

Colorado River and the Boulder Canyon Project

Historical and Physical Facts in Connection With the
Colorado River and Lower Basin Development

BY

THE COLORADO RIVER COMMISSION
OF THE
STATE OF CALIFORNIA

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LETTER OF TRANSMITTAL

Gov. C. C. YOUNG,
Sacramento, California.

SIR: There is hereby transmitted a compilation of historical data and information from official documents giving somewhat detailed information in connection with the development of the Colorado River with particular reference to the projects and development affecting California.

The information assembled herein comes from such scattered sources that it has been deemed advisable to bring it together in one volume in order to have the facts for ready reference in compact form.

Respectfully submitted.

CALIFORNIA-COLORADO RIVER COMMISSION,
By JOHN L. BACON, Chairman.

San Diego, California,
December 1, 1930.

FOREWORD

An attempt is made in this pamphlet to bring together original documents and data having to do with Boulder Canyon project and data relating thereto. Some of the information given in the following pages is conflicting but it has been thought best to give reports from various sources and make available in one volume figures and data used by the commissions of the various states in Colorado River negotiations.

It has been the policy of the California Colorado River Commission to try to obtain in every case accurate information on the points under discussion. In many cases the published information given out by the Federal Government through the Interior Department and Bureau of Reclamation has been several years old when made available. Surveys adding to the printed information available are constantly being made and as far as possible the results of these surveys have been incorporated in the data herein printed.

Two other publications issued by the Colorado River Commission of the State of California, *i. e.*, "Analysis of Boulder Canyon Project Act" and "The Boulder Canyon Project" should be taken in conjunction with the information given in this booklet. The first booklet mentioned above traces in detail the text of the present Boulder Canyon Project Act and the amendments offered thereto while the bill was being considered in Congress. The text of the act and various other documents are given in the two publications mentioned above. Some of these documents are not reprinted in this pamphlet.

Every effort has been made to have the facts historically correct, and copious references have been given to aid in detail search when such is desired. The desire has been to give facts rather than a connected narrative and to serve this end the matter has been broken up into sections with cross references to avoid repetition as much as possible.

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Units Commonly Used in Water Calculation

1 cubic foot of water=62.5 pounds.

1 second-foot flow=40 miner's inches (California and Arizona) or

1 second-foot flow=38.4 miner's inches (Colorado).

1 second-foot flow=7.48 U. S. gallons per second.

1 second-foot flow=448.8 U. S. gallons per minute.

1 second-foot flow=646,317 U. S. gallons per day.

1 second-foot flow=about 1 acre-inch per hour.

1 second-foot flow=86,400 cubic feet per day.

1 second-foot flow=1.983 acre-feet per day.

1,000,000 gallons=3.07 acre-feet.

1,000,000 gallons per day=1.55 second-feet flow.

1,000,000 gallons per day for 1 year=1120 acre-feet.

1 acre-foot=43,560 cubic feet.

1 acre-foot per year=.00138 second-foot flow.

1 acre-foot=325,850 gallons.

1 horsepower=550 foot-pounds per second.

1 horsepower=33,000 foot-pounds per minute.

1 horsepower=746 watts=.746 kilowatts (kw.).

1 horsepower (hp.)=1 second-foot of water falling 8.80 feet.

1½ horsepower=approximately 1 kilowatt.

1 cent per kilowatt hour=\$87.60 per kilowatt per year.

Approximate water power=
$$\frac{\text{Second feet} \times \text{fall in feet}}{11} = \text{Net horse-}$$

power at water wheel realizing 80% of theoretical power.

Definitions

Boulder Canyon Project Act—An act to provide for the construction of works for the protection and development of the Colorado River Basin.

Colorado River Compact—A compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes. The compact as originally drawn was between the seven States as listed above but due to the failure of Arizona to ratify the compact, it was afterwards modified to include only the States of California, Colorado, Nevada, New Mexico, Utah and Wyoming.

Santa Fe Compact—Same as Colorado River Compact.

Colorado River Basin States—Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

Lower Basin—Means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry.

Upper Basin—Means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry.

Upper Division—Refers to the States of Colorado, New Mexico, Utah, and Wyoming.

Lower Division—Refers to the States of Arizona, California, and Nevada.

Colorado River System—Means that portion of the Colorado River and its tributaries within the United States of America.

Lee Ferry—Means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

Domestic Use—Shall include the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power.

Acre-foot—Quantity of water required to cover one acre of land one foot deep.

Second-foot—Is an abbreviation for cubic foot per second and is the unit for the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at the rate of 1 foot per second.

Water Duty—Number of acre-feet of water used on an acre of irrigated land in one year.

Gravity Water—Means water which is taken directly from a river or from behind the dam and flows through a system of canals or conduits directly onto land without being pumped.

Pump Water—Means water which is used on land above the level of the canals or river and has to be pumped up to these higher elevations. The distance in height that the water has to be pumped is known as the *pump lift*. For instance, if water had to be pumped from a canal up into another canal at 100 feet higher elevation, it would be spoken of as a pump lift of 100 feet.

Beneficial Use—Is a term used to describe the actual use of water in such a way that it returns some kind of a benefit. The water may not be actually used up in process. Water from Boulder Dam running through the power plant will generate power which is a beneficial use but the water will immediately flow back into the river and there will be no loss of actual water. This generation of power is a beneficial use.

Beneficial Consumptive Use—This is use where water is actually consumed or is actually used up. All water used on land for irrigation excepting that drained off and used again is consumptively used. In other words where water is put to beneficial consumptive use the water is actually consumed or used up and no further use can be made of it.

Firm Water or Title Water—These two terms have been used as being almost synonymous. In dividing up and discussing the water of the Colorado River it has been customary to talk of two kinds of water. No one knows exactly how much water can be depended upon to flow continuously down the Colorado River so in making agreements a smaller quantity of water than is known to be present in the river has been used for the purpose of division and efforts have been made to give individual states or groups of states the absolute right to use a certain amount of water. This water to which the right to use is not questioned in any way is known as firm or title water. The Colorado River System will always have more water in it than is represented by the firm water and the water over and above the amount of firm water is variously referred to as surplus, unapportioned, unallocated or excess water. The firm water and the excess water together make up the water which is actually physically present in the stream or in the system.

Recapture—This is a term commonly used in connection with discussions of power and refers to the right of some agency to take power some time in the future that has been previously used by some other agency, or in other words, it is the right, some time in the future, to take away from somebody already using it a certain amount of power.

BRIEF CHRONOLOGY

COLORADO RIVER EXPLORATIONS, INVESTIGATIONS AND REPORTS

1539. Francisco de Ulloa discovered mouth of the Colorado.
1540. Hernando de Alarcon sailed up the Colorado above the Gila. Merchier Diaz explored the Colorado.
- 1540-42. Coronado expeditions marched along rim of Grand Canyon.
1542. Don Lopez de Cardenas discovered the Grand Canyon.
1605. Juan de Onate went down the Colorado from Williams River to Gulf.
1618. Zalvidor and Padre Jeminez visited Marble Canyon.
- 1680-1711. Eusibio Francisco Kino made expeditions to the Colorado.
1721. Ugarte visited mouth of the Colorado.
1744. Jacobo Sedelmain visited the Gila and the Colorado at Williams River.
1771. Francisco Garces went down the Gila to mouth of the Colorado.
1774. Francisco Garces with Capt. Anza crossed the Colorado to California.
- 1775-76. Garces visited mouth of the Colorado, the Mohave, and the Little Colorado.
1776. Escalante visited San Juan, Dolores, Green, Virgin, Marble Canyon from Lee Ferry.
1777. Father Font crossed the Colorado at Camp Mohave.
- 1779-81. Garces began to establish a settlement at Yuma.
1782. Don Pedro Foges made first trip from the Colorado River to San Diego, California.
1808. Andrew Henry visited valley of the Green River.
1824. Wm. H. Ashley established trappers on the Green River.
1825. Ashley made trip through Flaming Gorge to Brown's Park. J. O. Pattie went down the Gila and up the Colorado.
1826. Lieut. Hardy went down the Gila and up the Colorado. Jedediah Smith went down the Colorado from Virgin to Needles. Kit Carson visited the Colorado River Basin.
1827. Ewing Young, trapper, visited the Colorado River Basin. Jas. P. Pattie visited the Colorado River Basin.
1828. Salton Sink flooded by the Colorado River.
1830. Wm. Wolfskill visited the Colorado River Basin.
1831. J. T. Warner, Waldo and Young crossed the Colorado at Yuma to San Diego, California.
1832. Capt. Bonneville visited the Colorado River Basin.
1839. Thomas J. Farnham visited the Colorado River Basin.
1840. Flood water from the Colorado in Salton Sink.
1841. John Bidwell passed through the Colorado River Basin, in first wagon train to San Francisco, California.
1842. General John C. Fremont explored headwaters of the Colorado River Basin.

1846. General Kearney reached the Colorado as Commander of Army of West.
1847. Mormons crossed the Colorado River Basin and settled in Salt Lake City.
1849. Dr. O. M. Wozencraft journeyed across Salton Sink and planned irrigation Imperial Valley.
Flood water from the Colorado in Salton Sink.
1850. First steamboat to Yuma, Arizona.
Lieut. Geo. H. Derby made reconnaissance of Gulf of California and Colorado River to Yuma.
- 1850-53. J. R. Bartlett of Boundary Survey made exploration of Colorado Desert.
1851. Ft. Yuma established and steamboat used on river.
George A. Johnson visited mouth of the Colorado in schooner.
1852. Lorenzo Sitgreaves explored Zuni and Little Colorado.
Flood water from the Colorado in Salton Sink.
1854. Lieut. Whipple surveyed railroad on 35th parallel.
- 1855-60. Railroad surveys made.
1857. E. F. Beale made wagon road survey on 35th parallel.
Capt. Geo. Johnson, using camels, went above Vegas, Washington, in steamer.
- 1857-58. Lieut. J. C. Ives navigated in steamer to Vegas, Washington.
1858. Stage line through Yuma established.
1859. Flood waters of the Colorado in Salton Sink.
Capt. J. N. Macomb and Dr. J. S. Newberry explored Grand and Green Rivers.
1861. Berthoud and Bridger explored road Denver, to Salt Lake.
1862. Flood waters of the Colorado in Salton Sink.
1864. Capt. Sam'l Adams explored El Dorado Canyon.
1866. Capt. Rogers steamed up the Colorado to Callville.
1867. James White reported to have gone through Grand Canyon on raft.
Flood waters of the Colorado in Salton Sink.
- 1868-69. Maj. John Wesley Powell explored Grand Canyon.
1869. Lieut. Geo. M. Wheeler made reconnaissance of Grand Canyon.
Gold spike on first transcontinental road driven.
Major J. W. Powell made first trip to the Virgin River.
- 1871-72. Major Powell made second trip through Grand Canyon.
1876. Lieut. Eric Bergland surveyed Grand Canyon to Needles.
1877. Railroad completed through Yuma to Maricopa Wells.
1879. Lieut. Col. C. S. Stewart and Lieut. Payson explored river.
1883. Railroad crossed the Colorado at Needles.
Railroad crossed the Green in Gunnison Valley.
- 1889-90. R. B. Stanton and F. M. Brown made railroad surveys Grand Canyon.
- 1891-93. C. R. Rockwood surveyed Imperial Valley.
- 1891-96. Mexican Boundary Commission made map of Colorado River.
1894. Lieut. C. L. Potter navigated river Diamond Creek to Virgin.
- 1895-96. Messrs. Gallaway, Stone and Richmond went through Grand Canyon.

1896. Geo. F. Flavell descended the Green River to Yuma.
Chas. E. L. B. Davis made preliminary survey of river.
California Development Company organized.
1900. George Chaffey made contract for Imperial Valley Canal.
1901. Water flowing into Imperial Valley by canal.
- 1901-02. J. B. Lippincott made reconnaissance Needles to Yuma.
1902. Imperial Valley irrigation begun.
- 1902-03. J. P. Lippincott, E. T. Perkins, E. C. Barnard and R. B. Marshall continued investigation.
1904. Yuma project construction approved.
W. W. Schlecht made survey of Green River to Ouray, Utah Basin.
- 1905-06. Break in levees to Imperial Valley, Feb., 1905-Nov., 1906.
- 1906-07. Break to Imperial Valley, Dec., 1906-Feb., 1907.
- 1907-08. Messrs. Chas. Russell, E. R. Monett and Albert Loper descended the Colorado River in boats from Green River to below Grand Canyon.
1909. Flood to Volcano Lake and Ockerson Levee built.
J. F. Stone and N. Galloway descended the Colorado River, from Green, Wyoming, through the canyons.
1911. Flood broke through Ockerson Levee.
- 1911-12. Kolb brothers descended the Colorado River, Green River, Wyoming, to Needles.
1916. Flood at Yuma, Arizona.
Wyoming conference report on Green River.
Imperial Valley Irrigation System sold at auction to railroad company.
1919. All-American Canal report issued.
First All-American Canal Bill (Kettner Bill) introduced in Congress.
1920. Congress authorized investigation of the Colorado River.
Second All-American Canal Bill (Kettner Bill) introduced in Congress.
1921. Wiley, Munn, Savage and Young reported on Boulder Dam.
Southern California Edison Co. surveys down to Lee Ferry.
Preliminary report on "Problems of Imperial Valley" issued.
1922. Utah P. and L. Co. and U. S. G. S. surveyed canyons to Marble Canyon.
Boulder Dam Bill (Swing-Johnson) introduced in Congress.
Report on problems of Imperial Valley issued as Sen. Doc. 142.
Nov. 24, Colorado River Compact executed at Santa Fe, N. M.
1923. C. H. Birdseye and U. S. G. S. party survey canyons.
1924. Weymouth report rendered in eight manuscript volumes.
Second Boulder Dam Bill (Swing-Johnson) introduced in Congress.
Cosby report on Colorado River issued.
E. C. LaRue and party.
- 1925-26. Dec. 21, Third Swing-Johnson Bill introduced in Congress, H. R. 6251. Identical bill S. 1868 was introduced by Senator Johnson in the Senate about this date. H. R. 6251 was replaced Feb. 27, 1926, by H. R. 9826. These two bills are referred to as the third Swing-Johnson bill.

1927. Special advisers made report to Secretary of the Interior. Conference of governors on Colorado River.
1928. Fourth Boulder Dam Bill—"Boulder Canyon Project Act"—(Swing-Johnson) introduced, passed by Senate December 14, by the House December 18, approved and signed by President Coolidge December 21.
1929. President Hoover issues proclamation declaring six-state ratification of Colorado River Compact in effect and declaring Boulder Canyon Project Act effective this date, June 25, 1929.
1930. Contract signed by Secy. Wilbur with Metropolitan Water District of Southern California for delivery of water, April 24. Contract signed by Secy. Wilbur with Metropolitan Water District of Southern California for electrical energy, April 26, amended May 31. Contract signed by Secy. Wilbur with City of Los Angeles and Southern California Edison Company for electrical energy, April 26, amended May 28, and Department of Water and Power of City of Los Angeles made party to contract in addition to City of Los Angeles.
1930. Second Deficiency Appropriation Bill appropriating \$10,660,000 to start Boulder Dam work passed by House and Senate, July 3d. Secretary Wilbur drives first spike starting railroad and construction of Boulder Dam at Las Vegas, Nevada, September 17th, and issues order that dam be called "Hoover Dam."

EARLY HISTORY AND NAVIGATION OF COLORADO RIVER

The following extract, having to do with the early history of the Colorado River and the use of this river for navigation, is taken from the First Annual Report, Reclamation Service, published in 1903, as House Document No. 79, 57th Congress, 2d Session, p. 121.

HISTORICAL REVIEW OF EXPLORATIONS ALONG THE LOWER COLORADO RIVER

In connection with the discussion of the possibility of utilizing Colorado River, it is interesting to note the earlier history of the stream, and important to consider it from the standpoint of navigation. The construction of dams and diversion canals will bring about some modification in the stream, which may or may not be favorable to the interests of navigation. These interests are so small that it may be questionable whether they are worth considering. Under this heading are inserted some notes bearing upon the subject. Facts concerning the early history of the river have been brought together by Mr. Jeremiah Aheru, and data concerning navigation and related facts have been added by Mr. Lippincott.

In 1539 Ulloa sailed to the head of the Gulf of California, and, noting the turbid condition of the water, inferred that a great river entered the gulf near its head. He, however, did not see the river, but indicated its supposed position on a sketch map made by him at the time. The actual discovery of Colorado River took place in 1540, three explorers, one by sea and two by land, having reached it in that year. Alarcon, the first to arrive, sailed up the Gulf of California to its head, entered Colorado River and ascended it in boats for fifteen days. He gives the distance as 85 Spanish leagues—an equivalent of 234 miles—which would bring him to near the present site of Ehrenberg, Ariz.

Diaz, separating from Coronado's main party near the present site of Ures, Mexico, made a journey to the mouth of the Colorado, and, proceeding up the river to a point several leagues above the Gila, crossed and explored some of the country to the west.

Cardenas, another lieutenant of Coronado's, traveling through what is now northern Arizona, according to the chronicler of the expedition, "arrived at a river the banks of which seemed to be more than 3 or 4 leagues apart in an air line." This is the first written description of the Grand Canyon of the Colorado.

Onate, during his expedition in 1604-5 from the Rio Grande to the mouth of the Colorado, came to a stream flowing northwesterly, which he named Colorado—the Little Colorado of the present day. So far as known, he was the first person to use the name Colorado. Then, traveling in a southwesterly direction to Williams River, he followed it to its junction with the Colorado, and, following the latter stream to the gulf, returned by the same route. He also noted the Gila.

In 1744 Father Sedelmayer followed the Gila to the great bend, and from there went overland about 40 leagues to the Colorado, reaching it near Williams River.

In 1771 Father Garces journeyed down the Gila to its junction with the Colorado; thence down the latter stream at least as far as tidewater. In 1774 he was a member of Captain Anza's expedition which traversed the Gila to its mouth, crossing the Colorado at this point and proceeding across the desert to San Gabriel and Monterey. Anza gives the width of the Colorado at the place of crossing as 550 feet and its depth somewhat more than 5½ feet. He was informed by the Indians that a branch of the Colorado ran westward and northwestward. This may be a reference to an overflow from the Colorado to Salton Sea.

During the eighteenth century the Lower Colorado was visited by several other Catholic priests. Father Kino, who made the first map of that region in 1701, spent from 1690 to 1702 in traversing the region along the Gila and Colorado.

In 1775-76 Father Garces explored the Colorado from the mouth of the Gila to the present site of Camp Mohave, and his journal gives extensive information in regard to the geography of the country passed through. In 1780 he established the mission Purisima Concepcion opposite the mouth of the Gila, and on the site where

seventy years afterward Fort Yuma was established. In the same year he also founded the mission of San Pedro y San Pablo on the right bank of the river a few miles below the mouth of the Gila. Both of these missions were destroyed by Indians in 1781 and about 50 Spaniards were killed, including Father Garces and 3 other priests. This was the only attempt to establish missions on the Colorado.

In 1776 another Catholic missionary, Father Escalante, traveled from Santa Fe to Utah, and, after having discovered Utah Lake, pursued a southwesterly course toward the sources of the Virgin, and crossed to the Colorado, which he forded just above the point where it enters Arizona.

In 1777 Father Font, who had been a member of Anza's expedition of 1775-76, traveling eastward from Monterey, Cal., crossed the Colorado near the present site of Camp Mohave.

The foregoing include all of the more important exploratory expeditions to the Lower Colorado up to the beginning of the nineteenth century.

As early as 1825 American trappers appeared along the Colorado River. On his second overland journey to California in 1826 Jedediah S. Smith followed the Colorado from the mouth of the Virgin to near the present crossing of the Santa Fe Railroad. He was the first American to reach California by the overland route. In 1825 James O. Pattie made two trips down the Gila, and in the following year went down the Gila to its junction with the Colorado and up the Colorado and across the Rocky Mountains. Steamboating on the Colorado began in 1851.

From 1846 to the beginning of the Civil War the Lower Colorado was visited and explored by surveying and exploring parties under the direction of the War Department. The most detailed examination of the river made during this period was by Lieut. J. C. Ives in 1857-58. He ascended the river in an iron steamboat 50 feet long, built in Philadelphia and shipped in sections to the mouth of the Colorado via San Francisco. A very detailed examination, with the view of determining how far it was navigable for steamboats, was made from the mouth of the Colorado to near the mouth of the Las Vegas Wash.

After the close of the Civil War topographic parties, under the direction of the Chief of Engineers, U. S. Army, made various preliminary surveys in the region along the Lower Colorado. Lieut. E. Bergland, who examined the Lower Colorado in 1876, states that during stages of high water the river changes its channel to a considerable extent, also that portions of the bottom lands are subject to overflow, and that consequently it would be necessary to build levees to prevent the river from overflowing the bottom lands adjacent and destroying the irrigation canals and ditches.

IMPROVEMENT OF THE RIVER

The matter of improving the river for navigation has been considered by the army engineers and information has been published in the annual report. The following extracts are taken from the Annual Report of the Chief of Engineers, U. S. Army, for 1886, part 3:

"January 13 the barge dropped down 46 miles to Bulls Head Canyon, when it was decided to take advantage of the low stage for work on an isolated rock directly in the channel and in very swift water. The area of this rock at low water was 30 feet by 15 feet, and its highest point 4 feet above that level.

This rock was drilled and blasted down to 1 foot 5 inches below low water, which makes it no longer an obstacle in the present condition of the river.

Near the lower end of the canyon a point of rocks projected from the west bank, confining the river at 4-foot stage to a width of 120 feet, throwing a strong current against the nearly vertical rocks of the west bank and making the passage by steamers very dangerous. This point was graded off to 5 feet above low water, which it is thought will make the passage safe.

The following statistics, showing the entire business on the Colorado River for the year ending June 30, 1886, are furnished by the Southern Pacific Company:

Number of passengers transported.....	130
Freight transported.....	tons 4,695

The following extracts are from the Annual Report of the Chief of Engineers, U. S. Army, for 1879.

The following is from the report of Lieut. Col. C. Seaforth Stewart (Ann. Rept. Chief of Engrs., U. S. Army, for 1879, Pt. II, p. 1774):

As to the improvements below Camp Mohave and above Ehrenberg, there is so little prospect now of anything but greatly diminished traffic in the river since the practical completion of the railway eastward from Yuma to Maricopa Wells, that I

do not feel justified in recommending any expenditure under the plan submitted for them, nor indeed for those higher up.

The following is from the report of Lieut. A. H. Payson (Ann. Rept. Chief of Engrs., U. S. Army, for 1879, Pt. II, pp. 1776-1782) :
 Commerce and Navigation—

Before the railway reached the Colorado River at Yuma, all supplies sent from San Francisco to the interior of Arizona went by sea-going steamers to the head of the Gulf of California, and were there transferred to the river boats of the Colorado Steam Navigation Company, to be left at various points along the river and freighted overland to their destination. The most considerable portion of the transportation was between the gulf and Yuma, which was the starting point for Tucson; and of that on the upper river the greater part was to and from Ehrenberg, from whence there was the most convenient road to Prescott and the important country adjacent.

Above Ehrenberg we find only the Indian agency at Camp Colorado, the so-called towns of Aubrey and Hardyville, the military post of Camp Mohave, and the little mining camp at El Dorado Canyon.

Aubrey and Hardyville are each small adobe buildings, occupied as stores, at which supplies are landed for a few mining camps in the interior, of which the most important are Signal, Hackberry, and Mineral Park.

The mine at El Dorado is said to be a good one, but the company is supposed to be in financial difficulty, and its abandonment in the near future is, to say the least, not impossible.

As soon as the railway crossed at Yuma, the best part of the river business was stopped at once; the steamers passed into the hands of the railway company; the old establishment at the mouth of the river was abandoned and all trips from thence to Yuma discontinued.

During the past winter the Southern Pacific road has been rapidly pushed into Arizona, and, when operations are discontinued for the hot weather of the coming summer, its terminus is expected to be at Maricopa Wells, 190 miles east from Yuma. When this happens, freight for Prescott and its tributary districts will no longer go by boat to Ehrenberg but by rail to Maricopa Wells; and with this change disappears at once not only the greater portion of the remaining need for river transportation, but also the chief reason for the existence of the town of Ehrenberg itself.

We are therefore confronted with the fact that our estimate of the necessity for increased communication facilities by the river must be based on the needs of the country above Ehrenberg dependent on it for supply.

It is of course not improbable that new mines may be discovered in the very imperfectly known country adjoining the Colorado's course, but such a consideration is altogether too uncertain a one to be entertained at present; while with reference to future agricultural development in the very limited areas of fertile land through which the river flows it may simply be said that none will be possible unless preceded by such works of reclamation and control as would in themselves definitely settle the question of navigation.

Roughly stating the extent of these arable lands as 500 square miles, by the ordinary methods of estimating the quantity of water needed for their irrigation, it will be seen that more than one-half of the low-water discharge would have to be diverted for that purpose.

By the railway company I have been furnished with statistics of the river traffic since it came under their management. They cover a period of nineteen months, from May 21, 1877, to January 1, 1879.

Before the first-named time there are no data which can be obtained.

I have tried to separate these statistics for the different sections in the following table.

Freight Carried	<i>Tons of 2000 pounds</i>
1. Between Yuma and Ehrenberg-----	7,973.3
2. Between Yuma and Ehrenberg and points between Ehrenberg and Hardyville-----	4,784.7
3. Between Yuma and points above Hardyville-----	77.9
4. Points between Ehrenberg and Camp Mohave and points above Camp Mohave-----	25.1
5. Between Camp Mohave and points above-----	2,864.2
Total freight business for nineteen months-----	15,725.2

Probably the greater part of the item in the fourth line of the table was for Hardyville. The fifth line contains a large item which I believe consists mainly, if not wholly, of firewood, towed up from Cottonwood Island—26 miles—for the supply of the quartz mill at El Dorado Canyon.

I have not been able to get statistics of the passenger traffic in a very intelligible form, but the following numbers will give some idea of its amount:

Passengers Carried	
From Yuma	1,621
From Ehrenberg	687
From Aubrey	230
From Castle Dome	71
From Chimney Peak	64
From Picache Mill	3
From Roads Ranch	4
From Camp California	6
From Gastons	2
From Taylors	2
From Drift Desert	9
From Swan Lagoon	6
From Quien Sabe	1
From Indian Agency	21
From Empire Flat	8
From Chin-e-hue-vis	3
From Camp Mohave	100
From Hardyville	35
From Cotton Island	2
From El Dorado	11
Total	2,286

It remains to show what facilities for commerce the river affords in its present unimproved conditions.

The head of high water navigation was put by Lieutenant Ives in the lower part of the Black Canyon, and a steamer has actually ascended to the now abandoned town of Colville, 25 miles above the mill at El Dorado, but the difficulties and dangers of this upper portion of the river, combined with the lack of any present reason for going there, have made the latter place the practical upper limit of the navigable portion of the stream.

To this point the boats in use on the Colorado can go at any time from the spring rise till the latter part of August or fore part of September without other obstacles than those interposed by the swiftness of the current.

After that Hardyville becomes the low-water head of navigation, and can generally be reached, with more or less difficulty, at all times, though occasionally, in extremely low stages, freight for this place has to be landed at the foot of Pest House Rapid, 4 miles below.

It may be safely said, therefore, that if there is freight enough to pay for the trouble it can be sent to the foot of Pest House Rapid in all seasons and to El Dorado Canyon for from three to four months in each year.

The chief obstacles to the low-water navigation are encountered in the valleys, which may be said to form an almost continuous obstruction, over 200 miles in length, while in the canyons there are comparatively few.

Above Camp Mohave there is probably quite as much water as below, but the general character of the bars changes from yielding and semifluid sand to cobble of constantly increasing size, and steamers are unable to force their way over or through them, as they are continually obliged to do in the river below.

The boats in use on the Colorado are from 150 to 170 feet long, 30 to 37 feet beam, and draw slightly more than 2 feet.

Their load is carried on board in high stages, but during low water it is placed on a barge and the latter towed astern by a long line, which reaches to a tow post set amidship in the steamer's hull.

Previous knowledge of the channel is of no avail, and the pilot judges the course of the river at each moment by the appearance of the water surface, shape of the bars, direction of the drift, and other slight indications significant alone to his experienced eyes. A sounding pole is kept going constantly, and the boat is frequently aground each day. She is then hauled over by all sorts of devices, with

spars, anchors, and capstan, or, as a last resort, is backed up to the bar and digs her way slowly through by stirring up with the wheel the loose material of the bottom, until enough has been carried away by the rapid current. In this manner they have actually made a cut for themselves and hauled a barge through a bar of fine gravel, over which there had been found only from 2 to 3 inches of water.

A trip from Yuma to Hardyville can generally be made in low stages in from ten to fourteen days; the return in from five to ten.

Much uncertainty is introduced into these calculations by the wind, which occasionally blows with extreme violence straight up or down river, greatly hindering or even completely preventing navigation for three or four days at a time.

As a result of all this and the lack of any competition, transportation is extremely expensive, freight being charged for in pounds and the weight estimated by measurement. Cost will vary greatly for different classes of supplies, but the average price for the government from Yuma to Camp Mohave is said to be 4 cents per pound.

Summary.

The Colorado River between Yuma and Camp Mohave, about 300 miles, is generally navigable, though with more or less difficulty, at all seasons of the year. It has been shown that most of the Ehrenberg trade will disappear during the coming summer. Leaving it out, therefore, the freight carried to and from all points on this portion of the river has, during the past two years, averaged less than 300 tons per month.

The principal obstructions to navigation being the shoal and shifting channels in the valleys, no plan will give any permanent change for the better unless it provides for the entire and certain confinement and control of more than 200 miles of river, while there is manifestly no present justification for so vast an expenditure as the execution of such a plan would entail.

Improvements, however, could be effected, and would probably be permanent, at certain gravel bars for about \$13,000.

The section of the river between Camp Mohave and El Dorado Canyon can at present be navigated for more than three months in the year, and throughout it low-water navigation could probably be provided for about \$90,000, though unforeseen contingencies might increase that amount.

Most of the freight which seeks to go above Camp Mohave is for Hardyville, while the distance between the two places is only 7 miles and traversed by a good road.

During the entire nineteen months preceding January 1, 1879, less than 100 tons was transported from below to points above Hardyville, the principal and only important reason for the navigation of the upper portion of the river being the supply of wood to the El Dorado mill.

There seems no reason why this business could not perfectly well be done during high water in the future as heretofore, and I am therefore decidedly of the opinion that the interests now involved are very far from warranting the expenditure of so much money, not really to enable the transportation company to accommodate them, but merely to render it more convenient to do so."

CHRONOLOGICAL HISTORICAL SYNOPSIS OF EXPLORATION AND DEVELOPMENT OF COLORADO RIVER BASIN

The following is a chronology of the events in connection with the exploration and development of the Colorado River with particular reference to the Lower Colorado and development of Imperial Valley.

This synopsis is taken almost entirely from the records of the U. S. Bureau of Reclamation, the information having been furnished by that Bureau. Where no other notation is given in the reference, reports of, or to, the Reclamation Department are indicated.

In giving the references in connection with the following historical data an abbreviated title is used in connection with many of the references. The following are some of the books and reports referred to in an abbreviated form:

The Romance of the Colorado River, by Frederick S. Dellenbaugh, G. P. Putnam's Sons, 1909.

First Annual Report of the Reclamation Service from June 17th to December 1, 1902, published as Document 79, House of Representatives, 57th Congress, 2d Session, 1903.

The Colorado River, Yesterday, Today and Tomorrow, by Lewis R. Freeman, Dodd, Mead and Company, 1923.

Water Supply Paper No. 395, Colorado River and Its Utilization, U. S. Geological Survey, 1916.

Spanish Institutions of the Southwest, F. W. Blackmar, Johns-Hopkins Press, Baltimore, 1891.

Breaking the Wilderness, Frederick S. Dellenbaugh, G. P. Putnam's Sons.

On the Trail of the Spanish Pioneers, Elliott Coues, F. P. Harper, New York, 1900.

1539. Ulloa, Francisco de. Sailed from Acapulco, July 8, 1539, with a fleet of three vessels, and after many difficulties reached shallow water at the head of the Sea of Cortes (now known as the Gulf of California). This seems to have been the first visit of Europeans to the mouth of the Colorado. Ulloa did not see the river but surmised that one might be there.

References:

U. S. Water Supply Paper 395, p. 16.

First Reclamation Report, p. 121.

The Colorado River, L. R. Freeman, p. 3-6.

Heroes of California, Geo. W. James, p. 1-3.

Romance of the Colorado, p. 7.

1540. Alarcon, Hernando de. Under Coronado's orders, under Mendoza, Viceroy, Colorado River discovered by Alarcon. Sailed in May, 1540, to explore the region north of New Spain and at last reached the head of the Sea of Cortes. He says: "And it pleased God that after this sort we came to the very bottom of the bay, where we found a very mighty river, which ran with so great fury of a stream that we could hardly sail against it." Here began

the acquaintance of Europeans with the river now known as the Colorado of the West. Alarcon proceeded up the Colorado in small boats to a point about 100 miles above the mouth of the Gila River. (Note: Freeman estimates the farthest north point reached by Alarcon to be about 35 to 50 miles above the mouth of the Gila. J. L. B.)

References:

- Water Supply Paper 395, p. 16.
 First Reclamation Report, p. 121.
 Spanish Institutions in Southwest, F. W. Blackmar, p. 217-222.
 Principal navigations, voyages, etc., Richard Hakluyt, v. 9, p. 279-318. (From Gulf of 85 Leagues beginning May 9, 1540.)
 Pioneer Spaniards in North America, Wm. H. Johnson, p. 217-253.
 Spanish Settlements Within the United States, Woodbury Lowry, p. 283-336. (Coronado's route to Cibola, p. 470-472.)
 Smithsonian Annual Report, Jas. H. Simpson.
 Discovery of Colorado, House Document 153, 41st Congress, 3d Session, p. 309-340. (Serial No. 1460.)
 Ethnology Bureau, 14th Annual Report, 1893, p. 329-637, Discovery of the Colorado River.
 The Colorado River, L. R. Freeman, p. 6-17-19.
 Heroes of California, Geo. W. James, p. 1-3.
1540. Diaz, Melchior. In the fall of 1540, explored the Colorado and surrounding country in the vicinity of the Chocolate Mountains. At about the same time (1542) Don Lopez de Cardenas discovered the Grand Canyon. The canyons of the river, however, remained unexplored for 329 years thereafter—until 1869.
- References:
 Water Supply Paper 395, p. 17.
 First Reclamation Report, p. 122.
 Heroes of California, Geo. W. James, p. 4-6.
 Spanish Settlements within the United States. Woodbury Lowry, p. 283-336.
 The Colorado River, L. R. Freeman, p. 18-21.
- 1540-2. Coronado, Francisco Vasques de. Marched by land in search of the "Seven Cities of Cibola" and is credited with reaching Cibola.
- References:
 Smithsonian Report, Jas. H. Simpson, House Doc. 153, p. 309-340, Serial No. 1460. Marching Along the Rim of the Grand Canyon.
 Ethnology Bureau, 14th Annual Report, Geo. P. Winship, p. 329-637. Coronado Expedition, 1540-1542.
 Journey of Coronado, etc., Geo. P. Winship. City of Mexico to Grand Canyon and Great Plains.
 The Colorado River, L. R. Freeman, p. 6 (brief).
 Spanish Institutions in Southwest, F. W. Blackmar, p. 217-222.
1542. Cardenas, Don Lopez de. Discovered the Grand Canyon. The canyons of the river, however, remained unexplored for 329 years thereafter—until 1869.
- References:
 Water Supply Paper 395, p. 17.

- First Reclamation Report, p. 122.
 Spanish Settlements Within the United States, Woodbury Lowry, p. 283-336.
 The Colorado River, L. R. Freeman, p. 21-23.
- 1604-5. Ornate, Don Juan de (Governor of New Mexico). Made trip from village of San Juan on the Rio Grande to the Colorado in the vicinity of Williams River and went down the Colorado to the Gulf, Feb. 28, 1605. He encountered the Little Colorado, which he named Colorado. So far as known was first to use name Colorado. He followed this stream to junction with main Colorado and thence to Gulf and also noted the Gila.
- References:
 Water Supply Paper 395, p. 17.
 First Reclamation Annual Report, p. 122.
 The Colorado River, L. R. Freeman, p. 24-25.
 Breaking the Wilderness, F. S. Dellenbaugh, p. 116-117.
1618. Zalvidar and Padre Jiminez. Went to Moki and thence to the Rio de Buena Esperanza (Colorado River) but they evidently encountered Marble Canyon and soon returned.
- Reference:
 Water Supply Paper 395, p. 17.
- 1680-1711. Kino, Padre Eusibio Francisco (an Austrian by birth and a member of the Jesuit order). Made many journeys over the whole of northern Sonora and the southern half of Arizona, then comprising the Pimeria Alta, the upper land of Pimas, and Papaguera, the land of Papagos. His base of explorations was the mission of Dolores, which he established in Sonora in 1687. Made first map in 1701. Died in 1711. (Note: This name is also spelled Kuhn, Kuhne, Quino and other ways.)
- References:
 Water Supply Paper 395, p. 17.
 First Reclamation Annual Report, p. 122.
1697. Mange, Captain Juan Mateo. An officer detailed with his command to escort the padres on their perilous journeys, made trip with Kino to ruins of Casa Grande near present town of Florence.
- Reference:
 The Romance of the Colorado River, F. S. Dellenbaugh, p. 82.
1721. Ugarte. Came up along the eastern coast of Lower California and sailed to the mouth of the Colorado in July, 1721.
- References:
 The Romance of the Colorado River, F. S. Dellenbaugh, p. 86.
 The Colorado River, C. E. Grunsky, Sen. Doc. 103, 65th Congress, 1st Session, p. 38.
1744. Sedelmair, Padre Jacobo. Went down the Gila from Casa Grande to the great bend, and thence across to the Colorado at about the mouth of Williams River, but his journey was no more fruitful than those of his predecessors in the last two centuries.
- References:
 Water Supply Paper 395, p. 17.
 First Reclamation Annual Report, p. 122.

1746. Consag, Fernando. Came up Gulf to mouth of Colorado.

Reference:

The Romance of the Colorado River, F. S. Dellenbaugh, p. 86.

1768-1774. Garces, Padre Francisco. A Franciscan. Made five expeditions. First was made in 1768, second in 1770 (but he did not reach the Colorado), third in 1771, when he went down the Gila to the Colorado and descended the Colorado along its banks, possibly to the mouth. In the fourth, in 1774, he went with Capt. Anza to the Colorado and to the Mission of San Gabriel in California near Los Angeles.

References:

Water Supply Paper 395, p. 17.

First Reclamation Annual Report, p. 122.

On the Trail of the Spanish Pioneers, Elliott Coues.

Yuma-Gulf of Cal., Dec., 1775, v. 1, p. 154-199.

Yuma-Mohave, Feb., 1776, v. 1, p. 220-233.

Mohave-Moqui, June, 1776, v. 2, p. 313-360.

Discovery Grand Canyon, v. 2, p. 347.

Mohave-Yuma and up Gila, July 25-Sept. 17, 1776, v. 2, p. 415-440.

The Colorado River, L. R. Freeman, p. 25-28.

History of California, H. H. Bancroft, v. 1, p. 340-4, 353-371.

1774-1776. Anza, Capt. de. In 1774 he went with Francisco Garces to the Colorado and to the Mission of San Gabriel in California near Los Angeles. In 1775-76 he again accompanied Garces. He was bound for the present site of San Francisco, there to establish a mission.

References:

Water Supply Paper 395, p. 17.

First Reclamation Annual Report, p. 122.

History of California, H. H. Bancroft, 1st trip, Sonora, v. 1, p. 220-3; 2d trip, v. 1, p. 257-264.

Heroes of California, Geo. W. James, p. 16-23.

1775-76. Garces, Padre Francisco. In his fifth and most important expedition, in 1775-1776, he again accompanied Capt. Anza, who was bound for the present site of San Francisco, there to establish a mission. At Yuma he left the Anza party, went down to the mouth of the Colorado, and up the river to Mohave. Leaving Mohave June 4, 1776, Garces struck eastward across Arizona and passed near the rim of the Grand Canyon, though he did not then see it. Found his way down to the Little Colorado by means of a side canyon and got up on the other side in the same way. July 2, 1776, he arrived at the pueblo of Oraibi, and left July 4, reached the Colorado again July 25, and arrived at his mission of San Xavier del Bac, near the present site of Tucson, Sept. 17, 1776.

References:

Water Supply Paper 395, p. 17.

First Reclamation Annual Report, p. 122.

On the Trail of the Spanish Pioneers, Elliott Coues.

Yuma-Gulf of California, Dec., 1775, v. 1, p. 154-199.

Yuma-Mohave, Feb., 1776, v. 1, p. 200-233.

Mohave-Moqui, June, 1776, v. 2, p. 313-360.

Discovery of Grand Canyon, v. 2, p. 347.

Mohave-Yuma and up Gila, July 25-Sept. 17, 1776, v. 2, p. 415-440.

The Colorado River, L. R. Freeman, p. 25-28.

1776. Escalante, Fray Padre Francisco Silvestre Velez, a Franciscan. Started from Santa Fe in search of a route to Monterey. He reached the San Juan about where it first meets the north line of New Mexico; thence crossed several tributaries to head of Dolores River; made his way across Grand River, the Book Plateau, and White River to the Green (called the San Buena Ventura), which was forded apparently near the foot of Split Mountain Canyon; went up the Uinta and crossed the Wasatch Range, coming down the western side to Utah Lake; thence southwesterly through Sevier River Valley along the west edge of the high plateaus south past Parowan and came to the headwaters of a branch of the Virgin in Cedar Valley. Going generally southeast he struck the Colorado at Marble Canyon. Twice descended the river but was unable to cross. On Nov. 8, 1776, reached the ford now known as the Crossing of the Fathers, about 35 miles north of Lee Ferry, a few miles north of the Utah-Arizona State line. From this crossing to the Moki towns and then to Santa Fe. He completed a circuit of more than 1500 miles, mainly through unknown country.

References:

Water Supply Paper 395, p. 17-18.

First Reclamation Annual Report, p. 122.

Romance of the Colorado River, F. S. Dellenbaugh, p. 86.

The Colorado River, L. R. Freeman, p. 29-54.

1777. Font, Father. Was on Anza's expedition of 1775-76, and in 1777 traveled eastward from Monterey, California, and crossed the Colorado River near the present site of Camp Mohave.

Reference:

First Reclamation Annual Report, p. 123.

1779-1781. Garces, Padre Francisco. Went to Yuma in 1779 to prepare the way for two missions on the Lower Colorado. One Purisima Concepcion was established 1780 at what is now Fort Yuma; the other about 8 miles down, San Pedro y San Pablo de Bicuener, on the right bank of the river a few miles below the mouth of the Gila. An uprising of the Yuma Indians destroyed both missions and massacred most of the men, July 17, 1781, and Garces and his assistant, Barraneche.

References:

Water Supply Paper 395, p. 18.

First Reclamation Annual Report, p. 122.

History of California, H. H. Bancroft, v. 1, p. 340-344, 353-371.

On the Trail of the Spanish Pioneers, Elliott Coues, 2 vols.

The Romance of the Colorado River, F. S. Dellenbaugh, p. 104.

1782. Foges, Don Pedro. Made the first record trip from the Colorado River to San Diego, Cal.

1808. Henry, Andrew. Crossed over the south pass into the valley of Green River in Wyoming.

Reference:

Water Supply Paper 395, p. 18.

1824. Ashley, Gen. William Henry. Having previously organized a fur-trading company in St. Louis, then the center of all western commerce, had established himself in Green River Valley with a large band of expert trappers. Freeman states Ashley "crossed the Continental Divide on April 1, 1825 * * * it was not until the eighteenth of April that the party came down to the banks of the river we now call the Green."

References:

Water Supply Paper 395, p. 19.

Breaking the Wilderness, F. S. Dellenbaugh, p. 234, etc.

The Colorado River, Freeman, p. 86.

1825. Ashley, Gen. William Henry. In 1825 Ashley had established a camp at the mouth of Henry's Fork, near Flaming Gorge. During this year Ashley and his party constructed boats to go down the Green for the purpose of trapping beaver. The trip was successful through Flaming Gorge and Horseshoe Canyon, but in Red Canyon their boats were wrecked in a cataract now known as Ashley Falls. Ashley and his party left the river at Browns Park. This was, no doubt, the first attempt to navigate Green River.

References:

Water Supply Paper 395, p. 19.

The Colorado River, L. R. Freeman, Chap. IV, Ashley on the Green, p. 82-103.

1825-6. Pattie, James O. Went down the Gila and up the Colorado, and across the Rocky Mountains. He was a trapper from St. Louis. March 28, 1826, the Pattie party reached what is probably Black Canyon, "the first white men on record to reach it."

References:

Water Supply Paper 395, p. 19.

First Annual Reclamation Report, p. 123.

Heroes of California, Geo. W. James, Chap. VI, p. 28-39.

The Colorado River, L. R. Freeman, p. 57-81-117.

1825-39. During this period the Colorado Basin was visited by many trappers and explorers. Some of the most prominent were James O. Pattie and his father (1825), R. W. H. Hardy (1826), Jedediah Smith (1826), Kit Carson, one of the greatest scouts and trappers (1826), Ewing Young, trapper (1827), William Wolfskill (1830), Capt. Bonneville (1832), and Thomas J. Farnham (1839). By the time the third decade of the nineteenth century was fairly begun the trappers were crossing in considerable numbers from the headwaters of the Missouri and the Platte into the valleys of the Colorado and the Columbia.

Reference:

Water Supply Paper 395, p. 19.

1826. Carson, Kit. Kit Carson, one of the greatest scouts and trappers, visited the Colorado Basin during this year.
References:
Water Supply paper 395, p. 19.
Heroes of California, Geo. W. James, Chap. XIII, p. 94-103.
1826. Smith, Jedediah S. Visited the Colorado Basin this year; on his second overland journey to California, following the Colorado from the mouth of the Virgin to present crossing of Santa Fe railroad at Needles. He was the first American to reach California by the overland route.
References:
Water Supply Paper 395, p. 19.
First Reclamation Annual Report, p. 123.
Heroes of California, Geo. W. James, Chap. VII, p. 40-44.
1827. Hardy, R. W. H., Lieut. of Br. Navy. Went down the Gila and up the Colorado. Visited the mouth of the Colorado in the interests of the General Pearl and Coral Fishery Association of London in 25-ton schooner *Bruja*, July 20, 1826, anchored near Baja, Cal., Aug. 15, 1826, and sailed out of the head of the Gulf of California. Charted gulf and mouth of river.
References:
Water Supply Paper 395, p. 19.
The Colorado River, L. R. Freeman, Chap. V, p. 104-125.
Travels in the Interior of Mexico, in 1825, 1826, 1827 and 1828, London, 1829.
The Geographical Review, illus., April, 1926, v. 16, p. 236.
Article by Godfrey Sykes, The Delta and Estuary of the Colorado, illus., p. 232-255.
1827. Pattie, James P. and father.
References:
Grunsky, p. 38.
The Colorado River, Freeman, p. 117.
1827. Young, Ewing (trapper). Visited the Colorado Basin this year.
Reference:
Water Supply Paper 395, p. 19.
1828. Flood waters into Salton Sink.
References:
Colorado River, L. R. Freeman, p. 386.
"The Salton Sea," by D. T. McDougal, The Carnegie Institute, Washington, 1913.
1830. Wolfskill, William. Visited the Colorado Basin in that year.
References:
Water Supply Paper 395, p. 19.
Breaking the Wilderness, F. S. Dellenbaugh, p. 270.
1831. Warner, Jonathan T. Formed an expedition under the leadership of Jackson, Waldo and Young, which crossed the Colorado River at Yuma and went to San Diego, Cal.
1832. Bonneville, Capt. Visited the Colorado Basin during this year.
References:
Water Supply Paper 395, p. 19.
Breaking the Wilderness, F. S. Dellenbaugh, p. 273-284.

1836. Julien, D. The inscription "D. Julien, 1836, 3 Mai" was found cut in rocks on canyon sides in Cataract Canyon, Stillwater Canyon, and about middle of Bowknot Bend, Labyrinth Canyon, Green River, supposed to have been cut by an unknown French or Canadian navigator.
References:
The Colorado River, Freeman, p. 132.
Romance of the Colorado River, Dellenbaugh, p. 353.
1839. Farnham, Thomas J. Visited the Colorado Basin during that year.
Reference:
Water Supply Paper 395, p. 19.
1840. Flood water in Salton Sink.
References:
Colorado River, L. R. Freeman, p. 386.
The Salton Sea, D. T. McDougal.
1841. Bidwell, John. Reached San Francisco by the first emigrant wagon train.
- 1842-46. Fremont, John C. In 1842 Fremont came up the North Platte and Sweetwater Branch, crossing from that stream by the South Pass over to the headwaters of the Colorado. Fremont's explorations of the Colorado and the West covered the period 1842 to 1846.
References:
Water Supply Paper 395, p. 19.
Romance of the Colorado, Dellenbaugh, p. 138.
Fremont and '49, Dellenbaugh.
- 1845-46. Kearny, General. General Kearny reached the Colorado River in command of the Army of the West.
Reference:
Romance of the Colorado, Dellenbaugh, p. 138.
1847. Mormons. In 1847 the Mormons crossed the Colorado River Basin and settled in Salt Lake Valley.
Reference:
Water Supply Paper 395, p. 19.
1849. Gold discovered in California. In 1849 the discovery of gold in California led many emigrants to cross the Colorado River Basin.
References:
Water Supply Paper 395, p. 19.
Death Valley in Forty-nine, W. L. Manly, San Jose, p. 94.
The Colorado River, L. R. Freeman, Chap. VII, p. 126-141.
"Manly Down the Canyons."
1849. Coutts, Lieut. Cave J. September, 1849, commanded an escort for some boundary surveyors under Lieut. Whipple. Coutts established a ferry at the mouth of the Gila, 1849.
Reference:
Colorado River, L. R. Freeman, p. 140.
1849. Manly, Wm. Lewis. Early in 1849 a party consisting of Wm. Lewis Manly, M. S. McMahan, Chas. and Joseph Hazelrig, Richard

Field, Alfred Watson and John Rogers, started from a point on the Green River in Wyoming down the Colorado in a boat. Manly's story given in his book, "Death Valley in '49," published San Jose, California, by company of which Henry L. Brainard was head, in 1894. (First published in Santa Clara Valley "Weekly.")

Reference:

The Colorado River, Freeman, p. 132.

1849. Wozencraft, Dr. O. M. Discovered the key route and conceived the idea of bringing the water to Imperial Valley in a journey across the Sink in spring of 1849. This was later worked out in collaboration with Ebenezer Hadley, surveyor of San Diego County.

References:

Heroes of California, Geo. W. James.

The Colorado River, L. R. Freeman, p. 386-388.

1849. Flood water in Salton Sink.

Reference:

Colorado River, Freeman, p. 386.

1849-50. Anderson, General. Built a ferryboat near Yuma and left it with the Indians, who maintained a ferry about 4 or 5 miles below Yuma.

1850. Hobbs, Lieut. According to Lieut. Hobbs, the first steamboat, *Yuma*, came up the Colorado to Yuma in 1850, frightening the Yumas so that they ran for their lives. Probably came as Capt. James Hobbs, author of "Wild Life in the Far West," and whom Dellenbaugh refers to as "a mountaineer who was at Yuma in 1851."

References:

Water Supply Paper 395, p. 19.

Romance of the Colorado, Dellenbaugh, p. 140.

1850-51. Derby, Lieut. Geo. H. Of the Topographical Engineers, made a reconnaissance of the Gulf of California and the Colorado River for the War Department for the purpose of seeking a route for water transportation of supplies to Fort Yuma. An expedition was sent to attempt the entrance of the Colorado River from the Gulf of California, and to ascend the river as far as the junction of the Gila, with a view to establishing that as a route of supply. Observations were taken of soundings, rise and fall of tide. Sketches were made of coast and shores in the neighborhood of the mouth of the river, and the Hardy maps were checked as far as Ft. Yuma.

References:

Govt. Report S. Exec. Doc. 81, 28 pp., 32d Congress, 1st Session, Serial 620.

Colorado River, L. R. Freeman, Chap. VII, p. 142-170.

Geographical Review, Apr., 1926, v. 16, p. 239. Article by Godfrey Sykes, The Delta and Estuary of the Colorado, illus., p. 232-255.

1850-53. Bartlett, J. R. Boundary survey U. S. and Mexico. Explorations of the Colorado Desert, Colorado River and country near Yuma, and the facility of irrigation in connection with the surveys of the United States and Mexican Boundary Commis-

sion in the States of Texas, New Mexico, California, and in Sonora and Chihuahua.

Reference:

Report on the explorations and incidents in Texas, New Mexico, California, Sonora and Chihuahua, connected with the United States and Mexican Boundary Commission during years 1850-52. (Gives a resume of early explorations and discoveries of the Colorado, the basin of the Gila, the character of the country and its inhabitants.)

1851. Ft. Yuma was established. Steamer *Uncle Sam* used on Colorado River. Established by Major Heintzelman on site of old Spanish Mission of Garces' time.

References:

Water Supply Paper 395, p. 19.

First Reclamation Annual Report, p. 123.

Romance of the Colorado River, Dellenbaugh, p. 140.

1851. Johnson, George A. Came to the mouth of the Colorado on the schooner *Sierra Nevada*.

Reference:

Water Supply Paper 395, p. 19.

1852. Sitgreaves, Lorenzo. Expedition down the Zuni and Colorado Rivers. Gives description of the country from Zuni, in New Mexico, through the basin of the Little Colorado to the Colorado River. Accompanied by a full report on zoology, mammals, birds, reptiles, fishes, with excellent maps and illustrations.

Reference:

U. S. Govt. Report, S. Doc. 39 (198 pp.), 32d Congress, 2d Session, Serial 668.

1852. Flood water from the Colorado River in Salton Sink.

Reference:

Colorado River, L. R. Freeman, p. 386.

1854. Whipple, Lieut. Survey of railroad route near 35th parallel from Mississippi to Pacific for the Government in 1854.

References:

Pacific Railroad surveys. A. A. Humphreys, vol. 1, p. 74-78.

Breaking the Wilderness, F. S. Dellenbaugh, p. 316.

- 1854-55. Boundary Surveys. New boundary line surveys were made by Major Emory and Lieut. Mickler.

- 1855-60. Railroad Survey Reports, 13 vols.

1857. Beagle, E. F. Wagon road survey New Mexico-California along the 35th parallel for the Government. An interesting account of a trip made with camels along the Little Colorado across Arizona to the main Colorado at Bill Williams Fork, where the camels successfully swam the river.

References:

Heroes of California, Geo. W. James, p. 94-103.

Report of Exploration (camels), Sen. Doc. 43 (51 pp.), Serial 929, 35th Congress, 1st Session, vol. 12.

Breaking the Wilderness, F. S. Dellenbaugh, p. 316.

