects in Arizona.

Q. What is the form of town government?

A. The city manager plan is followed and he is responsible to the construction engineer. An advisory commission of three supplements the city manager. Two chief rangers and seven rangers, who have been appointed Deputy United States Marshals, constitute the police force, and a United States Commissioner will hold court.

Q. What are the average temperatures in that locality?

A. They vary from 20° to 120°.

Q. How near will the new town be to Las Vegas?

A. About 21 miles southeast in an air line, 24 miles by highway, and 37 miles by railroad.

Q. What is the elevation of the town site?

A. About 2,500 feet above sea level.

Q. What is the area of the town site?

A. About 200 acres.

ALL-AMERICAN CANAL:

Q. Is the All-American Canal a part of the Boulder Canyon project?

A. Yes. There are three features included in the project—the Hoover Dam, power plant, and the All-American Canal.

Q. What is the purpose of the canal?

A. To carry water from the Colorado River to the Imperial and Coachella Valleys in the southeastern part of California.

Q. Why the name, "All-American"?

A. Because the canal will be built entirely in the United States. The present Imperial main canal is largely in Mexico.

Q. What part of the \$165,000,000 cost of the Boulder Canyon project is allotted to the canal?

A. \$38,500,000, not including interest during construction. The Boulder Canyon Project Act of December 21, 1928, authorized the building of a main canal from the Colorado River to the Imperial and Coachella Valleys. The Bureau of Reclamation, as a result of recent surveys and studies, estimates that both canals can be built for about \$34,000,000. This amount includes the cost of a diversion dam.

Q. Is this expenditure reimbursable?

A. Yes. Under a repayment contract now being negotiated with the irrigation district the cost of the canals and appurtenant structures will be returned to the Government as provided in the reclamation law.

Q. Will the district have to pay for the water?

A. There will be no charge for the use, storage, or delivery of water for irrigation or water for potable purposes.

Q. Where is the proposed location of the intake?

A. A new diversion dam will be built about 15 miles northeast of Yuma, Ariz., and 5 miles north of Laguna Dam, the diversion point for the main canal of the Yuma (Federal) irrigation project.

Q. How much water will the canal carry?

A. An initial diversion of 15,000 cubic feet per second is planned, which includes 2,000 cubic feet per second diverted at the Siphon Drop, for the Yuma project, and 3,000 cubic feet per second diverted at Pilot Knob for power development.

Q. What will be the dimensions of the canal?

A. The maximum section will be about 200 feet wide at the water surface, 134 feet bottom width, and 22 feet deep.

Q. What will be the length?

A. The All-American Canal to Imperial Valley will be 80 miles long, and the branch canal to the Coachella Valley will be 130 miles long.

Q. Are the sand hills to be crossed by the canal?

A. Yes. The canal for 10 miles will pass through a ridge of shifting sands. Here the deepest cutting is about 100 feet.

Q. What means are being considered to prevent blow sand from drifting into the canal?

A. Growing vegetation in a zone each side of the canal. Covering the dune sand with the coarser excavated material. Spraying the sand with crude oil. Maintaining a 15-foot berm on each side of the canal at mesa floor level.

Q. Will any portion of the canal be lined with concrete?

A. The lining of 4 miles of the All-American and 47 miles of the Coachella branch may be found necessary.

Q. What structures are proposed?

A. Siphons or culverts will be required to carry the canal under numerous washes, 10 on the All-American and 79 on the Coachella branch. The All-American Canal will have to be carried under the Alamo and New Rivers by siphons.

Q. What is the estimated total of excavation?

A. 60,000,000 to 65,000,000 cubic yards, of which 4 per cent is rock.

Q. Are there opportunities for power development?

A. Yes. At Pilot Knob, about 7 miles west of Yuma, and also at four drops on the canal.

Q. How much power can be developed?

A. About 60,000 kilowatts.

Q. Is additional water supply for the city of San Diego tied in to All-American Canal plans?

A. San Diego is considering the feasibility of having water carried through the projected All-American Canal and the Imperial Irrigation District system, to be taken from some point on the west side of the Imperial Valley to San Diego.

Q. How much water is San Diego asking for?

A. 155 cubic feet of water per second, together with the necessary energy from the Hoover Dam power plant to lift this water and deliver it to the coastal plain in San Diego County. The pumping lift is over 4,000 feet

IMPERIAL AND COACHELLA VALLEYS:

Q. What is the irrigable area of the Imperial Irrigation District?

A. 522,000 acres, to water which requires 1,700 miles of canals and laterals.

Q. How much land is now irrigated?

A. From 400,000 to 450,000 acres.

Q. What are the principal crops?

A. Alfalfa, cantaloupes, lettuce, barley, corn, milo maize, and small fruits. About 30,000 carloads of cantaloupes and lettuce are shipped out each season.

Q. What are the average crop yields?

A. Alfalfa 7 to 10 tons per acre, a ton to a cutting; barley 8 to 20 sacks per acre; cantaloupes 96 crates per acre.

Q. What is the growing season?

A. 365 days.

Q. What is the elevation of the valley?

A. From 250 feet below sea level at the Salton Sea to 0 or sea level. The adjoining mesas or high lands vary in elevation from 50 to 150 feet.