1857. Johnson, Capt. Geo. With steamboat *Colorado* navigated Colorado River to a point several miles above Vegas Wash.
Reference:
Water Supply Paper 395, p. 19.
- 1857-8. Ives, Lieut. J. C. With metal steamboat *Explorer*, 50 feet long, shipped from Philadelphia to mouth of Colorado in sections and assembled there, navigated Colorado River to a point called "the Head of Navigation." The highest point reached by him was Vegas Wash. Important and interesting report on the lower course of the Colorado River and of its canyon as seen from the plateaus on the south. The geologist of the expedition was Newberry, by whom a clear statement was made of the origin of the canyon and of the cliffs on the plateau lands by ordinary erosion.
References:
Water Supply Paper 395, p. 19.
First Reclamation Annual Report, p. 123.
Report by Lieut. Jos. C. Ives, Quarto "Report upon the Colorado River of the West," illus. and maps, Wash. 1861, Ho. Doc. 90, 36-1 (Serial No. 1058).
Wheeler's U. S. Surveys, v. 1, part 3, p. 608-610.
The Colorado River, L. R. Freeman, Chap. VII, p. 142-170.
Breaking the Wilderness, F. S. Dellenbaugh, 317 pages.
Ives map reproduced in Geographical Review, Apr., 1926, v. 16, p. 241, in article by Godfrey Sykes. The Delta and Estuary of the Colorado, illus., p. 232-255.
1858. Overland letter mail stage via Yuma established, Sept. 15, between San Francisco, Cal., and St. Louis, Mo., the time being 25 days and fare \$100. It continued until March, 1861.
1859. Flood waters in Salton Sink.
Reference:
Colorado River, L. R. Freeman, p. 386.
1859. Macomb, Capt. John N., and Newberry, Dr. J. S. (eminent geologist). Report of the exploration made during the summer of 1859 in New Mexico and Utah. A preliminary report of the expedition made to determine the practicability of a route from the settlements of New Mexico to those of Utah, between the Spanish Trail of the north, which crosses the Grand and Green rivers, and the wagon route along the 35th parallel of north latitude.
References:
Water Supply Paper 395, p. 19.
U. S. Rpt. Ann. Rpt. War Dept., S. Doc. 1; 36th Congress, 2d Session, p. 149-152.
Wheeler's Surveys of United States, vol. 1, part 3, p. 610-611.
1861. Berthoud, E. L., and Bridger, James. Explored a road from Denver to Salt Lake, crossing the Green near the mouth of the Uinta. "Jim" Bridger, in 1843, established a trading post at one of the branches of Green River.
Reference:
Romance of the Colorado River, Dellenbaugh, p. 139.
1862. Flood Water from the Colorado in Salton Sink.
Reference:
Colorado River, L. R. Freeman, p. 386.

1864. Adams, Capt. Samuel. Descended on raft Colorado mouth—El Dorado Canyon. A report telling of the wonders of the country, discovery of ancient ruins, cities, canals, abandoned mines, etc.; valleys of wild wheat, oats, barley, rye and clover; the extent of the country, canyons of the upper and lower Colorado, scenery, climate, soil, and general capacity of the region. Later ascended in a steamer above El Dorado Canyon from the mouth, and in 1866 made a second trip up to Callville.

References:

Exploration of the Colorado River, Ho. Doc. 12, 41st Congress, 3d Session, 22 pp., Serial 1462.

Exploration of the Colorado River, Ho. Doc. 37, 42d Congress, 1st Session, 20 pp., Serial 1472.

Colorado River, L. R. Freeman, Chap. IX, p. 201–22. Adams on the Blue and the Grand.

1866. Rogers, Capt. In steamboat *Esmeralda* went up the Colorado as far as Callville, near the mouth of the Virgin, which was several miles above the highest point attained by Ives in his skiff but little if any farther than Johnson had come with his steamboat. This steamer was 97 feet long and drew $3\frac{1}{2}$ feet of water.

Reference:

Water Supply Paper 395, p. 19.

1867. Flood waters, Colorado River in Salton Sink.

Reference:

Colorado River, L. R. Freeman, p. 386.

1867. White, James. Reported to have made trip through Grand Canyon on raft, summer, Sept. 8, San Juan to Callville. The trip lasted about 14 days. No surveys were made but the feasibility of drifting through the canyon appears to have been established and the story was widely published in newspapers in 1867.

References:

U. S. Government Report, Thos. F. Dawson, Sen. Doc. 42, 65–1.

Rocky Mountain News, Jan., 1869.

The Colorado River, L. R. Freeman, p. 171–200. Chap. VIII, The raft voyage of James White.

Trans. St. Louis Academy of Sci., Dr. C. C. Perry.

Outing, April, 1907.

The Trail, Denver, Colo., Sept., 1919, articles by Stanton. The alleged journey and the real journey of James White on the Colorado River, 1867.

1868–69. Powell, Maj. John Wesley. During winter of '68 and '69 made several important journeys for the purpose of exploration; one southward as far as Grand River, the second followed White River to its junction with the Green; a third went northward around the base of Uinta Mountains. Funds were furnished by State Institutions of Illinois and the Chicago Academy of Sciences; none by the Federal Government; the Congress authorized him to draw rations for 12 men from western Army posts. On May 24, 1869, Maj. Powell and his party left Green River, Wyo., on their journey down the Green and the Colorado to the mouth of the Virgin, which they reached the last week in August.

Reference:

Water Supply Paper 395, p. 20.

1869. Powell, Maj. John Wesley. On May 24, 1869, Maj. Powell and his party left Green River, Wyo., on their voyage down the Green and the Colorado to the mouth of the Virgin. There were 12 men in the party; three of the four boats were of oak, 21 feet long, and one was of light pine, 16 feet long. During the last week in August, Powell reached his goal, the mouth of Virgin River. Here he left the party, but the others continued down the river to the Gulf, which they reached before the end of September, 1869. Although Powell had demonstrated the possibility of passing alive through the 1000-mile stretch of canyons on the Green and the Colorado, the scientific results of his hazardous voyage were not what he desired. Owing to numerous disasters many instruments had been lost and he had been prevented by this as well as many other circumstances from fully accomplishing his intentions. For this reason he determined to make another descent if he could obtain pecuniary aid from the Government. Congress appropriated a sum for a second expedition.

References:

Water Supply Paper 395, p. 20.

Breaking the Wilderness, F. S. Dellenbaugh, 360 pp.

The Colorado River, L. R. Freeman, Chap. X, 221-251. First through the Grand Canyon.

1869. Wheeler, Lieut. Geo. Montague. A military reconnaissance through southern and southeastern Nevada. Contains an account of the crossing of the Colorado River at the Grand Canyon, describes the physico-geographical character of the Colorado River, climate, agricultural, grazing and wood lands.

References:

Wheeler's U. S. Surveys, vol. 1, part 3.

Smithsonian Report, all explorations Colorado, 1869-1872, 291 pp.

U. S. Government Report, Ho. Doc. 173, 12 pp., 42-2; Serial 1526.

1869. May 10, the gold spike on the first transcontinental railroad was driven by Stanford, 3.05 p.m. (N. Y. time).

1869. Union Pacific Railroad constructed to Green River, Wyo. Completed May 10.

Reference:

Water Supply Paper 395, p. 20.

1871. Wheeler, Lieut. Geo. M. While the Powell party was making its second voyage down the Green and the Colorado another expedition was being made up the Colorado. Lieut. Wheeler, topographical engineer of the War Department, started from Fort Mohave September 16, 1871, to explore the Colorado to the mouth of Diamond Creek, which he reached October 22. It required four weeks of extremely hard work to make the voyage up the Colorado from Fort Mohave to the mouth of Diamond Creek, whereas members of the party made the trip from the mouth of Diamond Creek to Fort Mohave in five days.

References:

Water Supply Paper 395, p. 20.

The Colorado River, L. R. Freeman, Chap. XI, p. 252-263, Wheeler up the Grand Canyon. List of party, p. 254.

1871-2. Powell, Maj. John Wesley. On May 22, 1871, Powell left Green River, Wyo., on his second voyage down the Green and the Colorado, to Lee Ferry. Here the boats were cached and the party spent the winter in the vicinity of Kanab. On Aug. 17, 1872, Powell returned to his boats and started through the Grand Canyon, to Kanab Creek.

References:

Water Supply Paper 395, p. 20.

U. S. Government Report, Ho. Doc. 76, 16 pp., 42-3; Serial 1572.

The Colorado River, L. R. Freeman, Chap. XII, p. 264-292, The Second Powell Expedition.

1872. On August 16, 1872, Maj. Powell returned to his boats at the mouth of the Paria and started on his second voyage through the Grand Canyon. On reaching the mouth of Kanab Creek, Powell decided to end the river work on account of the extreme high water, which made the rapids in the second granite gorge impassable. The topographic, geologic, and geodetic work of the survey did not cease with his departure from the river but was continued in the territory adjacent to the Grand Canyon.

References:

Water Supply Paper 395, p. 20.

U. S. Government Report, Ho. Doc. 265; 29 pp., 43-1; Serial 1621.

1872. Lee, John D. The Powell expedition going down the Colorado found a Mormon, John D. Lee, living just below the mouth of the Paria River, and this has been known as Lee Ferry since 1873.

Reference:

Romance of the Colorado River, F. S. Dellenbaugh, p. 216, 316.

1873-75. Dewey, Commander (later Admiral). Surveyed the Gulf of California in U. S. S. *Narragansett* and visited mouth of Colorado several times, but his work did not extend above deep-water navigation.

Reference:

Geographical Review, April, 1926, vol. 16, p. 240, in article by Godfrey Sykes on "The Delta and Estuary of the Colorado," illus., p. 232-255.

1876. Bergland, Lieut. Eric. Investigations flood conditions, Lower Colorado. Surveys were confined to portion of river embraced between foot of lower Grand Canyon and vicinity of Needles, with a view to determining the feasibility of diverting the Colorado River for purposes of irrigation. One of the purposes of this survey was the investigation of an All-American Canal route to irrigate Imperial Valley.

References:

First Reclamation Annual Report, p. 123.

War Department Annual Report C. E. 1876-77, vol. 2, pt. 3, p. 329-345, Ex. Doc. 1, pt. 2; Serial No. 1745.

Unpublished report by F. E. Weymouth, Department of the Interior, February, 1924, vol. 3.

1877. Southern Pacific Railroad to Yuma. Was completed to Colorado River at Yuma, Ariz., in 1877.

Reference:

Water Supply Paper 395, p. 20.

1879. Southern Pacific Railroad was completed through Yuma to Maricopa Wells and the Chief of Engineers, U. S. A., reported a decreasing river traffic and no necessity for submitting plans for improvement of river.

References:

Annual Report Chief of Engineers, U. S. Army, for 1879, p. 1774.

First Annual Report Reclamation Service, p. 124.

1879. Stewart, Lt. Col. C. Seaforth, and Payson, Lt. A. H. Reported adversely to farther attempts to develop navigation on river and gave tables of distances for some 300 miles up river from Yuma.

References:

First Reclamation Annual Report, p. 124-129.

Chief of Engineers Report, 1879, Pt. II, p. 1774, 1776-82.

1883. A. & P. Railroad (Santa Fe) crossed Colorado at Needles.

Reference:

Water Supply Paper 395, p. 20.

1883. Rio Grande Western Railroad. Crossed the Green in Gunnison Valley, Utah, in 1883.

Reference:

Water Supply Paper 395, p. 20.

1886. Imperial Valley. Dr. Wozencraft's plans for reclaiming Imperial Valley revived by John C. Beatty, who organized the Colorado River Irrigation Co., with C. R. Rockwood as engineer. Failed, and plans bought by Dr. Heffernan of Los Angeles.

1886. Army Engineers, War Department. Report some work done in removing obstructions in Bulls Head Canyon in effort to aid navigation and state statistics "showing the entire business on the Colorado River for the year ending June 30, 1886, are furnished by the Southern Pacific Company:

Number of passengers transported----- 130

Freight transported—tons----- 4,695"

References:

First Reclamation Annual Report, p. 123-4.

Chief of Engineers, War Dept., 1886. Pt. III, pp. 1931-32.

1889-90. Stanton, Robert B. and Frank M. Brown. Survey for a new railroad (low grade) from Grand Junction, Colorado, down the Colorado through the canyons to the Gulf of California, about 1200 miles. Brown drowned below Soap Creek Rapids in Marble Canyon. Trip through the lower canyons on the Colorado was completed March 17, 1890. This party was the first to navigate the Colorado for its entire length.

References:

Water Supply Paper 395, p. 20-21.

Romance of the Colorado, F. S. Dellenbaugh.

Colorado River, L. R. Freeman, 1923, Chap. XIII, p. 293-323, the Brown and Stanton voyages.

Down the Colorado Canyons, Cosmopolitan, Nov., 1889.
Trans. Am. Soc. C. E., No. 523, vol. 26, Apr., 1892.
Down the Colorado Canyons. Scribner's, Nov., 1890.

1891. Hilda Island formed at mouth of Colorado, and disappeared as a shoal later.

References:

Geographical Review, April, 1926, vol. 16, p. 242, Article by Godfrey Sykes, entitled "The Delta and Estuary of the Colorado," illus., p. 232-255.

Bulletin of American Geographic Society, vol. 38, 1906, p. 1-16, article on "The Delta of the Rio Colorado," by D. T. MacDougal.

1891. Best expedition wrecked.

1891-93. Godfrey Sykes made meander surveys and examination of the river channel from Yuma to sea.

Reference:

Geographical Review, Apr., 1926, vol. 16, p. 240, in article by Godfrey Sykes, on "The Delta and Estuary of the Colorado," illus., p. 232-255.

1891-93. Steamer *Major Powell* brought from Chicago by railroad and launched in September, 1891. A screw was soon broken and an attempt to go down the river was abandoned. Another effort was made in 1892, but was unsuccessful. In 1893 the *Major Powell* was taken down to the junction of Green and Grand and back, making a second trip in April.

Reference:

Water Supply Paper 395, p. 21.

1892-93. Rockwood, Engineer C. R. An engineer sent to the lower Colorado to report on an irrigation scheme in northern Sonora (Mexico). Rockwood on own responsibility made tour along old Alamo River to Salton Sink and visioned this means of irrigating Imperial Valley. Rockwood and his associates organized the Colorado River Irrigation Company in 1892. This company failed and was succeeded in 1896 by California Development Company.

Reference:

Colorado River, L. R. Freeman, p. 388-389, Sen. Doc. 142, 67th Congress, 2d Session, p. 72.

1891-96. Mexican Boundary Commission. Report upon survey and remarking of boundary between the United States and Mexico west of the Rio Grande, includes description of each monument and its locality, with pictures of each, and map of Colorado River, the first topographic map made of that section. This survey made in pursuance of agreement between United States and Mexico known as Boundary Convention (or treaty) of 1884, concluded November 4, 1884, and extended by further convention (or treaty) signed March 1, 1889, this latter convention was extended by agreements signed Nov. 6, 1896; Oct. 29, 1897; Dec. 2, 1898; Dec. 22, 1899, and Nov. 21, 1900.

References:

Report by Commission, 3 vols., Sen. Doc. 247, 55th Congress, 2d Session, Serial Nos. 3612, 3613 and 3614.

Hearings House Committee on Irrigation of Arid Lands, 66th Congress, 1st Session, 1919, p. 200-208.

1894. Potter, Lieut. C. L. Made a successful voyage from Diamond Creek to the mouth of the Virgin.

Reference:

Water Supply Paper 395, p. 21.

1895-96. Galloway, Nathan; Stone, Julius F., and Richmond, William. Started from Green River, Wyo., and made trip in flat-bottomed boats, to Lee Ferry, in 1895. In Sept., 1896, they started again from Henry Fork, Wyo., and went to the Needles, reaching there Feb. 10, 1897. The purpose of this trip was to secure photos of canyon scenery.

References:

Water Supply Paper 395, p. 21.

The Colorado River, L. R. Freeman, Chap. XIV, p. 324-338.
Galloway and Stone and a new canyon boat.

1896. Imperial Valley. California Development Company organized to develop the Imperial Valley and arrangements made for nine Mutual Water Companies to purchase water at 50 cents an acre-foot, with C. R. Rockwood, promoter of old Colorado River Irrigation Company, in charge of engineering and construction. Mr. A. H. Heber was head of the company.

References:

Sen. Doc. 142, 67th Congress, 2d Session, "Problems of Imperial Valley and Vicinity," p. 72.

Irrigation Districts in California, Bulletin 21, 1929, State of California, Dept. of Public Works, p. 335.

1896. Flavell, George F. Left Green River, Wyoming, in August, 1896, and descended the Colorado to Yuma, Ariz., reaching there December, 1896.

References:

Water Supply Paper 395, p. 21.

Colorado River, L. R. Freeman, 1923, p. 335.

The Trail, Denver, Sept., 1919, p. 13.

1896. Davis, Chas. E. L. B. Preliminary examination of Colorado River, Ariz., in which opinion is given that the river is not worthy of improvement.

Reference:

Chief of Engineers, War Dept., 1897, Annual Report, Pt. 4, p. 3339-3340.

1896. California Development Company. Organized, 1896. Successors to Colorado River Irrigation Company.

References:

Heroes of California, Geo. W. James.

Sen. Doc. 142, 67th Congress, 2d Session, 1922, p. 72.

1896-97. Galloway and Richmond. Sept., 1896, started from Henry Fork, Wyo., and made boat trip down Colorado, arriving at Needles Feb. 10, 1897.

Reference:

Water Supply Paper 395, p. 21.

1900. Chaffey, Geo. Made contract in April, 1900, for construction of Imperial Canal for California Development Company, and in May, 1901, water was flowing into Imperial Valley and in 22 months 400 miles of canal and laterals built.

References:

Heroes of California, Geo. W. James.

Colorado River, L. R. Freeman, p. 390.

1900-04. Imperial Valley. 1900, construction work begun by California Development Company. In March, 1902, water was turned into the main canal; September, 1904, 700 miles of canal under operation, with 8000 settlers and 75,000 acres cropped.

1901-02. Lippincott, J. B., and Ahern, Jeremiah. Party composed of Lippincott and Ahern as hydrographers, and W. B. Clapp and F. M. Barnes, field assistants, started reconnaissance of Lower Colorado River between Needles and Yuma, December 29.

Reference:

First Reclamation Report, p. 112-117.

1902. Irrigation began in Imperial Valley.

1902-03. J. B. Lippincott, E. T. Perkins, E. C. Barnard, R. B. Marshall and Hersey Monroe. Investigations were in October-November, 1902, and June, 1903, and included surveys and reconnaissance of various projects on Colorado and tributaries, including work on Salt River and San Carlos projects on Gila River in Arizona.

References:

Second Reclamation Report, p. 123-161.

Salt River Project, continued surveys, designs and plans leading to construction; p. 71-87.

San Pedro: Reconnaissance of Charleston reservoir site; p. 88.

San Carlos: Investigation storage on Gila (con.); p. 88-91.

Babacomari Reservoir reconnaissance; p. 91-92.

Colorado River: Continued investigation by E. T. Perkins leading to construction of Yuma project; p. 123-161.

Uncompahgre project: Continued surveys leading to construction; p. 182-200.

White River project, reconnaissance; p. 201-206.

Northwestern Colorado reconnaissance, Yampa, etc.; p. 206-209.

1903-6. Imperial Valley Break. Imperial Valley at this time was receiving its water through a headgate into the Colorado River about 100 yards north of the international boundary line. From this point a canal ran down into Mexico approximately parallel with the river, carrying water to the old channel of the Alamo and thence through Mexico back across the boundary line into the Salton Sink. During 1903 and 1904 there was a water shortage, and headgate was obstructed by silt deposit, making it difficult to divert water. A concession was obtained from the Mexican

Government early in 1904, a dredger cut was made from the river about four miles below the boundary line into the canal. December, 1904, an unusual winter flood came, washing out the temporary diversion works and deflecting the river into the canal. In May and June, 1905, attempts were made to close the break, but failed. In 1906 the break was closed by the Southern Pacific Company. December 7, 1906, the river broke through again but the break was closed in two months.

References:

Sen. Doc. 142, 67th Congress, 2d Session, p. 72.

Report of All-American Canal Board, June 17, 1919, printed 1920, p. 19.

1904. Yuma Project. Construction recommended by Board of Engineers April 8, 1904, authorized by Secretary May 10, 1904. First irrigated by Reclamation Service, season of 1907. Laguna Dam completed March, 1909. Colorado River Siphon completed June 29, 1912. Gravity water from Laguna Dam to Yuma Valley through siphon June 29, 1912.

Reference:

Sen. Doc. 142, 67th Congress, 2d Session, p. 62.

1904. Apr. 28th. Investigation of Lower Colorado River by Secretary of Interior authorized by Congress.

References:

Public Joint Res. of April 28, 1904, 33 Stat. 591.

Federal Reclamation Law Annotated, p. 56.

1905-07. Floods and overflows in Imperial Valley. Break in levees 15 months—about Feb., 1905, to Nov. 4, 1906—but Dec. 7th flood from Gila broke through again to Feb. 14, 1907. Area of Salton Sea, 285,000 acres. Men who worked on closure of the break were: A. H. Heber, C. R. Rockwood, engineer; F. S. Edinger, a bridge engineer of S. P. R. R.; H. T. Cory, engineer; E. H. Harriman.

References:

Colorado River, L. R. Freeman, p. 395-397.

The Story of the First Decade of Imperial Valley, Edgar F. Howe and Wilbur J. Hall (Imperial, 1910).

Geographical Review, Apr., 1926, vol. 16, p. 246, article by Godfrey Sykes on "The Delta and Estuary of the Colorado."

The Desert Basins of the Colorado Delta, by D. T. MacDougal, Bull. Am. Geogr. Soc., vol. 39, p. 705-729.

A Decade of the Salton Sea, by D. T. MacDougal, Geogr. Review, vol. 3, 1917, p. 457-473.

1906-07. Flood, Imperial Valley. Oct. 11, 1906, the Colorado broke through again and was closed off Nov. 7, 1906, a flash flood from the Gila came down the river and the levees were again broken, $\frac{1}{2}$ mile south of the November closure and in 36 hours the entire river was again flowing through the break. President Roosevelt requested E. H. Harriman to make closure at government expense and on Feb. 14, 1907, the break was closed again.

Reference:

The Colorado River, Freeman, p. 399-400.

1907-08. Russell, Charles, E. R. Monett, and Albert Loper. Each in a steel boat, left Green River, Utah, to make descent of river on Sept. 20th. Loper and one damaged boat reached Hite, near the mouth of the Fremont River. Russell and Monett proceeded but lost one boat in the beginning of Grand Canyon, but with remaining one reached exit from Grand Canyon Jan. 31, 1908.

References:

Water Supply Paper 395, p. 21.

Colorado River, L. R. Freeman, 1923, p. 336-338.

A Daring Voyage through the Grand Canyon, David White, Wide World Magazine, Nov., 1908.

1909. Ockerson levee built. Congress appropriated a million dollars for a levee to confine the Colorado to a reasonably straight channel and the Government built the Ockerson Levee running about parallel with the mesa along the eastern side of the delta. This levee was built in 1909 but the summer floods of 1911 breached it and the river meandered back and forth through the levee, destroying about 15 miles of the southern portion. This is now abandoned, only about 10 miles of the northern portion being now maintained.

References:

Colorado River, L. R. Freeman, p. 403.

Map, Colorado Delta, Imperial Irrigation District, 1927.

1909. W. H. Holabird was appointed receiver on December 12, 1909, of the properties of the California Development Company in an action entitled: "Title Insurance and Trust Company vs. California Development Company et al.," in the Superior Court of the State of California, in and for the County of Los Angeles. This action was brought in the nature of a foreclosure of the bonds of the California Development Company, and resulting in a sale by the receiver under court order on Feb. 8, 1916, to the Southern Pacific Company.

References:

Engineering News, Feb. 24, 1916, p. 390.

Letter Sept. 15, 1930, from Chas. L. Childers, Att., Imperial Irrigation District, El Centro, Cal.

1909. Stone, Julius F., and Galloway, N. Left Green River, Wyo., Sept. 12, 1909, making a successful descent through the many canyons of the Green and the Colorado to Needles for the purpose of securing photographs.

Reference:

Water Supply Paper 395, p. 22.

1911. Flood through Ockerson levee. Fifteen miles of levee destroyed and abandoned. Total length of levee about 25 miles.

References:

The Colorado River, L. R. Freeman, Chap. IV, p. 339-358.

Map, Colorado River Delta, Imperial Irrigation District, 1927.

1911. July 12. Imperial Irrigation District authorized by election. July 25. Imperial Irrigation District organized under California State law then known as Wright Act, now part of California Irrigation District Act.

References:

Eng. News, March 11, 1915, vol. 73, p. 509.

Annual Report Imperial Irrigation District, 1927, p. 4.

- 1911-12. Kolb, Ellsworth and Emery (brothers). Left Green River, Wyo., on a photographic trip down the Green and the Colorado. Obtained first moving pictures. Landed at Needles Jan. 18, 1912. In 1913, E. L. Kolb completed the trip from Needles to the Gulf.

References:

Water Supply Paper 395, p. 22.

The Colorado River, L. R. Freeman, Chap. XV, p. 339-358.

Through the Grand Canyon, Ellsworth Kolb.

1913. Charles Smith started through canyons in November and disappeared.

1916. February 8. Imperial Valley Irrigation System sold at auction and bought by the Southern Pacific Company for \$3,875,000. The Irrigation Canal System of the Imperial Valley, California, was bought at auction on Feb. 8th by the Southern Pacific Company for \$3,875,000. This is a step in the transfer of the property of the California Development Company to the Imperial Irrigation District. It is expected that the transfer will be completed soon. Col. William H. Holabird is receiver, and Chester Allison is chief engineer for the California Development Company. C. R. Rockwood, El Centro, Cal., is chief engineer of the Imperial Irrigation District. The properties of the California Development Company and its subsidiary company, the Compania de Terrenos y Aguas de la Baja California S. A., were purchased June 22, 1916, by the Imperial Irrigation District from the Southern Pacific Company, which had acquired title by foreclosure and receiver's sale of Feb 8, 1916.

References:

Eng. News, Feb. 24, 1916, p. 390.

Annual Report, Imperial Irrigation District, 1923, p. 5.

1916. La Rue, E. C. Report, Colorado River and Its Utilization.

Water Supply Paper 395.

1916. Southern Pacific Company deeded on June 22, 1916, all of the properties of the California Development Company for which a receiver was appointed Dec. 12, 1909, with the exception of certain Mexican properties to the Imperial Irrigation District for a consideration of \$3,000,000. This deed is recorded in Book 111 of Deeds, p. 156, Records of Imperial County.

References:

Records of Imperial County, Book 111 of Deeds, p. 156.

Letter Sept. 15, 1930, from Chas. L. Childers, Atty. Imperial Irrigation District, El Centro, Cal.

1917. Jan. 25. Yuma Auxiliary project authorized by Act of Congress.

References:

Act of Congress, Jan. 25, 1917, 39 Stat. 868.

Federal Reclamation Laws Annotated, p. 159-161.

1917. March. Mead, Henny and Jacobs report on Irrigation and Flood Control, Imperial Valley.

1917. June 14. Report on Hualpai Wells, Arizona, by W. W. Schlecht.
1918. Jan. 1. Legal report on water rights and resources made in 1916-17, transmitted by Judge Will R. King, Chief Counsel, made by Messrs. W. J. Egleston, B. E. Stoutmeyer, E. W. Burr, and H. L. Holgate, and assisted by H. D. Padgett, Ottomar Hamele, H. L. Kennedy, R. B. Worhty, Don R. Cather, Eldon P. King, Chas. E. Wormersley and C. T. Byrd (388 pages in manuscript).
1918. June. Whistler and La Rue reports. Summary by C. A. Bissell.
1919. Feb., June. H. L. Baldwin's preliminary report summary of Boulder Canyon project.
1919. March 10. Whistler report on policy and development of flood control.
1919. Apr. 9. Grunsky's report on problems of Lower Colorado River.
1919. June 17. All-American Canal. First bill introduced in Congress by Congressman Kettner authorizing construction of canal.
Reference:
H. R. 6044, 66th Congress, 1st Session, June 9 to 14, 1919.
1919. Dubendorf lost his life in attempt to navigate canyon.
1919. August. Dr. Elwood Mead's plan for reclaiming and peopling mesa lands bordering the Imperial Irrigation District. Printed as Agricultural Experiment Station Bulletin of the College of Agriculture, University of California, 6 pages. (Headings: Need for a more social land settlement policy; objections to proposed sale of the lands; and settlement should be aided and directed by the Government.)
1919. Aug. 26. Report on Relief of Imperial Valley (H. R. 6044) by representatives of State, Treasury, War and Interior Departments. Henry P. Fletcher, State Department. S. P. Gilbert, Jr., Treasury Department; W. M. Black, War Department; A. P. Davis, Reclamation Service, 25 pp. and map.
Reference:
Report in manuscript form of 25 pages dated Aug. 21, 1919, and transmitted to President, Aug. 26, 1919.
1919. June 17. All-American Canal Report issued. Board consisted of Elwood Mead, W. W. Schlecht, C. E. Grunsky. Also report of Engineer in charge of Surveys and Examinations, Porter J. Preston.
Reference:
Report All-American Canal Board, published by Department of Interior, 1920.
1920. Hamlin, Homer. Made a boat trip of exploration and investigation from the Virgin River to Yuma.
1920. Jan. 7. 2d All-American Canal Bill. Bill introduced by Congressman Kettner provides for "canal and necessary works, entirely within the United States, connecting the present irrigation system of the Imperial Irrigation District with Laguna Dam."
Reference:
H. R. 11553, 66th Congress, 2d Session, 1920.

1920. May 18. Congress appropriated money for investigation. (41 Stat. 600). This was "Kinkaid Act" appropriating \$20,000 for investigation of irrigable lands in Imperial Valley and instructed that Secretary of Interior render report giving costs and plans, Imperial Valley interests were required to pay at least one-half of cost of investigation. The final report rendered under authority of this act was the Fall-Davis Report. (Senate Doc. 142, 67th Congress, 2d Session, 1922.)

Reference:

Act of May 18, 1920, 41 U. S. Stat. 600.

1920. Dec. Preliminary report Imperial Valley issued. "Problems of Imperial Valley." Preliminary report made to comply with time limit in Kinkaid Act.

Reference:

Sen. Doc. 142, 67th Congress, 2d Session, p. 236.

1920. March 1. Castle Peak Project, estimate and cost. Lytel and Preston.

July 30. Preliminary estimate, Boulder.

Nov. 10. Preliminary design and estimate, Boulder.

Nov. 16. Dam for navigation.

Nov. 18. Preliminary design and estimate.

Dec. Castle Peak Project, Drager.

1920. San Carlos Project report in 2 vols. manuscript by C. C. Fisher, includes report on Red Rock, Alma and other reservoir sites.

Reference:

2 Vol. Report in M. & F.

1921. Jan. 14. Lowry & Howell, theory arch dam.

Feb. 15. Castle Peak Project, Drager. (Sup.)

May 10. Preliminary design and site, Upper "c" site.

May 26. Board of Engineers Boulder Canyon.

Water Surface 1265, capacity 26,500,000 acre-feet.

June 9. Preliminary estimate and design, Boulder.

Oct. 26. Supp. Ed. report, Boulder Canyon.

Nov. 19. Design 26,500,000 and 31,400,000 acre-feet.

Dec. 27. Preliminary design 31,400,000 acre-feet.

Dec. Tentative plan La Rue rockfill dam Lee Ferry.

Dec. Green River Project, by W. M. Green.

1921. May 26. Report on Boulder Canyon Dam, Colorado River, by a Board of Engineers consisting of S. J. Wiley, James Munn, J. L. Savage and W. R. Young. (8 pages.)

1921. Southern California Edison Co. W. R. Chenoweth, E. C. La Rue, Sidney Paige, and Kolb Bros. and Frank Stoudt. Green River, Utah. Started at Junction of Green and Grand, Sept. 15, surveyed Cataract Canyon to Lee Ferry.

Reference:

The Colorado River, L. R. Freeman, p. 260-263.

1921. Aug. 19. Compact regarding water of Colorado River permitted by Act of Congress.

References:

Act of Congress, Aug. 19, 1921 (42 Stat. 171).

Federal Reclamation Laws Annotated, p. 206.

1922. Jan. 10. Visit to Boulder and Black canyons.
 Feb. 1. Preliminary estimate of dam and power.
 Feb. 25. Ariz. Bull. No. 95, Colorado River, G. E. P. Smith.
 March 4. Preliminary estimate and design of dam and power.
 Apr. 12. Preliminary designs flood control.
 May 4. Preliminary design.
 May 26. F. A. Noetzli on rockfill dam.
 Sept. 26. Board of Engineers.
 Sept. 28. Board of Engineers.
 Dec. 20. Board of Engineers Glen Canyon site.
 Dec. 20. Board of Engineers Boulder and Black.

1922. Report Imperial Valley issued. This is the "Fall-Davis" report issued as Senate Document 142, 67th Congress, 2d Session. This report is sometimes referred to as the "Bible" of the Colorado River and is the report on which subsequent proceedings leading to the construction of the Boulder Canyon Dam were based.

1922. Bill for development Lower Colorado River Basin. First Swing-Johnson bill and first bill to authorize construction Boulder Canyon Dam introduced by Congressman Phil D. Swing, April 25th. This bill was introduced to carry out the recommendations of the Fall-Davis report.

Reference:

H. R. 11449, Hearings Committee on Irrigation of Arid Lands, House of Representatives, 67th Congress, 2d Session, June, 1922.

1922. Colorado River (Compact) Commission. Herbert Hoover, Chairman. Held the following meetings:

No.	Date	Executive meetings
1	Jan. 26	Washington, D. C., organized.
2	Jan. 27	Washington, D. C., afternoon.
3	Jan. 27	Washington, D. C., evening.
4	Jan. 28	Washington, D. C., morning.
5	Jan. 28	Washington, D. C., afternoon.
6	Jan. 30	Washington, D. C., morning.
7	Jan. 30	Washington, D. C., afternoon.
8	Mar. 15	Phoenix, Ariz.
9	Apr. 1	Denver, Colo.
10-27	Nov. 9-24	Santa Fe, New Mexico.

Public Hearings

- Mar. 15-17—Phoenix, Ariz. Mar. 31—
 Mar. 20—Los Angeles, Cal. Apr. 1—Denver, Colo.
 Mar. 27-28—Salt Lake City, Utah Apr. 2—Cheyenne, Wyo.
 Mar. 29—Grand Junction, Colo. Nov. 9—Santa Fe, N. M.

References:

- Reclamation Record, Dec., 1922, vol. 13, p. 302-305.
 Colorado River, L. R. Freeman, p. 412-414.

1922—Utah L. & P. Co. and U. S. G. S. cooperate. K. W. Trimble, Chief; R. R. Wooley, J. B. Reeside and H. L. Stoner of U. P. & L. Co. Surveyed canyons of the Green River. Started July 13, 1922,

X

Green River, Wyo. Surveyed from Flaming Gorge to head of Marble Canyon.

Reference:

Colorado River, L. R. Freeman, p. 363-365.

1922. Construction plans by Ray Carberry and Frank Higley for levees on Lower Colorado to Pescadero Cut.

Reference:

Colorado River, L. R. Freeman, p. 405-407.

1922. Nov. 24. Colorado River Compact executed at Santa Fe, New Mexico, by the Commission consisting of Herbert Hoover, chairman; W. S. Norviel, Arizona; W. F. McClure, California; Delph E. Carpenter, Colorado; J. G. Scrugham, Edward Clarke and C. P. Squires, Nevada; Stephen B. Davis, Jr., New Mexico; R. E. Caldwell, Utah, and Frank C. Emerson, Wyoming. The Commission was organized January 26, 1922, at Washington, D. C., and held 27 executive sessions between the date of organization and execution of compact; seven at Washington, D. C., one each at Phoenix and Denver, and 18 at Bishop's Lodge, Santa Fe, New Mexico. A number of public hearings were also held at Phoenix, Los Angeles, Salt Lake City, Grand Junction, Denver, Cheyenne and Bishop's Lodge, Santa Fe.

Reference:

Reclamation Record, December, 1922, p. 302-305.

- 1922-23. Southern California Edison Co. drill. Lee Ferry.

Reference:

Colorado River, L. R. Freeman, p. 426-429.

1923. March 23. Board of Engineers, core drilling, etc.

March 28. Pub. Ser. Dept., City of Los Angeles, comparison of Colorado River dams.

1923. May 19. Comparative statement of Boulder and Glen Canyon sites issued.

1923. July. Report by E. C. La Rue on Mohave Valley site issued.

1923. Sept. 18. Report by G. W. Sturtevant and E. L. Stan on the Spencer Canyon, High Line Canal, dated Sept. 18, 1923.

1923. Birdseye, Col. C. H. Survey of Grand Canyon. Party consisted of Leigh Lint, H. E. Blake, Jr., Frank Word, Col. C. H. Birdseye, R. C. Moore, R. W. Burchardt, E. C. La Rue, Lewis R. Freeman and Emery C. Kolb, and two additional men in four boats. The canyon sections of the river between Lee Ferry and Boulder Canyon were completely mapped.

References:

Eng. News-Record, Nov. 15, 1923, v. 91, p. 808-811.

Eng. & Contracting, Aug. 20, 1924, v. 62, p. 381-389.

1923. Dec. 15. Preliminary report on cost data of different dams issued.

1923. December. Arizona Engineering Commission report issued December 20, 1923 (printed). Reconnaissance report of Arizona Land Irrigable from the Colorado River. Members of Commission: E. C. La Rue, Chairman, Hydraulic Engineer U. S. Geological Survey, Pasadena, Cal.; Porter J. Preston, Project Manager U. S.

Reclamation Service, Yuma, Ariz.; H. E. Turner, Irrigation Engineer with Arizona State Water Commission, Phoenix, Ariz.

Reference:

Arizona Engineering Commission, 1923, report of 72 pages with maps and profiles.

1923. Dec. 10. Bill for development Lower Colorado River Basin. 2d Swing-Johnson bill introduced as H. R. 2903 by Congressman Phil D. Swing of California. Companion bills to the Swing bills were introduced in the Senate by Senator Hiram W. Johnson. The four bills, all of which provided for the construction of Boulder Canyon Dam, were introduced in the House by Congressman Phil D. Swing and in the Senate by Senator Hiram W. Johnson. The bills were known as the Swing-Johnson bills on this account. These successive bills were introduced in the 67th, 68th, 69th and 70th congresses, the reason for the successive introduction of these bills was that all of the bills, with the exception of the one introduced in the 70th Congress, failed to come to a vote in both houses, thus requiring their reintroduction at each successive session of Congress. All of the bills were introduced with the purpose of carrying out the recommendations in Senate Document 142 (Fall-Davis Report).

Reference:

Hearings before House Committee on Irrigation and Reclamation on H. R. 2903, 1924.

1924. February. Weymouth, F. E. Report on the Colorado River consisting of nine volumes in manuscript, which had not been printed up to the fall of 1927. (Eight vols. original and one supp.) Part of this report was afterward printed in Senate Document 186, 70th Congress, 2d Session.
1924. March 17. Cosby Report. On March 17 the following committee of engineers, appointed by Secretary Work, submitted a report of eight typewritten pages: Spencer Cosby, U. S. A.; E. B. Debler, Bu. Rec.; W. Kelly, Fed. Power Com.; Herman Stabler, U. S. G. S.; F. E. Weymouth, Bu. Rec.; W. R. Young, Bu. Rec.
1924. March 17. Memorandum statement issued by the Department of the Interior on the development of the Colorado River Basin, including the Cosby report. (16 pages.)
1924. March 20. Report to the Secretary of the Interior on the Sturtevant-Stam report on the development of the Colorado River. Diversion of water near Spencer Canyon by Messrs. Spencer Cosby, E. B. Debler, W. Kelly, Herman Stabler, F. E. Weymouth and Walker R. Young. (6 pages.)
1924. March 22. Mimeographed statement of supplementary report of Board of Engineers on the Colorado River, being a plan for diversion of the Colorado River at Spencer Canyon, by Spencer Cosby, W. Kelly, E. B. Debler, Herman Stabler, F. E. Weymouth and Walker R. Young. (5 pages.)
1924. March 24. Mimeographed copy of letter by Messrs. John W. Weeks, Secretary of War; Hubert Work, Secretary of the Interior, and Henry C. Wallace, Secretary of Agriculture, to Hon. Addison T. Smith, House of Representatives, relative to H. R. 2903 on the Colorado River, issued by the Fed. Power Com. (8 pages.)

1924. May 26. Flood claim of Southern Pacific Railroad for closing break to Imperial Valley, filing permitted with Court of Claims by Act of Congress.
References:
Act of Congress, May 26, 1924 (43 Stat. 171).
Federal Reclamation Laws Annotated, p. 230.
1924. June 25. Report by W. G. Clark, Consulting Engineer, 8 West 40th St., New York, and also 707 Bank of Italy Building, Los Angeles, California, relative to the Colorado River.
1924. Colorado River. Sept.-Oct. E. C. La Rue and party surveyed dam sites above Pierce's Ferry and below Black Canyon.
Reference:
Eng. News-Record, Sept. 18, 1924, v. 93, p. 479.
1925. Feb. 10. Bulletin No. 100. University of Arizona, discussion of certain Colorado River problems by G. E. P. Smith (p. 143 to 175).
1925. Feb. 21. Yuma Mesa Project appropriations authorized by Act of Congress.
Reference:
Act of Congress, Pub. Res. No. 51, dated February 21, 1925. (43 Stat. 962.)
1925. Mar. 3. Levee system, Colorado River, Yuma Project, appropriation authorized to reimburse the Reclamation Fund. \$650,000.
References:
Act of Congress, Mar. 3, 1925. (43 Stat. 1186.)
Federal Reclamation Laws Annotated, p. 257.
1925. Oct. 28. Mimeographed statement of meetings of the Federal Power Commission relative to the Girard application, and power development on the Colorado River. (Includes list of power applications. 8 pages.)
1925. Dec. 30. Two mimeographed statements: (1) Letter to Hon. Charles L. McNary, Chairman on Irrigation and Reclamation, United States Senate, relative to legislation on the Colorado River and a statement in regard to proposals for handling Colorado River Power Project, if done by the United States, both issued by Federal Power Commission. (10 and 4 pages, respectively.)
1926. Jan. 12. Memorandum to the Press by the Department of the Interior on the proposed Boulder Canyon Project. (Includes estimates of cost, power development, etc. 16 pages.)
1926. Feb. 27. Boulder Canyon Project Act. H. R. 9826 introduced February 27th by Congressman Phil D. Swing. Companion bill was introduced in the Senate by Senator Johnson. This was the third bill introduced for the construction of Boulder Canyon Dam. This later failed to come to a vote in both houses and was succeeded by a similar bill in the 70th Congress, which passed.
Reference:
Hearings, House Committee on Irrigation and Reclamation, 69th Congress, 1st Session, p. 1.

1926. Apr. 13. The Colorado River Problem. Transaction of the Commonwealth Club of California. Vol. 221, No. 2. April 13, 1926, 3500 pages (very interesting paper with remarks and discussions).
1926. Apr. 19. Boulder Canyon Reclamation Project. Sen. Report 654 in 2 parts, 69th Congress, 1st Session. Part 1, 28 pages; part 2, 88 pages.
1926. Apr. 27. Report by Walter G. Clark, Consulting Engineer, Insurance Exchange Bldg., Olive and Ninth Sts., Los Angeles, California, relative to a cooperative plan for financing the Colorado River Dam and power development. (7 pages manuscript.)
1926. May 3. Mimeographed statement to the Press by the Department of the Interior, relative to the construction of Boulder Canyon Dam. (4 pages.)
1926. June 8. Report by Chas. Kirby Fox, 436 I. W. Hellman Bldg., Los Angeles, California, giving outline of suggested gravity development of Colorado River (in manuscript with plans, 10 pages manuscript).
1926. July 3. All-Gravity-American Colorado River Constructive plan, statement by Geo. H. Maxwell, in Congressional Record of July 12th, p. 13022-13027, by Ralph H. Cameron.
1926. Nov. Storage investigations made by the Reclamation Service in the Colorado River Basin by E. C. Bebb, Fed. Power Commission. (Abstract of Whistler Report, 10 pp.)
1926. Dec. 29. Memorandum on Ultimate Consumption of Irrigation Water, Upper Basin, Colorado, by C. A. Bissell, manuscript, 9 pp.
1927. "Fact Finding Committee" on Boulder Canyon. On April 9, 1927, the Secretary of the Interior appointed the following members of a "fact finding committee" on the Colorado River: Hon. Charles W. Waterman, U. S. Senate; Hon. James G. Scrugham, Carson City, Nev.; Hon. Frank C. Emerson, Cheyenne, Wyo. (Governor); Hon. James R. Garfield, Natl. City Bldg., Cleveland, Ohio; Prof. Wm. F. Durand, Stanford University, California. Reports were rendered in January, 1928. (These are appointed as "Special Advisers" to act individually and not as a committee, board, etc.)
- Reference:
 Reports in full from Garfield, Durand, Scrugham and Emerson are given in hearings, Committee on Irrigation and Reclamation, House of Representatives, 70th Congress, 1st Session, Jan. 14, 1928.
1927. Mexican Water Commission. May 30, announcement made that Mexico had appointed commissioners—Engineers Gustave P. Serrano, Frederico Ramos, Javier Sanches Mejorada—for treaty for equitable distribution of waters of the Rio Grande and Colorado River.
1927. College Men Expedition, through Colorado River Canyon. June-July. On June 27, thirteen college men started from Green River, Utah, in a trip down the Colorado River of 758 miles in

42 days. They ran all but ten of the 600 rapids, and had three specially built boats, two 20 feet and one 16 feet. One of the boats was lost in the trip. The party was under the leadership of Clyde L. Eddy and included W. Gordon Adger of Shreveport, La.; O. A. Seager of St. James, Minn.; Robert F. Bartl, La Crosse, Wis.; Vincent F. Carey, Duluth, Minn.; Edward L. Holt, Blanchard, Iowa; Robert H. Weatherhead, Cleveland, Ohio; John H. Marshall, Chestnut Hill, Mass.; Frederick L. Felton, West Newton, Mass.; ——— Blackwell, Oscar Jaeger of Dubuque, Iowa, Vincent Callaway, Grundy Center, Iowa, and a trapper and guide, Parley N. Galloway. The party reached Lee Ferry on July 12th. Messrs. Blackwell, Felton and Marshall did not complete the trip with the other ten men.

Reference:

Washington Star for Sept. 4 and 5, 1927.

1927. Jan. 21. Levee system, Colorado River, Yuma Project, appropriation of \$100,000 a year authorized.

References:

Act of Congress, Jan. 21, 1927, Pub. No. 560, 69th Congress.

Federal Reclamation Laws Annotated, p. 309.

1927. March 3. Commission of 3 authorized to study Rio Grande and Lower Colorado Rivers, and an appropriation of \$50,000.

References:

Act of Congress, Pub. Res. 62, dated March 3, 1927, 69th Congress (H. J. Res. 345).

Federal Reclamation Laws Annotated, p. 314.

- X 1927. March 4. Federal Power Commission licenses on Colorado restrictions until March 5, 1929, or approval of act.

References:

Act of Congress dated March 4, 1927, Public Res. No. 71, 69th Congress (S. J. Res. 4).

Federal Reclamation Laws Annotated, p. 316.

- / 1927. Feb. 23. Article from the American Bar Association Journal on Colorado River by Wayne C. Williams, in Congressional Record, by Hon. Wm. N. Vaile. Including history of case, law of case, and Colorado River Compact.

Reference:

Congressional Record, March 9, 1927, Appendix, p. 5749-5752.

1927. Feb. 22. All-night session on Boulder Dam Bill. Most spectacular session of the Senate in year was held. An effort was being made by Senators Ashurst and Cameron of Arizona, assisted by several other Senators, to filibuster on the Boulder Dam Bill. In an effort to defeat the filibuster the Senate remained in session all night. For the first time in years the Sergeant at Arms was sent out to bring in the absent members. This session continued without interruption straight through without recessing until 5.23 p.m. February 23. A most spectacular fight against the filibuster was carried on by Senator Johnson of California, assisted by other Senators, notably Senator LaFollette of Wisconsin.

Reference:

Congressional Record, Feb. 22-23, 1927.

1927. Governor's Conference, Aug. 22-Sept. 2 and Sept. 19th to 29th, Oct. 4. Conference called by Gov. Geo. H. Dern of Utah, Gov. Frank C. Emerson of Wyoming, Gov. William H. Adams of Colorado and Gov. Richard E. Dillon of New Mexico. Meetings were at Denver, Colorado, and all above Governors were in attendance, as were also Gov. C. C. Young of California, Gov. W. P. Hunt of Arizona and Gov. F. B. Balzar of Nevada, together with the Colorado River Commissioners of the various States. Stenographic reports were kept of these meetings, copies of which are in hands of California-Colorado River Commission.

1927. Sept. Colorado River Fact Finding Committee of Utah issued several printed bulletins. Bulletin 2, Protection to the Imperial Valley, Sept. 1, 1927, 6 pages (letter size).

1927. Hon. J. Q. Tilson, member of Congress, majority floor leader of the House, to visit Boulder Canyon and Imperial Valley about Sept. 3, 1927.

1927. Dec. 5-6. Boulder Canyon Project Act. Bill authorizing construction of Boulder Canyon Dam was introduced in the 70th Congress December 5, 1927, by Congressman Phil D. Swing as H. R. 5773. A companion bill was introduced in the Senate by Senator Hiram W. Johnson December 6, 1927, as S. 728. This is the bill which finally passed both houses and was approved December 21, 1928, and became the Act under which the Boulder Dam construction is provided. This was the fourth of the Swing-Johnson bills, the preceding bills having died through failure to come to a vote in both houses during the sessions of Congress in which they were introduced.

1927-1928. Dec. 16-Jan. 9. Special Advisers to Secretary of the Interior, consisting of F. C. Emerson, Governor of Wyoming; W. F. Durand, of Stanford University; J. G. Scrugham, former Governor of Nevada; Jas. R. Garfield, former Secretary of the Interior, made report to Secretary Hubert Work during the latter part of December and early in January which were published as an appendix to hearings of the Senate Committee on Irrigation on the Colorado River Basin in 1928, and later reprinted as separates for distribution.

References:

Senate Irrigation Committee Hearings on the Colorado River Basin, S. 728 and S. 1274, 70th Congress, 1st Session, Jan. 17 to 21, 1928. Lawrence C. Phipps, Chairman, 517 pp.

Development of the Colorado River, Separate of above hearings, p. 365-435, 71 pages.

1928. Feb. Silt in the Colorado River. Department of Agriculture issued a Bulletin (Technical Bulletin No. 67) on the subject by Messrs. Samuel Fortier and Harry F. Blaney, includes a list of bibliography cited on pages 93-94.

Reference:

Silt in the Colorado River and its relation to irrigation, illus., Tech. Bull. No. 67, Department of Agriculture, 95 pages with numerous tables and bibliography.

1928. May 25. Gila River investigations above San Carlos authorized by Congress to be made by the Secretary of the Interior who is empowered to prepare plans for irrigation works, and expend not to exceed \$12,500 provided equal contribution made by interested parties.

References:

Act of Congress, Pub. No. 508, 70th Congress (45 Stat. 739).

In Supplement to Federal Reclamation Laws Annotated, July, 1928, p. 11.

1928. May 25. Boulder Canyon Project Act, Swing-Johnson Bill (H. R. 5773) passed House with amendments. The Senate in the meantime had under consideration the companion bill, S. 728, and had held extensive hearings. Upon the passage by the House of the amended bill and reference to the Senate, the House bill was substituted December 5, 1928, for S. 728. The Senate then amended the House bill, H. R. 5773, by "striking out all after the enacting clause and inserting in lieu thereof the language of the Senate Bill (S. 728)," and further amendments were made on the floor of the Senate. The bill thus amended was passed by the Senate on December 14, 1928. On December 18th the Senate amendment to the bill was taken up in the House and agreed to. The bill, having thus passed Congress, was referred to the President of the United States for approval, and President Coolidge approved the bill December 21, 1928.

1928. May 29. Board of engineers and geologists to be appointed to examine site for dam for Boulder Canyon project under the act. Sibert Board has made report.

References:

Act of Congress (Pub. Resolution 65) approved, May 29, 1928, 70th Congress (45 Stat. 1011).

In supplement to Federal Reclamation Laws Annotated, July, 1928, p. 16.

1928. Nov. 24. "Colorado River" (Sibert) Board, consisting of Messrs. Wm. L. Sibert, Chairman; Chas. P. Berkey, Daniel W. Mead, Warren J. Mead and Robert Ridgeway, made a report on the Boulder Canyon Project with regard to engineering feasibility, earthquakes, plans and estimate, adequacy, water supply, Yuma gagings, stream flow and rainfall record, mineral salts, silt in reservoir, silt below reservoir, power, economic feasibility.

References:

Memo. for Press, dated Dec. 3, 1928 (P. N. 28, 129) trans., report of 29 pages.

Report printed as Ho. Doc. 446, 70-2, dated Dec. 3, 1928, 15 pages. Survey in Reclamation Era, Jan., 1929, vol. 20, p. 2-3.

Speech of Phil D. Swing, Dec. 14, 1928, Appendix Congressional Record, Dec. 18, 1928, vol. 70, p. 843-849.

1928. Dec. 3. Memo. for Press. Transmitting first report of the Colorado River Board, dated Nov. 24, 1928.

References:

Memo. for Press dated Dec. 3, 1928, P. N. 28, 129, inclusive, report of 19 pages.

- Report printed as Ho. Doc. 446, 70-2, by Ho. Com. on Irrigation. 15 pages.
1928. Dec. 14. Hon. Phil D. Swing of California delivered a speech in House of Representatives entitled "Boulder Dam given favorable report by Sibert Board of Engineers." Extensive quotations of the Board's report and much additional data, including tables of pressures on foundations, cost data on power stations, and estimate and actual costs of Bureau of Reclamation Dams.
Reference:
Congressional Record, Dec. 18, 1928, vol. 70, p. 843-849.
1928. Dec. 21. Boulder Canyon Project Act (Public No. 642, 70th Congress) authorizing the construction of the Boulder Canyon Project, approved by President.
References:
Public No. 642, 70th Congress (was bill H. R. 5773) 11 pages.
Public Reclamation Laws Annotated, April 1, 1929, with compact. p. 15-31. (45 Stat. 1057.)
Chart of Act (1 page) issued as a separate No. 23,640.
1929. Feb. 14. Parker-Gila Project investigations and Colorado River Basin work.
Reference.
Memo. for Press, dated Feb. 14, 1929, P. N. 29,782, 3 pp.
1929. March 2. Gila River and San Francisco River Compact permitted by Act of Congress.
References:
Act. Pub. No. 963, 70-2; March 2, 1929, 45 Stat. 1517.
Supp. to Fed. Rec. Laws annotated, April 1, 1929, p. 41.
1929. Apr. 25. Secretary of Interior Wilbur announced appointment of three consulting engineers for Boulder Canyon Project, as follows: L. C. Hill, Los Angeles, Cal.; A. J. Wiley, Boise, Idaho; W. F. Durand, Stanford University, Cal.
Reference:
Memo. P. N. 31,716, dated Apr. 25, 1929. 1 p.
1929. June 10. Court of Claims decided case of the Southern Pacific Company vs. U. S. for flood damage in Imperial Valley and awarded judgment of \$1,012,665.17 to company for expenses in connection with controlling break in Colorado River from Dec. 1, 1906, to Nov. 30, 1907. Area railroad lands 307,219 acres. Area other lands 906,391.35 acres. Value of land and improvements over \$19,000,000. Case was filed May 28, 1925, asking for \$1,099,737.90, No. E-352.
Reference:
Court of Claims Decision No. E-352, dated June 10, 1929. 4 p.
1929. June 25. President Herbert Hoover issued proclamation (No. 1882) making Boulder Canyon Project Act effective.
Reference:
Public Proclamation No. 1882. Distributed by the Department of State.
1929. July 15. Secretary Wilbur returned after inspection trip through West when he inspected site of Boulder Dam with Dr.

Mead and R. F. Walter, chief engineer, and general plans were outlined for building of railroad and laying out of townsite. The problem of conservation was discussed and public domain and water supply.

Reference:

Memo. for Press, dated July 15, 1929, P. N. 33,732.

1929. July 27. R. F. Walter authorized to increase engineering staff. (2 pp., mimeographed.)

Reference:

Mimeographed statement. 2 pp., P. N. 34,095.

1929. July 29. Townsite proposed and description of plans for the town and plans for the future.

Reference:

Memo. for Press, dated July 29, 1929, P. N. 34,075, 3 pp.

1929. Sept. 10. Power Report "Rate which public and private corporations can afford to pay for power at Boulder Canyon and rate which will produce sufficient revenue to repay cost of Boulder Canyon Dam and power plant in 50 years with interest."

Reference:

Report of 63 pages (including 6 plates) by McClellan and Durand, dated Sept. 10, 1929 (manuscript).

1929. Sept. 10. Secretary of Interior sent notices to all prospective purchasers of power under Boulder project that application must be filed by October 1, 1929.

Reference:

Memo. for Press, Sept. 10, 1929, P. N. 35,335, 1 p.

1929. Oct. 2. Secretary Wilbur announced requests for power on Boulder Canyon Project insured that all power would be taken and insured repayment of cost of dam in accordance with law.

Reference:

Memo. for Press, Oct. 2, 1929, P. N. 35,970, 2 pp.

1929. Oct. 21. Allocation of Boulder Canyon power announced by Secretary of Interior.

Reference:

Memo. for Press, dated Oct. 21, 1929, P. N. 36,514, 3 pp.

1929. Dec. 26. Attorney General Wm. D. Mitchell rendered a decision upholding the constitutionality of the Boulder Canyon Project Act in answering three questions asked by the Secretary of the Interior.

Reference:

Mimeographed statement dated Dec. 26, 1929, No. 38,436, 18 pp.

1929. Dec. 28. Attorney General's opinion on three questions quoted extensively.

Reference:

Memo. for Press, dated Dec. 28, 1929, P. N. 38,418, 3 pp.

1930. Jan. 9. Conference in office of Secretary of Interior on: (1) Price for power Boulder Canyon; (2) division of water; (3) storage charge for water, Metropolitan District.

Reference:

Memo. to Secretary of Interior by Commissioner Mead, dated Jan. 10, 1930, 5 pp.

1930. Jan. 17. Legal opinion of Solicitor of the Department, E. C. Finney, on various phases of Boulder Canyon, discussed and the term "Public Interest."
- Reference:
Memo. for Press, dated Jan. 17, 1930, P. N. 38,981, 7 pp.
1930. Jan. 31. Statement regarding present and future irrigation development of the Colorado River Basin above Boulder Canyon Dam, by E. B. Debler, p. 53-99.
- Reference:
Mimeographed statement, 47 pp., "exhibit B."
1930. Feb. 17. Dr. F. L. Ransom's report on Salt deposits in Reservoir indicates no danger from that source. Area of deposits only 22 acres in reservoir with an area of about 150,000 acres.
- Reference:
Memo. for Press, dated Feb. 17, 1930, P. N. 40,086, 1 p.
1930. March 23. Secretary of Interior Ray Lyman Wilbur announced agreement regarding allocation of power had been reached.
- Reference:
Memo. for Press, dated March 23, 1930, P. N. 41,194, 6 pp.
1930. Apr. 16. The Colorado River (Sibert) Board made a second report on the storage dam with reference to raising the crest of the dam 25 feet to elevation 1232. Signed by Messrs. Sibert, Berkey, D. W. Mead, W. J. Mead and Ridgeway. (See also Report No. 1, dated Nov. 24, 1928.)
- References:
Board Report in (manuscript) 4 pages.
See Reclamation Era, June, 1930, vol. 21, p. 113.
Memo. for Press, dated Apr. 21, 1930, P. N. 42,365, 3 pp.
1930. Apr. 18. Report of the American section of the International Water Commission United States and Mexico, giving very complete information regarding establishment of International boundary and international rights on the Colorado, Rio Grande and Tia Juana rivers.
- Issued as House Document 359, 71-2, 492 pp.
1930. Apr. 25. President Herbert Hoover withdrew public lands on the Boulder Canyon Project in States of Arizona and Nevada, by Executive Order No. 5339.
- Reference:
Executive Order No. 5339, Apr. 25, 1930.
1930. Apr. 28. 50-year power contracts signed by Metropolitan Water District of Southern California and others have been received. Discussed.
- Reference:
Memo for Press, dated Apr. 28, 1930, P. N. 42,804, 2 pp.
1930. May 2. Secretary Wilbur announced estimates required for commencing construction of Boulder Canyon project and plans for construction, townsite, tunnels, area to be flooded by reservoir.
- Reference:
Memo. for Press, dated May 2, 1930, P. N. 42,799, 2 pp.

1930. May 3. Analysis of Boulder Dam power contracts by the Secretary of the Interior, Ray Lyman Wilbur. Discussion: Machinery, operation, repairs, clauses favorable to States, other contractors, quantity and rates of energy, payments, duration, remedies of U. S., interpretations, records, inspection; transmission, title, public lands, transfers, performance, modifications, arbitrations, etc.
Reference:
Mimeographed statement, issued by Department of Interior, entitled "Analysis of Boulder Dam Power Contracts," No. 42,814, 6 pages.
1930. May 6. Withdrawn lands aggregating 4212 sq. mi. in the vicinity of Boulder Dam Project.
Reference:
Memo. for Press, dated May 6, 1930, P. N. 42,875, 1 p.
1930. May 6. San Diego request to amend its application for power allowed, on account of raising height of dam.
Reference:
Memo. for Press, dated May 6, 1930, P. N. 42,876, 1 p.
1930. May 7. Boulder Canyon Reservoir as a pleasure resort discussed.
Reference:
Memo. for Press, dated May 7, 1930, P. N. 42,912, 1 p.
1930. May 8. "Green River and its utilization," a valuable resource of the West. Notice of Geological Water Supply Paper 618 and account of power development.
References:
Memo. for Press, dated May 8, 1930, P. N. 42,943, 2 pp.
Water Supply Paper 618.
1930. May 14. Arizona and the Boulder Canyon Project. Letter from the Secretary of the Interior to Governor of Arizona, regarding certain facts in connection with project.
Reference:
Memo. for Press, dated May 14, 1930, of letter of Secretary of Interior Ray Lyman Wilbur to Governor John C. Phillips of Arizona, P. N. 43,199, 7 pp.
1930. May 26. Fort Callville, as head of navigation on Colorado River, will be submerged by reservoir.
Reference:
Memo. for Press, dated May 26, 1930, P. N. 43,581, 1 p.
1930. June 9. Attorney General rendered an opinion on the validity and binding effect of the Boulder Canyon power contracts, and advised that requirements of the Act had been met.
References:
Memo. for Press, dated June 9, 1930, P. N. 44,008, 2 pp.
Copy of decision of Attorney General Wm. D. Mitchell, to the President, 44,002, 13 pp., mimeographed.
1930. June 28. Mohave County, Arizona, wires congratulations on Boulder Canyon legislation.
Reference:
Memo. for Press, dated June 28, 1930, P. N. 44,675, 1 p.

1930. July 3. President Herbert Hoover signed Deficiency Appropriation Bill containing an item of \$10,660,000 for beginning construction of Boulder Canyon Project.
Reference:
Public Act, No. 519, 71st Congress, p. 20-21.
1930. July 7. Order No. 436 by Secretary to Commissioner Mead: "You are directed to commence construction on Boulder Dam today."—Ray Lyman Wilbur.
Reference:
Memo. for Press, dated July 7, 1930, P. N. 44,786, 6 pp.
1930. July 9. Secretary advises power contractors that construction has begun and thanks them for continued cooperation.
Reference:
Memo. for Press, dated July 9, 1930, P. N. 44,923, 2 pp.
1930. July 21. Conference four Upper Basin States at State Capitol, Denver, with Dr. Mead and Chief Engineer. W. R. Wallace, R. R. Lyman, Utah; F. C. Emerson, W. O. Wilson, J. A. Whiting, Wyoming; F. C. Wilson, H. Yeo, New Mexico; M. C. Hinderlider, R. J. Tipton, R. E. Winbourn, Colorado.
Reference:
Monthly report, Denver, July, 1930.
1930. Sept. 8. Townsite location announced after careful examination by consulting engineer on town planning, S. R. DeBoer.
Reference:
P. N. 46,508, Sept. 8, 1930, 2 pp.
1930. Sept. 17. The Secretary of the Interior, Ray Lyman Wilbur, advised Commissioner Mead as follows: "This is to notify you that the dam which is to be built in the Colorado River at Black Canyon is to be called THE HOOVER DAM."
Reference:
Order of Secretary of the Interior dated Sept. 17, 1930.
1930. Sept. 17. Construction of Boulder Canyon project begun by the driving of a silver spike near Las Vegas, Nevada, by Secretary Ray Lyman Wilbur in the presence of approximately 10,000 persons, including governors or representatives of all basin States except Arizona, and also of the Union Pacific Railroad.
1930. Sept. 20. Palo Verde and Cibola Valley investigations report by R. M. Priest. Prepared in accordance with bill H. R. 9442, approved by the President Apr. 19, 1930, Pub. No. 149, 71st Congress, 2d Session. (See Law Fed. Rec. Laws annotated Supp. July, 1930, p. 58.)
Reference:
Report in manuscript of 32 pages, and 4 maps and 7 large photo mosaics and 7 large topographic sheets. (See also Eng. News, v. 85, p. 465, and v. 99, p. 226-7.)
1930. Oct. 13. Supreme Court gave a decision on the application of Arizona Attorney General, K. Berry Peterson, for permission to file suit in behalf of Arizona to test constitutionality of the Boulder Canyon Project Act, and announced that California and other

interested States and the Secretary of the Interior would leave until Jan. 5, 1931, to show cause why suit should not be filed.

Reference:

Washington daily press of October 13 and 14, 1930.

1930. Oct. 13. Secretary of Interior Wilbur announced that Comptroller General of U. S. declined request of State of Arizona to withhold funds (in 12-page decision) for construction of Boulder Canyon Dam.

Reference:

Memo. for Press, dated Oct. 13, 1930, P. N. 47,460, 2 pp.

1930. Oct. 15. Power contract awarded to Southern Sierras Power Company of Riverside, California, under Spec. 486-D. Estimated cost in excess of \$1,730,000.

References:

Memo. for Press, dated Oct. 15, 1930, P. N. 47,526, 2 pp.

Specifications 486-D, bids opened Sept. 29, 1930.

1930. Nov. 1. Contract information, awards and proposed work, plans for advertising and issue of specifications.

Reference:

Mimeographed circular dated Nov. 1, 1930, 47,986, 1 sheet.

1930. Nov. 1. Preliminary work on Hoover Dam to extent of \$3,000,000 to be advertised about Nov. 15.

Reference:

Memo. for Press, dated Nov. 1, 1930, P. N. 48,026, 2 pp.

1930. Nov. 3. Hoover Dam specifications to be ready about Dec. 1st. Bids will call for expenditure of 60 to 70 million dollars.

Reference:

Memo. for Press, dated Nov. 3, 1930, P. N. 48,027, 2 pp.

BOULDER CANYON PROJECT LEGISLATION

(Acts of Congress and of various states having to do with the Colorado River (Santa Fe) Compact are given under a separate heading dealing with the compact and its ratification.)

Briefly, the Boulder Canyon Project Act (H. R. 5773) was "An act to provide for the construction of works for the protection and development of the Colorado River Basin, for the approval of the Colorado River Compact, and for other purposes." The act states that it is for "the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters thereof for the reclamation of public lands and other beneficial uses exclusively within the United States and for the generation of electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking."

The act also authorized the Secretary of the Interior "to construct, operate and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon adequate to create a storage reservoir of a capacity of not less than 20,000,000 acre-feet of water and a main canal and appurtenant structures located entirely within the United States, connecting the Laguna Dam, or other suitable diversion dam * * * with the Imperial and Coachella valleys in California. * * * Also to construct, equip, operate and maintain * * * or cause to be constructed, a complete plant and incidental structures suitable for the fullest economical development of electrical energy from the water discharged from said reservoir."

Reference: Boulder Canyon Project Act, preamble and section 1.

The Boulder Canyon Project Act was the final result of various bills introduced at successive sessions of Congress.

In connection with the evolution of the final act Congress passed an act known as the Kinkaid Act (approved May 18, 1920) for the purpose of getting a report on Colorado River development. This report, rendered by reason and under authority of the Kinkaid Act, was rendered February 28, 1922, and was known as the "Fall-Davis" report and was printed as Senate Document 142, 67th Congress, 2d Session.

Very extensive hearings were held by both the Senate and House Committees on Irrigation and Reclamation, and other reports of engineering boards, and the Department of the Interior, were made to assist in acquiring full and accurate information. After over nine years of investigations, hearings and debate the Boulder Canyon Project Act was finally passed and was approved by President Coolidge December 21, 1928.

The original proposal which developed into the Boulder Canyon Project Act was a bill introduced in Congress June 17, 1919, to construct an All-American Canal to connect Imperial district with Laguna Dam. (1st Kettner Bill, H. R. 6044.) The preamble of the bill stated the purpose to be "To assist in increasing the productive agricultural

area of the Imperial and Coachella valleys, California, and for other purposes.”

Under this bill it was proposed that the Imperial Irrigation District and such other districts as would receive water for irrigation, issue bonds in an amount sufficient to cover cost of construction and deposit these bonds with the Secretary of the Treasury, he to collect the interest and principal when due, from the district or districts. The Secretary of the Treasury upon receipt of the irrigation district bonds was to issue and sell U. S. bonds equal in face value to the district bonds deposited and the money thus raised was to finance the project.

The Secretary of the Treasury, Carter Glass, objected to this method of financing. (Hearings House Irrigation Committee, July 9, 1919, p. 9.)

This bill did not come to a vote in Congress.

When the next bill was introduced, January 7, 1920 (2d Kettner Bill, H. R. 11553) it also was for an All-American Canal as provided in the first bill, and also authorized the Secretary of the Interior “to construct such storage reservoirs and other works as in his judgment are necessary to provide an adequate supply of water * * *.”

Under this bill the Secretary of the Interior was to apportion the cost of the works to be constructed among the various irrigation interests and unentered public lands. All money from the sale of public lands thus developed was to be placed in the construction fund and each of the irrigation districts was to issue bonds equal in amount to their allocated share of the cost of construction. The bonds were to be turned over to the Secretary of the Interior and sold by him to defray the cost of construction.

This bill also failed to come before Congress for a vote.

The next bill was introduced April 25, 1922 (1st Swing-Johnson Bill, H. R. 11449), and extended the scope of the contemplated work and authorized construction of a dam at or near Boulder Canyon, the All-American Canal, and such canals as might be necessary to reclaim public lands.

This bill authorized the Secretary of the Interior to lease the power privileges at the dam and also provided that no work was to be done until “the lands to be irrigated * * * shall have first been legally obligated to repay their proper proportion.” The act also, for the first time, authorized an appropriation, \$70,000,000, for carrying out construction work. The receipts from the power leases and payments by benefited lands were to repay the amount expended by the government. Secretary of the Interior Albert B. Fall, June 14, 1922, in a letter to the chairman of the house committee suggested that certain changes in the financial set-up be made. (Hearings, H. R. 11449, pt. 1, p. 4.)

Secretary Fall’s suggestion was to the effect that United States bonds be issued to defray cost of construction and that the Secretary of the Interior be “authorized and directed to enter into contracts for the sale or lease of the hydroelectric power to be developed through the construction and use of such dam and machinery, at such charges, by sales, leases, or rentals, as will produce revenues sufficient to meet the semi-

annual interest upon such bonds, and to provide a sinking fund for the redemption of such bonds.”

This bill also failed to come up for a vote before Congress.

The second of the Swing-Johnson bills was introduced December 10, 1923 (H. R. 2903, 68th Congress, 1st Session), and provided about the same financial structure as the preceding bill but went into more detail regarding power leases. This bill also failed to come to a vote.

The third Swing-Johnson bill (H. R. 6251, 69th Congress, 1st Session) was really a preliminary bill about the same as H. R. 2903 of the previous Congress, but upon receiving the comments and suggestions of Secretary of the Interior Hubert Work, made to the committee having the bill under consideration, Congressman Swing redrafted the bill to comply with the Secretary's suggestions and this new bill (H. R. 9826) was substituted, February 27, 1926.

Secretary Work in a letter to Chairman McNary of the Senate Committee on Irrigation and Reclamation, January 12, 1926 (House Hearings H. R. 6251 and H. R. 9826, part 1, p. 5) made the following suggestion among others, “the building of a unified power plant by the federal government in the place of allocating power privileges, as proposed in the bill, is regarded as more efficient and cheaper. It will obviate controversies between applicants, and long delays in their adjustment. In the end, results will, I believe, be superior to those possible under an allocation of privileges.”

The new bill, H. R. 9826, incorporating this suggestion, authorized the Secretary of the Interior to construct an electric generating plant at the dam and sell the power at the switchboard. The authorized appropriation was increased from \$70,000,000 to \$120,000,000. This bill also failed to come to a final vote.

The fourth Swing-Johnson bill (H. R. 5773 and S. 1274) was introduced in December, 1927. This was the bill, with various amendments, which finally passed. As introduced the amount authorized was \$120,000,000, but as passed this amount was raised by amendment to \$165,000,000, the amount being increased to comply with the Sibert report.

The brief tabulation below gives the dates of introduction and numbers of the various bills introduced in the House. The Kettner bills were introduced by Congressman William Kettner, who was from the same district and was succeeded, upon his retiring, by Congressman Swing.

The Swing-Johnson bills were introduced at approximately the same time in both the House of Representatives and the Senate by Congressman Phil D. Swing and Senator Hiram W. Johnson, respectively. As is common in the United States Congress, these bills were popularly known by the names of its co-authors, hence the name Swing-Johnson.

H. R. 6044, 1st Kettner bill—66th Congress, 1st Session, June 17, 1919.

H. R. 11553, 2d Kettner bill—66th Congress, 2d Session, January 7, 1920.

H. R. 11449, 1st Swing-Johnson bill—67th Congress, 2d Session, April 25, 1922.

H. R. 2903, 2d Swing-Johnson bill—68th Congress, 1st Session, December 10, 1923.

H. R. 6251-H. R. 9826, 3d Swing-Johnson bill—69th Congress, 1st Session, December 21, 1925—February 27, 1926.

H. R. 5773, 4th Swing-Johnson bill—70th Congress, 1st Session, January 6, 1928.

The Boulder Canyon Project really started from an effort on the part of Imperial Valley to obtain a water supply that would be independent of the control of a foreign nation (Mexico). The first bill introduced was a bill for what was known as an All-American Canal. This was purely a local issue.

As time went on and more thorough investigations were made of conditions in the Lower Colorado River Basin, development of the project commenced to be of more and more importance to Colorado River Basin states; then, when the element of hydroelectric generation of power was introduced as a means of financing the project, Colorado River development began to awaken national interest.

When it was proposed that the government should obtain a revenue from the power generated by the stored water strong opposition developed on the part of the public utility companies engaged in the hydroelectric generation of power and for a long time it was almost impossible to get the bill out of committee and onto the floor of Congress.

What probably was the turning point in the fate of the Boulder Canyon legislation occurred during a spectacular session of the Senate held the night of February 22, 1927. At this time the Boulder Canyon Project Bill was before the Senate and held the right of way over other legislation. The Senate was anxious to take up other business of importance and a filibuster was attempted to displace the bill on the floor of the Senate. As a means of combating this filibuster the friends of the measure were successful in keeping the Senate in session throughout the night of February 22d, no adjournment being had until the evening of February 23d. This all-night session in the Senate gave rise to some rather spectacular proceedings, receiving head lines in the newspapers from one end of the country to the other, and had the effect of arousing the interest of the people of the United States in the Boulder Canyon development as nothing else had done.

While bitter fights were carried on in both the Senate and the House, the method of procedure in the Senate, with its rule of unlimited debate, was such as to make the Senate proceedings more spectacular and this all-night session of the Senate created universal public interest in the Boulder Canyon Bill.

While the bill then under discussion failed to pass and the filibuster was temporarily successful, a similar bill did pass in the following Congress and became the Boulder Canyon Project Act.

Many members of both the House and Senate fought valiantly for the passage of the bill, but Senator Hiram W. Johnson and Congressman Phil D. Swing, as co-authors of the bill, bore a large share of the brunt of the fight. It was looked upon as their measure, and they as the generals, in the campaign for its passage.

When the bill was finally passed, in December, 1928, and sent to President Coolidge for his signature, one of the Washington papers published a cartoon which rather aptly summed up the situation. This cartoon appeared in the *Washington Evening Star*, December 19, 1928, and is reproduced as Plate I.

PLATE I



END OF EARLY AND ENERGETIC SHOPPING

FOURTH SWING-JOHNSON BILL

(As amended and passed)

(This Swing-Johnson Bill is the one which, as finally amended, was passed by the Congress and approved December 21, 1928. This is the act which is now law and under which the Boulder Canyon Project is being built.)

(H. R. 5773, 70th Congress, 2d Session.)

Introduced—December 5, 1927

BOULDER CANYON PROJECT ACT

(Public No. 642—70th Congress)

(H. R. 5773)

An act to provide for the construction of works for the protection and development of the Colorado River Basin, for the approval of the Colorado River compact, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters thereof for reclamation of public lands and other beneficial uses exclusively within the United States, and for the generation of electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior, subject to the terms of the Colorado River compact hereinafter mentioned, is hereby authorized to construct, operate, and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon adequate to create a storage reservoir of a capacity of not less than twenty million acre-feet of water and a main canal and appurtenant structures located entirely within the United States connecting the Laguna Dam, or other suitable diversion dam, which the Secretary of the Interior is hereby authorized to construct if deemed necessary or advisable by him upon engineering or economic considerations, with the Imperial and Coachella Valleys in California, the expenditures for said main canal and appurtenant structures to be reimbursable, as provided in the reclamation law, and shall not be paid out of revenues derived from the sale or disposal of water power or electric energy at the dam authorized to be constructed at said Black Canyon or Boulder Canyon, or for water for potable purposes outside of the Imperial and Coachella Valleys: *Provided, however,* that no charge shall be made for water or for the use, storage, or delivery of water for irrigation or water for potable purposes in the Imperial or Coachella Valleys; also to construct and equip, operate, and maintain at or near said dam, or cause to be constructed, a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from said reservoir; and to acquire by proceedings in eminent domain, or otherwise, all lands, rights of way, and other property necessary for said purposes.

Sec. 2. (a) There is hereby established a special fund, to be known as the "Colorado River Dam fund" (hereinafter referred to as the "fund"), and to be available, as hereafter provided, only for carrying out the provisions of this Act. All revenues received in carrying out the provisions of this Act shall be paid into and expenditures shall be made out of the fund, under the direction of the Secretary of the Interior.

(b) The Secretary of the Treasury is authorized to advance to the fund, from time to time and within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of this Act, except that the aggregate amount of such advances shall not exceed the sum of \$165,000,000. Of this amount the sum of \$25,000,000 shall be allocated to flood control and shall be repaid to the United States out of 62½ per centum of revenues, if any, in excess of the amount necessary to meet periodical payments during the period of amortization, as provided in section 4 of this Act. If said sum of \$25,000,000 is not repaid in full during the period of amortization, then 62½ per centum of all net revenues shall be applied to payment of the remainder. Interest at the rate of 4 per centum per annum accruing during the year upon the amounts

so advanced and remaining unpaid shall be paid annually out of the fund, except as herein otherwise provided.

(c) Moneys in the fund advanced under subdivision (b) shall be available only for expenditures for construction and the payment of interest, during construction, upon the amounts so advanced. No expenditures out of the fund shall be made for operation and maintenance except from appropriations therefor.

(d) The Secretary of the Treasury shall charge the fund as of June 30 in each year with such amount as may be necessary for the payment of interest on advances made under subdivision (b) at the rate of 4 per centum per annum accrued during the year upon the amounts so advanced and remaining unpaid, except that if the fund is insufficient to meet the payment of interest the Secretary of the Treasury may, in his discretion, defer any part of such payment, and the amount so deferred shall bear interest at the rate of 4 per centum per annum until paid.

(e) The Secretary of the Interior shall certify to the Secretary of the Treasury, at the close of each fiscal year, the amount of money in the fund in excess of the amount necessary for construction, operation, and maintenance, and payment of interest. Upon receipt of each such certificate the Secretary of the Treasury is authorized and directed to charge the fund with the amount so certified as repayment of the advances made under subdivision (b), which amount shall be covered into the Treasury to the credit of miscellaneous receipts.

Sec. 3. There is hereby authorized to be appropriated from time to time, out of any money in the Treasury not otherwise appropriated, such sums of money as may be necessary to carry out the purposes of this Act, not exceeding in the aggregate \$165,000,000.

Sec. 4. (a) This Act shall not take effect and no authority shall be exercised hereunder and no work shall be begun and no moneys expended on or in connection with the works or structures provided for in this Act, and no water rights shall be claimed or initiated hereunder, and no steps shall be taken by the United States or by others to initiate or perfect any claims to the use of water pertinent to such works or structures unless and until (1) the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming shall have ratified the Colorado River compact, mentioned in section 13 hereof, and the President by public proclamation shall have so declared, or (2) if said States fail to ratify the said compact within six months from the date of the passage of this Act then, until six of said States, including the State of California, shall ratify said compact and shall consent to waive the provisions of the first paragraph of Article XI of said compact, which makes the same binding and obligatory only when approved by each of the seven States signatory thereto, and shall have approved said compact without conditions, save that of such six-State approval, and the President by public proclamation shall have so declared, and, further, until the State of California, by act of its legislature, shall agree irrevocably and unconditionally with the United States and for the benefit of the States of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming, as an express covenant and in consideration of the passage of this Act, that the aggregate annual consumptive use (diversions less returns to the river) of water of and from the Colorado River for use in the State of California, including all uses under contracts made under the provisions of this Act and all water necessary for the supply of any rights which may now exist, shall not exceed four million four hundred thousand acre-feet of the waters apportioned to the lower basin States by paragraph (a) of Article III of the Colorado River compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact.

The States of Arizona, California, and Nevada are authorized to enter into an agreement which shall provide (1) that of the 7,500,000 acre-feet annually apportioned to the lower basin by paragraph (a) of Article III of the Colorado River compact, there shall be apportioned to the State of Nevada 300,000 acre-feet and to the State of Arizona 2,800,000 acre-feet for exclusive beneficial consumptive use in perpetuity, and (2) that the State of Arizona may annually use one-half of the excess or surplus waters unapportioned by the Colorado River compact, and (3) that the State of Arizona shall have the exclusive beneficial consumptive use of the Gila River and its tributaries within the boundaries of said State, and (4) that the waters of the Gila River and its tributaries, except return flow after the same enters the Colorado River, shall never be subject to any diminution whatever by any allowance of water which may be made by treaty or otherwise to the United States of Mexico but if, as provided in paragraph (c) of Article III of the Colorado River compact, it shall become necessary to supply water to the United States of Mexico from waters over and above the quantities which are surplus as defined by

said compact, then the State of California shall and will mutually agree with the State of Arizona to supply, out of the main stream of the Colorado River, one-half of any deficiency which must be supplied to Mexico by the lower basin, and (5) that the State of California shall and will further mutually agree with the States of Arizona and Nevada that none of said three States shall withhold water and none shall require the delivery of water, which can not reasonably be applied to domestic and agricultural uses, and (6) that all of the provisions of said tri-State agreement shall be subject in all particulars to the provisions of the Colorado River compact, and (7) said agreement to take effect upon the ratification of the Colorado River compact by Arizona, California, and Nevada.

(b) Before any money is appropriated for the construction of said dam or power plant, or any construction work done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this Act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and the repayment, within fifty years from the date of the completion of said works, of all amounts advanced to the fund under subdivision (b) of Section 2 for such works, together with interest thereon made reimbursable under this Act.

Before any money is appropriated for the construction of said main canal and appurtenant structures to connect the Laguna Dam with the Imperial and Coachella Valleys in California, or any construction work is done upon said canal or contracted for, the Secretary of the Interior shall make provision for revenue, by contract or otherwise, adequate in his judgment to insure payment of all expenses of construction, operation, and maintenance of said main canal and appurtenant structures in the manner provided in the reclamation law.

If during the period of amortization the Secretary of the Interior shall receive revenues in excess of the amount necessary to meet the periodical payments to the United States as provided in the contract, or contracts, executed under this Act, then, immediately after the settlement of such periodical payments, he shall pay to the State of Arizona 18 $\frac{1}{2}$ per centum of such excess revenues and to the State of Nevada 18 $\frac{3}{4}$ per centum of such excess revenues.

Sec. 5. That the Secretary of the Interior is hereby authorized, under such general regulations as he may prescribe, to contract for the storage of water in said reservoir and for the delivery thereof at such points on the river and on said canal as may be agreed upon, for irrigation and domestic uses, and generation of electrical energy and delivery at the switchboard to States, municipal corporations, political subdivisions, and private corporations of electrical energy generated at said dam, upon charges that will provide revenue which, in addition to other revenue accruing under the reclamation law and under this Act, will in his judgment cover all expenses of operation and maintenance incurred by the United States on account of works constructed under this Act and the payments to the United States under subdivision (b) of section 4. Contracts respecting water for irrigation and domestic uses shall be for permanent service and shall conform to paragraph (a) of section 4 of this Act. No person shall have or be entitled to have the use for any purpose of the water stored as aforesaid except by contract made as herein stated.

After the repayments to the United States of all money advanced with interest, charges shall be on such basis and the revenues derived therefrom shall be kept in a separate fund to be expended within the Colorado River Basin as may hereafter be prescribed by the Congress.

General and uniform regulations shall be prescribed by the said Secretary for the awarding of contracts for the sale and delivery of electrical energy, and for renewals under subdivision (b) of this section, and in making such contracts the following shall govern:

(a) No contract for electrical energy or for generation of electrical energy shall be of longer duration than fifty years from the date at which such energy is ready for delivery.

Contracts made pursuant to subdivision (a) of this section shall be made with a view to obtaining reasonable returns and shall contain provisions whereby at the end of fifteen years from the date of their execution and every ten years thereafter, there shall be readjustment of the contract, upon the demand of either party thereto, either upward or downward as to price, as the Secretary of the Interior may find to be justified by competitive conditions at distributing points or competitive centers, and with provisions under which disputes or disagreements as to interpretation or performance of such contract shall be determined either by arbitration or court proceedings, the Secretary of the Interior being authorized to act for the United States in such readjustments or proceedings.

(b) The holder of any contract for electrical energy not in default thereunder shall be entitled to a renewal thereof upon such terms and conditions as may be authorized or required under the then existing laws and regulations, unless the property of such holder dependent for its usefulness on a continuation of the contract be purchased or acquired and such holder be compensated for damages to its property, used and useful in the transmission and distribution of such electrical energy and not taken, resulting from the termination of the supply.

(c) Contracts for the use of water and necessary privileges for the generation and distribution of hydroelectric energy or for the sale and delivery of electrical energy shall be made with responsible applicants therefor who will pay the price fixed by the said Secretary with a view to meeting the revenue requirements herein provided for. In case of conflicting applications, if any, such conflicts shall be resolved by the said Secretary, after hearing, with due regard to the public interest, and in conformity with the policy expressed in the Federal Water Power Act as to conflicting applications for permits and licenses, except that preference to applicants for the use of water and appurtenant works and privileges necessary for the generation and distribution of hydroelectric energy, or for delivery at the switchboard of a hydroelectric plant, shall be given, first, to a State for the generation or purchase of electric energy for use in the State, and the States of Arizona, California, and Nevada shall be given equal opportunity as such applicants.

The rights covered by such preference shall be contracted for by such State within six months after notice by the Secretary of the Interior and to be paid for on the same terms and conditions as may be provided in other similar contracts made by said Secretary: *Provided, however*, That no application of a State or a political subdivision for an allocation of water for power purposes or of electrical energy shall be denied or another application in conflict therewith be granted on the ground that the bond issue of such State or political subdivision, necessary to enable the applicant to utilize such water and appurtenant works and privileges necessary for the generation and distribution of hydroelectric energy or the electrical energy applied for, has not been authorized or marketed, until after a reasonable time, to be determined by the said Secretary, has been given to such applicant to have such bond issue authorized and marketed.

(d) Any agency receiving a contract for electrical energy equivalent to one hundred thousand firm horsepower, or more, may, when deemed feasible by the said Secretary, from engineering and economic considerations and under general regulations prescribed by him, be required to permit any other agency having contracts hereunder for less than the equivalent of twenty-five thousand firm horsepower, upon application to the Secretary of the Interior made within sixty days from the execution of the contract of the agency the use of whose transmission line is applied for, to participate in the benefits and use of any main transmission line constructed or to be constructed by the former for carrying such energy (not exceeding, however, one-fourth the capacity of such line), upon payment by such other agencies of a reasonable share of the cost of construction, operation, and maintenance thereof.

The use is hereby authorized of such public and reserved lands of the United States as may be necessary or convenient for the construction, operation, and maintenance of main transmission lines to transmit said electrical energy.

Sec. 6. That the dam and reservoir provided for by section 1 hereof shall be used: First, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses and satisfaction of present perfected rights in pursuance of Article VIII of said Colorado River compact; and third, for power. The title to said dam, reservoir, plant, and incidental works shall forever remain in the United States, and the United States shall, until otherwise provided by Congress, control, manage, and operate the same, except as herein otherwise provided: *Provided, however*, That the Secretary of the Interior may, in his discretion, enter into contracts of lease of a unit or units of any Government-built plant, with right to generate electrical energy, or, alternately, to enter into contracts of lease for the use of water for the generation of electrical energy as herein provided, in either of which events the provisions of section 5 of this Act relating to revenue, term, renewals, determination of conflicting applications, and joint use of transmission lines under contracts for the sale of electrical energy, shall apply.

The Secretary of the Interior shall prescribe and enforce rules and regulations conforming with the requirements of the Federal Water Power Act, so far as applicable, respecting maintenance of works in condition of repair adequate for their efficient operation, maintenance of a system of accounting, control of rates and service in the absence of State regulation or interstate agreement, valuation for

rate-making purposes, transfers of contracts, contracts extending beyond the lease period, expropriation of excessive profits, recapture and/or emergency use by the United States of property of lessees, and penalties for enforcing regulations made under this Act or penalizing failure to comply with such regulations or with the provisions of this Act. He shall also conform with other provisions of the Federal Water Power Act and of the rules and regulations of the Federal Power Commission, which have been devised or which may be hereafter devised, for the protection of the investor and consumer.

The Federal Power Commission is hereby directed not to issue or approve any permits or licenses under said Federal Water Power Act upon or affecting the Colorado River or any of its tributaries, except the Gila River, in the States of Colorado, Wyoming, Utah, New Mexico, Arizona, and California until this Act shall become effective as provided in section 4 herein.

Sec. 7. That the Secretary of the Interior may, in his discretion, when repayments to the United States of all money advanced, with interest, reimbursable hereunder, shall have been made, transfer the title to said canal and appurtenant structures, except the Laguna Dam and the main canal and appurtenant structures down to and including Syphon Drop, to the districts or other agencies of the United States having a beneficial interest therein in proportion to their respective capital investments under such form of organization as may be acceptable to him. The said districts or other agencies shall have the privilege at any time of utilizing by contract or otherwise such power possibilities as may exist upon said canal, in proportion to their respective contributions or obligations toward the capital cost of said canal and appurtenant structures from and including the diversion works to the point where each respective power plant may be located. The net proceeds from any power development on said canal shall be paid into the fund and credited to said districts or other agencies on their said contracts, in proportion to their rights to develop power, until the districts or other agencies using said canal shall have paid thereby and under any contract or otherwise an amount of money equivalent to the operation and maintenance expense and cost of construction thereof.

Sec. 8. (a) The United States, its permittees, licensees, and contractors, and all users and appropriators of water stored, diverted, carried, and/or distributed by the reservoir, canals, and other works herein authorized, shall observe and be subject to and controlled by said Colorado River compact in the construction, management, and operation of said reservoir, canals, and other works and the storage, diversion, delivery, and use of water for the generation of power, irrigation, and other purposes, anything in this Act to the contrary notwithstanding, and all permits, licenses, and contracts shall so provide.

(b) Also the United States, in constructing, managing, and operating the dam, reservoir, canals, and other works herein authorized, including the appropriation, delivery, and use of water for the generation of power, irrigation, or other uses, and all users of water thus delivered and all users and appropriators of waters stored by said reservoir and/or carried by said canal, including all permittees and licensees of the United States or any of its agencies, shall observe and be subject to and controlled, anything to the contrary herein notwithstanding, by the terms of such compact, if any, between the States of Arizona, California, and Nevada, or any two thereof, for the equitable division of the benefits, including power, arising from the use of water accruing to said States, subsidiary to and consistent with said Colorado River compact, which may be negotiated and approved by said States and to which Congress shall give its consent and approval on or before January 1, 1929; and the terms of any such compact concluded between said States and approved and consented to by Congress after said date: *Provided*, That in the latter case such compact shall be subject to all contracts, if any, made by the Secretary of the Interior under section 5 hereof prior to the date of such approval and consent by Congress.

Sec. 9. That all lands of the United States found by the Secretary of the Interior to be practicable of irrigation and reclamation by the irrigation works authorized herein shall be withdrawn from public entry. Thereafter, at the direction of the Secretary of the Interior, such lands shall be opened for entry, in tracts varying in size but not exceeding one hundred and sixty acres, as may be determined by the Secretary of the Interior, in accordance with the provisions of the reclamation law, and any such entryman shall pay an equitable share in accordance with the benefits received, as determined by the said Secretary, of the construction cost of said canal and appurtenant structures; said payments to be made in such installments and at such times as may be specified by the Secretary of the Interior, in accordance with the provisions of the said reclamation law, and shall constitute revenue from said project and be covered into the fund herein provided

for: *Provided*, That all persons who have served in the United States Army, Navy, or Marine Corps during the war with Germany, the war with Spain, or in the suppression of the insurrection in the Philippines, and who have been honorably separated or discharged therefrom or placed in the Regular Army or Navy Reserve, shall have the exclusive preference right for a period of three months to enter said lands, subject, however, to the provisions of subsection (c) of section 4, Act of December 5, 1924 (Forty-third Statutes at Large, page 702); and also, so far as practicable, preference shall be given to said persons in all construction work authorized by this Act: *Provided further*, That in the event such an entry shall be relinquished at any time prior to actual residence upon the land by the entryman for not less than one year, lands so relinquished shall not be subject to entry for a period of sixty days after the filing and notation of the relinquishment in the local land office, and after the expiration of said sixty-day period such lands shall be open to entry, subject to the preference in this section provided.

Sec. 10. That nothing in this Act shall be construed as modifying in any manner the existing contract, dated October 23, 1918, between the United States and the Imperial Irrigation District, providing for a connection with Laguna Dam; but the Secretary of the Interior is authorized to enter into contract or contracts with the said district or other districts, persons, or agencies for the construction, in accordance with this Act, of said canal and appurtenant structures, and also for the operation and maintenance thereof, with the consent of the other users.

Sec. 11. That the Secretary of the Interior is hereby authorized to make such studies, surveys, investigations, and do such engineering as may be necessary to determine the lands in the State of Arizona that should be embraced within the boundaries of a reclamation project, heretofore commonly known and hereafter to be known as the Parker-Gila Valley reclamation project, and to recommend the most practicable and feasible method of irrigating lands within said project, or units thereof, and the cost of the same; and the appropriation of such sums of money as may be necessary for the aforesaid purposes from time to time is hereby authorized. The Secretary shall report to Congress as soon as practicable, and not later than December 10, 1931, his findings, conclusions, and recommendations regarding such project.

Sec. 12. "Political subdivision" or "political subdivisions" as used in this Act shall be understood to include any State, irrigation or other district, municipality, or other governmental organization.

"Reclamation law" as used in this Act shall be understood to mean that certain Act of the Congress of the United States approved June 17, 1902, entitled "An Act appropriating the receipts from the sale and disposal of public land in certain States and Territories to the construction of irrigation works for the reclamation of arid lands," and the Acts amendatory thereof and supplemental thereto.

"Maintenance" as used herein shall be deemed to include in each instance provision for keeping the works in good operating condition.

"The Federal Water Power Act," as used in this Act, shall be understood to mean that certain Act of Congress of the United States approved June 10, 1920, entitled "An Act to create a Federal Power Commission; to provide for the improvement of navigation; the development of water power; the use of the public lands in relation thereto; and to repeal section 18 of the River and Harbor Appropriation Act, approved August 8, 1917, and for other purposes," and the Acts amendatory thereof and supplemental thereto.

"Domestic" whenever employed in this Act shall include water uses defined as "domestic" in said Colorado River compact.

Sec. 13. (a) The Colorado River compact signed at Santa Fe, New Mexico, November 24, 1922, pursuant to Act of Congress approved August 19, 1921, entitled "An Act to permit a compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," is hereby approved by the Congress of the United States, and the provisions of the first paragraph of Article XI, of the said Colorado River compact, making said compact binding and obligatory when it shall have been approved by the legislature of each of the signatory States, are hereby waived, and this approval shall become effective when the State of California and at least five of the other States mentioned shall have approved or may hereafter approve said compact as aforesaid and shall consent to such waiver, as herein provided.

(b) The rights of the United States in or to waters of the Colorado River and its tributaries howsoever claimed or acquired, as well as the rights of those claiming under the United States, shall be subject to and controlled by said Colorado River compact.

(c) Also all patents, grants, contracts, concessions, leases, permits, licenses, rights of way, or other privileges from the United States or under its authority, necessary or convenient for the use of waters of the Colorado River or its tributaries, or for the generation or transmission of electrical energy generated by means of the waters of said river or its tributaries, whether under this Act, the Federal Water Power Act, or otherwise, shall be upon the express condition and with the express covenant that the rights of the recipients or holders thereof to waters of the river or its tributaries, for the use of which the same are necessary, convenient, or incidental, and the use of the same shall likewise be subject to and controlled by said Colorado River compact.

(d) The conditions and covenants referred to herein shall be deemed to run with the land and the right, interest, or privilege therein and water right, and shall attach as a matter of law, whether set out or referred to in the instrument evidencing any such patent, grant, contract, concession, lease, permit, license, right of way, or other privilege from the United States or under its authority, or not, and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and the users of water therein or thereunder, by way of suit, defense, or otherwise, in any litigation respecting the waters of the Colorado River or its tributaries.

Sec. 14. This Act shall be deemed a supplement to the reclamation law, which said reclamation law shall govern the construction, operation, and management of the works herein authorized, except as otherwise herein provided.

Sec. 15. The Secretary of the Interior is authorized and directed to make investigation and public 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 purpose of making such information available to said States and to the Congress, and of formulating a comprehensive scheme of control and the improvement and utilization of the water of the Colorado River and its tributaries. The sum of \$250,000 is hereby authorized to be appropriated from said Colorado River Dam fund, created by section 2 of this Act, for such purposes.

Sec. 16. In furtherance of any comprehensive plan formulated hereafter for the control, improvement, and utilization of the resources of the Colorado River system and to the end that the project authorized by this Act may constitute and be administered as a unit in such control, improvement, and utilization, any commission or commissioner duly authorized under the laws of any ratifying State in that behalf shall have the right to act in an advisory capacity to and in cooperation with the Secretary of the Interior in the exercise of any authority under the provisions of Sections 4, 5, and 14 of this Act, and shall have at all times access to records of all Federal agencies empowered to act under said sections, and shall be entitled to have copies of said records on request.

Sec. 17. Claims of the United States arising out of any contract authorized by this Act shall have priority over all others, secured or unsecured.

Sec. 18. Nothing herein shall be construed as interfering with such rights as the States now have either to the waters within their borders or to adopt such policies and enact such laws as they may deem necessary with respect to the appropriation, control, and use of waters within their borders, except as modified by the Colorado River compact or other interstate agreement.

Sec. 19. That the consent of Congress is hereby given to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming to negotiate and enter into compacts or agreements, supplemental to and in conformity with the Colorado River compact and consistent with this Act for a comprehensive plan for the development of the Colorado River and providing for the storage, diversion, and use of the waters of said river. Any such compact or agreement may provide for the construction of dams, headworks, and other diversion works or structures for flood control, reclamation, improvement of navigation, division of water, or other purposes and/or the construction of power houses or other structures for the purpose of the development of water power and the financing of the same; and for such purposes may authorize the creation of interstate commissions and/or the creation of corporations, authorities, or other instrumentalities.

(a) Such consent is given upon condition that a representative of the United States, to be appointed by the President, shall participate in the negotiations and shall make report to Congress of the proceedings and of any compact or agreement entered into.

(b) No such compact or agreement shall be binding or obligatory upon any of such States unless and until it has been approved by the legislature of each of such States and by the Congress of the United States.

Sec. 20. Nothing in this Act shall be construed as a denial or recognition of any rights, if any, in Mexico to the use of the waters of the Colorado River system.

Sec. 21. That the short title of this Act shall be "Boulder Canyon Project Act." Approved, December 21, 1928.

FIRST KETTNER BILL

(H. R. 6044, 66th Congress, 1st Session)

Introduced June 17, 1919

A bill to assist in increasing the productive agricultural area of the Imperial and Coachella Valleys, California, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That all unentered public lands of the United States in Imperial Valley and Coachella Valley, California, found by the Secretary of the Interior to be susceptible of irrigation from the canals the construction of which is provided for by section 6 hereof, shall be offered for sale by the Secretary of the Interior at \$10 per acre, plus the \$1.25 per acre Government charge under the desert land laws, for cash, or on deferred payments, at the option of the purchaser, one-fifth cash and the balance in four annual installments bearing interest at the rate of 6 per centum per annum from date of sale, patent to issue upon full payment of purchase price and upon proof of satisfactory water right therefor: *Provided,* That no purchaser shall be permitted to purchase more than one hundred and sixty acres under the provisions of this act: *Provided, further,* That any person having a valid entry upon lands similarly situated but not patented may, at his option, acquire title under this act by proof of satisfactory water right and upon the payment of the \$10 per acre mentioned in this section, plus any Government charge remaining unpaid.

Sec. 2. That all moneys derived from the sale of the lands mentioned in the first section hereof in excess of the Government charge of \$1.25 per acre shall be deposited in the Treasury of the United States in a special fund to be known as the "bond guaranty fund," to guarantee the payment of the principal and interest of bonds to be deposited with the Secretary of the Treasury as hereinafter provided. No privately owned lands whose reclamation has been made possible by the construction of the irrigation works hereinafter provided for shall be permitted to benefit by said works until said lands shall have first paid into the Treasury of the United States to the credit of the bond guaranty fund the sum of \$10 per acre.

Sec. 3. That when the Imperial irrigation district and such other irrigation districts or county water districts as now are or may be organized under the laws of the State of California for the purpose of irrigating the lands referred to in the first section hereof shall have duly voted and issued bonds bearing interest at a rate to be fixed by the Secretary of the Interior, not to exceed 5 per centum per annum, in sufficient amount to cover the cost of the construction of the canals and works described in section 6 hereof, as estimated by the Secretary of the Interior, and the legality and validity of such bond issue or issues shall have been duly confirmed by the courts in the manner provided by the State laws of California, the Secretary of the Interior is authorized and directed, when he shall have found the irrigation project of said district or districts to be feasible and the bonds offered not disproportionate to the security which will exist upon the completion of said canal, to accept such district bonds and deposit the same with the Secretary of the Treasury, who shall collect the principal and interest thereof and apply the same to the payment of the principal and interest of the certificates of indebtedness hereinafter authorized.

Sec. 4. That upon the receipt by the Secretary of the Treasury of such district bonds he shall issue certificates of indebtedness of the United States in amount equal to the face value of such district bonds and bearing interest at the same rate in such form as he may prescribe and in denominations of \$50 or multiples thereof, the principal and interest to be payable in gold coin of the United States, the principal and interest thereof to become due not less than sixty days after the due date of the principal and interest of the corresponding district bonds, respectively. Such certificates of indebtedness shall run for the same period as the corresponding district bonds, not exceeding, however, forty years.

Sec. 5. That from time to time, as funds may be required for construction purposes, such certificates of indebtedness shall be disposed of by the Secretary of the Treasury under such rules and regulations as he may prescribe, giving all persons an equal opportunity to subscribe therefor, but no commission shall be

allowed, and the aggregate issue of such certificates shall not exceed the amount of the district bonds deposited with the Secretary of the Treasury, and the proceeds from the sale of such certificates of indebtedness shall be deposited in a special fund to be known as the "project fund," to and for the credit of the district or districts, respectively, issuing said bonds, to be used by the Secretary of the Interior in constructing the canals and necessary works as provided in section 6 hereof.

Sec. 6. That any and all moneys that may at any time hereafter be in the Treasury of the United States to the credit of the project fund are hereby appropriated for carrying out the objects and purposes of this act. The Secretary of the Interior is hereby authorized and directed to expend such moneys for the construction of a canal and necessary works, entirely within the United States, connecting the present irrigation system of the Imperial irrigation district with Laguna Dam, substantially in accordance with the plans and specifications of the joint survey made by the United States and the Imperial Irrigation District under the contract entered into by them February 16, 1918, said canal to be of sufficient size and capacity and of proper construction to supply all lands within the present boundaries of the Imperial Irrigation District, as well as all other lands within the United States susceptible of practical reclamation by gravity flow from said canal, for which lands bonds have been voted, issued, and accepted as herein provided within a time limit to be set by the Secretary of the Interior, and also for the construction of a main line canal and necessary works connecting said above-described canal with any other district or districts whose bonds have been filed with and accepted by the Secretary of the Interior under this act; said canal to be of sufficient capacity to irrigate the arid lands within said districts susceptible of practical reclamation by gravity flow from said canal.

Sec. 7. That each district shall bear its proportionate cost of the construction of the canal or canals and necessary works serving such district, and that the proportionate amount to be paid by each of said districts for the construction of the canal or canals and necessary works above described shall be fixed and determined by the Secretary of the Interior, and shall be based upon the number of acres in each district susceptible of practical reclamation by gravity flow from said canals, and such district or districts shall issue their bonds in the amount so determined by the Secretary.

Sec. 8. That should a surplus remain from the proceeds of the sale of such certificates of indebtedness issued in connection with said project after the construction of the canal and works provided for in section 6 hereof, such surplus shall be credited as payment of interest on the bonds held by the Secretary of the Treasury on account of such project until said surplus is exhausted.

Sec. 9. That if the bond guaranty fund shall be diminished by the payment under the provisions of this act of the obligations of any district, proceedings may be at once instituted by the United States Government, or any district interested in said bond guaranty fund, to compel the defaulting district to meet its said obligations, and the money so collected shall be returned to said bond guaranty fund. When said bond guaranty fund shall have served its purpose of guaranteeing the payment of the district bonds accepted by the Government under this act it shall be applied upon the payment of the last bonds held by the Government hereunder. The funds shall be applied as nearly as possible to the payment of the bonds of the respective districts in the proportion the money was derived from the lands within said districts.

Sec. 10. That the certificates of indebtedness herein authorized shall be exempt from taxes or duties of the United States as well as from taxation in any form by or under the State, municipal, or local authority, and a sum not exceeding one-tenth of 1 per centum of the amount of the certificates of indebtedness issued under this act is hereby appropriated out of the said bond guaranty fund to pay the expenses of preparing, advertising, and issuing the same: *Provided*, That the said bond guaranty fund shall be reimbursed for such expenditure out of the proceeds of sale of such certificates of indebtedness.

Sec. 11. That the unpatented lands of the United States within the limits of any district whose bonds are accepted by the Secretary of the Interior under this act shall be subject to the provisions of the act entitled "An act to promote the reclamation of arid lands," approved August 11, 1916 (Thirty-ninth Statutes, page 506.)

Sec. 12. That all lands outside of the present boundaries of the Imperial Irrigation District reclaimed by means of the irrigation works constructed hereunder shall have a water right secondary to that of the lands within the present boundaries of the Imperial Irrigation District.

SECOND KETTNER BILL

(H. R. 11553, 66th Congress, 2d Session)

Introduced January 7, 1920

A bill for the relief of the Imperial Valley, California, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior is hereby authorized and empowered to construct a canal and necessary works, entirely within the United States, connecting the present irrigation system of the Imperial irrigation district with Laguna Dam, substantially in accordance with the plans and specifications of the joint survey made by the United States and the Imperial irrigation district under the contract entered into by them February 16, 1918, and to construct canals and other necessary works for the reclamation of all lands, public or private, which in his judgement are susceptible of successful reclamation by the diversion of water from the Colorado River by said dam; to construct such storage reservoirs and other works as in his judgment are necessary to provide an adequate supply of water for the successful irrigation of such lands, and on behalf of the United States to enter into such contracts and agreements, not inconsistent with the provisions of this Act, with the Imperial irrigation district, the Coachella Valley county water district, and other legally organized irrigation districts, water users' associations, and other legal organizations as may be necessary or expedient in carrying out the provisions of this Act, insuring compliance therewith and securing the repayment of the total costs of the said canals, reservoirs, and works, and the operation and maintenance thereof.

Sec. 2. That in carrying out the provisions of this Act the Secretary of the Interior shall find and determine the just and equitable proportion, or amount, of the cost of any such canals, reservoirs, and works to be borne by or made a charge against any such irrigation district, State land settlement board, soldier settlement board, water users' association, and other legal organizations, with due regard to the actual and comparative benefits to be derived by each thereof from the construction of such canals, reservoirs, or works, and no irrigation district, water users' association, or other organization shall receive any of the benefits of this Act nor secure the delivery of any water from the said canals, reservoirs, or works without first accepting the finding of the Secretary of the Interior, as herein provided, and paying, or entering into an agreement satisfactory to the said Secretary to pay, all costs assessed by the said Secretary, and otherwise fully complying with the provisions of this Act.