Q. What is the Salton Sea?

A. An inland sea in a depression in the northern part of Imperial Valley. Prior to 1905 it was only a small lake, but the Colorado River break of 1905-1907 increased the water surface area of the sea to 515 square miles, or $2\frac{1}{2}$ times the area of the Boulder Canyon reservoir. It had a length of 42 miles and maximum depth of 80 feet. The present area is 287 square miles and the elevation of the water surface is about stable at 250 feet below sea level.

Q. What is the water surface of the Colorado River which flows to the east and south of the valley?

A. About 100 feet above sea level, or from 100 to to 350 feet above the valley floor.

Q. Is the valley protected by levees?

A. Yes. There are 74 miles of protection levees, all in Mexico.

Q. What is the rainfall in this section?

A. About 3 inches a year.

Q. How large is the Coachella Valley?

A. The gross acreage is 187,000 acres. The estimated irrigable area under the proposed canal system is 150,000 acres. There are now about 16,000 acres under cultivation.

Q. What is the status of lands in the valleys as to ownership?

A. Approximately 20 per cent public, 70 per cent private, and 10 per cent State, railroad, and Indian.

Q. What will be the total irrigable area in the Imperial and Coachella Valleys and adjacent East Mesa, West Mesa, Pilot Knob Mesa, and Dos Palmas unit, under the proposed canals?

A. The estimated area is 1,000,000 acres.

LOS ANGELES AQUEDUCT:

Q. Is the aqueduct a part of the Boulder Canyon project?

A. No, but one of the purposes of the project is to provide a supplemental domestic water supply for Los Angeles and neighboring cities and towns. The aqueduct will transport water which is stored in the reservoir behind the Hoover Dam.

Q. What is the Metropolitan Water District?

A. A district comprising the cities and towns in southern California that will use this water supply. F. E. Weymouth is chief engineer, and the district offices are at 306 West Third Street, Los Angeles, Calif.

Q. What portion of the Colorado River water will the district receive?

A. The district has contracted with the Secretary of the Interior for delivery each year from the reservoir, up to but not exceeding 1,050,000 acre-feet. This corresponds to a flow of about 1,500 cubic feet per second.

Q. Will the district obtain power from the plant at Hoover Dam?

A. Yes. Its allocation is 36 per cent.

Q. What will be the cost of the aqueduct?

A. \$220,000,000 and financed by a bond issue authorized by a special election held on September 29, 1931.

Q. Where on the Colorado River will the intake for the aqueduct be located?

A. At the Parker dam site in Upper Parker Canyon, about 155 miles below Hoover Dam.

Q. What will be the height of the diversion dam?

A. The proposed Parker Dam will be 72 feet in height.

Q. What is the maximum pumping lift to cross the mountains?

A. About 1,520 feet.

Q. What is the total length of the proposed aqueduct.

A. About 226 miles of main aqueduct, and 155 miles of feeder lines.

Q. How many tunnels will be required?

A. There will be 46 tunnels totaling 111 miles in length. The longest is the San Jacinto, 12.7 miles. The maximum diameter of the tunnels is 16.1 feet.

Q. How many miles of conduit will be constructed?

A. Grade conduit, 16.9 feet high and 19.7 feet wide will total 154 miles.

Q. What amount of pipe-line construction is involved?

A. About 70 miles.

Q. What are the estimated quantities of the major items of construction?

A. There will be 38,000,000 cubic yards of excavation; 6,800,000 cubic yards of embankment; 4,900,000 cubic yards of concrete, involving the use of 6,400,000

barrels of cement; 129,000,000 pounds of reinforcing steel; 34,000,000 board feet of tunnel timber; 30,000,000 pounds of structural steel for transmission lines; 20,000,000 pounds of steel for penstocks.

Q. Will the construction be done by contract?

A. Yes.

Q. How long will it take?

A. The work will be scheduled for completion along with the Boulder Canyon project, or about five years from the start of the work.

SETTLEMENT:

Q. Are there any public lands open to homestead entry in the areas below Hoover Dam susceptible of irrigation?

A. No. All of these lands have been withdrawn from entry.

Q. When will these lands be opened to settlement?

A. Not until the dam is completed and water can be furnished for irrigation purposes, which will probably not be before 1938.

Q. How will the lands be opened?

A. Under the provisions of the reclamation law and similar to openings on the Federal irrigation projects.

Q. Will preference right of entry be given to ex-service men?

A. Yes, for a period of three months after date of opening.

Q. What Federal projects have climatic and crop conditions similar to those prevailing on the Boulder Canyon project?

A. The Salt River in Arizona, Yuma in Arizona-California, and Orland in California.

Q. What will be the principal crops grown?

A. Alfalfa, cotton, grain, melons, citrus and other fruits, vegetables.

Q. Have surveys been made to determine the irrigable areas?

A. No. Surveys are in progress in California, and also in Arizona.

Note: The figures used in the above "Questions and Answers" are in some cases taken from preliminary plans, studies and estimates and may be materially changed when final plans are approved and irrigable area surveys are made.

ELWOOD MEAD,
Commissioner.