Sec. 3. That at such times as the Secretary of the Interior shall direct, in order to obtain the benefits of this Act, each irrigation district, or other legal organization containing lands to be reclaimed under the provisions of this Act, now organized or hereafter to be organized, shall issue bonds in due form as provided by State law, running for a period not exceeding forty years and bearing interest at a rate to be fixed by the Secretary of the Interior, not exceeding 5 per centum per annum, for such sum as will cover the equitable proportion or amount estimated by the Secretary of the Interior as properly chargeable to such irrigation district or other organization for the construction of such canals, reservoirs, or other works, or of any part thereof, and such district or other legal organizations shall be bound to issue such additional bonds as, in the opinion of the Secretary of the Interior, shall be found necessary to cover all expenditures on account of the lands in such districts. When the legality and validity of such bonds shall have been duly confirmed by the courts and their sufficiency for the purpose for which issued, taking into consideration the security which will exist upon the completion of said canals and works, shall have been ascertained by the Secretary of the Interior, he is authorized and empowered to accept such bonds and shall collect the principal and interest thereof and apply the same to the payment of the principal and interest when due to the United States for the cost of the irrigation works constructed under authority of this Act.

Sec. 4. That the Secretary of the Interior is hereby authorized to sell such bonds, or any number thereof, whenever they can be sold at or above their par value, and to use the proceeds thereof, first, to reimburse the United States for expenditures theretofore made under authority of this Act, and, second, for the construction of the works herein authorized. In the event any of such bonds so deposited with the Secretary of the Interior shall not be sold prior to the expiration of a period of five years from and after the announcement by the Secretary of the Interior of the completion of the works herein provided for, then the Secretary of

the Interior may immediately sell the bonds so remaining in his possession at the highest price obtainable therefor in the open market; and in the event the price so obtained is less than the par value of such bonds, any and all districts or other organizations having issued any of the bonds which have been so sold for less than the par value shall bear the loss, and each district or other organization shall pay to the United States a sum or sums equal to the difference between the par value of the bonds issued by it and the amount received from such sale; and the Secretary of the Interior, prior to the time when any such district or other organization shall receive any benefit from the provisions of this Act, shall require each such district or organization to enter into a contract or contracts with the said Secretary for the enforcement of this provision.

Sec. 5. That upon default of any installment of the principal or interest of any bond held by the Secretary of the Interior in accordance with the terms of this Act the said Secretary may declare the entire amount of such bond issue in default and thereupon he shall call upon the State or county, under the authority of which such bonds were issued, through any of its authorized agencies, or officers, to levy and enforce the payment of any taxes, forced contributions, or special assessments necessary to pay the sums due to the United States, and upon failure of the State or county authorities so to do the Secretary of the Interior shall cause suit to be instituted in the name of the United States, and take such legal action as may be necessary to enforce the assessment and collection of such taxes for the payment of the amount of principal and interest in default or the entire amount of such bond issue, principal and interest. It shall be the duty of the Attorney General to prosecute such suit, and any United States district court for the district in which the lands affected by this Act, or any part thereof, are situated, is hereby vested with jurisdiction to enforce the provisions of this Act.

Sec. 6. That the proportion or amount of the cost of the canals and works, the construction of which are authorized by this Act to be borne by any irrigation district, State land settlement board, soldier settlement board, water users' association, or other organization, as fixed and determined by the Secretary of the Interior, may be paid in cash, and when so paid shall be deposited in the Treasury to the credit of the Laguna project fund hereinafter provided for, and may be expended by the Secretary of the Interior in the same manner as money appropriated by Congress pursuant to this Act.

Sec. 7. That the public lands of the United States declared by the Secretary of the Interior to be susceptible of reclamation under the provision of this Act, and included within any irrigation district or any other similar organization the boundaries and bonds of which are accepted by the said Secretary under the terms of this Act, shall be subject to the provisions of the Act entitled "An Act to promote the reclamation of arid lands," approved August 11, 1916, (Thirty-ninth Statutes at Large, page 506), notwithstanding the district may contain more than a majority acreage of such public lands.

Sec. 8. That, except as hereinafter provided, any unentered lands of the United States found by the Secretary of the Interior to be susceptible of irrigation from the irrigation works the construction of which is provided for by this Act, may be sold when water is available therefor, to citizens of the United States, not more than one hundred and sixty acres to any one purchaser, under such rules and regulations as the said Secretary may prescribe, at the fair appraised value thereof, which shall be fixed at not less than \$10 per acre. The land so sold shall be paid for in cash, or on deferred payments, at the option of the purchaser, in installments of one-fifth cash and one-fifth annually until fully paid, with interest on the deferred payments at the rate of 6 per centum per annum from date of sale, patent to issue upon full payment of the purchase price and compliance with all of the requirements of this Act.

Sec. 9. That all unentered public lands in California susceptible of irrigation hereunder lying south of the third standard parallel and east of the Imperial irrigation district shall be set apart and reserved until water is available for said lands, and all persons who served in the military or naval forces of the United States during any period in which the United States was engaged in war and who have been honorably separated or discharged therefrom or placed in the Regular Army or Naval Reserve, shall have the exclusive right of purchase thereof in tracts not to exceed one hundred and sixty acres to any purchaser at the rate of \$1.25 per acre, for a period of six months after said lands shall be opened to purchase: *Provided*, That any of said lands may be set aside for use under any soldier-settlement plan which may hereafter be authorized by Act of Congress: *And provided further*, That the State of California shall have the option for a period

of twelve months after the passage of this Act to acquire not to exceed fifty thousand acres thereof by exchange of State lands of equal area and value, or by purchase at \$1.25 per acre for settlement under provisions of the California State land settlement Act. All of said lands purchased by persons having served in the military or naval forces, as aforesaid, shall be included in one or more of the irrigation districts to be organized under the direction of the Secretary of the Interior and subject to assessment for payment of the bonds to be issued by said districts in payment for their proportionate part of the costs and charges hereunder: *Provided, however,* That in the event the State of California shall exercise the option herein granted, then the Secretary of the Interior and the proper authorities of the State of California shall enter into an agreement whereby not more than one hundred and sixty acres of such lands shall be sold to any one purchaser, and whereby persons having served in the military or naval forces, as aforesaid, shall have a preferential right of purchase, and whereby such lands shall be pledged for the payment of the proportion of the costs and charges to which such lands may be subject, and payment thereof shall be made in the manner determined by the Secretary of the Interior.

Sec. 10. That all lands susceptible of reclamation hereunder and not now included within a legally organized irrigation or county water district, or other legal organization, shall be organized in irrigation districts in accordance with State law, according to such boundaries as may be acceptable to the Secretary of the Interior: *Provided,* That no lands in excess of one hundred and sixty acres held in private ownership by any one person, firm, or corporation shall be included in any such district, nor shall any water be delivered to more than one hundred and sixty acres of land in any one ownership therein.

Sec. 11. That any citizen of the United States who, prior to January 1, 1919, had settled upon any public lands heretofore withdrawn from entry and outside the boundaries of the Imperial irrigation district and has successfully reclaimed and irrigated said lands with water carried through the canals of Imperial irrigation district, shall have the preference right for the period of ninety days after approval of this Act to purchase such lands at the price of \$10 per acre in tracts not exceeding one hundred and sixty acres to any one person, and such unpatented lands shall be subject to the usual charges of the irrigation district within which they may lie or of any other agency serving such lands with water.

Sec. 12. That the Secretary of the Interior may cooperate with the Arizona soldier-settlement board in the reclamation and settlement of any lands lying within the State of Arizona which may be irrigated from Laguna Dam or as the result of the works herein authorized to be constructed.

Sec. 13. That all moneys received from the sale of the entered or unentered public lands under the terms of this Act shall be deposited in the Treasury and shall be available for the construction of reservoirs under the provisions of this Act: *Provided,* That when the reservoirs and other irrigation works herein provided for have been announced to have been completed by the Secretary of the Interior then the sums received from the sales of lands provided for herein and in excess of \$1.25 per acre shall be credited to the contracting districts or other organizations wherein such lands may be located.

Sec. 14. That the title to the irrigation works constructed under authority of this Act shall remain in the United States: *Provided,* That the Secretary of the Interior is hereby authorized, in his discretion, to transfer to any irrigation district or other legal organization the care, operation, and maintenance of any part of such works, subject to such rules and regulations as he may prescribe and such irrigation district or other legal organization shall thereupon be bound to assume the responsibility therefor.

Sec. 15. That as to the natural flow of the Colorado River diverted under the provisions of this Act all lands in the State of California outside the present boundaries of the Imperial irrigation district reclaimed by means of the works constructed hereunder shall have a water right secondary to that of the lands within the present boundaries of said Imperial irrigation district.

Sec. 16. That for irrigation of lands in the Republic of Mexico the Secretary of the Interior is hereby authorized and empowered to dispose of any waters which are or may become available under the terms of this Act and not now or in the future necessary for irrigation of lands lying within the United States, on such terms as said Secretary may prescribe, without incurring any obligation for delivery of any specific quantity of water at any future time, conditioned upon the right being given to the United States, or its citizens, to maintain protective levees in Mexico, jointly with the Government of Mexico or property owners therein.

and in the event any stored water shall be so disposed of there shall be paid to the Government of the United States, upon such terms and in such installments as the said Secretary may prescribe, such proportion of the cost of the works provided for by this Act and such other sums as the Secretary of the Interior, after a public hearing at which all interested parties may appear and be heard, may determine to be fair and reasonable, and the moneys so received shall be created, respectively, to the districts and other legal organizations contributing to the cost of the works herein provided for in the proportions to be determined by said Secretary.

Sec. 17. That whenever practicable preference shall be given to honorably discharged soldiers, sailors, and marines when labor is employed on any work done under authority of this Act: *Provided*, That the rights and benefits conferred by this Act shall not extend to any person who, having been drafted for military service under the provisions of the selective-service Act, shall have refused to render such service or to wear the uniform of the United States.

Sec. 18. That there is hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act and such sums, when appropriated by Congress, shall be deposited in the Treasury and set aside in a special fund to be known as the Laguna project fund.

Sec. 19. That nothing in this Act contained shall be construed as in any way amending or affecting the Act to provide for an auxiliary reclamation project in connection with the Yuma project, Arizona, approved January 25, 1917, or as modifying the terms of the contract of October 23, 1918, between the United States and the Imperial irrigation district, and the construction charge per acre as heretofore fixed by the Secretary of the Interior for the lands of the Yuma reclamation project shall be proportionately reduced by the sums to be paid by the Imperial irrigation district for the right to use the Laguna Dam, as provided in section 9 of said contract.

Sec. 20. That the Secretary of the Interior is hereby authorized to perform any and all acts, to make rules and regulations for the disposal of the lands herein mentioned so as to assure the organization of the districts and the issuance of bonds herein provided for, to determine when water is available for the lands provided herein to be sold or disposed of, and to make such rules and regulations as in his opinion may be necessary and proper for the purpose of carrying the provisions of this Act into full force and effect.

FIRST SWING-JOHNSON BILL

(H. R. 11449, 67th Congress, 2d Session)

Introduced April 25, 1922

A bill to provide for the protection and development of the lower Colorado River Basin.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of providing for the regulation, control, and development of the Colorado River, an international, interstate, and navigable stream, in accordance with a comprehensive and unified plan, conserving natural resources, and aiding flood control, water supply, and power development, the United States hereby reserves to itself the exclusive right to construct, provide, and control dams, reservoirs, or diversion works upon the main trunk of said river below the mouth of the Green River.

Sec. 2. That, for the purpose of regulating the lower Colorado River and controlling the floods therein, providing storage of water for irrigation, securing the development of electrical power, and providing homes for honorably discharged men and women of the United States Army, Navy, and Marine Corps who served therein during the war with Germany, the War with Spain, or in the suppression of the insurrection in the Philippines, the Secretary of the Interior is hereby authorized and empowered to construct a dam and incidental works for the purpose of providing a reservoir at or near Boulder Canyon on said river, adequate for the purposes aforesaid, and to acquire by proceedings in eminent domain or otherwise all lands and rights of way necessary for the said reservoir and incidental works; also to construct a main canal and appurtenant structures located entirely within the United States, connecting the Laguna Dam on said river with the Imperial and Coachella Valleys, in California, together with such other canals and structures as may be required for the distribution and delivery of water from said reservoir and said river to lands in the United States which said Secretary may find practicable of irrigation and reclamation therefrom, and to acquire by proceedings

in eminent domain or otherwise all rights of way necessary for such canals and structures. No expenditures for the construction of canals or appurtenant structures authorized hereunder shall be made until the lands to be irrigated thereby shall have first been legally obligated to repay their proper portions, as may be determined by the Secretary of the Interior, of the total costs thereof to the United States in accordance with the terms of repayment prescribed in the Act of Congress approved June 17, 1902, entitled "An Act appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation works for the reclamation of arid lands," and Acts amendatory thereof or supplementary thereto, hereinafter referred to as the reclamation law.

Sec. 3. That the Secretary of the Interior is empowered to receive applications for the right to use for the generation of electrical power portions of the water discharged from said reservoir and available for the generation of electrical power at said dam, and, after full hearing of all concerned, to allocate to such applicants such portions of such power privileges as, in his judgment, may be consistent with an equitable distribution thereof among the various interested States and among the various interested communities in each State. The said Secretary, in making such allocation, may give consideration to the plans of the various applicants, having regard to their relative adaptability to utilize such power privileges in the public interest, and at reasonable cost to the communities served: *Provided*, That subject to such allocations he shall give preference to applications made by political subdivisions.

Sec. 4. That the said Secretary is authorized to make leases of the power privileges so allocated, limited to fifty years, on such terms and under such regulations as he may prescribe, and to fix what he may find to be a reasonable compensation therefor. Upon or after the expiration of any such lease, or renewal thereof, the United States may take over the property of the lessee which is dependent for its usefulness upon the continuation of the lease, and if it shall do so shall pay to the lessee its net investment in the property taken, not exceeding the fair value thereof at the time it is so taken, with reasonable severance damages to property of the lessee not taken. Such net investment, or fair value and damages, if not agreed upon, shall be fixed by a proceeding in equity in the district court of the United States in the district in which such property, or some part thereof, is situated. If the United States does not exercise its right to take over such property, the Secretary of the Interior may, by agreement with the lessee, renew the said lease for not more than fifty years, or in his discretion may make a lease under the terms hereof to a new lessee, upon the condition that such new lessee shall pay to the former lessee such net investment and damages determined as aforesaid. If such property is not taken over by the United States, or such new lessee, or such lease renewed, the said Secretary shall extend such lease from year to year until such property is so taken over or such lease renewed.

Sec. 5. That any such political subdivision, instead of entering into a lease, may, with the consent of the Secretary of the Interior, as the consideration for such power privileges as may be allocated to it as above provided, pay to the United States in annual installments, during such period not exceeding twenty-five years as may be agreed upon, a total sum which shall bear the same proportion to the cost of constructing such dam and incidental works and acquiring lands and rights of way for said reservoir and incidental works, as the water allocated to such political subdivision bears to all the water available for the generation of power at said dam, together with a like proportion of the annual expense of operating and maintaining such dam and incidental works, and interest at the rate of 5 per centum per annum on the unpaid portion of such proportionate part of such cost. Any or all of the installments of such proportionate part of such cost may be paid in advance. The right to use for the generation of electrical power the water so allocated, shall continue after the completion of the payment of such proportionate part of such cost, so long as such political subdivision shall pay annually such proportionate part of such expense of operating and maintaining such dam and incidental works. The said Secretary is authorized on such terms and under such regulations as he may prescribe to make any contracts which may be necessary to carry into effect the provisions of this section. The title to said dam and incidental works and reservoir site shall forever remain in the United States. Until the completion of said dam and incidental works the Secretary of the Interior is authorized to use any money received under this and the preceding section for the construction of said dam and incidental works.

Sec. 6. That the right to develop power from the water in any canal constructed under this Act, at points along such canal, shall belong to the districts,

communities, and lands which contribute to the construction costs of such canal and appurtenant structures, in proportion to their contributions: *Provided*, That so long as any money is owing to the United States on account of the construction of said canals and appurtenant structures, the Secretary of the Interior shall control the disposition of said rights to develop power and the net proceeds from any power development in said canals shall be applied upon such construction charges and covered into the Treasury of the United States, and credited to the various districts, communities, and lands in accordance with their interests in said canals.

Sec. 7. That no part of the cost of the construction of said dam or incidental works, or the acquisition of lands or rights of way for said reservoir, or incidental works, shall be charged against any lands to be irrigated therefrom, but the total cost of all irrigation canals and appurtenant structures which may be constructed hereunder shall be charged equitably against such lands, in accordance with the benefits they derive therefrom as may be determined by the Secretary of the Interior.

Sec. 8. That the dam and reservoir provided for by section 2 of this Act shall be used, first, for river regulation and flood control; second, for irrigation; and third, for power.

Sec. 9. That nothing contained in this Act shall be construed as limiting, diminishing, or in any manner interfering with any vested rights of the States above said reservoir, or of the citizens of said States, to the use, within the Colorado River watershed, of the waters of said Colorado River.

Sec. 10. That all lands of the United States found by the Secretary of the Interior to be practicable of irrigation and reclamation by the irrigation works authorized by the terms of this Act shall be withdrawn from public entry. Thereafter when such works shall have been so far constructed as to permit the delivery of water to any portion of said withdrawn lands which the Secretary of the Interior shall deem proper to open for entry, such portion of said lands shall be opened to entry in tracts, varying in size, but not exceeding one hundred and sixty acres, as may be determined by the Secretary of the Interior, in accordance with the provisions of the reclamation law, and any such entryman shall pay the proportionate share, as determined by the said Secretary, of the construction cost of the canal or canals and appurtenant structures, constructed for the irrigation and reclamation of said lands, as provided for by this Act, such construction cost to be paid in such installments, and at such times as may be specified by the Secretary of the Interior, in accordance with the provisions of the said reclamation law: *Provided*, That all persons who have served in the United States Army, Navy, or Marine Corps during the war with Germany, the war with Spain, or in the suppression of the insurrection in the Philippines, and who have been honorably separated or discharged therefrom or placed in the Regular Army or Navy Reserve, shall have the exclusive preference right for a period of three months to enter said lands; and also, so far as practicable, preference shall be given to said persons in all construction work authorized by this Act: *Provided*, That in the event such an entry shall be relinquished at any time prior to actual residence upon the land by the entryman for not less than one year, lands so relinquished shall not be subject to entry for a period of sixty days after the filing and notation of the relinquishment in the local land office, and shall, after the expiration of such sixty-day period, be subject to entry by the first qualified applicant.

Sec. 11. That for the purpose of constructing said dam and incidental works, and acquiring lands and rights of way for said reservoir and incidental works, and constructing said main canal from Laguna Dam to Imperial and Coachella Valleys, and appurtenant structures and acquiring rights of way therefor, there is hereby authorized to be appropriated, from any moneys in the Treasury not otherwise appropriated, such amounts as may be necessary to carry out the purposes of this Act, not exceeding in the aggregate the sum of \$70,000,000, to be appropriated from time to time upon estimates made by the Secretary of the Interior and transferred to the reclamation fund established under said reclamation law. All moneys received under leases and contracts authorized by sections 4 and 5 of this Act, in excess of the expense of operating and maintaining said dam and incidental works, and not used for construction as provided in section 5 hereof, shall be covered into the Treasury of the United States. All moneys transferred from the General Treasury to the reclamation fund, and used for the construction of any canal or appurtenant structures authorized under this Act, shall be repaid by the districts, communities, and lands benefited thereby, and the Secretary of the Interior is hereby empowered, after a full hearing of all concerned, to allocate the costs of

any such canal and appurtenant structures among the various districts, communities, and lands served thereby, according to the benefits derived therefrom.

Sec. 12. That nothing in this Act shall be construed as modifying in any manner the existing contract, dated October 23, 1918, between the United States and Imperial irrigation district, providing for a connection with Laguna Dam; but the Secretary of the Interior is authorized to modify the said contract, with the consent of said district, in order to provide for the construction, in accordance with the terms of this Act, of a canal or canals and appurtenant structures, adequate to serve the lands of said district, and other lands that may be served thereby, and to equitably allocate the costs thereof.

Sec. 13. That wherever the words "political subdivision" or "political subdivisions" are used herein they shall be understood to include any State, district, municipality, or other governmental organization.

SECOND SWING-JOHNSON BILL

(H. R. 2903, 68th Congress, 1st Session)

Introduced December 10, 1923

A bill to provide for the protection and development of the lower Colorado River Basin.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of regulating the lower Colorado River and controlling the floods therein, providing storage of water for irrigation and other beneficial uses, securing the development of electrical power, and providing homes for honorably discharged men and women of the United States Army, Navy, and Marine Corps who served therein during the war with Germany; the war with Spain, or in the suppression of the insurrection in the Philippines, the Secretary of the Interior is hereby authorized and empowered to construct a dam and incidental works for the purpose of providing a reservoir at or near Boulder Canyon on said river, adequate for the purposes aforesaid, and to acquire by proceedings in eminent domain or otherwise all lands and rights of way necessary for the said reservoir and incidental works; also to construct a main canal and appurtenant structures located entirely within the United States, connecting the Laguna Dam on said river with the Imperial and Coachella Valleys, in California; also to construct such other canals and structures as may be required for the delivery of water from said reservoir and said river to lands in the States of Arizona, Nevada, and California, which said Secretary may find practicable of irrigation and reclamation therefrom, and to acquire by proceedings in eminent domain or otherwise all rights of way necessary for such canals and structures; *provided, however,* That no expenditures for the construction of canals or appurtenant structures authorized hereunder shall be made until the lands to be irrigated thereby shall have first been legally obligated to repay their proper portions, as may be determined by the Secretary of the Interior, of the total cost thereof to the United States in accordance with the terms of repayment prescribed in the act of Congress approved June 17, 1902, entitled "An act appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation works for the reclamation of arid lands," and acts amendatory thereof or supplementary thereto, hereinafter referred to as the reclamation law.

Sec. 2. That the Secretary of the Interior is empowered to receive applications for the right to use for the generation of electrical power portions of the water discharged from said reservoir and available for the generation of electrical power at said dam, and, after full hearing of all concerned, to allocate to such applicants such portions of such power privileges as, in his judgment, may be consistent with an equitable distribution thereof among the various interested States and among the various interested communities in each State. The said secretary, in making such allocation, may give consideration to the plans of the various applicants, having regard to their relative adaptability to utilize such power privileges in the public interest, and at reasonable cost to the communities served; *Provided,* That subject to such allocations he shall give preference to applications made by political subdivisions.

Sec. 3. That the said secretary is authorized to make leases of the power privileges so allocated, limited to fifty years on such terms and under such regulations as he may prescribe, and to fix what he may find to be a reasonable compensation therefor. Upon or after the expiration of any such lease, or renewal thereof, the United States may take over the property of the lessee which is dependent for its

usefulness upon the continuation of the lease, and if it shall do so, shall pay to the lessee its net investment in the property taken, not exceeding the fair value thereof at the time it is so taken, with reasonable severance damages to property of the lessee not taken. Such net investment, or fair value and damages, if not agreed upon, shall be fixed by a proceeding in equity in the district court of the United States in the district in which such property, or some part thereof is situated. If the United States does not exercise its right to take over such property, the Secretary of the Interior may renew the said lease for not more than fifty years or in his discretion may make a lease under the terms hereof to a new lessee, upon the condition that such new lessee shall pay to the former lessee such net investment and damages determined as aforesaid. If such property is not taken over by the United States, or such new lessee, or such lease renewed, the said secretary shall extend such lease from year to year until such property is so taken over or such lease renewed. Compensation for leases, renewals, extensions, and new leases shall be fixed with a view to the United States receiving such payments and revenue therefrom, as with the payments and revenue from rights disposed of under section 4 hereof, will cover all expenses of operating and maintaining the said dam and incidental works and in addition thereto reimburse the United States for the entire cost of such dam and incidental works within a period of not to exceed fifty years from completion thereof.

Sec. 4. That any such political subdivision, instead of entering into a lease, may, as the consideration for such power privileges as may be allocated to it as above provided, pay to the United States in annual installments, during such period not exceeding twenty-five years as may be agreed upon, a total sum which shall bear the same proportion to the cost of constructing such dam and incidental works and acquiring lands and rights of way for said reservoir and incidental works, as the water allocated to such political subdivision bears to all the water available for the generation of power at said dam, together with a like proportion of the annual expense of operating and maintaining such dam and incidental works, and interest at the rate of 5 per centum per annum on the unpaid portion of such proportionate part of such cost. Any or all of the installments of such proportionate part of such cost may be paid in advance. The right to use for the generation of electrical power the water so allocated shall continue after the completion of the payment of such proportionate part of such cost so long as such political subdivision shall pay annually such proportionate part of such expense of operating and maintaining such dam and incidental works. The said Secretary is authorized, on such terms and under such regulations as he may prescribe, to make any contracts which may be necessary to carry into effect the provisions of this section. The title to said dam and incidental works and reservoir site shall forever remain in the United States. Until the completion of said dam and incidental works the Secretary of the Interior is authorized to use any money received under this and the preceding section for the construction of said dam and incidental works.

Sec. 5. That the right to develop power from the water in any canal constructed under this act, at points along such canal, shall belong to the districts, communities, and lands which contribute to the construction costs of such canal and appurtenant structures, in proportion to their contributions: *Provided*, That so long as any money is owing to the United States on account of the construction of said canals and appurtenant structures the Secretary of the Interior shall control the disposition of said rights to develop power, and the net proceeds from any power development in said canals shall be applied upon such construction charges and covered into the Treasury of the United States and credited to the various districts, communities and lands in accordance with their interests in said canals.

Sec. 6. That no part of the cost of the construction of said dam or incidental works, or the acquisition of lands or rights of way for said reservoir, or incidental works shall be charged against any lands to be irrigated therefrom, but the total cost of all irrigation canals and appurtenant structures which may be construction hereunder shall be charged equitably against such lands, in accordance with the benefits they derive therefrom as may be determined by the Secretary of the Interior.

Sec. 7. That the dam and reservoir provided for by section 1 of this act shall be used, first, for river regulation and flood control; second, for irrigation and domestic use; and, third, for power.

Sec. 8. That nothing contained in this act shall be construed as limiting, diminishing, or in any manner interfering with any right of the States above said reservoir, or of the citizens of said States, to the use of the waters of said Colorado River or its tributaries.

Sec. 9. That all lands of the United States found by the Secretary of the Interior to be practicable of irrigation and reclamation by the irrigation works authorized by the terms of this act shall be withdrawn from public entry. Thereafter when such works shall have been so far constructed as to permit the delivery of water to any portion of said withdrawn lands which the Secretary of the Interior shall deem proper to open for entry, such portion of said lands shall be opened to entry in tracts, varying in size, but not exceeding one hundred and sixty acres, as may be determined by the Secretary of the Interior, in accordance with the provisions of the reclamation law, and any such entryman shall pay the proportionate share, as determined by the said Secretary, of the construction cost of the canal or canals and appurtenant structures, constructed for the irrigation and reclamation of said lands, as provided for by this act, such construction cost to be paid in such installments, and at such times as may be specified by the Secretary of the Interior, in accordance with the provisions of the said reclamation law: *Provided*, That all persons who have served in the United States Army, Navy, or Marine Corps during the war with Germany, the war with Spain, or in the suppression of the insurrection in the Philippines, and who have been honorably separated or discharged therefrom or placed in the Regular Army or Navy Reserve, shall have the exclusive preference right for a period of three months to enter said lands; and also, so far as practicable, preference shall be given to said persons in all construction work authorized by this act: *Provided*, That in the event such an entry shall be relinquished at any time prior to actual residence upon the land by the entryman for not less than one year, lands so relinquished shall not be subject to entry for a period of sixty days after the filing and notation of the relinquishment in the local land office, and shall, after the expiration of such sixty-day period, be subject to entry by the first qualified applicant.

Sec. 10. That for the purpose of constructing said dam and incidental works, canals and appurtenant structures, and acquiring lands and rights of way therefor, there is hereby authorized to be appropriated, from any moneys in the Treasury not otherwise appropriated, such amounts as may be necessary to carry out the purposes of this act, not exceeding in the aggregate the sum of \$70,000,000 to be appropriated from time to time upon estimates made by the Secretary of the Interior and transferred to the reclamation fund established under said reclamation law. All moneys received under leases and contracts authorized by sections 3 and 4 of this act, in excess of the expense of operating and maintaining said dam and incidental works, and not used for construction as provided in section 4 hereof, shall be covered into the Treasury of the United States. All moneys transferred from the General Treasury to the reclamation fund, and used for the construction of any canal or appurtenant structures authorized under this act, shall be repaid by the districts, communities, and lands benefited thereby, and the Secretary of the Interior is hereby empowered, after a full hearing of all concerned, to allocate the costs of any such canal and appurtenant structures among the various districts, communities, and lands served thereby, according to the benefits derived therefrom.

Sec. 11. That nothing in this act shall be construed as modifying in any manner the existing contract, dated October 23, 1918, between the United States and Imperial irrigation district, providing for a connection with Laguna Dam; but the Secretary of the Interior is authorized to modify the said contract, with the consent of the said district, or to enter into a new contract or contracts with the said district, or any private corporation or any corporation subsidiary to said district, in order to provide for the construction, in accordance with the terms of this act, of a canal or canals and appurtenant structures, adequate to serve the lands of said district, and other lands that may be served thereby, and to equitably allocate the costs thereof.

Sec. 12. That wherever the words "political subdivision" or "political subdivisions" are used herein they shall be understood to include any State, district, municipality, or other governmental organization.

THIRD SWING-JOHNSON BILL

H. R. 6251 was the bill originally introduced December 21, 1925, and when this bill was submitted to the Secretary of the Interior, Honorable Hubert Work, he made some suggestions regarding this and the companion bill, S. 1868. Acting upon these suggestions a new bill was drafted as a substitute and H. R. 9826 was introduced February 27, 1926, and this latter bill was the one discussed in the committee hearings. Texts of both bills are given. (J.L.B.) Ref: Hearings H. R. 6251 and H. R. 9826, Part 2, Foreword.

(H. R. 6251, 69th Congress, 1st Session)

Introduced December 21, 1925

A bill to provide for the protection and development of the lower Colorado River Basin.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of regulating the lower Colorado River, controlling the floods therein and equating and stabilizing the flow thereof, providing storage of the waters thereof for reclamation and other beneficial uses within the United States, making possible the development of electrical power and providing of homes for honorably discharged men and women of the United States Army, Navy, and Marine Corps who served therein during the war with Germany, the war with Spain or in the suppression of the insurrection in the Philippines, the Secretary of the Interior is hereby authorized and directed to construct a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon adequate to create a storage reservoir of a capacity of not less than 20,000,000 acre-feet of water and to acquire by proceedings in eminent domain or otherwise all lands and rights of way necessary for said dam, reservoir, and incidental works; also to construct a main canal and appurtenant structures located entirely within the United States, connecting the Laguna Dam or other suitable diversion works to be located and constructed by the said Secretary, on said river, with the Imperial and Coachella Valleys in California; also to construct such other canals and structures as may be required for the delivery of water from said reservoir and said river to lands in the States of Arizona, Nevada, and California, which said Secretary may find practicable of irrigation and reclamation therefrom and to acquire by proceedings in eminent domain or otherwise all rights of way necessary for such canals and structures: *Provided, however,* That no expenditures for the construction of canals or appurtenant structures authorized hereunder shall be made until the lands to be irrigated thereby shall have first been legally obligated to repay their proper portions, according to benefits, as may be determined by the said Secretary, of the total costs thereof, together with expenses of their operation and maintenance, to the United States in accordance with the terms and conditions of repayment prescribed in the act of Congress approved June 17, 1902, entitled "An act appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation works for the reclamation of arid lands" and acts amendatory thereof or supplementary thereto, hereinafter referred to as the reclamation law: *Provided, however,* That the said Secretary shall so fix annual installments as to provide for complete repayment to the United States of the total construction, operation, and maintenance charges within twenty years from and after the completion of said canals and appurtenant structures.

Sec. 2. That the Secretary of the Interior is empowered to receive applications for the right to use for the generation of electrical power portions of the water discharged from said reservoir and available for the generation of electrical power at said dam, and, after full hearing of all concerned, to allocate to such applicants such portions of such power privileges as in his judgment may be consistent with an equitable distribution thereof among the various interested States and among the various interested communities in each State. Subject to such distribution the said Secretary shall give preference to applications made by political subdivisions, provided the plans for the same are deemed by said Secretary equally well adapted, or shall within a reasonable time to be fixed by the said Secretary be made equally well adapted, to utilize such power privileges in the public interest; and as between other applicants he may give preference to the applicant the plans of which he finds and determines are best adapted to utilize such power privileges in the public interest, if he be satisfied as to the ability of the applicant to carry out such plans: *Provided, however,* That no application of a political subdivision for an allocation of power privileges shall be denied or another application in conflict therewith be granted on the ground that the bond issue of such political subdivision, necessary to enable

the applicant to utilize the allocation of power privileges applied for, has not been authorized or marketed, until after a reasonable opportunity has been given to such applicant to have such bond issue authorized and marketed.

Sec. 3. That the said Secretary is authorized to make leases of the power privileges so allocated, limited to fifty years, on such terms and under such general regulations as he may prescribe, and to fix what he may find to be a reasonable compensation therefor: *Provided*, That the compensation to be paid by each allottee shall include the payment to the United States of one-half of the total rentals prescribed by the said Secretary for the allotment, in five equal annual installments, of which the first one shall be paid within one year after such allotment and upon execution of the lease therefor, and one each year thereafter for four successive years. Upon or after the expiration of any such lease, or renewal thereof, the United States may take over the property of the lessee which is dependent for its usefulness upon the continuation of the lease, and if it shall do so shall pay to the lessee its net investment in the property taken, not exceeding the fair value thereof at the time it is so taken, with reasonable severance damages to property of the lessee not taken. Such net investment or fair value and damages, if not agreed upon, shall be fixed by a proceeding in equity in the district court of the United States in the district in which such property, or some part thereof is situated. If the United States does not exercise its right to take over such property, the Secretary of the Interior may renew the said lease for not more than fifty years, or, in his discretion, may make a lease under the terms hereof to a new lessee, upon the condition that such new lessee shall pay to the former lessee such net investment and damages determined as aforesaid. If such property is not taken over by the United States, or such new lessee, or such lease renewed, the said Secretary shall extend such lease from year to year until such property is so taken over or such lease renewed.

Compensation for leases, renewals, extensions, and new leases shall be fixed with a view to the United States receiving such payments and revenue therefrom, as, with the payments and revenue from rights disposed of under section 4 hereof, will cover all expenses of operating and maintaining the said dam and incidental works, and in addition thereto reimburse the United States for the entire cost of such dam and incidental works, including the acquisition of necessary lands and rights of way for said reservoir and incidental works, together with interest at the rate of 4 per cent per annum, within a period of not to exceed 50 years from completion thereof.

Sec. 4. That any such political subdivision, instead of entering into a lease, may, as the consideration for such power privileges as may be allocated to it as above provided, pay to the United States in annual installments, during such period not exceeding 25 years as may be agreed upon, a total sum which shall bear the same proportion to the cost of constructing such dam and incidental works and acquiring lands and rights of way for said reservoir and incidental works as the water allocated to such political subdivision bears to all the water available for the generation of power at said dam, together with a like proportion of the annual expense of operating and maintaining such dam and incidental works, and interest at the rate of 4 per centum per annum on the unpaid portion of such proportionate part of such cost. Any or all of the installments of such proportionate part of such cost may be paid in advance: *Provided*, That, in any event, such political subdivision shall pay to the United States within five years from and after the making of such allotment one-half of the total amount to be paid by such political subdivision under this section. The right to use for the generation of electrical power the water so allocated shall continue after the completion of the payment of such proportionate part of such cost so long as such political subdivision shall pay annually its proportionate part of such expense of operating and maintaining such dam and incidental works. The said Secretary is authorized on such terms and under such general regulations as he may prescribe to make any contracts which may be necessary to carry into effect the provisions of this section.

The use is hereby authorized of such public and reserved lands of the United States as the said Secretary shall determine to be necessary or convenient for the construction, operation, and maintenance of power plants, works, and transmission lines under the allocations in this act provided for.

Sec. 5. The title to canals and incidental works in connection therewith shall remain in the United States until such time as the United States shall have been reimbursed for the cost thereof, together with expenses incurred in their operation and maintenance, whereupon the said Secretary shall transfer title to such

canals and incidental works to the districts or other agencies or owners of land paying therefor: *Provided*, That the right to develop power from the water in any canal constructed under this act, at points along such canal, shall belong to the districts, communities, and lands which contribute to the construction costs of such canal and appurtenant structures, in proportion to their contributions: *And provided, further*, That so long as any money is owing to the United States on account of the construction of said canals and appurtenant structures, the net proceeds from any power development in said canals shall be applied upon such construction charges and covered into the Treasury of the United States, and credited to the various districts, communities, and lands in accordance with their interests in said canals.

Sec. 6. That no part of the cost of the construction of said dam or incidental works, or the acquisition of lands or rights of way for said reservoir or incidental works, shall be charged against any lands to be irrigated therefrom.

Sec. 7. That the dam and reservoir provided for by section 1 hereof shall be used first, for river regulation and flood control; second, for domestic and irrigation use; and third, for power. The title to said dam and incidental works and reservoir created thereby shall forever remain in the United States and the United States shall always control, manage, and operate the same.

Sec. 8. (a) That the United States, in managing and operating the dam, canals, and other works herein authorized, including the delivery of water for the generation of power, irrigation, or other uses, shall observe and be subject to and controlled by the Colorado River Compact as signed at Santa Fe, New Mexico, on November 24, 1922, and particularly described in section 13 herein.

(b) All rights of the United States in or to waters of the Colorado River howsoever acquired, as well as the rights hereafter arising of those claiming under the United States, shall be subject to and controlled by said compact.

(c) Also all patents, grants, contracts, concessions, leases, permits, licenses, rights of way, or other privileges from the United States or under its authority, necessary or convenient for the use of waters of the Colorado River, or for the generation or transmission of hydroelectric power generated by means of the waters of said river, shall be upon the express condition and with the express covenant that the rights of the recipients or holders thereof to waters of the river, for the use of which the same is necessary, convenient, or incidental, shall likewise be subject to and controlled by said compact.

(d) The conditions and covenants referred to herein shall be deemed to run with the land and water right, and shall attach as a matter of law, whether set out or referred to in the instrument evidencing any such patent, grant, contract, concession, lease, permit, license, right of way, or other privilege from the United States or under its authority, or not, and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and the users of water thereunder, by way of defense or otherwise, in any litigation respecting the waters of the Colorado River.

Sec. 9. That all lands of the United States found by the Secretary of the Interior to be practicable of irrigation and reclamation by the irrigation works authorized by the terms of this act shall be withdrawn from public entry. Thereafter when such works shall have been so far constructed as to permit the delivery of water to any portion of said withdrawn lands, which the Secretary of the Interior shall deem proper to open for entry, such portion of said land shall be opened to entry in tracts varying in size but not exceeding one hundred and sixty acres, as may be determined by the Secretary of the Interior, in accordance with the provisions of the reclamation law, and any such entryman shall pay the proportionate share, as determined by the said Secretary, or the construction cost of the canal or canals and appurtenant structures constructed for the irrigation and reclamation of said lands, as provided for by this act, such construction cost to be paid in such installments and at such times as may be specified by the Secretary of the Interior, in accordance with the provisions of the said reclamation law: *Provided*, That all persons who have served in the United States Army, Navy, or Marine Corps during the war with Germany, the war with Spain, or in the suppression of the insurrection of the Philippines, and who have been honorably separated or discharged therefrom or placed in the Regular Army or Navy Reserve, shall have the exclusive preference right for a period of three months to enter said lands; and also, so far as practicable, preference shall be given to said persons in all construction work authorized by this act: *Provided*, That in the event such an entry shall be relinquished at any time prior to actual residence upon the land by the entryman for not less than one year, lands so relinquished shall not be subject to entry for a period of sixty days after the filing and notation of the relinquish-

ment in the local land office, and after the expiration of said sixty-day period such lands shall be open to entry, subject to the preference in this section provided.

Sec. 10. That for the purpose of constructing said dam and incidental works, canals, and appurtenant structures and acquiring lands and rights of way therefor there is hereby authorized to be appropriated from any moneys in the Treasury not otherwise appropriated such amounts as may be necessary to carry out the purposes of this act, not exceeding in the aggregate the sum of \$70,000,000, to be appropriated from time to time, upon estimates made by the Secretary of the Interior, and transferred to a subfund of the reclamation fund established under said reclamation law and to be designated "Boulder Dam project fund." All moneys received from the allocation of power rights or privileges at said dam or moneys received under contracts respecting the construction of canals and not used for construction purposes shall be covered into the Treasury of the United States. Moneys thus received during the course of construction are hereby reappropriated for said construction purposes for which said moneys were received, and moneys received on account of expenses of operation are hereby reappropriated for such purposes.

Sec. 11. That nothing in this act shall be construed as modifying in any manner the existing contract, dated October 23, 1918, between the United States and Imperial irrigation district, providing for a connection with Laguna Dam; but the Secretary of the Interior is authorized to modify the said contract, with the consent of the said district, or to enter into a new contract or contracts with the said district or any private corporation or any corporation subsidiary to said district, in order to provide for the construction, in accordance with the terms of this act, of a canal, or canals, and appurtenant structures, adequate to serve the lands of said district, and other lands that may be served thereby, and to equitably allocate the costs thereof.

Sec. 12. "Political subdivision" or "political subdivisions" as used herein shall be understood to include any State, irrigation, or other district, municipality, or other governmental organization.

"Net investment" as used herein shall be understood to mean "net investment" as defined by the Federal water power act, plus such portions of annual or other payments as shall be used by the Secretary of the Interior for construction purposes or to amortize the cost of said dam, lands, rights of way, and incidental works, which portions of said annual or other payments are hereby declared to be capital investment.

Sec. 13. The Colorado River compact signed by the commissioners of the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and by Herbert Hoover, as the representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922, pursuant to act of Congress approved August 19, 1921, entitled "An act to permit a compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," is hereby approved by the Congress of the United States, and the provisions of the first paragraph of Article 11 of the said Colorado River compact, making said compact binding and obligatory when it shall have been approved by the legislature of each of the signatory States, are hereby waived, and this approval shall become effective when by act or resolution of their respective legislatures at least six of the signatory States shall have approved or may hereafter approve said compact, and shall consent to such waiver.

Sec. 14. This act shall be deemed a supplement to the reclamation law, which said reclamation law shall govern the construction, financing, and management of the works herein authorized, except as otherwise herein provided.

(This bill was substituted for H. R. 6251.)

(H. R. 9826, 69th Congress, 1st Session)

Introduced February 27, 1926

A bill to provide for the protection and development of the lower Colorado River Basin.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, for the purpose of regulating the lower Colorado River, controlling the floods therein and equating and stabilizing the flow thereof, providing storage of the waters thereof for reclamation of public lands and other beneficial uses within the United States, and for the generation of

electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior is hereby authorized and directed to construct, operate, and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon adequate to create a storage reservoir of a capacity of not less than twenty-six million acre feet of water and a main canal and appurtenant structures located entirely within the United States connecting the Laguna Dam or other suitable diversion works to be located and constructed by the said Secretary on said river as a part of said canal with the Imperial and Coachella Valleys in California; also to construct and equip, operate and maintain at or near said dam a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from said reservoir; and to acquire by proceedings in eminent domain, or otherwise, all lands, rights of way and other property necessary for said purposes.

Sec. 2. That the Secretary of the Treasury is hereby authorized to borrow on the credit of the United States from time to time as the proceeds may be required to defray the expenditures authorized by this act (such proceeds when received to be deposited in a subfund of the reclamation fund established under the reclamation law and to be designated "Colorado River Dam Fund" and to be used only for the purpose of meeting such expenditures) the sum of \$125,000,000, or so much thereof as may be necessary, and to prepare and issue therefor coupon or registered bonds of the United States, in such form and denomination as he may determine, redeemable in gold coin at the pleasure of the United States after fifteen years from the date of their issue and payable in not to exceed fifty years from such date, and bearing interest at a rate not exceeding 4 per centum per annum, payable semiannually in gold coin: *Provided, however,* That the Secretary of the Treasury, in his discretion, may, at the request of the Secretary of the Interior, issue said bonds in series maturing in successive years commencing not earlier than fifteen years from the date of their issue, but all maturing in not to exceed fifty years from such date.

Sec. 3. That the sum of \$105,000,000 is hereby authorized to be appropriated from said subfund from time to time upon estimates of the Secretary of the Interior for the construction of the works herein authorized; and the Secretary of the Treasury is hereby authorized to pay out of the unappropriated balance in said subfund interest on said bonds during the period of the construction of the said works and until revenue therefrom for such purpose is received. Revenues from said project shall also be deposited in said subfund and are hereby reappropriated for operation and maintenance purposes, and payment of interest upon and amortization of said bonds.

Sec. 4. (a) No work shall be begun and no moneys expended on or in connection with the works or structures provided for in this act, and no water rights shall be initiated hereunder, until the respective legislatures of at least six of the signatory States mentioned in section 12 hereof shall have approved the Colorado River Compact mentioned in said section 12, and shall have consented to a waiver of the provision of the first paragraph of article 11 of said compact making the same binding and obligatory when it shall have been approved by the legislatures of each of the seven signatory States, and until the President, by public proclamation, shall have declared that the said compact has been approved by and become binding and obligatory upon at least six of the signatory States.

(b) Before any bonds shall be issued or sold, or any construction work done or contracted for, the said Secretary shall provide for revenue hereunder, by contract or otherwise, adequate, in his judgment, to insure payment of operation and maintenance expense of the works herein authorized to be constructed, interest on bonds (except interest during construction), and amortize the bonds within fifty years.

Sec. 5. That the said Secretary is hereby authorized, under such general regulations as he may prescribe, to contract for storage of water in said reservoir and for the delivery thereof at such points on the river and on said canal as may be agreed upon, for irrigation and domestic uses, and delivery at the switchboard to municipal corporations, political subdivisions, and private corporations of electrical energy generated at said dam, upon charges that will provide revenue which, in addition to other revenues accruing to the said subfund under the reclamation law or hereunder, will cover operation and maintenance expense of works constructed hereunder, interest on bonds after completion of the works, and provide for the amortization of said bonds within fifty years. Contracts respecting water

for domestic uses may be for permanent service but subject to rights of prior appropriators.

After the amortization of said bonds charges shall be on such basis as may hereafter be prescribed by the Congress.

General and uniform regulations shall be prescribed by the said Secretary for the awarding of contracts for the sale and delivery of electrical energy, and for renewals under subdivision (b) of this section, and in making such contracts the following shall govern:

(a) No contract for electrical energy shall be of longer duration than fifty years from the date at which such energy is ready for delivery.

(b) The holder of any contract for electrical energy, not in default thereunder, shall be entitled to a renewal thereof upon such terms and conditions as may be authorized or required under the then existing laws and regulations, unless the property of such holder dependent for its usefulness on a continuation of the contract be purchased or acquired and such holder be compensated for damages to its property, used and useful in the transmission and distribution of such electrical energy and not taken, resulting from the termination of the supply.

(c) Contracts for the sale and delivery of electrical energy shall be made with responsible applicants therefor who will pay the price fixed by the said Secretary with a view to meeting the revenue requirements of the project as herein provided for. In case of conflicting applications, if any, such conflicts shall be resolved by the said Secretary, after hearing, with due regard to the public interest, and in conformity with the policy expressed in section 7 of the "Federal Water Power Act" as to conflicting applications for permits and license: *Provided, however*, That no application of a political subdivision for an allocation of electrical energy shall be denied or another application in conflict therewith be granted on the ground that the bond issue of such political subdivision, necessary to enable the applicant to utilize the electrical energy applied for, has not been authorized or marketed, until after a reasonable opportunity has been given to such applicant to have such bond issue authorized and marketed.

(d) Any agency receiving a contract for electrical energy equivalent to one hundred thousand firm horsepower, or more, may, when deemed feasible by the said Secretary, from engineering and economic consideration and under general regulations prescribed by him, be required to permit other similar agencies having contracts hereunder for less than the equivalent of twenty-five thousand firm horsepower to participate in the benefits and use of any main transmission line constructed by the former for carrying such energy, upon payment by such other agencies of a reasonable share of the cost of construction, operation, and maintenance thereof.

The use is hereby authorized of such public and reserved lands of the United States as the said Secretary shall determine to be necessary or convenient for the construction, operation and maintenance of main transmission lines to transmit said electrical energy.

Sec. 6. That the dam and reservoir provided for by section 1 hereof shall be used: First, for river regulation and flood control; second, for irrigation and domestic uses; and, third, for power. The title to said dam, reservoir, plant, and incidental works shall forever remain in the United States and the United States shall always control, manage, and operate the same: *Provided, however*, That the said Secretary may, in his discretion, enter into contracts of lease of a unit or units of said plant, with right to generate electrical energy, or, alternatively, to enter into contracts of lease for the use of water for the generation of electrical energy, in either of which events the provisions of section 5 of this Act relating to revenue, term, renewals, determination of conflicting applications, and joint use of transmission lines under contracts for the sale of electrical energy, shall apply.

Sec. 7. That the said Secretary may, in his discretion when said bonds shall have been amortized, transfer the title to said canal and appurtenant structures to the districts or other agencies in the United States having a beneficial interest therein in proportion to their respective capital investments. The said districts or other agencies shall have the privilege at any time of utilizing such power possibilities as may exist upon said canal, in proportion to their respective contributions or obligations toward the capital cost of said canal and appurtenant structures from and including the diversion works to the point where each respective power plant may be located. The net proceeds from any power development on said canal shall be paid into said Colorado River Dam fund, and credited to said districts or other agencies on their said contracts, in proportion to their rights to develop power,

until the districts or other agencies using said canal shall have paid thereby and under any contract or otherwise an amount of money equivalent to the operation and maintenance expense and cost of construction thereof.

Sec. 8. (a) That the United States, in managing and operating the dam, canals, and other works herein authorized, including the delivery and use of water for the generation of power, irrigation, or other uses, shall observe and be subject to and controlled by the Colorado River compact as signed at Santa Fe, New Mexico, on November 24, 1922, and particularly described in section 12 herein.

(b) Also the rights of the United States in or to waters of the Colorado River howsoever acquired, as well as the rights hereafter arising of those claiming under the United States, shall be subject to and controlled by said compact.

(c) Also all patents, grants, contracts, concessions, leases, permits, licenses, rights of ways, or other privileges from the United States or under its authority, necessary or convenient for the use of waters of the Colorado River, or for the generation or transmission of electrical energy generated by means of the waters of said river, shall be upon the express condition and with the express covenant that the rights of the recipients or holders thereof to waters of the river, for the use of which the same is necessary, convenient, or incidental, shall likewise be subject to and controlled by said compact.

(d) The conditions and covenants referred to herein shall be deemed to run with the land and water right, and shall attach as a matter of law, whether set out or referred to in the instrument evidencing any such patent, grant, contract, concession, lease, permit, license, right of way, or other privilege from the United States or under its authority, or not, and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and the users of water thereunder, by way of defense or otherwise, in any litigation respecting the water of the Colorado River.

Sec. 9. That all lands of the United States found by the Secretary of the Interior to be practicable of irrigation and reclamation by the irrigation works authorized herein shall be withdrawn from public entry. Thereafter, at the direction of the Secretary of the Interior, such lands shall be opened for entry, in tracts varying in size but not exceeding one hundred and sixty acres, as may be determined by the Secretary of the Interior, in accordance with the provisions of the reclamation law, and any such entryman shall pay an equitable share in accordance with the benefits received, as determined by the said Secretary, of the construction cost of said canal and appurtenant structures; said payments to be made in such installments and at such times as may be specified by the Secretary of the Interior, in accordance with the provisions of the said reclamation law, and shall constitute revenue from said project and be covered into the said subfund herein provided for: *Provided*, That all persons who have served in the United States Army, Navy, or Marine Corps during the war with Germany, the war with Spain, or in the suppression of the insurrection in the Philippines, and who have been honorably separated or discharged therefrom or placed in the Regular Army or Navy Reserve, shall have the exclusive preference right for a period of three months to enter said lands, subject, however, to the provisions of subsection c of section 4, Act of December 5, 1924 (Forty-third Statutes at Large, page 702); and, also, so far as practicable, preference shall be given to said persons in all construction work authorized by this Act: *Provided, further*, That in the event such an entry shall be relinquished at any time prior to actual residence upon the land by the entryman for not less than one year, lands so relinquished shall not be subject to entry for a period of sixty days after the filing and notation of the relinquishment in the local land office, and after the expiration of said sixty-day period such lands shall be open to entry, subject to the preference in this section provided.

Sec. 10. That nothing in this act shall be construed as modifying in any manner the existing contract, dated October 23, 1918, between the United States and the Imperial irrigation district, providing for a connection with Laguna Dam; but the Secretary of the Interior is authorized to modify the said contract, with the consent of the said district, and also to enter into contract or contracts with the said district or other districts, persons, or agencies for the construction, in accordance with this act, of said canal and appurtenant structures, and also for the operation and maintenance thereof, with the consent of the other users.

Sec. 11. "Political subdivision" or "political subdivisions" as used in this act shall be understood to include any State, irrigation, or other district, municipality, or other governmental organization.

"Reclamation law" as used in this act shall be understood to mean that certain acts of congress and of the United States approved June 17, 1902, entitled "An act appropriating the receipts from the sale and disposal of public land in certain States and Territories to the construction of irrigation works for the reclamation of arid lands," and the acts amendatory thereof and supplemental thereto.

"Maintenance" as used herein shall be deemed to include in each instance provision for a fund sufficient to keep the works in good operating condition during the period of amortization of construction cost.

Sec. 12. The Colorado River compact signed by the commissioners of the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and by Herbert Hoover, as the representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922, pursuant to Act of Congress approved August 19, 1921, entitled "An act to permit a compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," is hereby approved by the Congress of the United States, and the provisions of the first paragraph of article 11 of the said Colorado River Compact, making said compact binding and obligatory when it shall have been approved by the legislature of each of the signatory States, are hereby waived, and this approval shall become effective when by act or resolution of their respective legislatures at least six of the signatory States shall have approved or may hereafter approve said compact and shall consent to such waiver.

Sec. 13. This act shall be deemed a supplement to the reclamation law, which said reclamation law shall govern the construction, operation, and management of the works herein authorized, except as otherwise herein provided.

Sec. 14. That the short title of this act shall be "Boulder Canyon project act."

COLORADO RIVER COMPACT

Chronology

- 1921. Feb. 22. Wyoming legislature authorized State Commissioner.
- 1921. March 5. Arizona legislature authorized State Commissioner.
- 1921. March 11. New Mexico legislature authorized State Commissioner.
- 1921. March 14. Utah legislature authorized State Commissioner.
- 1921. March 21. Nevada legislature authorized State Commissioner.
- 1921. April 2. Colorado legislature authorized State Commissioner.
- 1921. May 12. California legislature authorized State Commissioner.
- 1921. August 19. Act of congress authorizing states to compact.
- 1921. December 17. President Harding appointed Herbert Hoover to represent United States on commission.
- 1922. January 26. First meeting of commission.
- 1922. Commission holds numerous meetings and drafts compact.
- 1922. November 24. Signing of Colorado River Compact at Santa Fe, New Mexico, by commissioners.
- 1923. Legislatures of Colorado, California, Nevada, New Mexico, Utah and Wyoming ratify compact as written.
- 1925. Finney resolution adopted by California legislature making California ratification effective when storage reservoir of 20,000,000 acre-feet authorized.
- 1925. February 25. Wyoming ratification of six-state compact.
- 1925. February 26. Colorado ratification of six-state compact.
- 1925. March 17. New Mexico ratification of six-state compact.
- 1925. March 18. Nevada ratification of six-state compact.
- 1927. February 26. Utah legislature adopts act declaring Colorado and Green rivers in Utah to be navigable streams.
- 1929. March 4. California ratification of six-state compact and acceptance of water limitation.
- 1929. March 6. Utah ratification of six-state compact.
- 1929. June 25. President Hoover's proclamation making Boulder Canyon Project Act and six-state compact effective.

COLORADO RIVER COMPACT, DEVELOPMENT AND ANALYSIS

The Colorado River Compact, sometimes called the Santa Fe Compact, is a pact dividing the use of the waters of the Colorado River System among the seven states of the Colorado River Basin. When first proposed it was contemplated that the water would be divided among the individual states, but after some consideration the states were divided into two groups, the Upper Basin and the Lower Basin states, and apportionment of use of water was made between the groups.

The Colorado River Compact is so brief and clear in its wording that an attempt to paraphrase it seems to be useless but particular attention should be paid to the definitions given in Article II of the compact, as much of the controversy that has been waged between the states has been brought about by an effort to read into these definitions statements which are not therein contained.

During the framing of the compact there was lengthy discussion of the distinction between *ownership* and *right to use* water, but in the final drafting of the document the term "exclusive beneficial consumptive use" was used and apportionment made on that basis, a certain use being apportioned to each basin. The Upper Basin and the Lower Basin were each given the "exclusive beneficial consumptive use" of 7,500,000 acre-feet of water each year and in addition the Lower Basin was given the right to increase its beneficial consumptive use by 1,000,000 acre-feet per annum; thus the Upper Basin has 7,500,000 acre-feet, and the Lower Basin 8,500,000 acre-feet, of what might be, and sometimes is, called "firm water." This does not exhaust all possible water used in the system as the entire water yield of the system is probably somewhere in the neighborhood of 19,000,000 acre-feet. The pact recognizes this fact and provides for a possible future allocation of unallocated water after October, 1963.

The compact was drafted during the year 1922 by representatives of the states of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, and the representative of the federal government, the Honorable Herbert Hoover, Secretary of Commerce, who acted as chairman of the conferences. This group of men was known as the Colorado River Commission. The completed compact was signed by these representatives at Santa Fe, New Mexico, November 24, 1922.

As originally drawn the compact was between seven states and could not become effective until all seven states and congress had ratified it. Upon the continued refusal of Arizona to ratify, Congress in adopting the Boulder Canyon Project Act (Boulder Canyon Project Act, section 4), provided that the compact should become effective on a six-state basis under certain conditions. The Act provided that "no steps shall be taken by the United States or by others to initiate or perfect any claims to the use of water pertinent to such works or structures unless and until (1) the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming shall have ratified the Colorado River Compact, mentioned in section 13 hereof, and the President by public proclamation shall have so declared, or (2) if said States fail to ratify the said compact within six months from the date of the passage of this act, then, until six of said States, including the State of California, shall ratify said compact and shall consent to waive the provisions of

the first paragraph of Article XI of said compact, which makes the same binding and obligatory only when approved by each of the seven States signatory thereto, and shall have approved said compact without conditions, save that of such six-State approval, and the President by public proclamation shall have so declared, and, further, until the State of California, by act of its legislature, shall agree irrevocably and unconditionally with the United States and for the benefit of the States of Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming, as an express covenant and in consideration of the passage of this Act, that the aggregate annual consumptive use (diversions less returns to the river) of water of and from the Colorado River for use in the State of California, including all uses under contracts made under the provisions of this Act and all water necessary for the supply of any rights which may now exist shall not exceed four million four hundred thousand acre-feet of the waters apportioned to the Lower Basin States by paragraph (a) of Article III of the Colorado River Compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact." This in effect changed the seven-state compact to a six-state compact.

The Colorado River Compact has sometimes been referred to as the Seven-State Compact and later as the Six-State Compact.

During the year 1923 the legislatures of Colorado, Utah, California, Nevada, New Mexico and Wyoming ratified the compact. The compact was nonoperative until all seven states and the Congress of the United States had ratified it. Arizona failed to ratify and after two years had elapsed, Arizona still failing to ratify, Wyoming, New Mexico and Nevada adopted legislative acts waiving the requirement in Article XI of the Colorado River Compact which made the compact effective only when all seven states had ratified and accepted the condition that the compact should become effective when six of the signatory states had accepted the compact and waived the seven-state requirement; subject, of course, to like action on the part of the Congress of the United States. The acts adopted by the various states are given on pages 108-114.

California, realizing that by accepting the pact, unless immense storage was provided for lower basin use, the state might lose her present perfected rights, adopted April 8, 1925, what became known as the Finney Resolution (see page 109), which accepted the six-State ratification and provided that California's ratification should become effective if and when Congress authorized construction of a dam of 20,000,000 acre-feet storage capacity. (See text of Boulder Canyon Project Act.) In adopting this resolution the California legislature was actuated by the thought that the providing of 5,000,000 acre-feet of storage required by the compact was inadequate, and not large enough to protect California users of Colorado River Water against loss of rights running against upper basin users which would pass when this insufficient storage was provided; in other words, California lands would lose water rights in the normal flow of the river and under the operation of the pact alone would not be given sufficient storage to permit of replacing the water thus surrendered from stored flood water, California would be giving up a perfected right to divert water from

the ordinary river flow without equivalent protection and a certainty of the same supply of water in return.

As all of the states had at least unofficially stated that the main, if not the paramount, reason for the pact was to permit the construction of Boulder or a similar dam, the California legislature was making official what the legislature believed to be the universal understanding. The action simply fixed the time at which the California approval of the compact became effective and did not change the wording or meaning of the instrument.

When the Boulder Canyon Project Act was passed in 1928 provision was made to have the pact become effective when six states should agree to the condition waiving seven-state ratification and on the further condition that California would accept certain limitations on the use of water in that state. California by act of the legislature, approved March 4, 1929, accepted these conditions.

Utah, February 26, 1927, passed an act of legislature placing an interpretation upon paragraph (a) of Article IV of the Colorado River Compact which was considered to have the effect of modifying Utah's ratification of the compact. The act adopted by legislature of the state of Utah is given in full on page 112.

X Just previous to this it was believed that oil had been discovered beneath the bed of the Colorado River in Utah and that state proceeded on the theory that if the Colorado were a navigable river the stream bed belonged to the state. This act was adopted in the evident expectation that the development of oil under the river bed would prove to be a source of considerable income to the state of Utah. Later, the oil development having failed to materialize, Utah, on March 6, 1929, ratified the compact and accepted the six-state condition.

X To obtain a proper conception of the compact and the conditions which brought it about, the early history of the events and investigations, together with some understanding of the physical characteristics of the Colorado River,* is important.

A large proportion of the flow of the Colorado River System comes from melting snows in the mountains of the upper reaches of the river and its tributaries. This flow usually reaches a maximum in June, and, during May, June and July serious flood conditions may exist. During the month of August the flow very materially diminishes and from September until February the flow is usually very low. The low normal flow is roughly about one-eighth of the average flow during the month of June. Over a period of years from 1903 to 1920 about 25 per cent of the total yearly flow of the river came down during June. This is typical of the flow nearly every year.

* A book entitled "The Colorado River," by R. L. Olson, of Los Angeles, published in 1926, goes into the discussions at the meetings leading up to the actual drafting of the compact in some detail. This book is recommended for the investigator who wishes to dig deeper into the genesis of the compact. Unfortunately, there appears to be a typographical error in the actual text of the compact (Article VIII) as given in Mr. Olson's book. The compact is treated at great length from a legal standpoint and a number of cases are cited and decisions in connection with the points involved. (Mention is made of a resolution adopted at a meeting of the League of the Southwest in 1920 as being the real starting point of the Colorado River Compact. This resolution is reported to have been offered by Mr. Gillette, former State Engineer of New Mexico, and Mr. Delph E. Carpenter of Colorado is reported as having assisted in the drafting of the resolution. (Reference: Olson, page 14, or minutes of first meeting Colorado River Commission Washington, D. C., January, 1922, page 15.) Mr. Carpenter has been universally credited as being one of the men mainly responsible for the final drafting of the compact, he acting as the representative of Colorado upon the Colorado River Commission. J. L. B.

With the flow varying so greatly from month to month during the year, besides having considerable variation from year to year, agricultural development was of course limited to the normal flow of the river during the months of comparatively small flow.

When development work was first started on the river little attention was paid to storage, water simply being diverted from running streams. Some of these diversions were made as far back as the days of the Spanish fathers. On the other hand, if storage dams were created on the river and its tributaries, it would be possible to store up the vast quantities of flood water otherwise running to waste and utilize this stored water to increase the flow of the river during the dry months. This fact was recognized in the First Annual Report of the Reclamation Service, published in 1902, in which suggestions were made for dams to regulate the river to a more even flow throughout the year, and to conserve the flood waters for further future development.

Prior to about 1918 each state in the Colorado River Basin had gone ahead with development without very much regard for the other states. Appropriations were being made within each state under the laws of that state, with the result that at about this time it was realized that diversions from the river had become so great that the low water flow of the stream could not satisfy all appropriators and it was felt that in order to provide for an equitable distribution between the states of the uses of the water in the basin it would be necessary to reach some kind of a mutual understanding.

In the unpublished Weymouth report of February, 1924, Volume IV, Colorado River Compact, the following statement is made:

"At a meeting of the League of the Southwest in Denver, August 25-27, 1920, the following resolution, among others, was adopted:

"*Resolved*, That it is the sense of this conference that the present and future rights of the several states whose territory is in whole or in part included within the drainage area of the Colorado River, and the rights of the United States, to the use and benefit of the waters of said stream and its tributaries should be settled and determined by compact or agreement between said states and the United States, with consent of congress, and that the legislature of said states be requested to authorize the appointment of a commissioner for each of said states for the purpose of entering into such compact or agreement for subsequent ratification and approval by the legislature of each of said states and the congress of the United States."*

* The above resolution of the League of the Southwest has been credited as the start of the Colorado River Compact. This League of the Southwest was an organization formed for the purpose of discussing questions of common interest to the southwestern states. Weymouth states that the League of the Southwest was formed at Salt Lake City at a meeting of representatives of Arizona, California, Colorado, Nevada, New Mexico and Utah, on January 18-21, 1919, at the call of ex-Governor Wm. Spry of Utah, but there appears to have been a meeting held in San Diego about 1918 at which probably the organization was started. There also seems to have been another meeting in 1918 at Tucson, Arizona. Probably the 1919 meeting marked the formal organization of the League. Olson in his book gives an extract from the proceedings of the meeting of the League of the Southwest held in Los Angeles, April 1-3, 1920, in which the following statement is made: "At its meeting in San Diego, California, the Hon. Julius C. Gunter, then Governor of Colorado, and Governor Simon Bamberger of Utah led the discussion, which gave great momentum to the crystallization of intelligent sentiment for the development of the Colorado River Basin irrigation, reclamation, water storage, river control and water power projects." The League probably had its inception in the mind of Mr. H. L. Moody, then city auditor of San Diego, California. Mr. Moody was a very active member of the League of California Municipalities, an organization of representatives of California city and county governments for the purpose of discussing

Thereafter the legislatures of the seven states partially or wholly within the Colorado River Basin enacted legislation providing for representation on a commission to arrange the distribution of Colorado River waters and also provided for a representative to act in behalf of the United States Government.

"May 10, 1921, the governors of the seven states, or their duly accredited representatives, met at the city of Denver and there formulated resolutions calling upon the President of the United States and upon congress to provide for the appointment of a representative for the United States in harmony with the above-mentioned legislation by the states, and directed that the resolution so formulated be laid before the President and congress by the governors of the states. The resolution adopted by the governors at Denver was presented by the governors, or their duly accredited representatives, to the Secretary of the Interior, at Washington, May 17th, and to the President of the United States, May 19, 1921."

From these conferences there developed the acts of the various states, and the act of the federal government, approved August 19, 1921, under which representatives or commissioners were appointed to draw up a compact.

Acts of the various states authorizing the appointment of representatives on a Colorado River Commission were adopted as follows:

Wyoming, February 22, 1921, Laws of Wyoming, 1921, 166-167;
 Arizona, March 5, 1921, Laws of Arizona, 53-55;
 New Mexico, March 11, 1921, Laws of New Mexico, 1921, 217-220;
 Utah, March 14, 1921, Laws of Utah, 1919-1921, 184;
 Nevada, March 21, 1921, Laws of Nevada, 1920-1921, 190-191;
 Colorado, April 2, 1921, Laws of Colorado, 1921, 811-815;
 California, May 12, 1921, Statutes of California, 1921, 85-86.

Reference: Olson, p. 1.

The act of the federal government, dated August 19, 1921, authorizing the appointment of commissioners and negotiations of a compact is given on page 107, and the act of California legislature on page 108. This act was similar to, and typical of, acts adopted by the other legislatures.

After several meetings of the commission the idea of apportioning the water between the individual states was abandoned, as there appeared to be too little reliable data available on which to base such apportionment, and the scheme of dividing the states into two groups and allocating water to these groups was adopted. This grouping was along the lines of a natural geographical division. While portions of some of these states fall in both divisions or groups, for all practical purposes the states may be considered as being grouped as follows:

Upper Basin Group or Division—

Colorado, New Mexico, Wyoming and Utah.

Lower Basin Group or Division —

Arizona, California and Nevada.

questions of common interest, and he conceived the idea of forming an organization which would serve somewhat the same purposes to the southwestern states that the California League of Municipalities does to the State of California. The first meeting was held in San Diego about 1918. The League of the Southwest was organized along rather loose lines. Anyone could join and take out any number of memberships, by paying \$25 for each membership. This multiple membership, originally conceived for the purpose of financing the League, was later abused when efforts were made to pass resolutions on pending legislation and the League practically ceased to exist about 1924 or 1925. J. L. E.

The division point on the river between the upper and lower basins was defined as Lee Ferry, one mile downstream from the mouth of the Paria River. This is a few miles downstream from the northern boundary line of Arizona.

Disregarding state lines the Upper Basin of the Colorado River, under the terms of the compact, comprises all that area from which water drains into the Colorado River or any of its tributaries entering the main stream above Lee Ferry and also includes any area on which water from the Upper Basin might be diverted. Similarly, the Lower Basin comprises all that area from which water drains into the main stream or any tributary of the Colorado River below Lee Ferry and also any area on which any Lower Basin water might be diverted and used.

It should be particularly noted that the term "Colorado River System" is used throughout in the compact, and it is the waters of the system that are apportioned. No differentiation being made between tributaries and main stream water. The only time the term "main stream" is used is in defining the location of Lee Ferry and by inference in paragraph (d) of Article III in connection with the flow of the river between the Upper and Lower basins. This paragraph makes a provision for minimum flow in the river over a ten-year period.

Definitions given in the pact should be carefully noted, as much of the discussion centering around the use and development of the Colorado River water has hinged on these definitions. These definitions given in Article II of the compact are as follows:

"The term 'Colorado River System' means that portion of the Colorado River and its tributaries within the United States of America.

"The term 'Upper Basin' means those parts of the states of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said states located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry."

"The term 'Lower Basin' means those parts of the states of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said states located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry."

In apportioning the water under the Colorado River Compact (Article III) the apportionment in every case is made from the Colorado River System and in no other way. The compact contains the further statement that the apportionments so made "shall include all water necessary for the supply of any rights which may now exist."

In the negotiations between the states of California, Arizona and Nevada, the Arizona representatives have insisted that the only water to be considered in the Lower Basin was "main stream" water and that any compact signed by Arizona could only be signed under such an assumption. This is clearly not in accord with the terms and definitions of the Santa Fe Compact, although Arizona, never having signed

the compact, is of course free to negotiate upon any basis which she may choose.

Another peculiar point which developed in the later negotiations between the Lower Basin states grew out of the fact that under the terms of the Santa Fe Compact the Lower Basin is given the exclusive and unquestioned right to use 7,500,000 acre-feet of water per annum in the Colorado River System plus a right to increase its beneficial consumptive use by 1,000,000 acre-feet per annum. Another clause of the compact states that the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet during any ten consecutive years. Confusion arose from the fact that there was a supposed identity between the 7,500,000 acre-feet average annual flow from the Upper Basin and the right to use 7,500,000 acre-feet of water given to the Lower Basin.

The compact is very clear that the 7,500,000 acre-feet annual flow at Lee Ferry which the Upper Basin is required to maintain is merely a means of regulating a required flow between the two basins or rather a flow from the Upper Basin to the Lower Basin. It is in the nature of a guarantee that the Upper Basin will not deplete the flow of the river below that point. From a physical standpoint 7,500,000 acre-feet of water flowing by Lee Ferry could never reach the land upon which it would be used in the Lower Basin. River losses from evaporation and seepages through waste areas would reduce this quantity of water to somewhere around 6,000,000 acre-feet by the time it would reach diversion points to the canals carrying the water to the land.

In the Lower Basin the actual amount of water available for use is made up from two sources:

1. Water coming from the Upper Basin flowing down the main stream at Lee Ferry.
2. Water actually falling in the Lower Basin in the form of rain and collected in the tributaries and along the canyons of the main stream.

Under the terms of the compact any and all water used in the Lower Basin is chargeable against the allocated consumptive use of water. Water rights now existing must be satisfied from the 7,500,000 acre-feet of firm water. This is plainly shown by Article III, paragraph (a), which states that apportioned water "shall include all water necessary for the supply of any rights which may now exist."

Use of water from tributaries as well as use from the main stream falls within the allocated amount. For a more complete analysis of these points reference is made to the reply to questions asked Secretary Hoover by Congressman Hayden, and appearing in the Congressional Record, January 30, 1923, p. 2710. This questionnaire is given in full on page 100.

COLORADO RIVER COMPACT

Signed at Santa Fe, New Mexico, Nov. 24, 1922.

The States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, having resolved to enter into a compact under the Act of Congress of the United States of America approved August 19, 1921 (42 Statutes at Large, page 171), and the Acts of the Legislatures of the said States, have through their Governors appointed as their Commissioners:

W. S. Norviel, for the State of Arizona,
 W. F. McClure, for the State of California,
 Delph E. Carpenter, for the State of Colorado,
 J. G. Scrugham, for the State of Nevada,
 Stephen B. Davis, Jr., for the State of New Mexico,
 R. E. Caldwell, for the State of Utah,

Frank C. Emerson, for the State of Wyoming, who, after negotiations participated in by Herbert Hoover, appointed by the President as the representative of the United States of America, have agreed upon the following articles:

ARTICLE I

The major purposes of this compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System; to establish the relative importance of different beneficial uses of water; to promote interstate comity; to remove causes of present and future controversies; and to secure the expeditious agricultural and industrial development of the Colorado River Basin, the storage of its waters, and the protection of life and property from floods. To these ends the Colorado River Basin is divided into two Basins, and an apportionment of the use of part of the water of the Colorado River System is made to each of them with the provision that further equitable apportionments may be made.

ARTICLE II

As used in this compact:

(a) The term "Colorado River System" means that portion of the Colorado River and its tributaries within the United States of America.

(b) The term "Colorado River Basin" means all of the drainage area of the Colorado River System and all other territory within the United States of America to which the waters of the Colorado River System shall be beneficially applied.

(c) The term "States of the Upper Division" means the States of Colorado, New Mexico, Utah, and Wyoming.

(d) The term "States of the Lower Division" means the States of Arizona, California, and Nevada.

(e) The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

(f) The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry.

(g) The term "Lower Basin" means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry.

(h) The term "domestic use" shall include the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power.

ARTICLE III

(a) There is hereby apportioned from the Colorado River system in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.

(b) In addition to the apportionment in paragraph (a), the Lower Basin is hereby given the right to increase its beneficial consumptive use of such waters by one million acre-feet per annum.

(c) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River System, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).

(d) The States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact.

(e) The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water which can not reasonably be applied to domestic and agricultural uses.

(f) Further equitable apportionment of the beneficial uses of the waters of the Colorado River System unapportioned by paragraphs (a), (b), and (c) may be made in the manner provided in paragraph (g) at any time after October first, 1963, if and when either Basin shall have reached its total beneficial consumptive use as set out in paragraphs (a) and (b).

(g) In the event of a desire for a further apportionment, as provided in paragraph (f), any two signatory States, acting through their Governors, may give joint notice of such desire to the Governors of the other signatory States and to the President of the United States of America, and it shall be the duty of the Governors of the signatory States and of the President of the United States of America forthwith to appoint representatives, whose duty it shall be to divide and apportion equitably between the Upper Basin and Lower Basin the beneficial use of the unapportioned water of the Colorado River System, as mentioned in paragraph (f), subject to the legislative ratification of the signatory States and the Congress of the United States of America.

ARTICLE IV

(a) Inasmuch as the Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of its basin, the use of its waters for purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding.

(b) Subject to the provisions of this compact, water of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

(c) The provisions of this article shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use, and distribution of water.

ARTICLE V

The chief official of each signatory State charged with the administration of water rights, together with the Director of the United States Reclamation Service and the Director of the United States Geological Survey, shall cooperate, *ex officio*:

(a) To promote the systematic determination and coordination of the facts as to flow, appropriation, consumption and use of water in the Colorado River Basin, and the interchange of available information in such matters.

(b) To secure the ascertainment and publication of the annual flow of the Colorado River at Lee Ferry.

(c) To perform such other duties as may be assigned by mutual consent of the signatories from time to time.

ARTICLE VI

Should any claim or controversy arise between any two or more of the signatory States (a) with respect to the waters of the Colorado River System not covered by

the terms of this compact; (b) over the meaning or performance of any of the terms of this compact; (c) as to the allocation of the burdens incident to the performance of any article of this compact or the delivery of waters as herein provided; (d) as to the construction or operation of works within the Colorado River Basin to be situated in two or more States, or to be constructed in one State for the benefit of another State; or (e) as to the diversion of water in one State for the benefit of another State; the Governors of the States affected, upon the request of one of them, shall forthwith appoint Commissioners with power to consider and adjust such claim or controversy, subject to ratification by the Legislatures of the States so affected.

Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or by direct future legislative action of the interested States.

ARTICLE VII

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes.

ARTICLE VIII

Present perfected rights to the beneficial use of waters of the Colorado River System are unimpaired by this compact. Whenever storage capacity of 5,000,000 acre-feet shall have been provided on the main Colorado River within or for the benefit of the Lower Basin, then claims of such rights, if any, by appropriators or users of water in the Lower Basin against appropriators or users of water in the Upper Basin shall attach to and be satisfied from water that may be stored not in conflict with Article III.

All other rights to the beneficial use of waters of the Colorado River System shall be satisfied solely from the water apportioned to that basin in which they are situate.

ARTICLE IX

Nothing in this compact shall be construed to limit or prevent any State from instituting or maintaining any action or proceeding, legal or equitable, for the protection of any right under this compact or the enforcement of any of its provisions.

ARTICLE X

This compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination all rights established under it shall continue unimpaired.

ARTICLE XI

This compact shall become binding and obligatory when it shall have been approved by the Legislatures of each of the signatory States and by the Congress of the United States. Notice of approval by the Legislatures shall be given by the Governor of each signatory State to the Governors of the other signatory States and to the President of the United States, and the President of the United States is requested to give notice to the Governors of the signatory States of approval by the Congress of the United States.

In witness whereof the Commissioners have signed this compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America and of which a duly certified copy shall be forwarded to the Governor of each of the signatory States.

Done at the City of Santa Fe, New Mexico, this twenty-fourth day of November, A. D. one thousand nine hundred and twenty-two.

(Signed) W. S. NORVIEL
 (Signed) W. F. McCLURE
 (Signed) DELPH E. CARPENTER
 (Signed) J. G. SCRUGHAM
 (Signed) STEPHEN B. DAVIS, JR.
 (Signed) R. E. CALDWELL
 (Signed) FRANK C. EMERSON

Approved:

(Signed) HERBERT HOOVER

109167

EXPLANATION OF COMPACT

By HON. HERBERT HOOVER

Extension of remarks of Honorable Carl Hayden in House of Representatives, Tuesday, January 30th, 1923, Congressional Record, page 2710.

Department of Commerce,
Office of the Secretary,
Washington, January 21, 1923.

Hon. Carl Hayden,
House of Representatives, Washington, D. C.

My dear Mr. Hayden:

Referring to your letter of January 9 addressed to the Secretary, inclosing questionnaire on the Colorado River compact, I am requested by Mr. Hoover to forward to you his answers to the questions which you propounded.

Very truly yours,

Clarence C. Stetson,
Executive Secretary, Colorado River Commission

Question 1. What was the reason for dividing the drainage area of the Colorado River and its tributaries into two basins, as provided in Article II of the Colorado River compact?

The reasons were:

(a) The commission, upon analysis, found that the causes of present friction and of major future disputes lay between the lower basin States and the upper basin States, and that very little likelihood of friction lay between the States within each basin; that the delays to development at the present time are wholly interbasin disputes; and that major development is not likely to be impeded by disputes between the States within each basin. And in any event, the compact provides machinery for such settlements.

(b) The drainage area falls into two basins naturally, from a geographical, hydrographical, and an economic point of view. They are separated by over 500 miles of barren canyon which serves as the neck of the funnel, into which the drainage area comprised in the upper basin pours its waters, and these waters again spread over the lands of the lower basin.

(c) The climate of the two basins is different; that of the upper basin being, generally speaking, temperate, while that of the lower basin ranges from semitropical to tropical. The growing seasons, the crops, and the quantity of water consumed per acre are therefore different.

(d) The economic conditions in the two basins are entirely different. The upper basin will be slower of development than the lower basin. The upper basin will secure its waters more by diversion than by storage, whereas the development of the lower basin is practically altogether a storage problem.

(e) The major friction at the present moment is over the water rights which might be established by the erection of adequate storage in the lower basin, as prejudicing the situation in the upper basin, and regardless of legal rights in either case. The States are now divided into two groups in opposition to each other legislatively, with little hope of the cohesion that is necessary before Federal aid can ever be secured.

The use of the group method of division was therefore adopted both from necessity, as being the only practical one, and from advisability, being dictated by the conditions existing in the entire basin.

Question 2. Was the apportionment in Article III of the compact between the upper and lower basins arbitrary or was it based on the actual requirements of each basin?

The apportionment was not arbitrary. It was based on a careful consideration of respective needs of the two basins. The data available was the estimates provided by the Reclamation Service, which follow, showing the total new and old acreage in the two basins, including not only all existing projects but all projects considered economically feasible and also those of doubtful feasibility and intended to cover every prospective development during the next 75 years. The commissioners and engineering staffs of the different States varied somewhat from the basic esti-

mates of the Reclamation Service, and some compromise from these figures was agreed to by the commission to compensate in different directions. This was particularly the case with regard to the estimated consumption of water per acre. It will be noted that the total acreage in the lower basin, present and prospective, is given as 2,127,000, whereas that in the upper basin is given as 4,000,000. Therefore the amount of water depends partly on the consumption assumed per acre, and after general consideration an addition was made in each case to cover any possible mischances of calculation, the general addition being about 30 per cent more than the probable use.

Table of Colorado River Acreage

	Acreage Irrigated 1920	New Acreage	Total Acreage
Lower Basin—			
Arizona -----	507,000	640,000	1,147,000
California -----	450,000	490,000	940,000
Nevada -----	5,000	35,000	40,000
Total -----	962,000	1,165,000	2,127,000
Upper Basin—			
Colorado -----	740,000	1,018,000	1,758,000
New Mexico -----	34,000	483,000	517,000
Utah -----	359,000	456,000	815,000
Wyoming -----	367,000	543,000	910,000
Total -----	1,500,000	2,500,000	4,000,000

Question 3. Why was 40 years fixed as the time for a future apportionment of the surplus water of the Colorado River?

There was a decided conflict between the States over the period to be fixed in this paragraph, based chiefly on their ideas as to rapidity of development and actual use of the water. Some desired a shorter and some a longer time. Suggestions were made varying from 20 to 60 years. The 40-year period was finally arrived at as a common point of agreement. Judging by experience under other projects—the Imperial Valley and Salt River Valley, for instance—the full development of contemplated construction, as shown in the table following question 2, will take a much longer time than the one fixed.

Question 4. Why was the term "Colorado River system" used in paragraph (a) of Article III, wherein 7,500,000 acre-feet of water is apportioned to the upper and lower basins, respectively?

This term is defined in Article II as covering the entire river and its tributaries in the United States. No other term could be used, as the duty of the commission was to divide all the water of the river. It serves to make it clear that this was what the commission intended to do and prevents any State from contending that, since a certain tributary rises and empties within its boundaries and is therefore not an interstate stream, it may use its waters without reference to the terms of the compact. The plan covers all the waters of the river and all its tributaries, and the term referred to leaves that situation beyond doubt.

Question 5. Why is the basis of division changed from the "Colorado River system" to the "river at Lee Ferry" in paragraph (d) of Article III, the period of time extended to 10 years and the number of acre-feet multiplied by 10?

(a) I do not think there is any change in the basis of division as the result of the difference in language in Articles III (a) and III (b). The two mean the same. By reference to Article II (f) it will be seen that Lee Ferry, referred to in III (d), is the determining point in the creation of the two basins specified in III (a). The use of this term makes it plain that the 75,000,000 acre-feet are to be delivered in the main channel of the river above the various tributaries which contribute water below.

(b) The agreement as to the flow of 75,000,000 acre-feet at Lee Ferry during each 10-year period fixes a definite quantity of water which must pass that point. Under III (a) each basin is entitled to the use of 7,500,000 acre-feet annually. Judging by past records, there will always be sufficient flow in the river to supply

these quantities, but in the improbable event of a deficiency, the lower basin has the first call on the water up to a total use of 75,000,000 acre-feet each 10 years. While there was in the commission a firm belief that no such shortage will ever occur, still this provision was adopted as a matter of caution. The period of 10 years was fixed as a basis of measurement, as being long enough to allow equalization between years of high and low flow, and as representing a basis fair to both divisions.

Question 6. Are the 1,000,000 additional acre-feet of water apportioned to the lower basin in paragraph (b) of Article III supposed to be obtained from the Colorado River or solely from the tributaries of that stream within the State of Arizona?

The use of the words "such waters" in this paragraph clearly refers to waters from the Colorado River system, and the extra 1,000,000 acre-feet provided for can therefore be taken from the main river or from any of its tributaries.

Question 7. If more than 1,000,000 acre-feet of water are beneficially used and consumed annually on the tributaries of the Colorado River in Arizona, will the excess above that amount be charged against the 75,000,000 acre-feet of water to be delivered at Lee Ferry during any 10-year period, as provided in paragraph (d) of Article III? In other words, will the use of any amount of water from the tributaries of the Colorado below Lee Ferry in any way relieve the States of the upper division from their obligation not to cause the flow of the river to be depleted below 75,000,000 acre-feet in any period of 10 consecutive years?

I can see no connection between the use of waters in Arizona from Colorado River tributaries and the obligation of the upper States to deliver the 75,000,000 acre-feet each 10 years at Lee Ferry. Their undertaking in this respect is separate and independent and without reference to place of use or quantity of water obtained from any other source. On the face of this paragraph this amount of water must be delivered even though not used at all. The obligation certainly can not be diminished by the fact that Arizona obtains other water from another source. The contract is to deliver a definite amount of water at a definite point above the inflow of various important tributaries, and I find nothing in the compact which modifies this obligation, except the general limitation as to use, which is hereafter referred to.

Question 8. As a matter of fact more than 1,000,000 acre-feet of water from the tributaries of the Colorado below Lee Ferry are now being beneficially used and consumed within the State of Arizona. Will the excess above that amount be accounted for as a part of the 7,500,000 acre-feet first apportioned to the lower basin from the waters of the "Colorado River system" as provided in paragraph (a) of Article III?

By the provisions of paragraphs (a) and (b), Article III, the lower basin is entitled to the use of a total of 8,500,000 acre-feet per annum from the entire Colorado River system, the main river and its tributaries. All use of water in that basin, including the waters of tributaries entering the river below Lee Ferry, must be included within this quantity. The relation is reciprocal. Water used from these tributaries falls within the 8,500,000 acre-feet quota. Water obtained from them does not come within the 75,000,000 acre-feet 10-year period flow delivered at Lee Ferry, but remains available for use over and above that amount.

Question 9. Does paragraph (c) of Article III contemplate a treaty between the United States and the Republic of Mexico under which one-half of a deficiency of water for the irrigation of lands in Mexico shall be supplied from reservoirs in Arizona?

No. Paragraph (c) of Article III does not contemplate any treaty. It recognizes the possibility that a treaty may, at some time, be made and that under it Mexico may become entitled to the use of some water, and divides the burden in such an event, but the quantity to which that country may become entitled and the manner, terms, and conditions upon which such use may depend, can not be foreseen. It is a certainty that no such treaty will be negotiated and ratified which is unfair to the United States or any State or detrimental to their interests. To discuss whether or not a treaty might be made under which Mexico might be permitted to receive water impounded in a reservoir which may be constructed, is to indulge in speculation, but it is safe to say that if such a situation should result it will be only under conditions fair and satisfactory to all parties concerned.

Question 10. What is the estimated quantity of water which constitutes the undivided surplus of the annual flow of the Colorado River and may the compact be

construed to mean that no part of this surplus can be beneficially used or consumed in either the upper or the lower basins until 1963, so that the entire quantity above the apportionment must flow into Mexico, where it may be used for irrigation and thus create a prior right to water which the United States would be bound to recognize at the end of the 40-year period?

(a) The unapportioned surplus is estimated at from 4,000,000 to 6,000,000 acre-feet, but may be taken as approximately 5,000,000 acre-feet.

(b) The right to the use of unapportioned or surplus water is not covered by the compact. The question can not arise until all the waters apportioned are appropriated and used, and this will not be until after the lapse of a long period of time, perhaps 75 years. Assuming that each basin should reach the limit of its allotment and there should still be water unapportioned, in my opinion, such water could be taken and used in either basin under the ordinary rules governing appropriations, and such appropriations would doubtless receive formal recognition by the commission at the end of the 40-year period. There is certainly nothing in the compact which requires any water whatever to run unused to Mexico, or which recognizes any Mexican rights, the only reference to that situation being the expression of the realization that some such rights may perhaps in the future be established by treaty. As I understand the matter, the United States is not "bound to recognize" any such rights of a foreign country unless based upon treaty stipulations.

Question 11. Is there any possibility that water stored by dams in the tributaries of the Colorado River in Arizona, such as the Roosevelt Reservoir, on the Salt River, or the San Carlos Reservoir, on the Gila, might under the terms of such a treaty, be released for use in Mexico to the injury of the water users of the projects for whose benefit such dams were constructed?

I can not conceive of the making or the ratification of a treaty which would have such an effect. If it were possible to believe that the Federal Government would treat its own citizens with such absolute disregard of their property and rights, I presume that they would receive ample protection even as against the Government, under the provisions of the Federal Constitution.

It must be remembered that the United States now has a large financial interest in the projects already constructed. It is not to be presumed that action will be taken detrimental to these interests. Furthermore, each of the seven States directly concerned has two Members of the Senate, by which any treaty proposed must be ratified.

Question 12. Is it true, as has been asserted, that, if the Colorado River compact be approved, the water which should reclaim 2,500,000 acres of land in Arizona will go to Mexico and there irrigate a vast area owned by American speculators who will cultivate the same with Asiatic coolie labor and raise cheap crops in competition with Arizona and California farmers?

If such assertions have been made, there is absolutely nothing in the compact upon which they can be based. They are the result solely of unrestrained and unfounded imagination. As already stated, there is no reference in the compact to any rights of any persons in Mexico; none are created and none are recognized. That entire question, if it ever arises, must be dealt with by the Federal Government in the exercise of its treaty-making power. Such a subject was beyond the purview of the acts creating the commission, and it was intentionally omitted from the compact.

Question 13. Objection has been made to paragraph (d) of Article III in that it authorizes the withholding of an indefinite amount of water by the States of the upper division during a drought which might extend over two or three years. If the drought should be broken by heavy rains the ensuing floods would provide the total of 75,000,000 acre-feet within the 10 years, but water would be denied to the lower basin when worst needed and oversupplied when not needed. In your opinion, does this provision of the compact seriously menace the proper and maximum development of irrigation projects in the lower basin?

In my opinion, the provision about which you ask does not menace the proper and maximum development of irrigation projects in the lower basin.

The future development of the Colorado River Basin is dependent wholly upon the creation of storage. The lower States have certainly reached the limit of development by the direct diversion of the flow of the river. Reservoirs are imperative. They must be of sufficient size not merely to equalize the annual flow, but to impound the excessive floods of one year to supply a deficiency resulting from a following

lean year. Such construction will obviate, to a great extent, the likelihood of the situation you suggest. Furthermore, there can not be a drought or lack of water in the lower States without a similar condition in the upper. A shortage of water below can only be caused by lack of rainfall above. It is inconceivable that any upper State would attempt to store and withhold water it did not need. Such action would not be permitted under the ordinary rules of law and is prohibited by the compact itself. If the water is used in the upper States, the return flow, ultimately large in quantity, necessarily runs down the stream. The large reservoir sites capable of impounding the flow for more than one year are in the lower, not the upper, basin, and it would be a physical impossibility for the upper States to withhold all the flow of the river for any long period, even if they desired to do so. For these reasons, I answer this question in the negative.

Question 14. Can paragraph (d) of Article III be construed to mean that the States of the upper division may withhold all except 75,000,000 acre-feet of water within any period of 10 years and thus not only secure the amount to which they are entitled under the apportionment made in paragraph (a) but also the entire unapportioned surplus waters of the Colorado River?

No. Paragraph (a) of Article III apportions to the upper basin 7,500,000 acre-feet per annum. Paragraph (e) of Article III provides that the States of the upper division shall not withhold water that can not be beneficially used. Paragraphs (f) and (g) of this article specifically leave to further apportionment water now unapportioned. There is, therefore, no possibility of construing paragraph (d) of this article as suggested.

Question 15. Does paragraph (d) of Article III in any way modify the obligation of the States of the upper division, as expressed in paragraph (c), to permit the surplus and unapportioned waters to flow down in satisfaction of any right to water which may hereafter be accorded by treaty to Mexico? Within any year of a 10-year period, could the States of the upper division shift to the States of the lower division the entire burden of supplying such water to Mexico?

(a) No. It is provided in the compact that the upper States shall add their share of any Mexican burden to the delivery to be made at Lee Ferry, whenever any Mexican rights shall be established by treaty. By paragraph (c) of Article III, such an amount of water is to be delivered in addition to the 75,000,000 acre-feet otherwise provided for.

(b) In the face of the specific provision of Article III (c) that the burden of any deficiency must be "equally borne," I can see no possibility of placing upon the lower division the entire burden. If the surplus is sufficient, there is no burden on anyone. If it is insufficient the plain language is that it must be equally shared, with the equally plain provision that the upper division must furnish its half.

Question 16. Why is it that provision is made in paragraph (f) of Article III for a further apportionment, after 40 years, of the waters of the Colorado River system unapportioned by paragraphs (a), (b) and (c), but that no provision is made for a revision of the terms relating to the flow of the Colorado River at Lee Ferry, at set forth in paragraph (d)?

No such special provision was necessary. All that the present commission has done has been by virtue of its power "to divide and apportion equitably" the waters of the river. By specifying in this compact the powers of the second commission in identical language the same powers are necessarily granted, and that commission may do whatever this one could, subject only to noninterference with individual rights which may have become vested under this agreement. It was therefore not considered necessary to specify powers in detail, since the grant of the general power includes the particular.

In this connection it must be remembered that the further compact at the end of 40 years can be entered into only by unanimous agreement of the States. Given such unanimity, anything desired may be done and any existing provisions modified or annulled.

Question 17. In your opinion, will the States of the upper division or the States of the lower division benefit most by the terms of paragraph (e) of Article III when the same are in actual operation?

This paragraph applies only to an unreasonable or arbitrary withholding or demand. I do not anticipate either arbitrary action or unreasonableness on the part of any of the States concerned. The upper States can gain nothing by withholding

water not needed, nor can the lower States gain by demanding water for which they have no use. The paragraph is of value as an expression of the prohibition of such action, but I doubt if it is ever called into practical effect.

Question 18. Why is the use of the waters of the Colorado River for navigation made subservient to domestic, agricultural, and power uses, as provided in paragraph (a) of Article IV?

This article is an expression of the views of the commission as to the relative importance of the uses to which the waters of the river may be devoted. It is recognized that on many streams navigation is a paramount use, but on this particular river navigation is negligible in fact. As expressed in the language adopted, the river "has ceased to be navigable for commerce." This is a true statement of the existing situation. Below Yuma there is but little water in the river bed. The Laguna Dam, above Yuma, has made navigation between points above and below it physically impossible, and the construction of further dams in the development of the river will prevent navigation at other points, even if it were now physically possible. Power structures, irrigation dams and navigation can not conveniently exist together. It was therefore felt that the very great possible use of this water for power and irrigation far outweighed in economic importance the very slight and largely theoretical use which might be made for navigation, and this paragraph was drafted accordingly.

Question 19. Why is the impounding of water for power purposes made subservient to its use and consumption for agricultural and domestic purposes, as provided in paragraph (b) of Article IV?

(a) Because such subordination conforms to established law, either by constitution or statute, in most of the semi-arid States. This provision frees the farmer from the danger of damage suits by power companies in the event of conflict between them.

(b) Because the cultivation of land naturally outranks in importance the generation of power, since it is the most important of human activities, the foundation upon which all other industries finally rest.

(c) Because there was a general agreement by all parties appearing before the commission, including those representing power interests, that such preference was proper.

Question 20. Will this subordination of the development of hydroelectric power to domestic and agricultural uses, combined with the apportionment of 7,500,000 acre-feet of water to the upper basin, utterly destroy an asset of the State of Arizona consisting of 3,000,000 horsepower, which it is said could otherwise be developed within that State if the Colorado River continues to flow, undiminished in volume, across its northern boundary line and through the Grand Canyon?

(a) The subordination of power to agriculture will only diminish power in the case that it is necessary to stop the entire flow of the river at some lower dam at some particular season of the year in order to create reserves for the agricultural community. The normal engineering development of the river will proceed by various dams, of which the dam lowest down would be the only one where there would be the remotest probability of a complete stoppage of water flow. Indeed, this could not happen for at least a hundred years, as it would contemplate a development of acreage in the Lower Basin far beyond anything now dreamed of.

(b) The adequate development of power can only be obtained through the erection of storage and through the irrigation of the Upper Basin. Storage dams can be erected both in the lower and upper canyon in such a fashion as to secure an average flow of the water throughout the entire year, and thus the maximum power developed. The irrigation of the Upper Basin, as explained above, acts itself as a reservoir regulating the flow of the river, increasing the minimum flow, and thus increasing the average power.

(c) Obviously, the use of the water for irrigation in the upper basin must in some degree diminish the volume of power in the lower basin, even though the lower river were entirely regulated to secure an even flow of the water. But it can not be pretended that the upper basin is to be denied the right to the use of the water for agricultural purposes because of power demands in the lower basin. Such a pretension would not be supported in any of the courts, and if set up in the lower basin would mean that the basin will not be developed so long as the upper States can exert any legislative influence whatever. As a matter of fact, the power possi-

bilities of the river are in no way diminished by the compact, unless it is to be assumed that there is not to be an equitable division of water.

(d) The compact provides that no water is to be withheld above that can not be used for purposes of agriculture. The lower basin will therefore receive the entire flow of the river, less only the amount consumptively used in the upper States for agricultural purposes.

(c) The contention that the Colorado River is to continue to flow undiminished in volume across the northern boundary line of Arizona is a contention that the upper States shall have no rights to irrigation. It is a direct negation of both equity and human rights.

Question 21. Paragraph (c) of Article IV states that that article shall not interfere with the control by any State over the appropriation, use, and distribution of water within its own boundaries. Does this imply that the remainder of the compact may interfere with such intrastate control?

This article seems the only one of the compact which might affect the relations of citizens of one State with each other, and it was therefore considered advisable to add the clause to which your question refers. I do not believe, however, that its insertion in this article would, by implication or otherwise, preclude the complete control by each State of its own internal affairs.

Question 22. Does the Colorado River compact apportion any water to the State of Arizona?

No, nor to any other State individually. The apportionment is to the groups.

Question 23. In case of disagreements between the States of Arizona, California or Nevada as to a division among them of the waters of the Colorado River system apportioned by the compact to the lower basin, what procedure will be followed and what rules will govern the settlement of such differences?

This situation would be covered by Article VI. If its provisions are not sufficient or not satisfactory, then the dispute would be settled in the same way as other interstate conflicts now are, either by negotiation or agreement or by litigation.

Question 24. What was the necessity for Article VII relating to the obligations of the United States to Indian tribes?

This article was perhaps unnecessary. It is merely a declaration that the States, in entering into the agreement, disclaim any intention of affecting the performance of any obligations owing by the United States to Indians. It is presumed that the States have no power to disturb these relations, and it was thought wise to declare that no such result was intended.

Question 25. Article VIII is somewhat confusing to me and I would like to have your interpretation of its meaning. Why is the term "storage capacity" used? Does the capacity of a reservoir to hold water necessarily mean that it will be filled? If this "storage capacity" is destroyed by the reservoir filling with silt, are all rights to the use of water in the lower basin likewise destroyed? Why was so small a figure as 5,000,000 acre-feet agreed upon as the measure of this "capacity"?

(a) The first sentence of this paragraph is a recognition of the validity of present perfected rights to the use of waters and is inserted to obviate any fears on the part of present users that their rights might be impaired by the compact.

(b) The second sentence covers the situation now existing on the lower river. It is claimed that the entire low-water flow of the river has now been appropriated by users in California and Arizona, that rights to its continued and unimpaired flow have vested, and that any interference with these rights by attempted appropriation in the upper States could be prevented by appropriate legal proceedings. If such rights do exist, under the provisions of this paragraph they continue unimpaired until the use of water by direct diversion is substituted by its use through storage, at which time the enforcement of any rights to low-water flow for direct diversion obviously becomes unnecessary. When adequate storage has been provided, disputes over low-water flow necessarily cease. Five million acre-feet of storage is ample to provide water for all existing appropriations in the lower basin, and since it was intended only to meet the situation there it was agreed to. It is in no sense a limitation upon the size of the works to be built nor even an expression of opinion of the capacity to be adopted.

There can be no reasonable doubt in the mind of anyone as to the supply of water for a reservoir of this capacity. Given the capacity, the filling of the reservoir will result as a matter of course and physical necessity.

The rights to the use of water in the lower basin are in no way dependent upon the construction of this or any other storage. The clause in question affects only rights to the direct diversion of low-water flow. The apportionment of water between the basins and the guaranty of quantity by the upper States have no relation to this situation, and whether storage is or is not provided, whether or not reservoirs fill with silt, the apportionment and mutual obligations as to division of water remain unaffected and unimpaired.

Question 26. All of these questions have been asked primarily with a view to obtaining first-hand information for the benefit of the Legislature of the State of Arizona, which now has the Colorado River compact under consideration. Any further observations that you may care to make will, therefore, be appreciated.

It seems to me a primary fact that the legislative action necessary for appropriations from Congress can not be secured nor construction work established at any point unless an equitable division of the waters of the Colorado River is first accomplished. There are only two methods of doing this; one is by compact and the other is by litigation. If this compact is not ratified it is necessary to start the process all over again, and I can see little hope of any more constructive basis of handling the problem than this compact already embraces.

The minor objections to the compact are generally based on exploitation of theoretical figures, without a full appreciation of the physical facts that govern the flow of the Colorado River. I have found that careful consideration of these physical surroundings of the river dissipate fear whenever they are carefully inquired into.

It is to be remembered also that until the dams are constructed the present flood menace will continue to threaten the Yuma project, the Imperial Valley, and other Arizona and California territory adjacent to the river on its lower reaches.

ACT OF CONGRESS AUTHORIZING APPOINTMENT OF COMMISSIONERS

Approved August 19, 1921

(Public—No. 56—67th Congress)

An act (H. R. 6877) to permit a compact or agreement between the states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes.

Whereas the Colorado River and its several tributaries rise within and flow through or from the boundaries between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming; and

Whereas the territory included within the drainage area of the said stream and its tributaries is largely arid and in small part irrigated, and the present and future development necessities and general welfare of each of the said States and of the United States require the further use of the waters of said streams for irrigation and other beneficial purposes and that future litigation and conflict respecting the use and distribution of said waters should be avoided and settled by compact between said States; and

Whereas the said States, by appropriate legislation, have authorized the governors thereof to appoint commissioners to represent said States for the purpose of entering into a compact or agreement between said States respecting the future utilization and disposition of the waters of the Colorado River and of the streams tributary thereto; and

Whereas the governors of said several States have named and appointed their respective commissioners for the purposes aforesaid and have presented their resolution to the President of the United States requesting the appointment of a representative on behalf of the United States to participate in said negotiations and to represent the interests of the United States: Now, therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That consent of Congress is hereby given to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, to negotiate and enter into a compact or agreement not later than January 1, 1923, providing for an equitable division and apportionment among said States of the water supply of the Colorado River and of the streams tributary thereto, upon condition that a suitable person, who shall be appointed by the President of the United States, shall participate in said negotiations as the representative of and for the protection of the interests of the United States, and shall make report to

Congress of the proceedings and of any compact or agreement entered into, and the sum of \$10,000, or so much thereof as may be necessary, is hereby authorized to be appropriated to pay the salary and expenses of the representative of the United States appointed hereunder: *Provided*, That any such compact or agreement shall not be binding or obligatory upon any of the parties thereto unless and until the same shall have been approved by the legislature of each of said States and by the Congress of the United States.

Sec. 2. That the right to alter, amend, or repeal this act is herewith expressly reserved.

Approved, August 19, 1921.

CALIFORNIA AUTHORIZATION OF COMPACT COMMISSIONER

Approved May 12, 1921

CHAPTER 88

An act authorizing the governor of California to appoint a representative of the State of California to serve upon a joint commission composed of representatives of the states of Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming and the United States of America, and constituted for the purpose of negotiating and entering into an agreement between the several states hereinabove mentioned and between said states and the United States of America, subject to the consent of congress, respecting further use and disposition of the waters of the Colorado River and streams tributary thereto, and fixing and determining the rights of each of said states and rights of the United States in and to the use, benefit and disposition of the waters of said stream and its tributaries.

(Approved May 12, 1921. In effect immediately.)

The people of the State of California do enact as follows:

Section 1. The governor of California shall appoint the state engineer who shall serve without additional compensation as the representative of the State of California on a joint commission composed of one representative from each of the states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and two duly authorized representatives of the United States of America, the principal duty of which commission shall be to negotiate and enter into an agreement between the several states hereinabove mentioned and between the said states and the United States of America, subject to the consent of congress, respecting the further use and disposition of the waters of the Colorado river and streams tributary thereto, and fixing and determining the rights of each of said states and the rights of the United States in and to the use, benefit, and disposition of the waters of the Colorado river and its tributaries; *provided, however*, that any agreement so entered into by said states and the United States of America shall not be binding or obligatory upon any of the high contracting parties thereto unless and until such agreement shall have been ratified and approved by the legislature of each of the above-mentioned states and by the congress of the United States.

Sec. 2. The Governor of California, immediately after such representative of the State of California has been appointed and has qualified, shall notify the Governor of each of the above-mentioned states of the appointment of the said representative of California, giving his name and address, but said representative shall not enter upon the performance of his duties until a representative to serve upon said joint commission shall have been named and qualified for each of the states named in section 1 hereof.

Sec. 3. Said representative from California shall have full authority to make any and all investigations of the Colorado river and the drainage area thereof, which may become necessary in order to sufficiently advise said representative of the physical conditions obtaining upon said streams, and of the present and future need of the State of California and its citizens to the use and benefit of the waters of said stream. To that end, said representative shall have authority to administer oaths, examine and require the attendance of witnesses, and to perform such other duties as may be necessary to sufficiently apprise said representative of the facts and furnish him with adequate information in order that he may properly perform his duties as representative of the State of California upon said joint commission.

Sec. 4. Inasmuch as the Colorado river during flood periods constitutes a menace to life and property within this state and the purpose of the commission is to meet immediately upon the appointment and qualification of the representatives of the several states for the purpose of adopting a plan of agreement which will ultimately make possible the construction of impounding dams that will eliminate this hazard,

it is hereby declared that this act is an emergency measure necessary for the immediate preservation of the public health, peace and safety, and that under the provisions of section one of article four of the state constitution an urgency exists, and this act shall take effect immediately.

CALIFORNIA FINNEY RESOLUTION

CHAPTER 33

Assembly Joint Resolution No. 15—Relating to the Colorado River Compact between the states of California, Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming.

(Filed with Secretary of State April 8, 1925.)

Whereas, The legislature of the states of California, Colorado, New Mexico, Nevada, Utah and Wyoming have heretofore approved the Colorado River Compact, signed by the commissioners for said states and the state of Arizona, and approved by Herbert Hoover, as the representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922, and notice of the approval by the legislature of each of said approving states has been given by the governor thereof to the governors of the other signatory states, and to the President of the United States, as required by article eleven of said compact; and

Whereas, The said compact has not been approved by the legislature of the state of Arizona, nor by the congress of the United States. Now, therefore, be it

Resolved by the assembly and the senate of the legislature of the State of California, jointly, at its forty-sixth session commencing on the fifth day of January, 1925, a majority of all the members elected to each house of said legislature voting in favor thereof that the provisions of the first paragraph of article eleven of the said Colorado River Compact, making said compact binding and obligatory when it shall have been approved by the legislature of each of the signatory states are hereby waived and said compact shall become binding and obligatory upon the State of California, when by act or resolution of their respective legislatures at least six of the signatory states, which have approved or which may hereafter approve said compact, shall consent to such waiver and the congress of the United States shall have given its consent and approval; *provided, however*, that said Colorado River Compact shall not be binding or obligatory upon the State of California by this or any former approval thereof, or in any event until the President of the United States shall certify and declare (a) that the congress of the United States has duly authorized and directed the construction by the United States of a dam in the main stream of the Colorado River, at or below Boulder Canyon, adequate to create a storage reservoir of a capacity of not less than twenty million acre-feet of water; and (b) that the congress of the United States has exercised the power and jurisdiction of the United States to make the terms of said Colorado River Compact binding and effective as to the waters of said Colorado River.

That certified copies of the foregoing preamble and resolution be forwarded by the Governor of the State of California to the President of the United States, the Secretary of State of the United States, and the Governors of the states of Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming.

WYOMING RATIFICATION

Six-State Compact
Approved Feb. 25, 1925

CHAPTER 82

Original Senate File No. 75

RATIFICATION OF COLORADO RIVER COMPACT

An act relating to the Colorado River Compact

Whereas, the Legislatures of the States of California, Colorado, Nevada, New Mexico, Utah and Wyoming, heretofore have approved the Colorado River Compact, signed by the Commissioners for said States and the State of Arizona, and approved by Herbert Hoover as a representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922 (Chapter 3 of the Session Laws of Wyoming, 1923), and notice of the approval by the Legislature of each of said approving states has been given by the Governor to the Governors of the other signatory states, and to the President of the United States, as required by Article XI of said Compact; Now Therefore,

Be It Enacted by the Legislature of the State of Wyoming:

Section 1. That the provisions of the first paragraph of Article XI of the Colorado River Compact, making said compact effective when it shall have been approved by the Legislature of each of the signatory States, are hereby waived and said Compact shall become binding and obligatory upon the State of Wyoming, and upon the other signatory States which have ratified and may hereafter ratify it, whenever at least six of the signatory States shall have consented thereto and the Congress of the United States shall have given its consent and approval, provided however, that this Act shall be of no force and effect until a similar Act or Resolution shall have been passed or adopted by the Legislatures of the States of California, Colorado, Nevada, New Mexico and Utah.

Section 2. This Act shall take effect and be in force from and after its passage.
Approved February 25, 1925.

COLORADO RATIFICATION

Six-State Compact
Approved Feb. 26, 1925

CHAPTER 177

WATER COMMISSION
Colorado River Compact

An act relating to the Colorado River Compact

WHEREAS, the Legislatures of the States of California, Colorado, Nevada, New Mexico, Utah and Wyoming heretofore have approved The Colorado River Compact, signed by the Commissioners for said States and the State of Arizona and approved by Herbert Hoover as the representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922 (Chap. 189, pp. 684-693, Sess. Laws, Colo., 1923, etc.), and notice of the approval by the Legislature of each of said approving States has been given by the Governor to the Governors of the other signatory States and to the President of the United States, as required by Article XI of said Compact, now therefore,

Be It Enacted by the General Assembly of the State of Colorado:

Section 1. That the provisions of the first paragraph of Article XI of the Colorado River Compact, making said compact effective when it shall have been approved by the Legislature of each of the signatory States, are hereby waived and said compact shall become binding and obligatory upon the State of Colorado and upon the other signatory States, which have ratified or may hereafter ratify it, whenever at least six of the signatory states shall have consented thereto and the Congress of the United States shall have given its consent and approval, Provided, however, that this Act shall be of no force or effect until a similar Act or resolution shall have been passed or adopted by the Legislatures of the States of California, Nevada, New Mexico, Utah, and Wyoming.

Section 2. That certified copies of this Act be forwarded by the Governor of the State of Colorado to the President of the United States, the Secretary of State of the United States, and the Governors of the States of Arizona, California, Nevada, New Mexico, Utah and Wyoming.

Section 3. The General Assembly hereby finds, determines and declares that this Act is necessary for the immediate preservation of the public peace, health and safety.

Section 4. In the opinion of the General Assembly an emergency exists, therefore, subject to the provisions of Section 1 hereof, this Act shall take effect and be in force from and after its passage.

Approved February 26, 1925.

NEW MEXICO RATIFICATION

Six-State Compact
Approved March 17, 1925

SEVENTH LEGISLATURE

SENATE BILL No. 105

STATE OF NEW MEXICO

Introduced by Mr. Holt

An act relating to the Colorado River Compact

WHEREAS, the Legislatures of the States of California, Colorado, Nevada, New Mexico, Utah and Wyoming heretofore have approved The Colorado River

Compact, signed by the Commissioners for said States and the State of Arizona and approved by Herbert Hoover as the representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922 (Chap. 6, pp. 7-13, Laws of New Mexico, 1923), and notice of the approval by the Legislature of each of said approving States have been given by the Governor to the Governors of the other signatory States and to the President of the United States, as required by Article XI of said compact, now therefore,

Be it enacted by the Legislature of the State of New Mexico:

Section 1. That the provisions of the first paragraph of Article XI of The Colorado River Compact, making said compact effective when it shall have been approved by the Legislature of each of the signatory States, are hereby waived and said compact shall become binding and obligatory upon the State of New Mexico and upon the other signatory States, which have ratified or may hereafter ratify it, whenever at least six of the signatory States shall have consented thereto and the Congress of the United States shall have given its consent and approval, Provided, however, that this act shall be of no force or effect until a similar act or resolution shall have been passed or adopted by the Legislature of the States of California, Nevada, Colorado, Utah, and Wyoming.

Sec. 2. That certified copies of this Act be forwarded by the Governor of the State of New Mexico to the President of the United States, the Secretary of State of the United States, and the Governors of the States of Arizona, California, Nevada, Colorado, Utah and Wyoming.

Sec. 3. That it is necessary for the preservation of the public peace, health and safety of the inhabitants of the State of New Mexico, that the provisions of this act shall become effective at the earliest possible time, and therefore, an emergency is hereby declared to exist, and this act shall take effect and be in full force and effect from and after its passage and approval.

Attest:

A. J. Fischer,
Chief Clerk of the Senate.

Edward Sargent,
President of the Senate.

D. W. Smith,
Speaker of the House of Representatives.

Attest:

J. O. Morris,
Chief Clerk of the House of Representatives.

Approved by me this 17th day of March, 1925.

A. T. Hannett,
Governor of New Mexico.

Filed in office of Secretary of State of New Mexico Mar. 17, 1925, 3.10 p.m.

Soledad C. Cachon, Secretary.

NEVADA RATIFICATION

Six-State Compact

Approved March 18, 1925

(Senate Bill No. 87—Senator Smith)

Chap. 96—An Act relating to the Colorado river compact; waiving certain provisions of Article XI thereof; agreeing to and entering into said Colorado River Compact as so modified, and providing for the ratification and going into effect of said compact as so modified.

(Approved March 18, 1925)

WHEREAS, The legislatures of the States of California, Colorado, Nevada, New Mexico, Utah and Wyoming heretofore have approved the Colorado River Compact signed by the commissioners for said states and the state of Arizona and approved by Herbert Hoover as the representative of the United States of America, at Santa Fe, New Mexico, November 24, 1922, and the approval of the legislature of the State of Nevada was given and granted by Chapter No. 2 of resolutions and memorials passed at the thirty-first session, Nevada legislature, 1923, printed and published at pages 393 to 399, inclusive, and notice of the approval by the legislatures of each of the said approving states have been given by the governor and each

respective governor to the governors of the other signatory states and to the President of the United States, as required by Article XI of said compact; now, therefore,

The People of the State of Nevada, represented in Senate and Assembly, do enact as follows:

Section 1. That the provisions of the first paragraph of Article XI of the Colorado River Compact, making said compact effective when it shall have been approved by the legislature of each of the signatory states, are hereby waived and said compact shall become binding and obligatory upon the State of Nevada and upon the other signatory states which have ratified or may hereafter ratify it whenever at least six (6) of the signatory states shall have consented thereto and the Congress of the United States shall have given its consent and approval; provided, however, that this act shall be of no force or effect until this or a similar resolution shall have been passed or adopted by the legislatures of the states of California, Colorado, Nevada, New Mexico, Utah and Wyoming.

Sec. 2. That certified copies of this act be prepared by the secretary of State and forwarded by the governor of the State of Nevada to the President of the United States, the Secretary of State of the United States, and the governors of the States of Arizona, California, Colorado, New Mexico, Utah and Wyoming.

Sec. 3. Good cause appearing, this act shall take effect immediately from and after its passage.

UTAH'S MODIFICATION OF RATIFICATION

February 26, 1927

Be it enacted by the Legislature of the State of Utah:

Section 1. Colorado River in Utah and Green River in Utah declared to be navigable streams: That the State of Utah does hereby declare that the Colorado River in Utah and the Green River in Utah from time immemorial and at the time of the admission of Utah into the Union as one of the States of the United States of America were and ever since have been and now are navigable streams.

Sec. 2. Title to bed of all navigable rivers vested in State of Utah, when—Exceptions: That the title to the beds of said rivers and of each of them, as well as the title to the beds of all other streams and lakes which at the time of said admission of Utah into the Union were navigable in fact, vested in the State of Utah at the time of its said admission into the Union and said title has at all times thereafter been and now is vested in the State of Utah, except such portion or portions thereof as may have been heretofore disposed of by the State of Utah pursuant to law, by express grant.

Sec. 3. Intent with respect to paragraph (a) of Article IV, of the Colorado River compact—Colorado River navigable for intrastate commerce: That the State of Utah does hereby declare that its adherence to paragraph (a) of Article IV of the Colorado River compact as set forth in chapter 5, Laws of Utah, 1923, which paragraph reads as follows:

"(a) Inasmuch as the Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of its basin, the use of its waters for purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding."

UTAH RATIFICATION

Six-State Compact
Approved March 6, 1929

CHAPTER 31

House Bill No. 162

(Passed March 6, 1929. Approved March 6, 1929. In effect March 6, 1929)

COLORADO RIVER COMPACT

An Act waiving certain provisions of the Colorado River Compact and approving and ratifying the same when at least five other states signatory thereto, including California, have taken similar action, and providing for certification of the action of this State to the other states and the United States.

Be it enacted by the Legislature of the State of Utah:

Section 1. *When compact becomes binding.* That the provisions of the first paragraph, Article XI, of the Colorado River Compact, as set forth in the original

compact filed in the archives of the Department of State, of the United States, at Washington, D. C., a copy of which is set forth in Chapter 5, Session Laws of Utah, 1923, which article of said compact makes the compact effective when it shall have been approved by the legislatures of the signatory states and by the Congress of the United States, are hereby waived and said compact shall become binding and obligatory upon the State of Utah, and upon the other signatory states which have ratified or may hereafter ratify the said compact whenever at least six of the signatory states, including the State of California, shall have consented thereto, approved and ratified the same without conditions save that of six-state approval, and the Congress of the United States shall have given its consent and approval, provided that this Act shall be of no force or effect until this or a similar Act or resolution shall have been passed and adopted by the legislatures of six of the signatory States, including the State of California.

Section 2. *Governor to forward copies.* That certified copies of this Act be forwarded by the governor of the State of Utah, to the President of the United States, the Secretary of State of the United States, and the Governors of the States of Arizona, Colorado, California, New Mexico, Wyoming and Nevada.

Section 3. This Act shall take effect upon approval.

Approved March 6, 1929.

CALIFORNIA RATIFICATION

Six-State Compact

Approved March 4, 1929

CHAPTER 15

An act to waive certain provisions of the Colorado River Compact approved by California, January 10, 1929 (Statutes 1929, Chapter 1), and to make said compact effective on a six-state basis, and to direct that notice be given.

(Approved by the Governor, March 4, 1929. In effect August 14, 1929.)

The people of the State of California do enact as follows:

Section 1. The provisions of the first paragraph of Article XI of the Colorado River Compact, signed at Santa Fe, New Mexico, November 24, 1922, referred to and set out, at length in that certain act entitled "An act to ratify and approve the Colorado River Compact, signed at Santa Fe, New Mexico, November 24, 1922, to repeal conflicting acts and resolutions and directing that notice be given by the governor of such ratification and approval," approved January 10, 1929 (Statutes 1929, Chapter 1), making said compact binding and obligatory when it shall have been approved by the legislature of each of the signatory states are hereby waived, and said compact shall become binding and obligatory upon the State of California, and upon the other signatory states which have ratified or may hereafter ratify said compact, when at least six of the signatory states shall have consented thereto, approved and ratified the same, and the Congress of the United States shall have given its consent and approval; *provided, however,* that this act shall be of no force or effect until a similar act or resolution shall have been passed or adopted by the legislatures of the states of Colorado, Nevada, New Mexico, Utah and Wyoming.

Section 2. Certified copies of this act shall be forwarded by the governor to the President of the United States, the secretary of state of the United States, and the governors of the states of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming.

CALIFORNIA WATER LIMITATION

Approved March 4, 1929

An act to limit the use by California of the waters of the Colorado River in compliance with the Act of Congress known as the "Boulder Canyon Project Act," approved December 21, 1928, in the event the Colorado River Compact is not approved by all of the states signatory thereto.

(Approved by the Governor, March 4, 1929. In effect August 14, 1929.)

The people of the State of California do enact as follows:

Section 1. In the event the Colorado River Compact signed at Santa Fe, New Mexico, November 24, 1922, and approved by and set out at length in that certain act entitled "An act to ratify and approve the Colorado River Compact, signed at

Santa Fe, New Mexico, November 24, 1922, to repeal conflicting acts and resolutions and directing that notice be given by the governor of such ratifications and approval," approved January 10, 1929 (Statutes 1929, Chapter 1), is not approved within six months from the date of the passage of that certain act of the Congress of the United States known as the "Boulder Canyon Project Act," approved December 21, 1928, by the legislatures of each of the seven states signatory thereto, as provided by Article XI of the said Colorado River Compact, then when six of said states, including California, shall have ratified and approved said compact, and shall have consented to waive the provisions of the first paragraph of Article XI of said compact which makes the same binding and obligatory when approved by each of the states signatory thereto, and shall have approved said compact without conditions save that of such six states approved and the President by public proclamation shall have so declared, as provided by the said "Boulder Canyon Project Act," the State of California as of the date of such proclamation agrees irrevocably and unconditionally with the United States and for the benefit of the states of Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming as an express covenant and in consideration of the passage of the said "Boulder Canyon Project Act," that the aggregate annual consumptive use (diversions less returns to the river) of water of and from the Colorado River for use in the State of California including all uses under contracts made under the provisions of said "Boulder Canyon Project Act," and all water necessary for the supply of any rights which may now exist, shall not exceed four million four hundred thousand acre-feet of the waters apportioned to the lower basin states by paragraph "a" of Article III of the said Colorado River Compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact.

Sec. 2. By this act the State of California intends to comply with the conditions respecting limitation on the use of water as specified in subdivision 2 of section 4 (a) of the said "Boulder Canyon Project Act" and this act shall be so construed.

PRESIDENT HOOVER'S PROCLAMATION

Making Effective the Boulder Canyon Project Act of December 21, 1928

On June 25, 1929, President Hoover issued the following public proclamation:

Pursuant to the provisions of section 4 (a) of the Boulder Canyon Project Act approved December 21, 1928 (45 Stat. 1057), it is hereby declared by public proclamation:

(a) That the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming have not ratified the Colorado River Compact mentioned in section 13 (a) of said act of December 21, 1928, within six months from the date of the passage and approval of said act.

(b) That the States of California, Colorado, Nevada, New Mexico, Utah, and Wyoming have ratified said compact and have consented to waive the provisions of the first paragraph of Article XI of said compact, which makes the same binding and obligatory only when approved by each of the seven States signatory thereto, and that each of the States last named has approved said compact without condition, except that of six-State approval as prescribed in section 13 (a) of said act of December 21, 1928.

(c) That the State of California has in all things met the requirements set out in the first paragraph of section 4 (a) of said act of December 21, 1928, necessary to render said act effective on six-State approval of said compact.

(d) All prescribed conditions having been fulfilled, the said Boulder Canyon Project Act approved December 21, 1928, is hereby declared to be effective this date.

In testimony whereof I have hereunto set my hand and caused the seal of the United States of America to be affixed.

Done at the city of Washington this 25th day of June, in the year of our Lord one thousand nine hundred and twenty-nine, and of the Independence of the United States of America the one hundred and fifty-third.

[Seal]

HERBERT HOOVER.

By the President:

HENRY L. STIMSON,
Secretary of State.

CONTRACTS AND FINANCE

The Boulder Canyon Project Act provides that the Government is to be repaid within 50 years for all moneys expended in connection with the development of the project (Sec. 4 (b)). The act further provides that all moneys expended for the dam and incidental works, with the exception of the All-American Canal portion of the project, shall be charged with 4 per cent interest which must be repaid out of the revenues received from the sale of power and for the storage of water (Sec. 2 (b) and (d)).

The financial set-up of the project really is divided into two parts.

First, the dam, power plant and incidental structures at the dam.

Second, the All-American Canal and its incidental structures, the construction of which is to be carried out under the Reclamation Act (Sec. 4 (b)). Provisions for financing this portion of the project are to be carried through separately from that of the dam and power plant portion.

Twenty-five million dollars is allocated to flood control and payment of this amount, or part of it, may be deferred if the revenues from the project are not sufficient to repay within the fifty-year period (Sec. 2 (b)).

The following provision was made (Section 4 (b) Boulder Canyon Project Act) for financing the two divisions of the construction work.

"Before any money is appropriated for the construction of said dam or power plant, or any construction work done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this Act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and the repayment, within fifty years, from the date of the completion of said works, of all amounts advanced * * *

"Before any money is appropriated for the construction of said main canal and appurtenant structures to connect the Laguna Dam with the Imperial and Coachella Valleys in California, or any construction work is done upon said canal or contracted for, the Secretary of the Interior shall make provision for revenue, by contract or otherwise, adequate in his judgment to insure payment of all expenses of construction, operation, and maintenance of said main canal and appurtenant structures in the manner provided in the reclamation law."

The Act provides for an appropriation of \$165,000,000 to cover all costs, and provision is made that \$25,000,000 (Sec. 2 (b)) of this amount is to be allocated for flood control and payment of this may be deferred beyond the fifty-year period.

The cost of the dam and power house is to be repaid in fifty years with 4 per cent interest charged on outstanding amounts, and the All-American Canal part of the project is to be financed under the terms of the Reclamation Law, which would relieve this portion of the project of interest charge. Revenues from the dam and power plant can not be used to pay for the All-American Canal, nor can revenues from the All-American Canal be used to carry the power plant. The two parts are separate financial structures.

The Boulder Canyon Project Act allows the Secretary of the Interior considerable latitude in selling or leasing power or power rights. Some methods considered (see McClellan Report) were:

(a) The government may lease the right to generate power, lessee to install power plant and generate power.

(b) The government may build the power plant and lease the machinery installed, lessee to operate plant and pay for falling water used.

(c) The government may build and operate plant and sell power wholesale at switchboard.

When contracts were actually negotiated the Secretary adopted in substance the first method with a slight modification. The government will build the buildings housing the power plant, it will build and operate the structure up to the control valves, the lessees will pay for and operate the generating machinery but the government will install this machinery, the lessee paying for it in installments over a ten-year period. This machinery to be and remain the property of the government.

The lessees will pay for falling water, as measured by the outgoing electric current at the power house switchboard. This price has been fixed at 1.63 mills per kilowatt hour for firm, and one-half mill for secondary power.

The government will also charge for storage of water, this price has been fixed at 25 cents per acre-foot in the case of the Los Angeles Metropolitan Water District. Water for some purposes has been particularly exempted from any charge under the act (Sec. 1).

Before work could be started the Secretary of the Interior was required to have sound contracts for the sale of power and stored water on a basis that would net the government enough money each year to pay all operating and maintenance expenses of the dam and appurtenant works, interest at 4 per cent on money expended, and also repay in fifty years all money invested excepting the \$25,000,000 which has been allocated to flood control, payments of which may be deferred.

After these payments have been met each year, any excess revenue left over from the annual income is divided in this way (Sec. 4 (b)): 18 $\frac{3}{4}$ per cent of this excess is paid to the State of Arizona, and 18 $\frac{3}{4}$ per cent to the State of Nevada; of the 62 $\frac{1}{2}$ per cent remaining in the excess, the government is first repaid the \$25,000,000 allocated to flood control. Money left over out of this 62 $\frac{1}{2}$ per cent after making this payment, is to be used for general development of the Colorado River System (Sec. 5). If the 62 $\frac{1}{2}$ per cent does not provide enough to take care, during this fifty-year period, of the repayment of the flood control amount, then the balance is to be taken care of out of 62 $\frac{1}{2}$ per cent of net revenues after the end of the fifty-year period (Sec. 2 (b)).

Revenue received from power and stored water at the dam can be used for making repayments only on that portion of the project.

Revenue received from any power development or other payments made in connection with the All-American Canal can be used only in connection with the All-American Canal portion of the project. None of the power or storage revenues from the dam can be used for this purpose.

The following statement made by Dr. Elwood Mead, Commissioner of Reclamation, in an article appearing in the *Engineering News-*

Record, February 6, 1930, gives a very clear idea of how the financing of the project is to be carried through.

"An opinion widely held—that Boulder Dam is being paid for out of taxation—is erroneous. It must be paid for out of power revenues and charges for storing water. The cost of the All-American Canal, also made a part of this legislation, must be borne by the irrigators under that canal. After the Secretary has secured satisfactory contracts for power, he can then proceed to submit estimates for appropriations and make contracts for the building of the dam and power house.

"On the Secretary of the Interior falls the difficult task of determining the price to be charged for this power and the price to be charged for storing water. He must charge a price high enough to repay the cost of the dam and power plant with interest within a period not exceeding fifty years, as required by the act, which further prescribes that such price shall be fixed with a view to securing a reasonable return, and may be adjusted at ten-year periods as justified by competitive conditions.

"After a long and careful investigation the power experts employed by the department fixed a price for the power privilege at the dam of 1.63 mills per kilowatt-hour as meeting these requirements. Those who pay this price will have to install and operate the machinery. It is simply a means of fixing the price to be paid for falling water, with the government having nothing to do with the generation of hydroelectric energy. If the charge is much greater than this, customers can not be found. The city of Los Angeles and the coast counties of California might be constrained to pay more because of their overpowering need for water, which can be obtained only if the dam is built, but in other sections of the country the price to be paid for power would have to be on a competitive basis.

"This price will make the cost of Colorado River power delivered in southern California somewhat greater than the present cost of generating power in the vicinity of Los Angeles by oil or natural gas, but all are agreed that this latter cost is likely to increase. While there have been protests that the price was excessive, two offers for the entire output have been received, one from the Southern California Edison and related companies, and one from the department of power and light of the city of Los Angeles. Both of these bidders are in a position to dispose of all the power purchased. There have been other offers, but the ability to dispose of the power is so problematical that the secretary could not consider them with the facts now before him."

One hundred and sixty-five million dollars is the total estimated expenditure in connection with the construction work authorized by the Boulder Canyon Project Act. When the original estimates were made this figure was placed at \$125,000,000, but December 3, 1928, a report was rendered by a board of engineers (Sibert Board), which had been appointed under authority of a joint resolution (S. J. Res. 164, approved May 29, 1928), which made certain recommendations for changes in the design, estimates, etc., and submitted the following estimate of cost (House Hearings, Second Deficiency Appropriation Bill, 1930, p. 1121) :

"Estimated Cost:

Dam and reservoir (26,000,000 acre-feet capacity)-----	\$70,600,000
1,000,000 horsepower development-----	38,200,000
The All-American Canal-----	38,500,000
Interest during construction on above-----	17,700,000
Total-----	\$165,000,000

In this revision stresses in the dam have been limited to a maximum of 30 tons per square foot, and a diversion capacity of 200,000 second feet is provided.

Should the canal to Coachella Valley be considered a part of the main canal, the above estimates would be increased by the sum of \$11,000,000.

This would make the total estimated cost for all items in H. R. 5773 \$176,000,000. These estimates are based on a construction period of seven years."

Subsequent investigations with a more careful check of the estimates indicate that the figures given by the Sibert Board are considerably on

the safe side. The indications are that construction work will be carried through with a very material saving upon these figures. This gives an additional element of safety in the financial set-up.

Generating machinery at the dam is to be installed and owned by the government but paid for by the lessees of the plant within ten years. As this is a separate payment it is not included in the tabulations of income showing the amount of money received by the government.

A statement filed by Secretary Wilbur with the House Appropriation Committee (Committee Hearings, p. 1043) gives an explanation of the investment at the dam. As the All-American Canal part of the project is to be financed and developed by itself as a separate unit, and is to be financed from its own revenues, figures in connection with that portion of the project are not included in this financial set-up.

Explanation of Investment of \$82,675,000

"Estimated cost of Boulder Canyon project exclusive of interest during construction-----	\$109,446,000
Interest during construction-----	11,554,000
Total estimated cost-----	\$121,000,000
Amount added to cover cost of raising dam 25 feet (Sibert board said higher dam can be built within original estimate)-----	4,392,000
	\$125,392,000
Less \$25,000,000 allocated to flood control-----	25,000,000
	\$100,392,000
Less cost of machinery which is to be repaid separately in 10 years----	17,717,000
Net investment, exclusive of \$25,000 allocated to flood control and investment in machinery-----	\$82,675,000"

Secretary Wilbur at the ceremonies incident to starting work on the dam at Las Vegas, Nevada, on September 17, 1930, made a statement to the effect that "the falling of the water would pay for the dam." By passing the water released from the Boulder Canyon Project dam (Hoover Dam) through turbines an immense amount of power may be generated and the sale or lease of the power thus developed will produce an income large enough to pay for all expenses of operation and also repay the entire cost of construction with interest within fifty years.

Revenue to the project will come from the sale of two things:

1. Power.
2. Stored water.

Power revenue will in turn come from, (a) firm power, and, (b) secondary power. Firm power might be roughly defined as power certainly available at all times, and secondary power might be described as power uncertain as to quantity and time, to be taken if and when available. Secondary power is sometimes referred to as "dump" power.

Under the terms of the contracts (article 15, Los Angeles and Southern California Edison Company contract), firm energy is defined as follows:

"The amount of firm energy for the first year of operation * * * following the date of the completion of the dam * * * shall be defined as being four billion two hundred forty million (4,240,000,000) kilowatt-hours at transmission voltage. For every subsequent year the amount defined as firm energy shall be

decreased by eight million seven hundred sixty thousand (8,760,000) kilowatt-hours * * *

Secondary energy is defined in the same article of the contract as follows:

“The term ‘secondary energy’ wherever used herein shall mean all electrical energy generated in one year * * * in excess of the amount of firm energy as hereinabove defined, available in such year.”

The power and other income will yield enough revenue over and above the amounts required for repayment to the government to provide yearly payments to Nevada and Arizona in excess of \$550,000 each. (House Committee Hearings, Second Deficiency Appropriation Bill 1930, p. 1051). The revenue will also be sufficient to provide a fund, during the fifty years of the amortization period, of over \$62,000,000 for general Colorado River development, this money, under the terms of the act, “to be expended within the Colorado River Basin” (Boulder Canyon Project Act, Sec. 5).

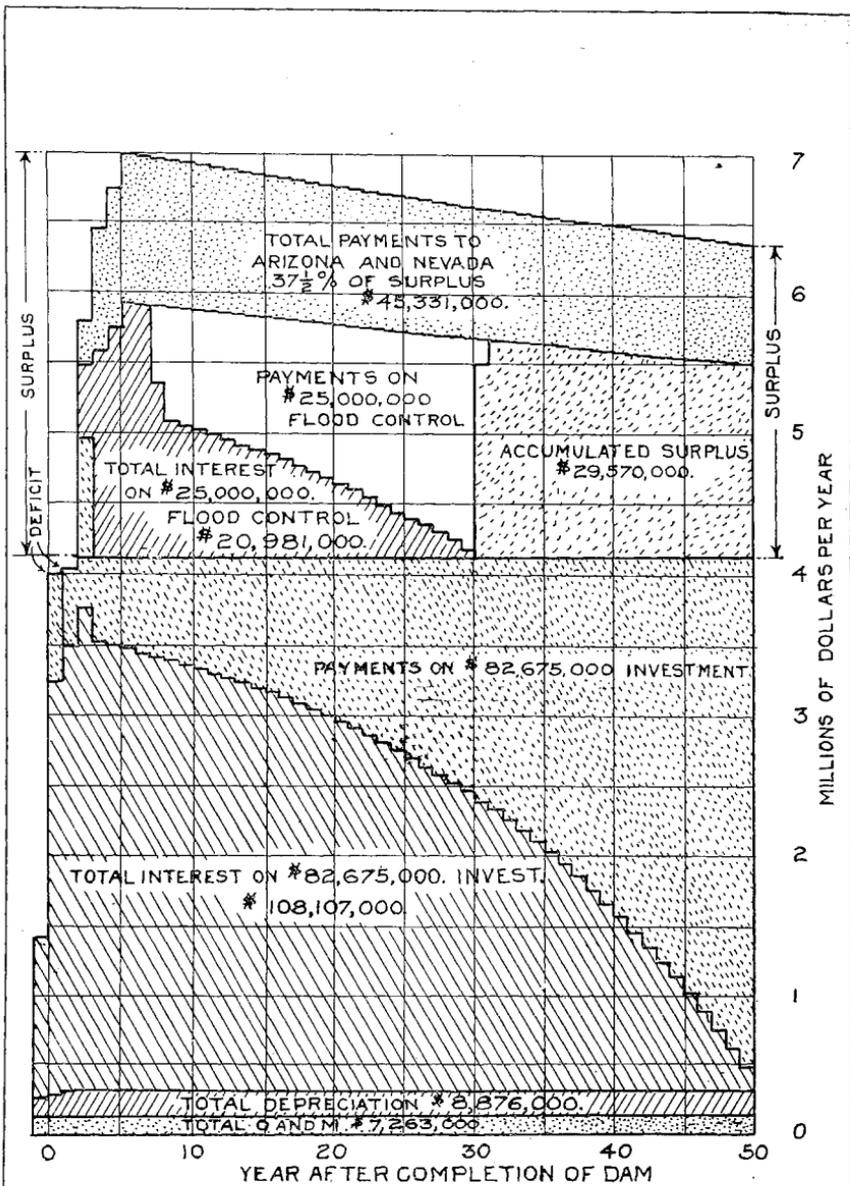
The following table is compiled from table given on page 950 of House Hearings, Second Deficiency Appropriation Bill for 1930.

Revenue from 100 per cent of firm energy only.		
No revenue from sale of water.		
No revenue from sale of secondary energy.		
Machinery investment repaid separately by lessees of power plant within ten years.		
Repayment period, fifty years.		
Gross revenue from sale of firm energy at 1.63 mills per kilowatt hour—		
City of Los Angeles.....	\$121,310,549	
Metropolitan Water District.....	118,031,886	
Southern California Edison Company.....	88,523,915	\$327,866,350
Distribution of revenue for fifty-year period—		
Operation and maintenance.....	\$7,262,557	
Depreciation	8,875,553	
Interest charges on all except the \$25,000,000 allocated to flood control.....	108,107,007	
Repayment (exclusive of flood control).....	82,674,907	
Interest charges on accumulated deficit.....	63,973	\$206,983,997
Surplus		
18½% to Arizona.....	\$22,665,441	\$120,882,353
18½% to Nevada.....	22,665,441	
Interest charge on flood control.....	20,981,308	
Repayment of flood control.....	25,000,000	91,312,185
Surplus (available for general development on Colorado River).....		
		\$29,570,168

A chart showing the rate and distribution of the above amounts is given in Plate II (taken from House Committee Hearings, Second Deficiency Bill 1930, p. 1109). This is taken from the graph prepared by the Department of the Interior and submitted by Secretary Wilbur during the Committee Hearings.

NOTE — If surplus is applied to repayment, the entire cost of the project would be repaid in about forty-three years.

The revenue from all firm energy alone will repay the entire estimated cost of the project and give Arizona and Nevada an average of \$450,000 per year each, in addition to amortizing the flood control allocation.



BOULDER CANYON POWER DEVELOPMENT

Revenue from sale of firm power only at 1.63 mills per kw-hr. Firm power defined as 4,330,000,000 kw-hr. per year at completion of Dam, and decreasing at rate of 8,760,000 kw-hr. per year thereafter.

From House Com. Hearings 2nd Def. Bill 1930 page 1109.

In the fifty-year period following completion of the dam in excess of \$29,000,000 would be paid into the Colorado River Dam fund from these power revenues, excluding revenue from water.

The above tabulation shows the revenue under what might be termed minimum receipts and does not take into consideration receipts from the sale of secondary energy and for storage of water. Considering these additional sources of revenue the receipts will be as shown in the tabulation following. (Contracts have already been made for the sale of secondary energy and for storage of water. See copies of contracts.)

The following tabulation is taken from figures furnished by the Reclamation Department (House Committee Hearings, Second Deficiency Appropriation Bill, 1930, pages 951 and 1051).

Revenue from 100 per cent of firm energy, plus revenue from sale of water, plus revenue from sale of secondary energy.

Machinery investment repaid separately by lessees of power plant within ten years.

Repayment period, fifty years.

Revenue from sale of firm energy at 1.63 mills per kilowatt hour—

City of Los Angeles.....	\$121,310,549	
Metropolitan Water District.....	118,031,886	
Southern California Edison Company.....	88,523,915	\$327,866,350

Revenue from sale of water at 25 cents per acre foot:

Metropolitan Water District.....		12,353,500
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Revenue from sale of secondary energy at 0.5 mills per kilowatt hour—

City of Los Angeles.....	\$12,314,526	
Metropolitan Water District.....	11,981,700	
Southern California Edison Company.....	8,986,274	33,282,500

Total gross revenue..... \$373,502,350

Distribution of revenue for fifty-year period—

Operation and maintenance.....	\$7,262,557	
Depreciation	8,875,553	
Interest charges on all except the \$25,000,000 allocated to flood control.....	108,107,007	
Repayment (exclusive of flood control).....	82,674,907	206,920,024

Surplus \$166,582,326

18¾% to Arizona..... \$31,234,196

18¾% to Nevada..... 31,234,196

Interest charge on flood control..... 12,477,929

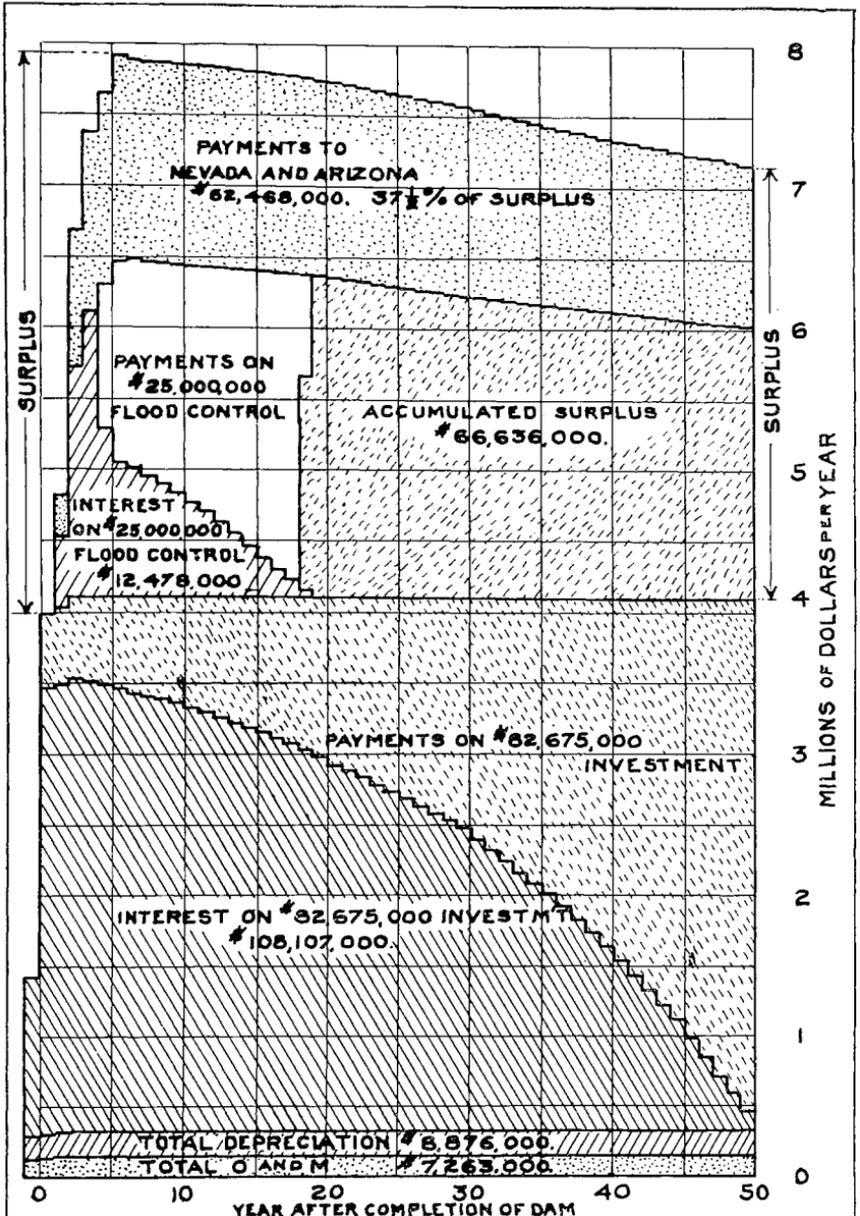
Repayment of flood control..... 99,946,321

Surplus (available for general development on Colorado River)..... \$66,636,005

A chart showing the rate and distribution of the above amounts is given in Plate III (taken from House Committee Hearings, Second Deficiency Bill, 1930, p. 1111. This is taken from the graph prepared by the Department of the Interior and submitted by Secretary Wilbur during the Committee Hearings.

NOTE— If surplus is applied to repayment, the entire cost of the project would be repaid in about thirty-four years.

In the fifty-year period in excess of \$60,000,000 would be paid into the Colorado River Dam fund from revenues, and the average annual payment to Arizona and Nevada would be in excess of \$550,000 each.



Revenue from sale of firm power at 1.63 mills per kw.hr., Sale of secondary power at 0.5 mills per kw.hr., and sale of water at 25¢ per acre foot. Firm power defined as 4,330,000,000 kw.hr. per year at completion of dam, and decreasing at rate of 8,760,000 kw.hr. per year thereafter. Secondary power average taken as 1,550,000,000 kw.hr. per year at completion of dam and decreasing at rate of 8,600,000 kw.hr. per year thereafter. Sale of water taken as 670 sec.ft. first year and increasing uniformly over a 16 year period to 1,500 sec.ft.

From House Com. Hearings, 2nd Def. Bill 1930, page 1111

BOULDER CANYON PROJECT CONTRACTS

In compliance with the obligations laid on the shoulders of the Secretary of the Interior by the Boulder Canyon Project Act (Sec. 5), the Secretary of the Interior, Honorable Ray Lyman Wilbur, has entered into contracts which he has stated will yield sufficient revenue to finance the dam and the power plant portions of the project (all of the project except the All-American Canal, which is to be financed on a separate basis).

Secretary Wilbur's statement before the House Appropriation Committee, May 19, 1930, when this committee was considering the Second Deficiency Appropriation Bill for 1930, which contained the initial appropriation (\$10,660,000) for starting work on the Boulder Canyon Project, was as follows: (Committee Hearings, p. 920.)

"As required by section 4 (b) of the Boulder Canyon Project Act I have made provision for revenues by contract in accordance with the provisions of the act, adequate, in my judgment, to insure payment of all expenses of operation and maintenance of the dam and power plant incurred by the United States, and the repayment within fifty years from the date of the completion of said works of all amounts advanced to the Colorado River Dam fund under subdivision (b) of section 2 of the project act for such works, together with interest thereon made reimbursable under that act.

These contracts are two in number: (1) A contract for lease of power privilege executed severally by the city of Los Angeles and the Southern California Edison Co. (Ltd.), and (2) a contract for electrical energy executed by the Metropolitan Water District of Southern California. In addition, under authority of section 5 of the act, I have executed with the Metropolitan Water District of Southern California, a contract for the delivery of water to be stored in the Boulder Canyon Reservoir."

Contracts entered into by the Secretary were given a very careful and thorough scrutiny by the members of the appropriation committee. As the financial soundness of the project and the guarantee of repayment to the government of all money expended depended upon the contracts, the committee was particularly anxious to be assured that the contracts covered these elements. In order to provide added security to the government and make certain of the payment of the amounts involved, a few slight changes were incorporated in the contracts as originally executed.

When the committee was considering the appropriation, the validity of the contracts entered into by the Secretary of the Interior was questioned by representatives of Arizona, and a very lengthy brief prepared by Washington attorneys was filed by Mr. Douglas of Arizona. The contracts were referred to the Attorney General of the United States for his opinion, and an opinion was rendered upholding the contracts. The concluding statement of the opinion rendered by the Attorney General (Committee Hearings, p. 1205) is "I am of the opinion that all the requirements of section 4 (b) of the Boulder Dam project act which are made conditions precedent to the appropriation of money, the making of contracts, and the commencement of work for the construction of a dam and power plant in Boulder Canyon have been fully met

and performed by the Secretary of the Interior in securing the contracts referred to in his letter.”

The Interior Department prepared an analysis of the contracts as finally executed. This analysis, the contracts in their final form, and the opinion of the Attorney General are given in full in the following pages.

An analysis of the Boulder Dam power contracts issued by the Interior Department is given below. This was issued in mimeograph form.

Department of the Interior

RAY LYMAN WILBUR

Secretary

ANALYSIS OF BOULDER DAM POWER CONTRACTS

GENERAL

As required by section 4 (b) of the Boulder Canyon Project Act, the Secretary has made provision for revenues by contracts adequate in his judgment to insure payment of all expenses of operation and maintenance of the dam, power plant and incidental works and the repayment within 50 years from the date of completion of said works of all amounts advanced to the Colorado River Dam fund for such works together with interest thereon made reimbursable under the Act.

These contracts are three in number, two being contracts for electrical energy and one for storage of water. The first is a several, not joint, lease of units of a Government-built plant, executed by the City of Los Angeles, which will generate for the public agencies which are allotted 91 per cent of all firm energy, and by the Southern California Edison Company. The second is a contract for electrical energy, executed by the Metropolitan Water District of Southern California. The third is a contract for the storage of water, executed by the latter organization.

One hundred per cent of the firm energy generated at Boulder Dam is guaranteed to be paid for under these contracts, although 36 per cent for Nevada and Arizona, and 6 per cent for smaller cities must be yielded if demanded. The City's maximum obligation is 37 per cent (13 per cent for itself, 6 per cent for other municipalities, and one-half of the 36 per cent allocated to the States until they use it). The Company's obligation is 27 per cent (9 per cent for itself and other utilities, plus payment for one-half the unused State power until the States require it). The District's is 36 per cent. The total amounts received by the United States under the two power contracts (if the power rates of 1.63 mills per kilowatt hour for falling water for generation of firm energy, and 0.5 mills for water for secondary energy, fixed under the contracts continue to be justified by competitive conditions when the rates are readjusted as required by the act), will vary between \$327,000,000 and \$361,000,000, depending upon the quantity of secondary energy and stored water sold.

The Metropolitan Water District is a municipal corporation now comprising twelve cities in Southern California, with a taxable valuation in excess of two billion dollars.

The City of Los Angeles is now in the power business and its total payments for purchase of power from other sources which Boulder Dam energy will supplant are in excess of the amounts which will be annually due the United States. It is accumulating a satisfactory surplus in the operation of this power department.

The Southern California Edison Company has assets in excess of \$300,000,000, is owned by 123,000 stockholders, and serves 450,000 consumers.

If these rates continue, performance by the two lessees will amortize the estimated cost within the required 50 years from completion of the dam, regardless of performance of any other allottee of power, and regardless of whether any secondary energy or stored water is sold. Similarly, performance by the Metropolitan Water District and the City of Los Angeles, even if all other allottees fail, will accomplish this result. Similarly, performance by the Company and by the District under its power and water contracts will suffice even if all other contractors fail. These statements are based on maintenance of the rates established in the power contracts; these rates are, however, under the terms of section 5 of the Act, subject to adjustment of 15 years from the date of execution, and each 10 years thereafter, either

upward or downward, as may be justified by competitive conditions at distributing points or competitive centers.

In the event that only 2 of these 3 primary contractors perform, postponement of amortization of some part of the flood control allocation will be required, but such postponement is permissible under the opinion of the Attorney General.

Bonds for these specific contracts have not been voted nor issued by the City nor the District. Nevertheless, their contracts are adequate, in view of the size and character of these municipal corporations, and to require a bond issue equal to the full obligation of their contracts would be a serious and unnecessary burden on them.

The rate fixed for storage of water for the Metropolitan Water District is 25 cents per acre-foot. The rate fixed for falling water for generation of primary energy is 1.63 mills; for secondary energy 0.5 mills. The above estimates of revenues are necessarily subject to the control of section 5 (c) of the Act, which provides for readjustment of power rates at periods as stated above. As the price, as readjusted, can not exceed the standard fixed by competitive conditions at distributing points for competitive centers, these estimates are necessarily conditioned on maintenance of the present prices of competitive energy.

On the basis of the rates now set and the estimated costs there will have been paid into the Colorado River Dam fund out of excess revenues during the 50 years following completion of the dam, as provided in section 2 (b) of the Act, between \$29,000,000 and \$66,000,000, depending on the quantity of secondary energy and stored water sold.

During the same period there will have been paid to each of the States of Arizona and Nevada under section 4 (b) of the Act between \$22,000,000 and \$31,000,000, depending on the same factors.

The amount which would be paid by the Metropolitan Water District for power and water under present rates, if they should continue to be justified by competitive conditions, during the fifty-year period would vary between \$118,000,000 and \$130,000,000. The amount similarly paid by the City of Los Angeles and the smaller municipalities would vary between \$121,000,000 and \$133,000,000, and the amount similarly paid by the utilities for their smaller allocation would vary between \$88,000,000 and \$97,000,000.

None of these contracts become effective until the first Act of Congress making an appropriation for construction of the dam has become law. (Note—Such an Act was passed July 3, 1930.)

Particular Provisions (references are to articles of the lease).

Machinery: Installation, Repayment of Cost, Title and Recapture. As required by section 6 of the Act, title to the dam and power plant will forever remain in the United States.

Machinery will be installed and owned by the United States. (Article 8). As compensation for its use, the two lessees will pay an amount equivalent to the cost thereof, in ten equal annual installments at the beginning of the lease period, amounting to a prepayment of rent for the whole lease period. This is in addition to the charge for falling water.

Under this arrangement, no equitable interest in the machinery ever vests in the lessees and in the event of recapture no payment will be owing to them on account of the original installation.

Operation of the Power Plant. The lease is a several, not joint, lease on separate units of a Government-built plant to the city and to the company (Article 10), operated separately by the two lessees under the general supervision of a Director appointed by the Secretary (Articles 10 (c), 12).

The two lessees will generate at cost for all other allottees (Articles 10, 12). The cost will be determined by the Secretary (Article 10-iii, Article 12).

Repairs and Replacements. In articles 12 and 13 the lessees assume the obligation to operate and maintain the plant, including the repairs and replacements, at their own expense; except that replacements made after the last readjustment of rates will be considered at the end of the lease period and compensation made to the lessees for the unused life of such replacements.

Provisions in Favor of States. Under the allocation of energy made in Article 14 Arizona and Nevada are each allocated 18 per cent, without the obligation to now contract for it. Each State may withdraw and relinquish energy in any amount until its full allocation is in use, on six months' notice if the amount required is 1000 horse power or less, until it has withdrawn 5000 horse power in

any one year, and on two years' notice if larger quantities. Whatever right may be available to either State to execute a firm contract instead of accepting this drawback arrangement is left unimpaired. But under such a firm contract if, say, made for 33 1/3 per cent of the energy, the minimum obligation of the States over the fifty-year period may be compared with minimum payments expected from the Metropolitan Water District for 36 per cent of the firm energy, which amount to \$118,000,000, a firm obligation whether the energy is wanted or not. All the contracts of the States for electrical energy, like the contracts of all other contractors, will be made directly by the Secretary and enforced by the Government Director at the plant. Generation for all allottees must be effected at actual cost, determined by the Secretary.

Either State may increase its allocation up to 22 per cent after 20 years if the other State does not take its full 18 per cent by that time.

Generation for Other Contractors. Under Article 14 the lessees undertake to generate at cost energy which the Secretary may contract to furnish to the other allottees, as follows: Metropolitan Water District 36 per cent of the firm energy plus all the secondary energy, plus first call or unused State allocations, all limited to use for pumping; eleven smaller municipalities, 6 per cent of the firm energy; the States, 36 per cent of the firm energy. The City of Los Angeles generates, in addition to these allocations, 13 per cent for itself. The company generates 9 per cent for itself and other public utilities. The division of the 64 per cent allocated California is in accord with agreements submitted to the Secretary by all these California interests on March 20 and April 7.

Quantity and Rates for Energy. Firm energy is defined as 4,240,000,000 kilowatt hours (Article 15) based on the best available studies of the river flow over the past thirty-five year period, decreasing annually not more than 8,760,000 kilowatt hours, in anticipation of increasing upper basin use. Additional energy is considered as secondary energy. Nevertheless, if the United States builds a higher dam and thus provides a greater quantity of firm energy it reserves the right to dispose of it to any municipality independently of the above allocations. The rate for falling water for firm energy is 1.63 mills; for secondary energy 0.5 mill (Article 16). These rates, as required by the Act, will be readjusted at the end of fifteen years and every ten years thereafter, either upward or downward, as justified by competitive conditions at competitive centers but not to exceed the standard so fixed.

Minimum Annual Payments: Load-Building Provisions. A minimum annual payment is required of each contractor for the firm energy allocated, equivalent to the number of kilowatt hours allocated to it multiplied by 1.63 mills. Nevertheless to provide an absorption period at the beginning of each lease period the requirement for the first year is fixed at 55 per cent of the ultimate obligation, for the second year, 70 per cent, for the third year 85 per cent, and for the fourth year and subsequent years, 100 per cent. Energy taken in excess of these quantities will be paid for at the rate for secondary energy.

Duration of the Leases. Under Article 9 the first energy available (expected some time in advance of completion of the dam), shall go to the city, with the district commencing to take one year thereafter, and the company three years thereafter. Under Article 26 all contracts terminate when the city contract ends, which means that the company is given a 47-year lease and the district a 49-year contract. Nevertheless, the rental paid by the company for its 47-year term is the same as that paid by the city for its 50-year term, per kilowatt of capacity; that is, an amount equal to the cost of the machinery used. (Article 9.)

Remedies of the United States. Under Articles 19 and 20, generation of energy for any allottee in arrears must be stopped on demand by the Secretary. If the lessees themselves are in arrears more than twelve months or fail to furnish energy in accordance with the allocations to other contractors, the United States can enter and operate the plant and, on two years notice, terminate the lease and make other disposition of the power, subject to a ten-year right to redemption under the lease. This period of redemption is justified by the lessees' prepayment of rent for the whole fifty-year period in the first ten years (Article 9), which leaves the United States in possession of the machinery as a substantial guarantee of performance.

A provision for posting of security bond when and if required by the United States is inserted in the District contract, as it provides no machinery.

Monthly Payments and Penalties. Under Article 18 power bills must be paid monthly subject to a one per cent penalty per month in arrears.

Interruptions in the Delivery of Water. Under Article 21 the United States is not liable for interruptions in the delivery of water but the power bills are reduced to the extent of such interruption. All contracts are made subject to the Colorado River Compact, subordinating the use of water for power to use for irrigation, flood control, navigation, etc.

Measurement and Record of Energy. Records of energy generated and its distribution to the various allottees are to be kept by the lessees and reported monthly. (Articles 22, 23.) Meters will be Government-tested and inspected.

Inspection by the United States. Full right of entry and inspection of all machinery and books is reserved by the United States (Article 24).

Transmission. The city agrees to transmit for the district and the smaller municipalities. The company agrees to transmit for the other utilities. Transmission for the States will be a separate problem as the lines will run in different directions from those of the city, company and the district (Article 25).

Title to Remain in the United States. Under Article 27 title to the dam, power plant, and incidental works, as required by section 6 of the Act, remain in the United States forever.

Power Reserved for United States. Five thousand kilowatts from each lessee is reserved for the United States for construction purposes on this or other dams. (Article 28.)

Use of Public Lands for Transmission Lines, as provided in the Act (sec. 5) is permitted (Article 29).

Claims of the United States have priority over all others, as required by sec. 17 of the Act (Article 30).

Contracts Between the City and the Company now in force are modified so as to remove any restrictions on either of them from entering into this contract with the United States. (Article 31.)

Transfers of Interests under these contracts are forbidden without the Secretary's consent. (Article 32.)

The Contracts Are Subject to the Secretary's Rules and Regulations with a right of hearing to the contractors before modifications are made. (Article 33.)

Agreement Is Subject to the Colorado River Compact. (Article 34.)

Arbitration of Disputes Between Contractors Is Provided; and also machinery for arbitration between the United States and contractors, if both the United States and the disputant agree to arbitrate. (Article 35.)

Performance Is Made Contingent on Appropriations. (Article 36.)

Modifications in favor of one contractor shall not be denied to another. (Article 37.)

Members of Congress are excluded from benefits in the contracts, except as shareholders of corporations, in accordance with specific statutory provision.

UNITED STATES DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 BOULDER CANYON PROJECT

Contract for power privilege with the City of Los Angeles and Southern California Edison Company, Ltd.

<i>Article</i>	<i>Title</i>
1	Contract for Lease of Power Privilege.
2-5	Explanatory Recitals.
6	Construction by United States.
7	Operation and Maintenance of Dam.
8	Installation of Machinery.
9	Compensation for Use of Machinery.
10	Lease of Power Plant.
11	Assumption of Operation of Power Plant.

<i>Article</i>	<i>Title</i>
12	Operation and Maintenance of Power Plant.
13	Keeping Leased Property in Repair.
14	Allocation of Energy.
15	Firm and Secondary Energy Defined.
16	Schedule of Rates.
17	Minimum Annual Payment.
18	Monthly Payments and Penalties.
19	No Energy to be Delivered Without Payment.
20	Contract May be Terminated in Case of Breach.
21	Interruptions in Delivery of Water.
22	Measurement of Energy.
23	Record of Electrical Energy Generated.
24	Inspection by the United States.
25	Transmission.
26	Duration of Contract.
27	Title to Remain in United States.
28	Electrical Energy Reserved for United States.
29	Use of Public and Reserved Lands of the United States.
30	Priority of Claims of the United States.
31	Other Contracts.
32	Transfer of Interest in Contract.
33	Rules and Regulations.
34	Agreement Subject to Colorado River Compact.
35	Disputes and Disagreements.
36	Contingent Upon Appropriations.
37	Modifications.
38	Member of Congress Clause.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BOULDER CANYON PROJECT

Contract for lease of power privileges between the United States and Los Angeles and Southern California Edison Co. (Ltd.), April 26, 1930.

Amended May 28, 1930

(1) THIS CONTRACT, made this 26th day of April, nineteen hundred thirty, pursuant to the Act of Congress approved June 17, 1902 (32 Stat., 388), and acts amendatory thereof or supplemental thereto all of which acts are commonly known and referred to as the reclamation law, and particularly pursuant to the Act of Congress approved December 21, 1928 (45 Stat., 1057), designated the Boulder Canyon Project Act, between THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, acting for this purpose by Ray Lyman Wilbur, Secretary of the Interior, hereinafter styled the Secretary, and severally, THE CITY OF LOS ANGELES, a municipal corporation, and its department of water and power (said department acting herein in the name of the city, but as principal in its own behalf as well as in behalf of the city; the term "city" as used in this contract being deemed to be both the city of Los Angeles and its department of water and power, and SOUTHERN CALIFORNIA EDISON COMPANY, LTD., a private corporation, hereinafter styled the Company, both of said corporations being organized and existing under the laws of the State of California, and hereinafter styled the Lessees:

WITNESSETH:

Explanatory Recitals

(2) WHEREAS, for the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters for reclamation of public lands and other beneficial uses exclusively within the United States, and for the generation of electrical energy, the Secretary, subject to the terms of the Colorado River Compact, is authorized to construct, operate and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon, adequate to create a storage reservoir of a capacity of not less than twenty million acre-feet of water; also to construct, equip, operate and maintain at or near said dam, or cause to be constructed, a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from said reservoir; and

(3) WHEREAS, after full consideration of the advantages of both the Black Canyon and Boulder Canyon dam sites, the Secretary has determined upon Black Canyon as the site of the aforesaid dam, hereinafter styled the Boulder Canyon Dam, and has determined that, the provision for revenues made by this contract, considering all of its provisions, including Article sixteen (16), together with other contracts in accordance with the provisions of the Boulder Canyon Project Act, is adequate in his judgment to insure payment of all expenses of operation and maintenance of the Boulder Canyon Dam and appurtenant works incurred by the United States, and the repayment within fifty (50) years from the date of completion of said works of all amounts advanced to the Colorado River Dam fund under Sub-division (b) of Section (2) of the Boulder Canyon Project Act, together with interest thereon made reimbursable under said Act; and

(4) WHEREAS, the lessees are desirous severally of entering into contracts of lease of units of a Government built electrical plant, with right to generate electrical energy;

(5) NOW, THEREFORE, in consideration of the mutual covenants herein contained, the parties hereto agree as follows, to-wit:

Construction by United States

(6) The United States will, at its own cost, construct in the main stream of the Colorado River at Black Canyon, a dam, creating thereby at the date of completion, a storage reservoir having a maximum water surface elevation at about twelve hundred twenty-two (1222) feet above sea level (U. S. Geological Survey datum) of a capacity of about twenty-nine million five hundred thousand (29,500,000) acre-feet. The United States will also construct in connection therewith outlet works, pressure tunnels, penstocks, power plant buildings, and furnish and install generating, transforming and high voltage switching equipment for the generation of the energy allocated to the various allottees respectively as stated in Article fourteen (14) hereof.

Operation and Maintenance of Dam

(7) The United States will operate and maintain the dam, reservoir, pressure tunnels, penstocks to but not inclusive of the shut-off valves at the inlets to the turbine casings, and outlet works, and will have full control of all water passing the dam for any and all purposes. The dam and reservoir will be operated and used: First, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses and satisfaction of present perfected rights in pursuance of Article VIII of the Colorado River compact; and, third, for power.

Installation of Machinery

(8) The machinery and equipment for the generation of power will be provided and installed and owned by the United States. The City and the Company shall each notify the Secretary of the Interior, in writing, within two (2) months after receipt of written notice from him that diversion of the Colorado River has been effected for the construction of Boulder Canyon Dam, as to their respective generating requirements in order that the United States may be able to determine the type and initial and maximum ultimate capacity of the generating equipment to be installed in the power plant. Generating units and other equipment to be installed by the United States shall be in sufficient number and of sufficient capacity to generate the energy allocated to and taken by the lessees and the various allottees, served by each lessee as stated in Article fourteen (14) hereof, upon the load factors stated by the respective allottees with proper allowance for the combined load factors of all allottees served by each lessee. Each lessee shall give notice to the Secretary of the date at which it requires its generating equipment to be ready for operation, such notice to be given at least three years before said date. If a lesser number of generating units is initially installed, the United States will furnish and install, at a later date or from time to time on like terms, such additional units as with the original installation will generate the energy allocated. The City and the Company shall each cooperate with the United States in the preparation of designs for the power plant, and in the preparation of plans and specifications for the machinery and equipment to be installed in connection therewith and required by each respectively.

Each allottee (including lessees) shall have opportunity to be heard by the Secretary or his representatives upon the design, capacity and cost of machinery before contracts therefor are let.

Compensation for Use of Machinery

(9) (a) Compensation for the use, for the periods of lease thereof, of machinery and equipment furnished and installed by the United States, for each lessee respectively, for the generation of electrical energy, equal to the cost thereof, including interest charges at the rate of four per cent (4%) per annum, compounded annually from the date of advances to the Colorado River Dam Fund for the purchase of such equipment and machinery to June first of the year next preceding the year when the initial installment becomes due under this article, shall be paid to the United States by the lessees, severally, in ten (10) equal annual installments, so as to amortize the total cost (including interest as fixed above), and interest thereafter upon such total cost at the rate of four per centum (4%) per annum. The first installment payable by each lessee shall be due on June first next following the date the machinery leased by such lessee is ready for operation and water is available therefor, as announced by the Secretary, and the subsequent nine installments shall be paid on June first of each year thereafter.

(b) No charge shall be made against either lessee on account of cost of, or as compensation for the use of, machinery required to be installed in consequence of execution of a contract for electrical energy by a State pursuant to Article fourteen (14) hereof, unless such machinery is to be used partially for the benefit of such lessee. In such event the charge made by the United States for compensation for the use thereof shall be adjusted between the State and such lessee as they may agree or if they fail to agree then by the Secretary.

Lease of Power Plant

(10) (a) The United States hereby leases to the City for fifty (50) years from the date at which energy is ready for delivery to the City, as announced by the

Secretary, in accordance with Article eleven (11) hereof, such power plant units and corresponding plant facilities and incidental structures as may be necessary to generate the energy allocated to it and energy for those allottees for whom the City is designated the generating agency, together with the right to generate such electrical energy.

(b) The United States hereby leases to the Company such power plant units and corresponding plant facilities and incidental structures as may be necessary to generate the energy allocated to it and energy for those allottees for whom the Company is designated the generating agency, together with the right to generate such electrical energy, for a period beginning with the date at which the first of such power plant units is ready for operation and water is available therefor as announced by the Secretary, and ending at a time fifty (50) years from the date at which energy is ready for delivery to the City as provided in Article eleven (11) (a) hereof.

(c) The machinery and equipment under lease to either lessee shall be operated and maintained by such lessee without interference from or control by the other lessee, but subject nevertheless to the supervisory authority of the Secretary or his representative, under the terms of the lease.

(d) Subject to conditions hereinafter stated, the designation of generating agencies shall be as follows:

Generation of energy allocated to and used by the States of Nevada and Arizona shall be effected by the City.

Generation of energy allocated to the Municipalities, including those contracting under the provisions of the last paragraph of Article fourteen (14), shall be effected by the City.

Generation of energy allocated to the District shall be effected by the City.

Generation of energy allocated to the Companies shall be effected by the Southern California Edison Company Ltd.

Nevertheless, the foregoing provisions are subject to the following conditions:

(i) Should it prove of material economic advantage to the District to have a portion of its energy generated as off-peak energy, the City, after generating energy for the District to the full extent of the generating capacity which has been installed at the request of the District, with allowance for the contemplated margin of reserve capacity, shall also generate such additional energy as may be needed by the District and as can be generated off-peak with other generating capacity leased to and being operated by the City at such times as such use does not conflict with the needs of the City and other allottees for whom the City is generating energy. The District will pay for the off-peak use of such other generating capacity together with an allowance for a fair proportion of the operation and maintenance expenses at rates to be agreed upon between the District and the City, and if they are unable to agree, to be determined by the Secretary.

Should the amount of energy which can be obtained by the District, from the generating capacity which has been installed at the request of the District and from other capacity leased to and being operated by the City, be insufficient to satisfy the requirements of the District, then the District may arrange with the Company for generation of such off-peak energy as may be needed by the District at such times and not obtainable from the City, to such an extent as such generation does not conflict with the needs of the Company and other allottees for whom the Company is generating energy. Charge shall be made against the District for such service at the rate to be agreed upon between the District and the Company and if they are unable to agree then at a rate to be determined in accordance with Article thirty-five (35) (a) hereof.

(ii) Disputes and disagreements between any allottee and the lessee generating energy for it, with respect to such generation, and/or the cost thereof, shall be determined by the Secretary unless otherwise specifically provided in this contract.

(iii) Except for off-peak power furnished the District which shall be as provided in Paragraph (i) of this Article, all generation shall be effected at cost as determined in accordance with Article twelve (12) hereof.

Assumption of Operation of Power Plant

(11) (a) Energy shall be ready for delivery to the City and to the municipalities, including those contracting under the last paragraph of Article fourteen (14), when the Secretary announces that one billion, two hundred fifty million (1,250,000,000) kilowatt-hours of energy per year is ready for delivery.

(b) Energy shall be ready for delivery to the District when the Secretary announces that two billion (2,000,000,000) kilowatt-hours of energy per year is available, which date, however, shall not be sooner than one (1) year after energy is ready for delivery to the City; provided however, that the time when energy is ready for delivery to the District may be advanced, subject to the approval of the Secretary, should the District so request, and that in such case the City shall be compensated by the District for interest and depreciation on and maintenance and operation of its main transmission line in case the total energy available to the City is reduced below one billion two hundred fifty million (1,250,000,000) kilowatt-hours per annum, in the proportion that such kilowatt-hours available to the City is less than one billion two hundred fifty million (1,250,000,000).

(c) Energy shall be ready for delivery to the Company when the Secretary announces that water capable of generating four billion two hundred forty million (4,240,000,000) kilowatt-hours of energy per year is available, which date, however, shall not be sooner than three (3) years after commencement of delivery of energy to the City and which shall not be until the water surface in Boulder Canyon reservoir on August first immediately preceding has reached an elevation of eleven hundred fifty (1150) feet above sea level (U. S. Geological Survey datum); provided, however, that the Secretary may require the Company to assume its obligations to take

and/or pay for Boulder Canyon energy in accordance with the provisions of this contract on the first day of the calendar month next following the date when the Company's system maximum demand in kilowatts is equal to or greater than it was at any time during the twelve month period immediately preceding the date when the City commences to obtain energy from Boulder Canyon power plant. "Maximum demand," as used in the sentence next preceding, shall be defined as the average of the five largest half-hourly peaks during any single month, after deducting therefrom the amount of kilowatts the Company may be temporarily carrying for any purpose other than supplying its own normal load.

(d) Upon written notification from the Secretary that generating equipment is ready for operation by it as provided in subparagraphs (a), (b) and (c) respectively of this article, and water is available for generating energy therefrom, each lessee shall assume the operation and maintenance of its respective portion of the power plant, and thereafter such lessee, severally, shall save the United States, its officers, agents and employees harmless as to injury and damage to persons and property which may in any manner arise out of the operation and maintenance of the portion of such plant leased to it.

Operation and Maintenance of Power Plant

(12) The respective portions of the power plant and appurtenant structures shall be operated and maintained by the City and the Company, severally, under the supervision of a Director appointed by the Secretary. The City and the Company shall each be responsible for the operation and maintenance of that part of the power plant operated by it and shall bear the cost thereof as provided in Article sixteen (16). The United States, in accordance with Article ten (10) hereof, will pay each lessee in the form of credits upon the account of such lessee for amounts due the United States under this contract, the cost incurred by it in generating energy for other allottees for whom it is the designated generating agency, and will require such other allottees to repay such cost to the United States. Except as provided in Article ten (10-d-i) hereof as to off-peak power, the term "cost," as used with reference to generating energy for other allottees, shall include a proper proportionate allowance for amortization of the amounts for which the respective lessees are obligated to the United States on account of use of machinery and equipment as provided in Paragraph (a) of Article nine (9) hereof and interest on the respective lessees' prepayments thereof; a proper proportionate part of any annuity set up in accordance with regulations of the Secretary provided for in Subdivision 3 of Article sixteen (16) hereof, and any additional expenditures made by the respective lessees with the approval of the Secretary, for the purpose of meeting the obligation of the lessees to make replacements; and a proper proportionate part of the actual outlay of the lessees for operating such machinery and equipment and keeping the same in repair, including reasonable overhead charges. The extent of the allowance for the several items and the system of accounting therefor, shall be prescribed by the Secretary under uniform regulations to be promulgated by him in accordance with the Boulder Canyon Project Act. The United States will compensate each lessee for the generation by it of any secondary energy not taken by the District or the lessees but disposed of by the United States, such compensation to cover the pro rata cost thereof as defined in this Article (in proportion to the total kilowatt-hours generated in that month by each lessee), during the time said secondary energy was generated. Such secondary energy will be disposed of by the United States subject only to the prior right thereto of the District and/or the lessees.

The Director, among other powers, shall have authority to enforce rules and regulations promulgated by the Secretary in accordance with the Boulder Canyon Project Act, respecting operation and maintenance of the power plant and appurtenant works and structures, pursuant to Article thirty-three (33) hereof.

Prior to the promulgation of any regulations, or the change or modification of regulations, the Secretary shall give any lessee and any allottee affected thereby, an opportunity to be heard.

Keeping Leased Property in Repair

(13) Except in case of emergency no substantial change in any leased property shall be made by either lessee without first having had and obtained the written consent of the Director and Secretary, and the Secretary's opinion as to whether any change in any leased property is or is not substantial shall be conclusive and binding upon the parties hereto. The lessees, severally, shall promptly make any and all repairs to and replacements of leased property (except those occasioned by act of God) in the control of each, respectively, which, in the opinion of the Secretary, are deemed necessary for the proper operation and maintenance of leased property. In case of neglect or failure of either lessee to make such repairs, the United States may, at its option, cause such repairs to be made and charge the actual cost thereof, plus fifteen per cent (15%) to cover overhead and general expense, to the lessee having control of such property which amount, together with interest at the rate of four per cent (4%) per annum from the date of the expenditure to the date of payment will be paid to the United States by the lessee responsible for such repairs. The cost to the United States, with overhead and interest as stated above, of making any of the repairs contemplated by this contract, shall be repaid by the lessee having control of the property so repaired, on June first immediately succeeding the date of completion of such repairs.

Allocation of Energy

(14) The Secretary reserves and as against the lessees may exercise the power in accordance with the provisions of this contract to contract with the other allottees

named in this article for the furnishing of energy to such allottees at transmission voltage in accordance with the allocation to each such allottee and the Secretary is authorized by each lessee to enforce as against it the rights acquired by such other allottees under such contracts. Each lessee severally in accordance with the agency designations made in paragraph (d) of Article ten (10), covenants to generate and furnish energy, at transmission voltage, needed to meet the following requirements of the allottees, (other than lessees) named below, the allocations of firm energy being made in percentages of the total firm energy as defined in Article fifteen (15) hereof to be delivered to such allottees at said Boulder Dam power plant.

Of Firm Energy

A. To the State of Nevada, for use in Nevada not exceeding eighteen per cent (18%) of said total firm energy.

B. To the State of Arizona, for use in Arizona, not exceeding eighteen per cent (18%) of said total firm energy.

Should either of the States not take its full eighteen per cent (18%) allocation within a period of twenty (20) years hereof, the other may then contract for the energy not so taken up to four per cent (4%) of the total firm energy, provided that the combined amount used by the two states shall not, at any time, exceed thirty-six per cent (36%) of such total firm energy.

C. To the Metropolitan Water District of Southern California for pumping Colorado River water into and in its Aqueduct for the use of such District within the following limits:

- (1) Thirty-six per cent (36%) of said total firm energy, plus
- (2) All secondary energy developed at the Boulder Dam power plant as provided in Article seventeen (17) hereof; plus
- (3) So much of the firm energy allocated to the States, the City and the Company as may not be in use by them. Energy allocated to the States but not in use by them, shall be released to the District by the two lessees equally (unless they agree upon a different ratio) as follows:

(a) If the District makes a firm contract with the Secretary for the balance of the lease period for part or all of such unused States energy (subject to the first right of the States thereto) such contract shall be made effective upon two years' written notice to the Secretary, and compensation to the lessees, respectively, for main transmission line property rendered idle;

(b) If the District does not so make a firm contract for such energy, then energy allocated to the States but not in use by them, shall be released to the District upon not less than fifteen (15) months' written notice to the Secretary and at such compensation as the District and such lessees, respectively, may agree upon, to cover cost and overhead of replacing energy which otherwise would have been received at the Pacific Coast end of the main transmission lines by the lessees, respectively. Such cost shall include interest on and depreciation and operation and maintenance of the plant capacity while required for the generation of such substitute energy; and also appropriate allowance for interest on and maintenance and depreciation of plant capacity rendered idle because of cessation of generation of such substitute energy until such time as such plant capacity would otherwise have been installed by the lessees, respectively, for their own requirements. If the District and the respective lessees fail to agree on such compensation, such energy shall nevertheless be released to the District, and the disagreement shall be determined in accordance with Article thirty-five (35) (a) hereof. Such determination shall include allowance for items of cost, and overhead as specified in this paragraph. Pending such determination, energy so released shall be paid for by the District at the rate for firm energy but the determination of compensation under Article thirty-five (35) (a) hereof shall not be controlled by such rate.

During any year beginning June first, the District shall not use any secondary energy nor any unused State energy, until it has first used subsequent to June first, next preceding, an amount of firm energy equivalent to one-twelfth of the amount of firm energy it is obligated to take and/or pay for annually multiplied by the number of months elapsed since June first next preceding.

- (4) If, due to temporary deficiency in secondary energy regularly used by the District; substitute energy is requested by the District in excess of the energy made available under the foregoing subparagraph (3) (b) the City and/or the Company may release so much energy as may be practicable on the same terms as provided in subsection (3) (b) preceding.

D. To the municipalities of Anaheim, Beverly Hills, Burbank, Colton, Fullerton, Glendale, Newport Beach, Pasadena, Riverside, San Bernardino and Santa Ana, (referred to herein as "the municipalities"), six per cent (6%) in all, to be allocated between them as they may agree; but if no agreement is submitted to the Secretary on or before April 15, 1931, the Secretary shall determine the allocation of each.

E. To the City of Los Angeles, thirteen per cent (13%).

F. To Southern California Edison Company Ltd., the Southern Sierras Power Company, the San Diego Consolidated Gas and Electric Company and the Los Angeles Gas and Electric Corporation, referred to herein as the companies, nine per cent (9%) in all, division whereof between the companies shall be made according to mutual agreement among them, if possible. If no such agreement is submitted to

the Secretary on or before April 15, 1931, the Secretary shall determine the allocation of each.

It is further agreed that:

- (i) So much of the energy allocated to the States (thirty-six per cent (36%) of the firm energy) and not in use by them, or failing their use, by the District for the above purposes, shall be taken and paid for one-half by the City and one-half by the Company.

In addition, all firm energy allocated to the city (13 per cent) shall be taken and paid for by the city.

- (ii) All of the energy allocated to the municipalities may be contracted for in compliance with regulations of the Secretary, by any one or more of them, as they may agree, on or before April 15, 1931. So much of the energy allocated to the municipalities as is not so contracted for, or if contracted for, not used by them directly or under contract for municipal purposes and/or distribution to their inhabitants shall be taken and paid for by the City.
- (iii) So much of the energy allocated to the Southern Sierras Power Company, the San Diego Consolidated Gas and Electric Company, and the Los Angeles Gas and Electric Corporation as is not firmly contracted for by them, severally, in compliance with regulations of the Secretary on or before April 15, 1931, shall be taken and paid for by the Company.
- (iv) If any allottee is permitted by the United States to divert water from the reservoir at a time when the reservoir is not spilling; in consequence of which the amount of energy, which would have been utilized is diminished, such diminution shall be debited to the allocation of firm energy herein made to such allottee; and charge for the energy equivalent of such diversion shall be made, and the amount of energy which the allottee shall otherwise be obligated to take and pay for hereunder shall be correspondingly reduced. The reservoir shall be considered as spilling whenever water is being discharged in excess of the amount used for the generation of power, whether such waste occurs over the spillway or otherwise.
- (v) Each of the States of Arizona and Nevada may, from time to time within the period of this lease, contract for energy for use within such State in any amount until the total allocated respectively to each is in use as provided above; and may terminate such contract, or contracts, without prejudice to the right to again contract for such energy. All such contracts shall be executed with the Secretary. A contract requiring one thousand (1000) horsepower (of maximum demand) or less may become effective or be terminated on six months' written notice of requirement or termination given the Director by the State; provided, that the notice given shall be two years if in the twelve months preceding said notice of demand the total increment to such state has exceeded five thousand (5000) horsepower of maximum demand or if in the twelve months preceding said notice of termination the decrement to such state has exceeded five thousand (5000) horsepower of maximum demand. In all cases the Director shall immediately transmit such notice to each lessee. Whenever the amount in use is in excess of five thousand (5000) horsepower of maximum demand, the lessees respectively shall be compensated for property rendered idle by use of such excess in such amount as the Secretary shall determine to be equitable. Firm energy not contracted for by the State shall be available for use by the District as herein elsewhere provided, and if not in use by the States and/or the District, shall be taken and paid for equally by the two lessees. No right which may be available to a State under Section five (5) (c) of the Boulder Canyon Project Act to execute a firm contract for electrical energy for use within the State shall be impaired by any provision of this lease; but if contract thereunder be executed with the Secretary no provision of this lease shall apply for the benefit of such State. If in consequence of execution of such contract the Secretary requires the allocation to either lessee or to an allottee using such lessee's main transmission lines to be diminished, such lessee may terminate its rights and obligations hereunder within two months thereafter on written notice to the Secretary. Provided, further, that the combined allocation of nineteen per cent (19%) as herein made to the city and the municipalities shall not be reduced because of any such firm contract with a state for energy.

Of Secondary Energy

It is further agreed that the District shall have the right to purchase and use all secondary energy as provided in Article fifteen (15) and Article seventeen (17) hereof for the purposes stated in the first paragraph of subdivision (c) of this article. The City and Company shall each have the right to purchase and use one-half of all secondary energy not used by the District. Any such energy not used by one lessee shall be available, for the time being, to the other. If secondary energy is not taken by the City, the District, and/or the Company, then and in such event, the United States reserves the right to take, and use and dispose of such energy, from time to time, as it sees fit, giving credit therefor as provided in Article twelve (12) hereof.

Of Firm Energy Allocated to But Not Used by the District

It is further agreed that in the event the District shall fail for any reason to use all or any of the firm energy herein allotted to it for the only purpose

for which said firm energy is allotted to it, that is, for pumping water into and in its aqueduct, then the Secretary shall dispose of such unused energy until required by the district for said purpose, crediting on the district's obligations the proceeds of such disposition as received. Provided, however, That no disposition of such firm energy shall be made by the Secretary without first giving to a successor to the district which may undertake to build or maintain a Colorado River aqueduct the opportunity to take said firm energy for the same purpose and under the same terms as those to which the district was obligated. And provided further, That in the event no such successor takes said firm energy as provided above, then no disposition of such firm energy shall be made by the Secretary without first giving to each lessee the opportunity to contract on equal terms and conditions, to be prescribed by the Secretary, for one-half of such energy, together with such portion of the remainder as the other lessee shall not elect to take.

Of Firm Energy Not Hereinbefore Disposed Of

It is further agreed that the United States reserves the right, in case the dam which it erects provides a maximum water surface elevation in excess of one thousand two hundred twenty-two (1222) feet above sea level (U. S. Geological Survey datum), and thereby increases the quantity of firm energy above the quantity of four billion two hundred forty million (4,240,000,000) kilowatt-hours allocated above, to dispose of such increase, but not to exceed ninety million (90,000,000) kilowatt-hours per year (June 1st to May 31st, inclusive) to any municipality or municipalities by firm contract executed with the Secretary on or before April 15, 1931. Such disposition shall be without prejudice to any provision of this lease or of the allocation above referred to. So much of such additional energy as is not so contracted for shall be taken and paid for by the City. Generation of such additional energy shall in any event be effected by the City.

Firm and Secondary Energy Defined

(15) The amount of firm energy for the first year of operation, (June 1 to May 31, inclusive) following the date of the completion of the dam as announced by the secretary shall be defined as being four billion two hundred forty million (4,240,000,000) kilowatt-hours at transmission voltage. For every subsequent year the amount defined as firm energy shall be decreased by eight million seven hundred sixty thousand (8,760,000) kilowatt-hours from that of the previous year.

Nevertheless, if it be determined by the Secretary that the rate of decrease of kilowatt-hours per year as above stated, is not in accord with actual conditions, the Secretary reserves the right to fix a lesser rate for any year, (June 1 to May 31, inclusive) in advance.

If, by reason of international obligations arising through treaty or otherwise subsequent to the effective date of this contract, or by reason of interference with the program of construction and/or operation of the dam as provided for and contemplated by this contract, or by reason of other contingencies not now foreseen, the amount of firm energy available through the release of water from the Boulder Canyon reservoir shall in fact be less than the amount of firm energy as above defined, then in any such event the obligation of the lessee to take and/or generate shall be reduced in an amount corresponding to such change. If for any reason the United States shall be wholly unable to fulfill its obligations hereunder in respect of the delivery of water, then the lessees, or either of them, may terminate this contract in so far as it affects such lessees or lessee.

If the dam erected by the United States provides a maximum water surface elevation in excess of twelve hundred twenty-two (1222) feet above sea level (U. S. Geological Survey datum), the United States reserves the right to dispose of additional firm energy thereby made available, not to exceed ninety million (90,000,000) kilowatt-hours per year, subject to pro rata of the eight million seven hundred sixty thousand (8,760,000) kilowatt-hours annual diminution above provided for.

The term "secondary energy" wherever used herein shall mean all electrical energy generated in one year (June 1 to May 31, inclusive) in excess of the amount of firm energy as hereinabove defined, available in such year.

The right of the district and/or lessee to take and pay for energy at the rate for secondary energy after discharge of such party's obligation to the United States to pay for energy at the rate for firm energy, shall not be impaired by reason of the fact that another allottee has not discharged its obligation to pay for energy at the rate for firm energy.

Schedule of Rates

(16) In consideration of this lease, the lessees severally agree:

- (1) To pay the United States for the use of falling water for the generation of energy for their own use, respectively, by the equipment leased hereunder (except as otherwise provided in Article seventeen (17) hereof), as follows:
 - (a) One and sixty-three hundredths mills (\$.00163) per kilowatt-hour, (delivered at transmission voltage) for firm energy;
 - (b) One-half mill (\$.0005) per kilowatt-hour, (delivered at transmission voltage) for secondary energy;
- (2) To compensate the United States for the use of the said leased equipment as herein elsewhere provided; and
- (3) To maintain said equipment in first-class operating condition, including repairs to and replacements of machinery; provided, however, that, if the expenditures for replacements shall exceed at any time the sum

accumulated by the lessees as a depreciation reserve in accordance with rules and regulations prescribed by the Secretary; pursuant to the Boulder Canyon Project Act, less all amounts previously withdrawn for replacements, then the rates aforesaid shall be readjusted as herein-after provided so as to reimburse the said lessees severally for such excess expenditures within the term of this lease.

At the end of fifteen (15) years from the date of execution of this contract and every ten (10) years thereafter, the above rates of payment for firm and secondary energy shall be readjusted upon demand of any party hereto, either upward or downward as to price, as the Secretary may find to be justified by competitive conditions at distributing points or competitive centers.

The rate for falling water for generation of firm energy which shall be uniform for both lessees provided for by any such readjustment shall be arrived at by deducting from the price of electrical energy justified by competitive conditions at distributing points or competitive centers, (1) all fixed and operating costs as provided for in this contract of transmission to such points, (2) all fixed and operating costs of such portion of the power plant machinery as is to be operated and maintained by the several lessees, including the cost of repairs and replacements, together with such readjustment as to replacements as is provided for in paragraph three (3) in this article; it being understood that such readjusted rates shall under no circumstances exceed the value of said energy, based upon competitive conditions at distributing points or competitive centers.

In arriving at the respective rates for "firm energy" and "secondary energy" as fixed herein, recognition has been given to the fact that "secondary energy" can not be relied upon as being at all times available, but is subject to diminution or temporary exhaustion; whereas "firm energy" is the amount of energy agreed upon as being available continuously as required during each year of the contract period. In the readjustment of the rate for "secondary energy," account shall be taken of the foregoing factors.

If the lessees severally or either of them shall not obtain a renewal of this contract at the expiration of the contract period as provided in article twenty-six (26) hereof, equitable adjustment for major replacements of machinery made between the date of the last readjustment of rates as provided for herein and the end of the contract period shall be made at the expiration of the contract.

Minimum Annual Payment

(17) The minimum quantity of firm energy which the city shall take and/or pay for each year (June 1 to May 31, inclusive), under the terms of this contract and after same is ready for delivery to the city as provided in subdivision (a) of article 11 hereof, shall be 37 per cent of all firm energy as defined in article 15 hereof for the generation of which the United States makes water available in said year, except as reduced by amounts of firm energy contracted for by others as provided in article 14. In addition, the city agrees to take and pay for, as provided in the last paragraph of article 14 hereof, all firm energy (not to exceed 90,000,000 kilowatt-hours per year (June 1 to May 31, inclusive), made available over and above the firm energy defined in article 15 hereof by the erection of a dam which provides a maximum water surface elevation in excess of 1222 feet above sea level. (United States Geological Survey data.)

The minimum quantity of firm energy which Southern California Edison Co. (Ltd.) shall take and/or pay for each year (June 1 to May 31, inclusive), under the terms of this contract and after same is ready for delivery to the company as provided in subdivision (c) of Article 11 hereof, shall be 27 per cent of all firm energy as defined in article 15 hereof for the generation of which the United States makes water available in said year, except as reduced by amounts of firm energy contracted for by others as provided in article 14.

The total payments made by each lessee for firm energy available in any year (June 1 to May 31, inclusive), whether any energy is generated or not, exclusive of its payments for use of machinery, shall be not less than the number of kilowatt-hours of firm energy available to said lessee and which said lessee is obligated to take and/or pay for during said year, multiplied by one and sixty-three hundredths mills (\$.00163), or multiplied by the adjusted rate of payment for firm energy in case the said rate is adjusted as provided in article sixteen (16) hereof, less credits on account of charges to other allottees, as provided for and referred to in article twelve (12) hereof. For a fractional year at the beginning or end of the contract period, the minimum annual payment for firm energy shall be proportionately adjusted in the ratio that the number of days water is available for generation of energy in such fractional year bears to three hundred sixty-five (365). Provided, however, that in order to afford a reasonable time for the respective lessees to absorb the energy contracted for, the minimum annual payments by each for the first three (3) years after energy is ready for delivery to such lessees respectively, as announced by the Secretary, as herein elsewhere provided, shall be as follows, in percentages of the ultimate annual obligation, to take and/or pay for firm energy:

1st year-----	55%
2nd year-----	70%
3rd year-----	85%
4th year and all subsequent years-----	100%

During said absorption period, if the quantity of energy taken in any one year (June 1 to May 31, inclusive) is in excess of the above percentages of the ultimate obligation during such year to take and/or pay for firm energy, such excess shall be paid for at the rate for secondary energy. Provided, further that the minimum annual payment shall be reduced in case of interruptions or curtailment of delivery of water as provided in article twenty-one (21) hereof.

Monthly Payments and Penalties

(18) The lessees, severally, shall pay monthly for energy in accordance with the rates established or provided for herein. When energy taken in any month is not in excess of one-twelfth (1-12) of the minimum annual obligation, bill for such month shall be computed at the rate for firm energy in effect when such energy was taken on the basis of the actual amount of energy used during such month. All energy used during any month in excess of one-twelfth (1-12) of the minimum annual obligation shall be paid for at the rate of secondary energy in effect when such energy was taken; provided, however, that the secondary rate shall not apply to any energy taken during any month unless and until an amount of energy equivalent to one-twelfth (1-12) of the minimum annual obligation has been taken for all months beginning with the month of June immediately preceding; provided, however, that the bill for the month of May shall not be less than the difference between the minimum annual payment, as provided in article seventeen (17) hereof, and the sum of the amounts charged for firm energy during the preceding eleven (11) months. The United States will submit bills to the lessees by the fifth of each month immediately following the month during which the energy is generated, and payments shall be due on the first day of the month immediately succeeding. If such charges (less credit allowances due lessees) are not paid when due, a penalty of one per cent (1%) of the amount unpaid shall be added thereto, and thereafter an additional penalty of one per cent (1%) of the amount unpaid shall be added on the first day of each calendar month thereafter during such delinquency.

No Energy to Be Delivered Without Payment

(19) After notice by the Secretary to the lessees no electrical energy shall be generated for, or delivered to, any lessee who shall be in arrears for more than twelve (12) months in the payment of any charge and/or penalty due or to become due the United States hereunder. Each lessee shall, upon receipt of written notice from the Secretary that any allottee is in arrears in the payment of any such charge and/or penalty immediately discontinue the generation for or delivery of energy to such allottee until receipt of further notice from said Secretary.

Contract May Be Terminated in Case of Breach

(20) In case of the breach by a lessee of the terms and conditions of this agreement to the extent that another allottee is deprived of all or any part of the electrical energy to which it is entitled under the allocation set forth in article fourteen (14) hereof, the generation of which is to be effected by such lessee, or in case either lessee shall be in arrears for more than twelve (12) months in the payment of any charge and/or penalty due or to become due the United States hereunder, the Secretary reserves the right to immediately enter, take possession of, and operate and maintain at the cost of such lessee, with proper deduction for charges as provided in this contract, due from the party or parties to whom such energy is delivered, so much property leased to such lessee, as may be necessary to deliver energy to such allottee, and thereafter upon two (2) years' written notice to such lessee, to terminate this contract as to such lessee; and upon such termination hereof all leased property shall be returned and delivered up to the United States in as good condition as when received, reasonable wear and damage by the elements excepted, provided, however, that in event of such termination, a lessee shall have the right at any time within ten (10) years from date of first default or breach for which such termination is demanded to become reinstated hereunder by removing all causes which resulted in termination hereof including payment of penalties, if any, and payment to the United States also of any and all loss incurred by it by reason of such termination. The waiver of a breach of any of the provisions of this contract shall not be deemed to be a waiver of any other provision hereof, or of a subsequent breach of such provision.

Interruptions in Delivery of Water

(21) The United States will deliver water continuously to each lessee in the quantity, in the manner, and at the times necessary for the generation of the energy which each of said lessees has the right and/or obligation to generate under this contract in accordance with the load requirements of each of said lessees and of allottees for which the respective lessees are generating agencies, excepting only that such delivery shall be regulated so as not to interfere with the necessary use of said Boulder Canyon Dam and Reservoir for river regulation, improvement of navigation, flood control, irrigation, or domestic uses, and the satisfaction of present perfected rights in or to the waters of the Colorado River, or its tributaries, in pursuance of Article VIII of the Colorado River Compact, and this contract is made upon the express condition, and with the express covenant, that the several rights of the lessees to the waters of the Colorado River, or its tributaries, are subject to, and controlled by, the Colorado River Compact. The United States reserves the right temporarily to discontinue or reduce the delivery of water for the generation of energy at any time for the purposes of maintenance, repairs and/or replacements, or installation of equipment, and for investigations and inspections necessary thereto; provided, however, that the United States shall except in case of emergency give to the lessees reasonable notice in advance of such temporary discontinuance or reduction, and that the United States shall make such inspections and perform such maintenance and repair work after consultation with the lessees at such times and in such manner as will cause the least inconvenience to the lessees, and shall prosecute such work with diligence, and, without unnecessary delay, will resume delivery of water so discontinued or reduced. Should the delivery of water be discontinued or reduced below the amount required, severally, for the normal generation of firm energy for the payment of which said lessee has hereby obligated itself, the total number of hours of such discontinuance or reduction in any year shall be determined

by taking the sum of the number of hours during which the delivery of water is totally discontinued, and the product of the number of hours during which the delivery of water is partially reduced and the percentage of said partial reduction below the actual quantity of water required by the lessees, severally, for the normal generation of firm energy. Total or partial reductions in delivery of water which do not reduce the power output below the amount required at the time by such lessee for the normal generation of firm energy, will not be considered in determining the total hours of discontinuance in any year. The minimum annual payment specified in article seventeen (17) hereof shall be reduced by the ratio that the total number of hours of such discontinuance bears to eight thousand seven hundred sixty (\$760). In no event shall any liability accrue against the United States, its officers, agents and/or employees, for any damage, direct or indirect, arising on account of drought, hostile diversion, act of God, or of the public enemy, or other similar cause; nevertheless interruptions in delivery of water occasioned by such causes shall be governed as hereinabove provided in this article.

Measurement of Energy

(22) All energy shall be measured at generator voltage and suitable metering equipment shall be provided and installed by the United States for this purpose. Suitable correction shall be made in the amounts of energy as measured at generator voltage to cover step-up transformer losses and energy required for operation of station auxiliaries, in determining the amounts of energy delivered at transmission voltage as provided in this contract. The said meter equipment shall be maintained by and at the expense of the respective lessees. Meters shall be tested at any reasonable time upon the request of either the United States or a lessee, and in any event they shall be tested at least once each year. If the test discloses that the error of any meter exceeds one per cent (1%), such meter shall be adjusted so that the error does not exceed one-half of one per cent ($\frac{1}{2}\%$). Meter equipment shall be tested by means of suitable testing equipment which will be provided by the United States, and which shall be calibrated by the United States Bureau of Standards as often as requested by any party hereto. Meters shall be kept sealed, and the seals shall be broken only in the presence of representatives of both the United States and the lessees respectively and likewise all test of meter equipment shall be conducted only when representatives of both the United States and the respective lessees are present.

Record of Electrical Energy Generated

(23) Each lessee shall make full and complete written monthly reports as directed by the Secretary, on forms to be supplied by the United States, of all electrical energy generated by it, and the disposition thereof to allottees. Such reports shall be made and delivered to the director on the third day of the month immediately succeeding the month in which the electrical energy is generated, and the records and data from which such reports are made shall be accessible to the United States on demand of the Secretary.

Inspection by the United States

(24) The Secretary or his representatives shall at all times have the right of ingress to and egress from all works of the lessees for the purpose of inspection, repairs and maintenance of works of the United States, and for all other proper purposes. The Secretary or his representatives shall also have free access at all reasonable times to the books and records of the lessees relating to the generation, transmission, and disposal of electrical energy hereunder with the right at any time during office hours to make copies of or from the same.

Transmission

(25) (a) The City shall operate and maintain at cost, including allowance for necessary overhead expense, the lines required for transmitting all Boulder Canyon power from the power plant to the pumping plants of the District, allocated to and used by the District for pumping water into and in its aqueduct; provided, that in the event it should prove materially to the advantage of the District, at any time during the 50-year period of this several lease, the District may operate and maintain such transmission lines itself; and provided further, that in the event of disagreement or dispute between the District and the City as to such matter, such disagreement shall be determined as provided in Article thirty-five (35) (a) hereof; and if by such determination energy allocated to and used by the District is to be transmitted by the District instead of the City, the Secretary will cause delivery of energy at transmission voltage to be made accordingly.

(b) The City of Los Angeles shall transmit over its main transmission line constructed for carrying Boulder Canyon power all such power allocated to and used by each of the municipalities, severally, and be compensated therefor on the basis of a reasonable share of the cost of construction, operation and maintenance of such line; subject to the understanding that, if on further investigation before April 15, 1932, it shall prove to be materially more economical for any municipality to make a different arrangement respecting transmission of its power, it may do so, provided that the arrangement so made shall not reduce the quantity of energy transmitted by the City below nineteen per cent (19%) of the firm energy generated, and subject to the further understanding that in case of any disagreement over the question of cost of transmission of Boulder Canyon power, such disagreement shall be determined in accordance with Article thirty-five (35) (a) hereof.

(c) The Company shall transmit over its main transmission lines, constructed for carrying Boulder Canyon power, such power, allocated to and used by the Southern Sierras Power Company, the San Diego Consolidated Gas and Electric Company and

the Los Angeles Gas and Electric Corporation, as they may desire to have transmitted over such lines, and the Company shall be compensated therefor as may be mutually agreed upon between the Company and the agency whose power is transmitted over the Company's lines. In case of any disagreement over the question of cost of transmission of Boulder Canyon power, such disagreement shall be determined in accordance with Article thirty-five (35) (a) hereof.

Duration of Contract

(26) This contract shall become effective as soon as the first Act of Congress appropriating funds for commencement of construction of Boulder Canyon Dam has become law, and as to each lessee shall remain in effect until the expiration of a period of fifty (50) years from the date at which energy is ready for delivery to the City, as announced by the Secretary. The holder of any contract for electrical energy, (including the lessees severally), not in default thereunder, shall be entitled to a renewal thereof upon such terms and conditions as may be authorized or required under the then existing laws and regulations, unless the property of such holder dependent for its usefulness on a continuation of the contract be purchased or acquired and such contractor be compensated for damages to its property, used and useful in the transmission and distribution of such electrical energy and not taken, resulting from the termination of the supply.

Title to Remain in United States

(27) As provided by Section six (6) of the Boulder Canyon Project Act, the title to Boulder Canyon Dam, reservoir, plant and incidental works, shall forever remain in the United States.

Electrical Energy Reserved for United States

(28) Each lessee by means of machinery leased hereunder shall furnish to the United States such electrical energy as may be desired at a maximum demand not to exceed five thousand (5000) kilowatts for construction and/or operation and maintenance purposes, and for diversion of water for irrigation and domestic uses, but not for resale to other than officers and employees and construction contractors of the United States, and to other persons in construction or operating camps constructed and/or maintained by the United States. Such power shall be delivered to the United States at the power plant, and shall be measured at the point of delivery by meters furnished and installed by the United States. The United States will pay each lessee for such power, through credit on monthly bills, at cost as provided in Article twelve (12) hereof.

Use of Public and Reserved Lands of the United States

(29) The use is authorized of such public and reserved lands of the United States as may be necessary or convenient for the construction, operation and maintenance of main transmission lines, to transmit electrical energy generated at Boulder Canyon Dam, together with the use of such public and reserved lands of the United States as may be designated by the Secretary, from time to time, for camp sites, residences for employees, warehouses and other uses incident to the operation and maintenance of the power plant and incidental works.

Priority of Claims of the United States

(30) Claims of the United States arising out of this contract shall have priority over all others, secured or unsecured.

Other Contracts

(31) Execution of this contract by the City, and performance of its obligations and assumptions of its rights hereunder, shall not be deemed in violation of any provision of any contract between the City and Company heretofore executed.

Transfer of Interest in Contract

(32) No voluntary transfer of this contract, or of the rights hereunder, shall be made without the written approval of the Secretary; and any successor or assign of the rights of either lessee, whether by voluntary transfer, judicial sale, foreclosure sale, or otherwise, shall be subject to all the conditions of the Boulder Canyon Project Act and also subject to all the provisions and conditions of this contract to the same extent as though such successor or assign were the original lessee hereunder; provided that a mortgage or trust deed or judicial sales made thereunder shall not be deemed voluntary transfers within the meaning of this article.

Rules and Regulations

(33) This contract is subject to such rules and regulations conforming to the Boulder Canyon Project Act as the Secretary may from time to time promulgate; provided, however, that no right of either lessee hereunder shall be impaired or obligation of either lessee hereunder shall be extended thereby; and provided further that opportunity for hearing shall be afforded each lessee by the Secretary prior to promulgation thereof.

Agreement Subject to Colorado River Compact

(34) This contract is made upon the express condition and with the express understanding that all rights hereunder shall be subject to and controlled by the Colorado River Compact, being the compact or agreement signed at Santa Fe, New Mexico, November 24, 1922, pursuant to Act of Congress approved August 19, 1921, entitled "An Act to permit a compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," which Compact was approved in Section 13 (a) of the Boulder Canyon Project Act.

Disputes and Disagreements

(35) (a) Disputes or disagreements arising under this contract between the lessees or between a lessee and another allottee shall be arbitrated by three arbitrators, but only in case where it is not provided herein that the determination shall be made by the Secretary. Each disputant shall name one arbitrator and these two shall name the third. If either disputant has notified the other that arbitration is demanded and that it has named an arbitrator, and if thereafter the other disputant fails to name an arbitrator for fifteen days, the Secretary, if requested by either disputant, shall name such arbitrator, who shall proceed as though named by the disputant. The two arbitrators so named shall meet within five days after appointment of the second, and name the third. If they fail to do so, the Secretary will, on request by either disputant or arbitrator, name the third. A decision by any two of the three arbitrators shall be binding on the disputants and enforceable by court proceedings or by the Secretary in his discretion. Arbitration as herein provided, or the failure of the arbitrators to render a decision within six months of appointment of the third arbitrator, shall be a condition precedent to suit by either disputant against the other upon the matter in dispute.

(b) Disputes or disagreements between the United States and a lessee or lessees as to the interpretation or performance of the provisions of this contract shall be determined either by arbitration or court proceedings, the Secretary of the Interior being authorized to act for the United States in such proceedings. Whenever a controversy arises out of this contract, and the disputants agree to submit the matter to arbitration, the lessees, if the matter in dispute affects the rights of both lessees, or if the matter in dispute affects the rights of only one lessee, then such lessee shall name one arbitrator and the Secretary shall name one arbitrator, and the two arbitrators thus chosen shall elect three other arbitrators, but in the event of their failure to name all or any of the three arbitrators within five (5) days after their first meeting, such arbitrators, not so elected, shall be named by the Senior Judge of the United States Circuit Court of Appeals for the Ninth Circuit. The decision of any three of such arbitrators shall be a valid and binding award of the arbitrators.

Contingent Upon Appropriations

(36) This contract is subject to appropriations being made by Congress from year to year of moneys sufficient to do the work provided for herein, and to there being sufficient moneys available in the Colorado River Dam Fund to permit allotments to be made for the performance of such work. No liability shall accrue against the United States, its officers, agents, or employees, by reason of sufficient moneys not being so appropriated nor on account of there not being sufficient moneys in the Colorado River Dam Fund to permit of said allotments. This agreement is also subject to the condition that if Congress fails to appropriate moneys for the commencement of construction work within five (5) years from and after execution hereof, or if for any other reason construction of Boulder Canyon Dam is not commenced within said time and thereafter prosecuted to completion with reasonable diligence, then and in such event any party hereto may terminate its obligations hereunder upon one (1) year's written notice to the other parties hereto.

Modifications

(37) Any modification, extension, or waiver by the Secretary of any of the terms, provisions or requirements of this contract for the benefit of any one or more of the allottees (including the lessees) shall not be denied to any other.

Member of Congress Clause

(38) No Member of or Delegate to Congress or Resident Commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom. Nothing, however, herein contained shall be construed to extend to this contract if made with a corporation for its general benefit.

IN WITNESS WHEREOF, the parties hereto have caused this contract to be executed the day and year first above written.

THE UNITED STATES OF AMERICA,

By RAY LYMAN WILBUR,
Secretary of the Interior.

Attest: NORTH CUTT ELY.

THE CITY OF LOS ANGELES,

Acting by and through its Board of Water
and Power Commissioners,

By JOHN R. HAYNES,
President.

COLORADO RIVER AND BOULDER CANYON PROJECT

Attest: JAS. P. VROMAN, Secretary.

DEPARTMENT OF WATER AND POWER OF
THE CITY OF LOS ANGELES,

By the Board of Water and Power
Commissioners,

By JOHN R. HAYNES,
President.

Attest: JAS. P. VROMAN, Secretary.

SOUTHERN CALIFORNIA EDISON CO. (LTD.),

By JOHN B. MILLER,
Chairman.

Attest: CLIFTON PETERS, Secretary.

Contract for electrical energy with Metropolitan Water District of Southern California.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BOULDER CANYON PROJECT

April 26, 1930.

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UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BOULDER CANYON PROJECT

Contract for Electrical Energy Between the United States and the Metropolitan Water District of Southern California, April 26, 1930, Amended May 31, 1930.

(1) THIS CONTRACT, made this 26th day of April, nineteen hundred thirty, pursuant to the Act of Congress approved June 17, 1902 (32 Stat., 388), and acts amendatory thereof or supplementary thereto, all of which acts are commonly known and referred to as the reclamation law, and particularly pursuant to the Act of Congress approved December 21, 1928 (45 Stat., 1057), designated the Boulder Canyon Project Act, between THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, acting for this purpose by Ray Lyman Wilbur, Secretary of the Interior, hereinafter styled the Secretary, and THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, a public corporation, organized and existing under and by virtue of the Laws of the State of California, hereinafter styled the District:

WITNESSETH:

Explanatory Recitals

(2) WHEREAS, for the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters for reclamation of public lands and other beneficial uses exclusively within the United States, and for the generation of electrical energy, the

Secretary, subject to the terms of the Colorado River Compact, is authorized to construct, operate and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon, adequate to create a storage reservoir of a capacity of not less than twenty million acre-feet of water; also to construct, equip, operate and maintain at or near said dam, or cause to be constructed, a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from said reservoir; and

(3) WHEREAS, after full consideration of the advantages of both the Black Canyon and Boulder Canyon dam sites, the Secretary has determined upon Black Canyon as the site of the aforesaid dam, hereinafter styled the Boulder Canyon Dam, and has determined that the revenues provided for by this contract, together with other contracts in accordance with the provisions of the Boulder Canyon Project Act, are adequate in his judgment to insure payment of all expenses of operation and maintenance of the Boulder Canyon Dam and appurtenant works incurred by the United States, and the repayment within fifty (50) years from the date of completion of said works of all amounts advanced to the Colorado River Dam Fund under Subdivision (b) of Section 2 of the Boulder Canyon Project Act, together with interest thereon made reimbursable under said Act; and

(4) WHEREAS, the United States proposes to enter into an agreement with the City of Los Angeles and Southern California Edison Company, Ltd., severally (hereinafter referred to as the lessees) for the lease, and the operation and maintenance of a Government-built power plant to be constructed at Boulder Canyon Dam, together with the right to generate electrical energy a copy of which said proposed lease is attached hereto marked Exhibit "A," and by this reference made a part hereof, wherein the Secretary has reserved the authority to, and in consideration of the execution thereof is authorized by each of the aforesaid lessees, severally, to contract with the other allottees named in the allocation set forth therein for the furnishing of energy to such allottees at transmission voltage in accordance with the allocation to each allottee, and the Secretary is therein granted by each lessee, severally, the power in accordance with the provisions thereof to enforce as against each lessee the rights to be acquired by such other allottees by contracts to be entered into with the United States; and

(5) WHEREAS, the District is desirous of entering into a contract with the United States providing for the delivery to the District each year from the Boulder Canyon Reservoir up to but not to exceed one million fifty thousand (1,050,000) acre-feet of water, and, in connection therewith and incident thereto, the District is desirous also of entering into a contract for the purchase of electrical energy to be generated at the power plant to be leased, as aforesaid, to the City of Los Angeles (hereinafter referred to as the City) and Southern California Edison Company, Ltd. (hereinafter referred to as the Company) to aid in the transportation of such water supply;

(6) NOW, THEREFORE, in consideration of the mutual covenants herein contained, the parties hereto agree as follows, to-wit:

Allocation of Electrical Energy

(7) The United States will cause to be delivered to the District under and in pursuance of and subject to the provisions of the aforesaid proposed lease, attached hereto as Exhibit "A," for a period of fifty (50) years from the date at which energy is ready for delivery to the City, as announced by the Secretary, in accordance with the following allocation, to wit:

Of Firm Energy.

A. To the State of Nevada, for use of Nevada, not exceeding 18 per cent (18%) of said total firm energy.

B. To the State of Arizona, for use in Arizona, not exceeding 18 per cent (18%) of said total firm energy.

Should either of the States not take its full 18 per cent (18%) allocation within a period of twenty (20) years hereof, the other may then contract for the energy not so taken up to four per cent (4%) of the total firm energy, provided that the combined amount used by the two States shall not, at any time, exceed 36 per cent (36%) of such total firm energy.

C. To the Metropolitan Water District of Southern California for pumping Colorado River water into and in its aqueduct for the use of such district within the following limits:

- (1) Thirty-six per cent (36%) of said total firm energy; which shall be paid for whether taken or not; plus
- (2) All secondary energy developed at the Boulder Dam power plant as provided in article fourteen (14) hereof; plus
- (3) So much of the firm energy allocated to the States, the City and the Company as may not be in use by them. Energy allocated to the States, but not in use by them, shall be released to the District by the two lessees equally (unless they agree upon a different ratio) as follows:
 - (a) If the District makes a firm contract with the Secretary for the balance of the lease period for part or all of such unused States energy (subject to the first right of the States thereto) such contract shall be made effective upon two years' written notice to the Secretary, and compensation to the lessees, respectively, for main transmission line property rendered idle;
 - (b) If the District does not so make a firm contract for such energy, then energy allocated to the States but not in use by them, shall be released to the District upon not less than fifteen months' written notice to the Secretary and at such compensation as the District and such lessees, respectively, may agree upon, to cover cost and overhead of replacing energy which

otherwise would have been received at the Pacific Coast end of the main transmission lines by the lessees, respectively. Such cost shall include interest on and depreciation and operation and maintenance of the plant capacity while required for the generation of such substitute energy; and also appropriate allowance for interest on and maintenance and depreciation of plant capacity rendered idle because of cessation of generation of such substitute energy until such time as such plant capacity would otherwise have been installed by the lessees, respectively, for their own requirements. If the District and the lessees, respectively, fail to agree on such compensation, such energy shall nevertheless be released to the District, and the disagreement shall be determined in accordance with article twenty-two (22) (a) hereof. Such determination shall include allowance for items of cost and overhead as specified in this paragraph. Pending such determination, energy so released shall be paid for by the District at the rate for firm energy but the determination of compensation under article twenty-two (22) (a) hereof shall not be controlled by such rate.

During any year beginning June 1st, the District shall not use any secondary energy or any unused State energy, until it has first used subsequent to June 1st, next preceding, an amount of firm energy equivalent to one-twelfth of the amount of firm energy it is obligated to take and/or pay for annually multiplied by the number of months elapsed since June 1st next preceding.

- (4) If, due to temporary deficiency in secondary energy regularly used in the District, substitute energy is required by the District in excess of the energy made available under the foregoing sub-paragraph (3) (b) the City and/or the Company may release so much energy as may be practicable on the same terms as provided in sub-section (3) (b) preceding.

D. To the municipalities of Anaheim, Beverly Hills, Burbank, Colton, Fullerton, Glendale, Newport Beach, Pasadena, Riverside, San Bernardino and Santa Ana, (referred to herein as "the municipalities"), 6 per cent (6%) in all, to be allocated between them as they may agree; but if no agreement is submitted to the Secretary on or before April 15, 1931, the Secretary shall determine the allocation of each.

E. To the City of Los Angeles, 13 per cent (13%).

F. To Southern California Edison Company, Ltd., the Southern Sierras Power Company, the San Diego Consolidated Gas and Electric Company and the Los Angeles Gas and Electric Corporation, referred to herein as the companies, 9 per cent (9%) in all, division whereof between the companies shall be made according to mutual agreement among them, if possible. If no such agreement is submitted to the Secretary on or before April 15, 1931, the Secretary shall determine the allocation of each.

It is further agreed that:

- (i) So much of the energy allocated to the States (thirty-six per cent (36%) of the firm energy) and not in use by them, or failing their use, by the District for the above purposes, shall be taken and paid for one-half by the City and one-half by the Company.
- In addition, all firm energy allocated to the City (13 per cent) shall be taken and paid for by the City.
- (ii) All of the energy allocated to the municipalities may be contracted for in compliance with regulations of the Secretary, by any one or more of them, as they may agree, on or before April 15, 1931. So much of the energy allocated to the municipalities as is not so contracted for, or if contracted for, not used by them directly or under contract for municipal purposes and/or distribution to their inhabitants, shall be taken and paid for by the City.
- (iii) So much of the energy allocated to the Southern Sierras Power Company, the San Diego Consolidated Gas and Electric Company, and the Los Angeles Gas and Electric Corporation as is not firmly contracted for by them, severally, in compliance with regulations of the Secretary on or before April 15, 1931, shall be taken and paid for by the Company.
- (iv) If any allottee is permitted by the United States to divert water from the reservoir, at a time when the reservoir is not spilling, in consequence of which the amount of energy which would have been utilized is diminished, such diminution shall be debited to the allocation of firm energy herein made to such allottee; and charge for the energy equivalent of such diversion shall be made, and the amount of energy which the allottee shall otherwise be obligated to take and pay for hereunder shall be correspondingly reduced.
- The reservoir shall be considered as spilling whenever water is being discharged in excess of the amount used for the generation of power, whether such waste occurs over the spillway or otherwise.
- (v) Each of the States of Arizona and Nevada may, from time to time within the period of the aforesaid lease, contract for energy for use within such State in any amount until the total allocated respectively to each is in use as provided above; and may terminate such contract, or contracts, without prejudice to the right to again contract for such energy. All such contracts shall be executed with the Secretary. A contract requiring one thousand (1000) horsepower (of maximum demand) or less may become effective or be terminated on six months' written notice of requirement or termination given the Director by the State; provided, that the notice given shall be two years if in the 12 months preceding said notice of demand the total increment to such state has exceeded five thousand (5000) horsepower of maximum demand or if in the 12 months preceding said notice of termination the decrement to such state has exceeded five thousand (5000) horsepower of maximum demand. In all cases the Director shall immediately transmit such notice to each lessee. Whenever the amount in use is in excess of five thousand (5000) horsepower

of maximum demand, the lessees respectively shall be compensated for property rendered idle by use of such excess in such amount as the Secretary shall determine to be equitable. Firm energy not contracted for by the States shall be available for use by the District as herein elsewhere provided, and if not in use by the States and/or the District, shall be taken and paid for equally by the two lessees. No right which may be available to a State under section five (5) (c) of the Boulder Canyon Project Act to execute a firm contract for electrical energy for use within the State shall be impaired by any provision of this contract.

Of Secondary Energy.

It is further agreed that the District shall have the right to purchase and use all secondary energy as provided in article nine (9) and article fourteen (14) hereof for the purposes stated in the first paragraph of subdivision (C) of this article. The City and the Company shall each have the right to purchase and use one-half of all secondary energy not used by the District. Any such energy not used by one lessee shall be available, for the time being, to the other. If secondary energy is not taken by the District, the City, and/or the Company then and in such event, the United States reserves the right to take, use and dispose of such energy, from time to time, as it sees fit, giving credit therefor as provided in article twelve (12) of exhibit "A" hereof.

Of Firm Energy Allocated to but not Used by the District.

It is further agreed that in the event the District shall fail for any reason to use all or any of the firm energy herein allotted to it for the only purpose for which said firm energy is allotted to it, that is, for pumping water into and in its aqueduct, then the Secretary shall dispose of such unused energy until required by the district for said purpose, crediting on the district's obligation the proceeds of such disposition as received; provided, however, that no disposition of such firm energy shall be made by the Secretary without first giving to a successor to the District which may undertake to build or maintain a Colorado River aqueduct the opportunity to take said firm energy for the same purpose and under the same terms as those to which the District was obligated; and provided further that in the event no such successor take said firm energy as provided above, then no disposition of such firm energy shall be made by the Secretary without first giving to each lessee the opportunity to contract on equal terms and conditions, to be prescribed by the Secretary, for one-half of such energy, together with such portion of the remainder as the other lessee shall not elect to take.

Of Firm Energy not Hereinbefore Disposed of.

It is further agreed that the United States reserves the right, in case the dam which it erects provides a maximum water surface elevation in excess of one thousand two hundred twenty-two (1222) feet above sea level (U. S. Geological Survey Datum), and thereby increases the quantity of firm energy above the quantity of four billion two hundred forty million (4,240,000,000) kilowatt hours allocated above, to dispose of such increase, but not to exceed ninety million (90,000,000) kilowatt hours per year (June 1st to May 31st, inclusive), to any municipality or municipalities by firm contract executed with the Secretary on or before April 15, 1931. Such disposition shall be without prejudice to any provision of this lease or of the allocation above referred to. So much of such additional energy as is not so contracted for shall be taken and paid for by the City. Generation of such additional energy shall in any event be effected by the City.

Installation of Machinery

(8) The district shall have opportunity to be heard by the Secretary or his representatives upon the design, capacity and cost of machinery to be provided and installed as stated in article eight (8) of exhibit "A" hereof before contracts therefor are let.

Firm and Secondary Energy Defined

(9) The amount of firm energy for the first year of operation (June 1 to May 31, inclusive), following the date of the completion of the dam as announced by the Secretary shall be defined as being four billion two hundred forty million (4,240,000,000) kilowatt hours at transmission voltage. For every subsequent year the amount defined as firm energy shall be decreased by eight million seven hundred sixty thousand (8,760,000) kilowatt hours from that of the previous year.

Nevertheless, if it be determined by the Secretary that the rate of decrease of kilowatt hours per year as above stated, is not in accord with actual conditions, the Secretary reserves the right to fix a lesser rate for any year (June 1 to May 31, inclusive) in advance.

If the dam erected by the United States provides a maximum water surface elevation in excess of 1222 feet above sea level (U. S. Geological Survey Datum), the United States reserves the right to dispose of additional firm energy thereby made available, not to exceed ninety million (90,000,000) kilowatt hours per year, subject to pro rata of the eight million seven hundred sixty thousand (8,760,000) kilowatt hours annual diminution above provided for.

The term "secondary energy" wherever used herein shall mean all electrical energy generated in one year (June 1 to May 31, inclusive) in excess of the amount of firm energy as hereinabove defined, available in such year.

If, by reason of international obligations arising through treaty or otherwise subsequent to the effective date of this contract, or by reason of interference with the program of construction and/or operation of the dam as provided for and contemplated by this contract, or by reason of other contingencies not now foreseen, the amount of firm energy available through the release of water from the Boulder Canyon reservoir shall in fact be less than the amount of firm energy as above defined, then in any such event the obligation of the District to take and pay for its allocation of firm energy shall be reduced in an amount corresponding to such change. If for any reason the United States shall be wholly unable to fulfill its obligations hereunder in respect of the delivery of water, then the District or either of them may terminate this contract.

The right of the District and/or lessees to take and pay for energy at the rate for secondary energy after discharge of such party's obligation to the United States to pay for energy at the rate for firm energy, shall not be impaired by reason of the fact that another allottee has not discharged its obligation to pay for energy at the rate for firm energy.

Generating Agencies

(10) In accordance with designation heretofore made by the Secretary, generation of energy allocated to the District shall be effected by the City. Nevertheless this provision is subject to the following conditions:

(i) Should it prove of material economic advantage to the District to have a portion of its energy generated as off-peak energy, the City, after generating energy for the District to the full extent of the generating capacity which has been installed at the request of the District with allowance for the contemplated margin of reserve capacity, shall also generate such additional energy as may be needed by the District and as can be generated off-peak with other generating capacity leased to and being operated by the City at such times as such use does not conflict with the needs of the City and other allottees for whom the City is generating energy. The District will pay for the off-peak use of such other generating capacity together with an allowance for a fair proportion of the operation and maintenance expenses at rates to be agreed upon between the District and the City and approved by the Secretary and if they are unable to agree then at a rate to be determined by the Secretary. Should the amount of energy which can be obtained by the District, from the generating capacity, which has been installed at the request of the District and from other capacity leased to and being operated by the City, be insufficient to satisfy the requirements of the District, then the District may arrange with Southern California Edison Company, Ltd., for generation of such off-peak energy as may be needed by the District at such times and not obtainable from the City to such an extent as such generation does not conflict with the needs of the Company and other allottees for whom the Company is generating energy. Charge shall be made against the District for such service at the rate to be agreed upon between the District and the Company and approved by the Secretary and if they are unable to agree then at a rate to be determined in accordance with article 22 (a) hereof.

(ii) Disputes and disagreements between any allottee and the lessee generating energy for it, with respect to such generation, and/or the cost thereof, shall be determined by the Secretary unless otherwise specifically provided in this contract.

(iii) Except for off-peak power furnished the District which shall be as provided in paragraph (i) of this article, all generation shall be effected at cost as determined in accordance with article 12 of exhibit "A" hereof.

Delivery of Electrical Energy

(11) (a) Energy shall be ready for delivery to the City and to the municipalities including those contracting under the last paragraph of article seven (7) hereof when the Secretary announces that one billion two hundred fifty million (1,250,000,000) kilowatt hours of energy per year is ready for delivery.

(b) Energy shall be ready for delivery to the District when the Secretary announces that two billion (2,000,000,000) kilowatt-hours of energy per year is available, which date, however, shall not be sooner than one (1) year after energy is ready for delivery to the City, provided, however, that the time when energy is ready for delivery to the District may be advanced subject to the approval of the Secretary, should the District so request, and that in such case the City shall be compensated by the District for interest and depreciation on and maintenance and operation of its main transmission line in case the total energy available to the City is reduced below one billion two hundred fifty million (1,250,000,000) kilowatt-hours per annum, in the proportion that such kilowatt-hours available to the City is less than one billion two hundred fifty million (1,250,000,000).

(c) Energy shall be ready for delivery to the Company when the Secretary announces that water capable of generating four billion two hundred forty million (4,240,000,000) kilowatt-hours of energy per year is available, which date, however, shall not be sooner than three (3) years after commencement of delivery of energy to the City and which shall not be until the water surface in Boulder Canyon Reservoir on August 1st immediately preceding has reached an elevation of eleven hundred fifty (1150) feet above sea level (U. S. Geological Survey datum).

(d) Upon written notification from the Secretary that generation equipment is ready for operation by it and water is available for generating energy therefrom, each lessee will be required to assume the operation and maintenance of its respective portion of the power plant, and thereafter the District will look to such lessee, severally, and not to the United States for compensation for injury and/or damages of any kind which may in any manner arise out of the operation and maintenance of the portion of such plant leased to it.

Charges to Be Paid the United States

(12) In consideration of this contract, the District agrees:

- (1) To pay the United States for the use of falling water for generation of energy for the District (except as otherwise provided in Article 15 hereof), as follows:
 - (a) One and sixty-three hundredths mills (\$.00163) per kilowatt-hour, (delivered at transmission voltage) for firm energy;
 - (b) One-half mill (\$.0005) per kilowatt-hour (delivered at transmission voltage) for secondary energy;
- (2) To pay the United States, for credit to the lessees, on account of use of the leased equipment as herein elsewhere provided; and
- (3) To pay the United States, for credit to the lessees, on account of maintenance of said equipment, including repairs to and replacements of machinery, as herein elsewhere provided.

At the end of fifteen (15) years from the date of execution of this contract and every ten (10) years thereafter, the above rates of payment for firm and secondary energy shall be readjusted upon demand of any party hereto, either upward or downward as to price, as the Secretary may find to be justified by competitive conditions at distributing points or competitive centers.

The rate for falling water for generation of firm energy which shall be uniform for both lessees provided for by any such readjustment shall be arrived at by deducting from the price of electrical energy justified by competitive conditions at distributing points or competitive centers, (1) all fixed and operating costs of transmission to such points, (2) all fixed and operating costs of such portion of the power plant machinery as is to be operated and maintained by the several lessees, including the cost of repairs and replacements, together with such readjustment as to replacements as is provided for in paragraph 3 in this Article: it being understood that such readjusted rates shall under no circumstances exceed the value of said energy, based upon competitive conditions at distributing points or competitive centers.

In arriving at the respective rates for "firm energy" and "secondary energy" as fixed herein, recognition has been given to the fact that "secondary energy" can not be relied upon as being at all times available, but is subject to diminution or temporary exhaustion; whereas "firm energy" is the amount of energy agreed upon as being available continuously as required during each year of the contract period. In the readjustment of the rate for "secondary energy," account shall be taken of the foregoing factors.

The charges agreed to be paid by the District to the United States, for credit to the City as generating agency, in this Article, shall be such proportion of the cost incurred by such generating agency as it and the District may agree.

The term "cost," as used with reference to generating energy, shall include a proper proportionate allowance for amortization for the cost of machinery and equipment as provided in Paragraph a of Article 9 of Exhibit A hereof, a proper proportionate part of any annuity set up in accordance with regulations of the Secretary provided for in Subdivision 3 of Article sixteen (16) of Exhibit "A" hereof, for the purpose of meeting the obligation of the City to make replacements; and a proper proportionate part of the actual outlay of the City for operating such machinery and equipment and keeping the same in repair, including reasonable overhead charges. The extent of the allowance for the several items in the event of disagreement between the City and District, and the system of accounting therefor, shall be prescribed by the Secretary under uniform regulations as required by Section 6 of the Boulder Canyon Project Act.

Monthly Payments and Penalties

(13) The District shall pay monthly for energy in accordance with the rates established or provided for herein, and for the generation thereof as provided in Article twelve (12).

When energy taken in any month is not in excess of one-twelfth (1/12) of the minimum annual obligation, bill for such month shall be computed at the rate for firm energy in effect when such energy was taken on the basis of the actual amount of energy used during such month. All energy used during any month in excess of one-twelfth (1/12) of the minimum annual obligation shall be paid for at the rate for secondary energy in effect when such energy was taken; provided, however, that the secondary rate shall not apply to any energy taken during any month unless and until an amount of energy equivalent to one-twelfth (1/12) of the minimum annual obligation has been taken for all months beginning with the month of June immediately preceding; provided, however, that the bill for the month of May shall not be less than the difference between the minimum annual payment, as provided in Article fourteen (14) hereof, and the sum of the amounts charged for firm energy during the preceding eleven months. The United States will submit bills to the District by the fifth of each month immediately following the month during which the energy is generated, and payments shall be due on the first day of the month immediately succeeding. If such charges are not paid when due, a penalty of one per cent (1%) of the amount unpaid shall be added thereto, and thereafter an additional penalty of one per cent (1%) of the amount unpaid shall be added on the first day of each calendar month thereafter during such delinquency.

The monthly charge for generation of such energy to be credited to the generating agency shall be in such amount as may be determined in accordance with Article twelve (12) hereof.

Minimum Annual Payment

(14) The minimum quantity of firm energy which the District shall take and/or pay for each year (June 1 to May 31, inclusive), under the terms of this contract, and after the same is ready for delivery to the District, as provided in Subdivision (b) of Article 11 hereof, shall be 36 per cent of all firm energy as defined in Article 9 hereof, available in said year. The total payments made by the District for firm energy available in any year (June 1 to May 31, inclusive), whether any energy is taken by it, or not, exclusive of its payments for credit to the generating agency, shall be not less than the number of kilowatt-hours of firm energy which the District is obligated to take and/or pay for during said year, multiplied by one and sixty-three hundredths mills (\$0.00163), or multiplied by the adjusted rate of payment for firm energy in case the said rate is adjusted as provided in Article twelve (12) hereof. For a fractional year at the beginning or end of the contract period, the minimum annual payment for firm energy shall be proportionately adjusted in the ratio that the number of days water is available for generation of energy in such fractional year bears to three hundred sixty-five (365). Provided, however, that in order to afford a reasonable time for the District to absorb the energy contracted for, the minimum annual payments by it for the first three (3) years after energy is ready for delivery to it, as announced by the Secretary, as herein elsewhere provided, shall be as follows, in percentages of the ultimate annual obligation, to take and/or pay for firm energy:

1st Year -----	55%
2nd Year -----	70%
3rd Year -----	85%
4th Year and all subsequent years -----	100%

During said absorption period, if the quantity of energy taken in any one year (June 1 to May 31, inclusive) is in excess of the above percentages of the ultimate obligation during such year to take and/or pay for firm energy, such excess shall be paid for at the rate for secondary energy. Provided, further, that the minimum annual payment shall be reduced in case of interruptions or curtailment of delivery of water as provided in Article sixteen (16) hereof.

The total payments made by the District for generation of such energy, to be credited to the generating agency, shall be determined in accordance with Article twelve (12) hereof.

No Energy to Be Delivered Without Payment

(15) Unless the written consent of the Secretary be first obtained, no electrical energy shall be generated for, or delivered to, the District if it shall be in arrears for more than twelve (12) months in the payment of any charge and/or penalty due or to become due the United States hereunder, whether for its own use or for credit to the generating agency.

Interruptions in Delivery of Water

(16) The United States will deliver water continuously to each lessee in the quantity, in the manner, and at the times necessary for the generation of the energy which each of said lessees has the right and/or obligation to generate under this contract in accordance with the load requirements of each of said lessees, and of allottees for which the respective lessees are generating agencies, excepting only that such delivery shall be regulated so as not to interfere with the necessary use of said Boulder Canyon Dam and Reservoir for river regulation, improvement of navigation, flood control, irrigation, or domestic uses, and the satisfaction of present perfected rights in or to the waters of the Colorado River, or its tributaries, in pursuance of Article VIII of the Colorado River Compact, and this contract is made upon the express condition, and with the express covenant, that the rights of the District to the waters of the Colorado River, or its tributaries, are subject to, and controlled by, the Colorado River Compact. The United States reserves the right temporarily to discontinue or reduce the delivery of water for the generation of energy at any time for the purpose of maintenance, repairs and/or replacements, or installation of equipment, and for investigations and inspections necessary thereto; provided, however, that the United States shall except in case of emergency give to the lessees reasonable notice in advance of such temporary discontinuance or reduction, and that the United States shall make such inspections and perform such maintenance and repair work after consultation with the lessees at such times and in such manner as will cause the least inconvenience to the lessees, and shall prosecute such work with diligence, and, without unnecessary delay, will resume delivery of water so discontinued or reduced. Should the delivery of water be discontinued or reduced below the amount required, severally, for the normal generation of firm energy for the payment of which said District has hereby obligated itself, the total number of hours of such discontinuance or reduction in any year shall be determined by taking the sum of the number of hours during which the delivery of water is totally discontinued, and the product of the number of hours during which the delivery of water is partially reduced and the percentage of said partial reduction below the actual quantity of water required by the lessees, severally, for the normal generation of firm energy. Total or partial reductions in delivery of water which do not reduce the power output below the amount required at the time by such lessee for the normal generation of firm energy, will not be considered in determining the total hours of discontinuance in any year. The minimum annual payment specified in Article fourteen (14) hereof shall be reduced by the ratio that the total number of hours of such discontinuance bears to eight thousand seven hundred sixty (8760). In no event shall any liability accrue against the United States, its officers, agents and/or employees, for any damage, direct or

indirect, arising on account of drought, hostile diversion, act of God, or of the public enemy, or other similar cause; nevertheless interruptions in delivery of water occasioned by such causes shall be governed as hereinabove provided in this article.

Measurement of Energy

(17) The energy received by the District shall be measured at transmission voltage at the point where the District's transmission lines connect to the switching station at Boulder Canyon dam called the point of delivery, or at the option of the Secretary, the energy received by the District shall be measured at the low voltage side of the substations serving the District, in which event suitable correction shall be made in the amounts of energy as measured to cover all losses between the points of measurement and the point of delivery at transmission voltage at Boulder Canyon dam. Suitable meter equipment satisfactory to the Secretary for measuring the energy received by the District shall be provided and maintained by and at the expense of the District. Meters may be tested at any reasonable time upon the request of either the United States or the District, and in all events they shall be tested at least once each year. If the test discloses that the error of any meter exceeds one per cent (1%) such meter shall be adjusted so that the error does not exceed one-half of one per cent ($\frac{1}{2}\%$). Meter equipment shall be tested by means of suitable testing equipment which will be provided by the United States, and which shall be calibrated by the United States Bureau of Standards as often as requested by either the United States or the District. Meters shall be kept sealed, and the seal shall be broken only in the presence of representatives of both the United States and the District and likewise all tests of meter equipment shall be conducted only when representatives of both the United States and the District are present.

Inspection by the United States

(18) The Secretary or his representatives shall at all times have the right of ingress to and egress from all works of the District for the purpose of inspection, repairs and maintenance of works of the United States, and for all other proper purposes. The Secretary or his representatives shall also have free access at all reasonable times to the books and records of the district relating to the disposal of electrical energy, with the right at any time during office hours to make copies of or from the same.

Transmission

(19) (a) The City having, in Article twenty-five (25) of Exhibit A hereof undertaken that it shall operate and maintain at cost, including allowance for necessary overhead expense, the lines required for transmitting all Boulder Canyon power from the power plant to the pumping plants of the District, allocated to and used by the District for pumping water into and in its aqueduct, provided, that in the event it should prove materially to the advantage of the District, at any time during the 50-year period of this lease, the District may operate and maintain such transmission lines itself; and provided further, that in the event of disagreement or dispute between the District and the City as to such matter, such disagreement shall be determined as provided in Article twenty-two (a) (22a) hereof; the Secretary will, if by such determination energy allocated to and used by the District is to be transmitted by the District instead of the City, cause delivery of energy at transmission voltage to be made accordingly.

Duration of Contract

(20) This contract shall become effective as soon as the first Act of Congress appropriating funds for commencement of construction of Boulder Canyon Dam has become law, and as to the District shall remain in effect until the expiration of a period of fifty (50) years from the date at which energy is ready for delivery to the City, as determined by the Secretary. The holder of any contract for electrical energy, including the District, not in default thereunder, shall be entitled to a renewal thereof upon such terms and conditions as may be authorized or required under the then existing laws and regulations, unless the property of such holder dependent for its usefulness on a continuation of the contract be purchased or acquired and such contractor be compensated for damages to its property, used and useful in the transmission and distribution of such electrical energy and not taken, resulting from the termination of the supply.

Contract May Be Terminated in Case of Breach

(21) If the District shall be in arrears for more than twelve (12) months in the payment of any charge and/or penalty due or to become due to the United States hereunder, and shall not have obtained an extension of time for payment thereof, or, if such extension be obtained, has not made such payment within the time as extended, then the Secretary reserves the right thereafter, and upon two (2) years' written notice to the District, to terminate this contract and dispose of the energy herein allocated as he may see fit; provided, that he shall first give opportunity to each lessee to contract on equal and uniform terms and conditions, to be prescribed by the Secretary, for one-half of such energy, together with such portion of the remainder as the other lessee shall not elect to take, and provided further, that such disposition shall be subject to the conditions that the District shall have the right at any time within ten (10) years from date of the first of the defaults or breaches for which the contract is terminated, to become reinstated hereunder by payment to the United States of all arrearages and penalties, if any, together with any and all loss incurred by the United States by reason of such termination, and compensation to the contractor or contractors for equipment ren-

dered idle by such reinstatement. In case of disagreement or dispute as to any of the items so to be paid the same shall be determined as provided in Article 22 hereof. The waiver of a breach of any of the provisions of this contract shall not be deemed to be a waiver of any other provisions hereof, or of a subsequent breach of such provision.

Disputes and Disagreements

(22) (a) Disputes or disagreements arising under this contract between the District and any lessee or other allottee shall be arbitrated by three arbitrators, except where otherwise provided in this contract. The District shall name one arbitrator, and the other disputant shall name one. These two shall name the third. If either disputant has notified the other that arbitration is demanded and that it has named an arbitrator, and if thereafter the other disputant fails to name an arbitrator for fifteen (15) days, the Secretary, if requested by either disputant, shall name such arbitrator, who shall proceed as though named by the disputant. The two arbitrators so named shall meet within five days after appointment of the second, and name the third. If they fail to do so, the Secretary will, on request by either disputant or arbitrator, name the third. A decision by any two of the three arbitrators shall be binding on the disputants and enforceable by court proceedings or by the Secretary in his discretion. Arbitration as herein provided, or the failure of the arbitrators to render a decision within six months of appointment of the third arbitrator, shall be a condition precedent to suit by either disputant against the other upon the matter in dispute.

(b) Disputes or disagreements between the United States and the District as to the interpretation or performance of the provisions of this contract shall be determined either by arbitration or court proceedings, the Secretary of the Interior being authorized to act for the United States in such proceedings. Whenever a controversy arises out of this contract, and the disputants agree to submit the matter to arbitration, the District shall name one arbitrator and the Secretary shall name one arbitrator, and the two arbitrators thus chosen shall elect three other arbitrators, but in the event of their failure to name all or any of the three arbitrators within five (5) days after their first meeting, such arbitrators, not so elected, shall be named by the Senior Judge of the United States Circuit Court of Appeals for the Ninth Circuit. The decision of any three of such arbitrators shall be a valid and binding award of the arbitrators.

Use of Public and Reserved Lands of the United States

(23) The use is authorized of such public and reserved lands of the United States as may be necessary or convenient for the construction, operation and maintenance of main transmission lines, to transmit electrical energy generated at Boulder Canyon Dam, together with the use of such public and reserved lands of the United States as may be designated by the Secretary, from time to time, for camp sites, residences for employees, warehouses and other uses incident to the operation and maintenance of the power plant and incidental works.

Priority of Claims of the United States

(24) Claims of the United States arising out of this contract shall have priority over all others, secured or unsecured.

Transfer of Interest in Contract

(25) No voluntary transfer of this contract, or of the rights hereunder, shall be made without the written approval of the Secretary; and any successor or assign of the rights of the District, whether by voluntary transfer, judicial sale, foreclosure sale, or otherwise, shall be subject to all the conditions of the Boulder Canyon Project Act and also subject to all the provisions and conditions of this contract to the same extent as though such successor or assign were the original contractor hereunder; provided, that a mortgage or trust deed or judicial sales made thereunder shall not be deemed voluntary transfers within the meaning of this article.

Rules and Regulations

(26) This contract is subject to such rules and regulations conforming to the Boulder Canyon Project Act as the Secretary may from time to time promulgate; provided, however, that no right of the District hereunder shall be impaired or obligation of the District hereunder shall be extended thereby; and provided further that opportunity for hearing shall be afforded the District by the Secretary prior to promulgation thereof.

Agreement Subject to Colorado River Compact

(27) This contract is made upon the express condition and with the express understanding that all rights hereunder shall be subject to and controlled by the Colorado River Compact, being the compact or agreement signed at Santa Fe, New Mexico, November 24, 1922, pursuant to Act of Congress approved August 19, 1921, entitled "An act to permit a compact or agreement between the states of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," which compact was approved in Section 13 (a) of the Boulder Canyon Project Act.

Performance Bond

(28) The District shall, upon demand of the Secretary, furnish and keep current for the use and benefit of the United States a performance bond in a penal sum

equal to the annual obligation assumed by it hereunder; or, in lieu thereof, deposit security satisfactory to the Secretary conditioned upon the faithful performance of this contract. In case security is deposited, the Secretary may make such disposition of the same as will accomplish the purpose for which submitted.

Contingent Upon Appropriations

(29) This contract is subject to appropriations being made by Congress from year to year of moneys sufficient to do the work provided herein, and to there being sufficient moneys available in the Colorado River Dam Fund to permit allotments to be made for the performance of such work. No liability shall accrue against the United States, its officers, agents or employees, by reason of sufficient moneys not being so appropriated or on account of there not being sufficient moneys in the Colorado River Dam Fund to permit of said allotments. This agreement is also subject to the condition that if Congress fails to appropriate moneys for the commencement of construction work within five (5) years from and after execution hereof, or if for any other reason construction of Boulder Canyon Dam is not commenced within said time and thereafter prosecuted to completion with reasonable diligence, then and in such event either party hereto may terminate its obligations hereunder upon one (1) year's written notice to the other party hereto.

Title to Remain in United States

(30) As provided by Section six (6) of the Boulder Canyon Project Act, the title to Boulder Canyon Dam, reservoir, plant and incidental works, shall forever remain in the United States.

Remedies Under Contract Not Exclusive

(31) Nothing contained in this contract shall be construed as in any manner abridging, limiting or depriving the United States of any means of enforcing any remedy either at law or in equity for the breach of any of the provisions hereof which it would otherwise have.

Member of Congress Clause

(32) No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom. Nothing, however, herein contained shall be construed to extend to this contract if made with a corporation for its general benefit.

IN WITNESS WHEREOF, the parties hereto have caused this contract to be executed the day and year first above written. (Executed in quadruplicate original.)

THE UNITED STATES OF AMERICA,

By RAY LYMAN WILBUR,

Secretary of the Interior.

Attest: NORTHCUTT ELY.

Approved as to form: W. B. MATHEWS, General Counsel.

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA,

By W. P. WHITSETT,

Chairman of the Board of Directors.

Attest: S. H. FINLEY, Secretary of the Board of Directors.

Contract for the delivery of water to Metropolitan Water District of Southern California.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BOULDER CANYON PROJECT

Contract for Delivery of Water

Article	Title
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2-5	Explanatory Recitals.
6	Delivery of Water by United States.
7	Receipt of Water by District.
8	Measurement of Water.
9	Record of Water Diverted.
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12	Refusal of Water in Case of Default.
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19	Rights Reserved under Section 3737, Revised Statutes.
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UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BOULDER CANYON PROJECT

Contract for Delivery of Water

(1) THIS CONTRACT, made this 24th day of April, nineteen hundred thirty, pursuant to the Act of Congress approved June 17, 1902, (32 Stat., 388), and acts amendatory thereof or supplementary thereto, all of which acts are commonly known and referred to as the reclamation law, and particularly pursuant to the Act of Congress approved December 21, 1928, (45 Stat., 1057), designated the Boulder Canyon Project Act, between THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, acting for this purpose by Ray Lyman Wilbur, Secretary of the Interior, hereinafter styled the Secretary, and THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, a public corporation, hereinafter styled the District, organized and existing under the laws of the State of California;

WITNESSETH:

Explanatory Recitals

(2) WHEREAS, for the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters for reclamation of public lands and other beneficial uses exclusively within the United States, the Secretary, subject to the terms of the Colorado River Compact, is authorized to construct, operate and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon, adequate to create a storage reservoir of a capacity of not less than twenty million acre-feet of water; and

(3) WHEREAS, after full consideration of the advantages of both the Black Canyon and Boulder Canyon dam sites, the Secretary has determined upon Black Canyon as the site of the aforesaid dam, hereinafter styled the Boulder Canyon Dam, creating thereby a reservoir to be hereinafter styled the Boulder Canyon Reservoir and has determined that the revenues provided by this contract, together with other contracts in accordance with the provisions of the Boulder Canyon Project Act, are adequate in his judgment to insure payment of all expenses of operation and maintenance of the Boulder Canyon Dam and appurtenant works incurred by the United States, and the repayment within fifty (50) years from the date of completion of said works of all amounts advanced to the Colorado River Dam Fund under Subdivision (b) of Section 2 of the Boulder Canyon Project Act, together with interest thereon made reimbursable under said Act; and

(4) WHEREAS, the District is desirous of entering into a contract for the delivery to it of water from Boulder Canyon Reservoir:

(5) NOW, THEREFORE, in consideration of the mutual covenants herein contained, the parties hereto agree as follows, to wit:

Delivery of Water by United States

(6) The United States shall deliver to the District each year from the Boulder Canyon Reservoir at a point in the Colorado River immediately below Boulder Canyon Dam, or as provided in Article 10 hereof, up to but not to exceed one million fifty thousand (1,050,000) acre-feet of water, which shall be delivered continuously as far as reasonable diligence will permit; provided, that such amount is without prejudice to any additional rights which the District may have or acquire in or to the waters of the Colorado River, or to the power of the parties to contract hereafter with reference thereto. The United States shall not be obligated to deliver water to the District when for any reason such delivery would interfere with the use of Boulder Canyon Dam, and reservoir for river regulation, improvement of navigation, flood control, and/or satisfaction of present perfected rights, in or to the waters of the Colorado River River, or its tributaries, in pursuance of Article VIII of the Colorado River Compact, and this contract is made upon the express conditions and with the express covenant that the right of the District to waters of the Colorado River, or its tributaries, is subject to and controlled by the Colorado River Compact. The United States reserves the right to discontinue or temporarily reduce the amount of water to be delivered for the purpose of investigation, inspection, maintenance, repairs, replacement or installation of equipment and/or machinery at Boulder Canyon Dam, but so far as feasible the United States will give the District reasonable notice in advance of such temporary discontinuance or reduction. The United States, its officers, agents and employees shall not be liable for damages when, for any reason whatsoever, suspensions or reductions in delivery of water occur. This contract is for permanent service, but is made subject to the express covenant and condition that in the event water for the District is not taken or diverted by the District hereunder for District purposes within a period of ten (10) years from and after completion of Boulder Canyon Dam as announced by the Secretary, it may in such event, upon the written order of the Secretary, and after hearing become null and void and of no effect.

Receipt of Water by District

(7) The District shall receive the water to be delivered to it by the United States under the terms hereof at the point of delivery above stated and shall at its own expense convey such water to its proposed aqueduct, and shall perform all acts required by law or custom in order to maintain its control over such water and to secure and maintain its lawful and proper diversion from the Colorado River,

Measurement of Water

(8) The water to be delivered hereunder shall be measured at the intake of the District's proposed aqueduct by such measuring and controlling devices or such automatic gauges or both, as shall be satisfactory to the Secretary. Said measuring and controlling devices, or automatic gauges, shall be furnished, installed and maintained by and at the expense of the District, but they shall be and remain at all times under the complete control of the United States, whose authorized representatives may at all times have access to them over the lands and rights of way of the District.

Record of Water Diverted

(9) The District shall make full and complete written monthly reports as directed by the Secretary, on forms to be supplied by the United States, of all water diverted from the Colorado River. Such reports shall be made by the fifth day of the month immediately succeeding the month in which the water is diverted, and the records and data from which such reports are made shall be accessible to the United States on demand of the Secretary.

Charge for Delivery of Water

(10) A charge of twenty-five cents (\$0.25) per acre-foot shall be made for water delivered to the District hereunder during the Boulder Dam cost repayment period. It is understood by the District that it may divert water above Boulder Canyon Dam, but that such diversion of water above the dam will reduce the amount of power otherwise available at said dam, and may reduce the amount which would have been utilized, except at times when the reservoir is spilling, and an additional charge, determined as stated below, will be made on account of any such reduction in energy which would otherwise have been utilized in case water is diverted above the dam. The energy which could have been generated by the water diverted above the dam and which would have been utilized, at times when the reservoir is not spilling will be calculated from the effective head, the quantity of water diverted and the overall efficiency of the power plant, as determined by the Secretary, whose determination shall be conclusive and binding upon the parties hereto. The additional charge per month for diversion above the dam will be the product of such amount of energy and the rate per kilowatt hour for firm energy at Boulder Canyon Dam in effect at the time of such diversion. Nevertheless if such diversion during any year (June 1st to May 31st, inclusive) has not reduced the amount of firm energy during such year, for which the United States has contracted, the diversion, to the extent that no reduction in firm energy has been occasioned, shall be computed at the rate for secondary energy then in force and credit given on the ensuing year's power bills of the District for the difference between the amount charged therefor and the amount so determined. The Secretary's determination of such credit shall be conclusive. The reservoir shall be considered as spilling whenever water is being discharged in excess of the amount used for the generation of power, whether such waste occurs over the spillway or otherwise. Energy equivalent to water delivered above the dam, determined as above, for which the firm energy rate is charged, shall be included in the total firm energy available at the dam, defined as four billion three hundred thirty million (4,330,000,000) kilowatt hours per year (June 1st to May 31st, inclusive), upon completion of the dam, as announced by the Secretary, and decreasing uniformly thereafter by eight million seven hundred sixty thousand (8,760,000) kilowatt hours per year, and also included in the District's allotment of firm energy. Nevertheless if it be determined by the Secretary that the rate of decrease above stated is not in accord with actual conditions, the Secretary reserves the right to fix a lesser rate for any year (June 1st to May 31st, inclusive), in advance.

Monthly Payments and Penalties

(11) The District shall pay monthly for all water delivered to it hereunder, or diverted by it from the Colorado River, in accordance with the rate herein in Article ten (10) established. Payments shall be due on the first of the second month immediately succeeding the month in which water is delivered and/or diverted. If such charges are not paid when due, a penalty of one per cent (1%) of the amount unpaid shall be added thereto, and thereafter an additional penalty of one per cent (1%) of the amount unpaid shall be added on the first day of each calendar month during such delinquency.

Refusal of Water in Case of Default

(12) The United States reserves the right to refuse to deliver water to the District in the event of default for a period of more than twelve (12) months in any payment due or to become due the United States under this contract.

Inspection by the United States

(13) The Secretary or his representatives shall at all times have the right of ingress to and egress from all works of the District for the purposes of inspection, repairs and maintenance of works of the United States, and for all other proper purposes. The Secretary or his representatives shall also have free access at all reasonable times to the books and records of the District relating to the diversion and distribution of water delivered to it hereunder with the right at any time during office hours to make copies of or from the same.

Disputes or Disagreements

(14) Disputes or disagreements as to the interpretation or performance of the provisions of this contract shall be determined either by arbitration or court proceedings, the Secretary of the Interior being authorized to act for the United States in such proceedings. Whenever a controversy arises out of this contract, and the parties hereto agree to submit the matter to arbitration the District shall name one arbitrator and the Secretary shall name one arbitrator, and the two arbitrators thus chosen shall elect three other arbitrators, but in the event of their failure to name all or any of the three arbitrators within five (5) days after their first meeting, such arbitrators, not so elected, shall be named by the Senior Judge of the United States Circuit Court of Appeals for the Ninth Circuit. The decision of any three of such arbitrators shall be a valid and binding award of the arbitrators.

Rules and Regulations

(15) There is reserved to the Secretary the right to prescribe and enforce rules and regulations governing the delivery and diversion of water hereunder. Such rules and regulations may be modified, revised and/or extended from time to time after notice to the District and opportunity for it to be heard, as may be deemed proper, necessary, or desirable by the Secretary to carry out the true intent and meaning of the law and of this contract, or amendments hereof, or to protect the interests of the United States. The District hereby agrees that in the operation and maintenance of its diversion works and aqueduct, all such rules and regulations will be fully adhered to.

Agreement Subject to Colorado River Compact

(16) This contract is made upon the express condition and with the express understanding that all rights hereunder shall be subject to and controlled by the Colorado River Compact, being the compact or agreement signed at Santa Fe, New Mexico, November 24, 1922, pursuant to Act of Congress approved August 19, 1921, entitled "An Act to permit a compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," which Compact was approved in Section 13 (a) of the Boulder Canyon Project Act.

Priority of Claims of the United States

(17) Claims of the United States arising out of this contract shall have priority over all others, secured or unsecured.

Contingent Upon Appropriations

(18) This contract is subject to appropriations being made by Congress from year to year of moneys sufficient to do the work provided for herein, and to there being sufficient moneys available in the Colorado River Dam Fund to permit allotments to be made for the performance of such work. No liability shall accrue against the United States, its officers, agents, or employees, by reason of sufficient moneys not being so appropriated nor on account of there not being sufficient moneys in the Colorado River Dam Fund to permit of said allotments. This agreement is also subject to the condition that if Congress fails to appropriate moneys for the commencement of construction work within five (5) years from and after execution hereof, or if for any other reason construction of Boulder Canyon Dam is not commenced within said time and thereafter prosecuted to completion with reasonable diligence, then and in such event either party hereto may terminate its obligations hereunder upon one (1) year's written notice to the other party hereto.

Rights Reserved Under Section 3737 Revised Statutes

(19) All rights of action for breach of any of the provisions of this contract are reserved to the United States as provided in Section 3737 of the Revised Statutes of the United States.

Remedies Under Contract Not Exclusive

(20) Nothing contained in this contract shall be construed as in any manner abridging, limiting or depriving the United States of any means of enforcing any remedy either at law or in equity for the breach of any of the provisions hereof which it would otherwise have.

Interest in Contract Not Transferable

(21) No interest in this agreement is transferable and no sublease shall be made by the District without the written consent of the Secretary, and any such attempted transfer or sublease shall cause this contract to become subject to annulment, at the option of the United States.

Member of Congress Clause

(22) No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom. Nothing, however, herein contained shall be construed to extend to this contract if made with a corporation for its general benefit.

IN WITNESS WHEREOF, the parties hereto have caused this contract to be executed the day and year first above written. (Executed in quadruplicate original.)

THE UNITED STATES OF AMERICA,

By RAY LYMAN WILBUR,
Secretary of the Interior.

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA,

By W. P. WHITSETT, (Signed)
Chairman of the Board of Directors.
(Corporate Seal.)

Approved as to form:

W. B. MATHIEWS, (Signed)
General Counsel.

Attest:

S. H. FINLEY, (Signed)
Secretary of the
Board of Directors.

Opinion of Attorney General Mitchell of the United States, Relative to Power Contracts

"Sir: I have the honor to acknowledge receipt of your communication of June 6, 1930, transmitting a letter dated June 6, 1930, from the Secretary of the Interior advising that, as required by section 4 (b) of the Boulder Canyon Project Act (45 Stat. 1057) a contract has been secured with the city of Los Angeles, its department of water and power, and the Southern California Edison Co. (Ltd.), which will provide revenue adequate in his judgment to pay operation and maintenance costs and insure repayment to the United States within 50 years from the completion of the dam, power plant, and related works of all amounts to be advanced for the construction of such works, together with the interest thereon made reimbursable by the act, and that in addition two contracts have been secured with the Metropolitan Water District of Southern California which will provide additional revenues for such purpose, and requesting that the opinion of the Attorney General be obtained as to whether or not these contracts comply with all the requirements of section 4 (b) of the Boulder Canyon Project Act which are by that section made conditions precedent to the appropriation of money, the making of contracts, and the commencement of work for the construction of a dam and power plant in Boulder Canyon.

"Responsive to your request for my opinion upon these questions, I have the honor to advise you as follows:

"Section 4 (b) of the Boulder Canyon Project Act provides:

"(b) Before any money is appropriated for the construction of said dam or power plant, or any construction work done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and the repayment, within fifty years from the date of the completion of said works, of all amounts advanced to the fund under subdivision (b) of section 2 for such works, together with interest thereon made reimbursable under this act."

"The contracts in question are:

"(1) A contract dated April 26, 1930, between the United States of America and the city of Los Angeles and the Southern California Edison Co. (Ltd.), entitled 'Contract for Lease of Power Privilege' as amended by supplemental contract dated May 28, 1930.

"(2) A contract dated April 26, 1930, between the United States of America and the Metropolitan Water District of Southern California, entitled 'Contract for Electrical Energy, as amended by a Supplemental Contract dated May 31, 1930.'

"(3) A contract dated April 24, 1930, between the United States of America and the Metropolitan Water District of Southern California, entitled 'Contract for Delivery of Water.'

"The Contract for Lease of Power Privilege, as amended, recites—

"(1) This contract, made this 26th day of April, 1930, pursuant to the act of Congress approved June 17, 1902 (31 Stat. 388), and acts amendatory thereof and supplemental thereto, all of which acts are commonly known and referred to as the

reclamation law, and particularly pursuant to the act of Congress approved June 21, 1928 (45 Stat. 1057), designated the Boulder Canyon Project Act, between the United States of America, hereinafter referred to as the United States, acting for this purpose by Ray Lyman Wilbur, Secretary of the Interior, hereinafter styled the Secretary, and severally the city of Los Angeles, a municipal corporation, and its department of water and power (said department acting herein in the name of the city but as principal in its own behalf as well as in behalf of the city; the term "city" as used in this contract being deemed to mean both the city of Los Angeles and its department of water and power) and the Southern California Edison Co. (Ltd.), a private corporation, hereinafter styled the company, both of said corporations being organized and existing under the laws of the State of California and hereinafter styled the lessees.

"The original and supplemental contracts for lease of power privilege were executed in the name of the city of Los Angeles, acting by and through its board of water and power commissioners, by the president of the board. The supplemental contract contains a recital that it was the intention that the department of water and power of the city of Los Angeles, as well as the city of Los Angeles, should be firmly bound as principals by the original contract of April 26, 1920, and the parties adopt and reaffirm the original contract as amended. The department of water and power commissioners, by the president of the board, executed the supplemental contract.

"There have been submitted to me certified copies of resolutions adopted by the board of water and power commissioners, and of resolutions and ordinances adopted by the council of the city of Los Angeles authorizing the execution of these contracts. Section 386 of the charter of the city of Los Angeles provides that contracts shall not be made without advertising for bids; but this section does not apply to contracts such as those here in question relating to a matter about which there is no competition and where advertising for bids would have been futile. (*Los Angeles Gas and Electric Corp. vs. City of Los Angeles*, 188 Cal. 307, 319.) In my opinion the ordinances and resolutions were sufficient to authorize the president of the board of water and power commissioners to execute the contracts.

"In substance the contract as amended imposes upon the city acting by and through its department of water and power, and therefore upon the department itself: First, the obligation, when the dam is completed and the generating equipment has been installed by the Government, to take over as lessee the generating plant and operate it, paying as rental in 10 annual installments the cost to the United States of the generating equipment, with interest at 4 per cent; second, the obligation to pay for electrical energy, as furnished, at stated rates; third, an obligation to operate and maintain at cost the transmission lines required for transmitting power to the pumping plants of the metropolitan water district, and to transmit over its main transmission line the power allocated to others, for compensation based on a reasonable share of the cost of construction, operation, and maintenance. As none of the transmission lines have been built, performance of these obligations will require their construction.

"Under the provisions of the charter of the city of Los Angeles the department of water and power is specifically authorized to construct, operate, maintain, extend, manage, and control works and property for the purpose of supplying the city and its inhabitants with water and electric energy. To this department of the city government is entrusted full responsibility and control in entering into such contracts as those here involved. Quite in conformity with the charter provisions the city, in its execution of the original and supplemental contracts for lease of power privilege, is described as acting by and through its board of water and power commissioners. The contract as amended is therefore to be regarded as made in the name of the city, but subject to all of the provisions of the charter of the city of Los Angeles relating to contracts executed by the department of water and power, and the question of the validity of this contract and the character of the resources available to secure its performance must be determined from a consideration of the power of the board of water and power commissioners of the department of water and power to make such a contract, and the sufficiency of the resources of the city which are specifically allocated under the terms of the charter to its control and expenditure in the performance of the obligations of such contracts.

"Under the charter of the city of Los Angeles, revenues for such purposes as those contemplated by these contracts are provided through the operations of the department of water and power, which, although an entity separate from the city for some purposes (*Shelton vs. City of Los Angeles*, 275 Pac. 421), is a department of the city government. Its revenues are revenues of the city, but are allocated to the control and disposition of the department.

"The charter provisions which are pertinent in this connection are as follows:

"Sec. 220. The department of water and power shall have the power and duty—

"(1) To construct, operate, maintain, extend, manage, and control works and property for the purpose of supplying the city and its inhabitants with water and electric energy, or either, and to acquire and take, by purchase, lease, condemnation, or otherwise, and to hold, in the name of the city, any and all property situated within or without the city, and within or without the state, that may be necessary or convenient for such purpose.

"(2) To regulate and control the use, sale, and distribution of water and electric energy owned or controlled by the city; the collection of water and electric rates and the granting of permits for connections with said water or electric works; and to fix the rates to be charged for such connection; and, subject to the approval of the council by ordinance, to fix the rates to be charged for water or electric energy for use within or without the city, and to prescribe the time and the manner of payment of the same. * * *

"(7) To control and order, except as otherwise in this charter provided, the expenditure of all money received from the sale or use of water, or from any other source in connection with the operation of said water works, and all money received from the sale or use of electric energy, or from any other source in connection with the operation of said electric works; provided, that all such money pertaining to said water works shall be deposited in the city treasury to the credit of a fund to be known as the water revenue fund, and all such money pertaining to said electric works shall be deposited in the city treasury to the credit of a fund to be known as the power revenue fund; and the money so deposited in each such fund shall be kept separate and apart from other money of the city, and shall be drawn only from said fund upon demands authenticated by the signature of the chief accounting employee of the board.

"Sec. 221. None of the money in or belonging to the water-revenue fund or the power-revenue fund shall be appropriated or used for any purpose except the following purposes pertaining to the municipal works from or on account of which such money was received, to wit:

"First. For the necessary expenses of operating and maintaining such works.

"Second. For the payment of the principal and interest, or either, due or coming due upon outstanding notes, certificates, or other evidences of indebtedness issued against revenues from such works, in pursuance of section 224, or bonds or other evidences of indebtedness, general or district, heretofore or hereafter issued for the purpose of such works, or parts thereof.

"Third. For the necessary expenses of constructing, extending, and improving such works, including the purchase of lands, water rights and other property; also the necessary expenses of conducting and extending the business of the department pertaining to such works; also for reimbursement to another bureau on account of services rendered or material, supplies or equipment furnished; also for expenditures for purposes for which bonds or evidences of indebtedness provided for in section 224, shall have been authorized, subject to reimbursement as soon as practicable, from moneys derived from the sale or issuance of such bonds or evidences of indebtedness.

"Fourth. To return and pay into the general fund of the city, from time to time, upon resolution of the board, from any surplus money in either such revenue fund, any sums paid by the city from funds raised by taxation for the payment of the principal or interest of any municipal bonds issued by the city for or on account of the municipal works to which such revenue fund pertains, or of liability arising in connection with the construction, operation, or maintenance of the municipal works to which said fund pertains.

"Fifth. For defraying the expenses of any pension system applicable to the employees of the department that shall be established by the city.

"Fifth (a). For establishing and maintaining a reserve fund to insure the payment at maturity of the principal and interest on all bonds now outstanding or hereafter issued for the purpose of the municipal works, and such other reserve funds pertaining to such works as the board may provide for by resolution subject to the approval of the council by ordinance. The money set aside and placed in such fund or funds so created shall remain in said fund or funds until expended for the purposes thereof and shall not be transferred to the "reserve fund" of the city.

"Sixth. To be transferred as provided in section 382 of this charter.

"Sec. 222. The board shall provide for the cost of extensions and betterments of said water works and electric works from the funds derived from the sale of bonds, general or district, so far as such funds shall be made available for the use of the

board for said purposes, and so far as such funds shall not be made available for the use of the board therefor, from revenues received from the works to which such extensions and betterments pertain, and from the proceeds of loans contracted as provided by section 224.

* * * * *

"Sec. 382. At the close of each fiscal year the controller and treasurer shall transfer all surplus money remaining in each fund over and above the amount of outstanding demands and liabilities payable out of such fund to the "reserve fund," except such surplus money as is in the several bond funds, interest and sinking funds, trust funds, the fire and police pension fund, the harbor revenue fund, the library fund, the park fund, the permanent improvement fund, the playground and recreation fund, the power revenue fund, and the water revenue fund, but the council may by ordinance direct that any or all said surplus money in either the harbor revenue fund, the power revenue fund or the water revenue fund be transferred to such reserve fund with the consent of the board in charge of such fund, but not otherwise."

"Leaving entirely out of consideration the proceeds from the sale of bonds, which would no doubt require, under section 18 of article 11 of the state constitution, the approval of two-thirds of the electors, and leaving entirely out of consideration the proceeds of loans contracted as provided by section 224 of the city charter, which are authorized only for emergency purposes, and bearing in mind that the department of water and power is not authorized to levy taxes, it is apparent that its resources are limited to its earnings from the sale or use of water and of electric energy, and that over these revenues it has complete control of expenditure for the construction, operation, and maintenance of all works and property for the purpose of supplying the city and its inhabitants with water and electric energy.

"I am advised by the Secretary of the Interior that yearly revenues of this department are more than ample to meet all of its liabilities under the original and amended contracts, and, therefore, to relieve the city of any necessity of financing the obligations which will arise under these contracts; that these revenues under the department of water and power are not only amply sufficient for this purpose, but its yearly earnings will in his judgment be amply sufficient to provide for the construction of the transmission lines as well.

"The only limitation upon the expenditure of such funds by this department is found in section 369 of the charter of the city of Los Angeles, which reads:

"No department, bureau, division, or office of the city government shall make expenditures or incur liabilities in excess of the amount appropriated therefor."

"The method of appropriation is, however, provided in section 83 as follows:

"The board of each department * * * the finances of which are not included in the general budget, but which department itself has control of definite revenues or funds, as elsewhere in this charter set forth, shall, prior to the beginning of each fiscal year, adopt an annual departmental budget and make an annual departmental budget appropriation, covering the anticipated revenues and expenditures of said department. Such departmental budget shall conform, as far as practicable, to the forms and times provided in this charter for the general city budget. Each such budget shall contain a sum to be known as the unappropriated balance, which sum shall be available for appropriation by the board later in the ensuing fiscal year to meet contingencies as they may arise. A copy of such budget, when adopted, and of every resolution subsequently adopted making appropriation from said unappropriated balance, shall promptly be filed with the mayor and controller, each. No expenditure shall be made or financial obligations incurred by any such department except as authorized by the annual departmental appropriation, or appropriations made subsequent to said annual budget."

"Question arises under section 369 of the charter as to whether by the execution of the original and amended contracts a present liability was incurred for the payments to be made thereunder in the future. No authorities have been found construing this charter provision, but similar questions have often arisen under section 18 of article 11 of the constitution of the State of California, and although this constitutional limitation has no application to contracts made by the department of water and power these authorities must be considered in determining the effect of section 369 of the charter upon the validity of the contracts here in question.

"Section 18 of article 11 of the constitution of California, provides:

"No county, city, town, township, board of education, or school district shall incur any indebtedness or liability in any manner or for any purpose exceeding in any year the income and revenue provided for such year, without the asset of two-

thirds of the qualified electors thereof, voting at an election to be held for that purpose, nor unless before or at the time of incurring such indebtedness provision shall be made for the collection of an annual tax sufficient to pay the interest on such indebtedness as it falls due, and also provision to constitute a sinking fund for the payment of the principal thereof on or before maturity, which shall not exceed 40 years from the time of contracting the same; * * * Any indebtedness incurred contrary to any provision of this section shall be void; * * *

"The obvious purpose of this limitation is to prevent the city from incurring indebtedness in excess of its yearly revenue, and the question has often arisen in the courts of California as to when an indebtedness or liability is incurred, within the meaning of this provision, when a contract is executed requiring payments to be made from time to time in the future.

"There is authority for the proposition that when a municipality receives the entire consideration for its promise to make payments or incur expenditures in the future, a liability is immediately incurred under the provisions of the state constitution. (See *Chester vs. Carmichael*, 187 Calif. 287; *In re City and County of San Francisco*, 195 Calif. 426; *Mahoney vs. City and County of San Francisco*, 201 Calif. 248.) But a municipality does not incur an 'indebtedness' or 'liability' invalid under the constitutional provision when it enters into a contract to pay for services as and when rendered from time to time in the future. The obligations here involved to pay rental and power rates can not be said to be incurred until the rental accrues and the power is received. Such liabilities are held, for the purpose of this constitutional provision, to be incurred when the services have been rendered and the obligation to pay for them arises. (See *McBean vs. Fresno*, 112 Calif. 195; *Smilie vs. Fresno County*, 112 Calif. 311; *Doland vs. Clark*, 143 Calif. 176; *In re City and County of San Francisco*, 191 Calif. 172; Compare *Walla Walla vs. Walla Walla Water Co.*, 172 U. S. 1.)

"It may, however, be said that if a contract imposes upon the municipality liabilities to arise in the future which in any year will necessarily exceed the income and revenue provided for such year, it will be invalid. The courts have held that the aggregate of all payments which will be required under such a contract is not to be regarded as a liability presently incurred upon the execution of the contract, and thus incurred within the year of its execution; but they have not held that a municipality may, in the face of the constitutional limitation incur future liabilities which will exceed the income and revenue for the year in which payment thereof will be required and so to hold would appear to be in direct contradiction of the express provision of the constitution.

"The city acting through its department of water and power will be under the necessity to construct transmission lines over which the power for which it has agreed to pay may be transmitted, but in so far as the parties to this contract are concerned it is under no express obligation to do so. Under no circumstances will it be necessary for the city to construct transmission lines in advance of the completion of the dam and generating equipment, and, if, therefore, it appears that during this period it will be able to finance such construction out of current revenues of its department of water and power, I am of the opinion that no legal objection can be made to the contract as amended because of the necessity or liability which may arise to defray these construction costs.

"Consideration of these authorities leads to the conclusion that the department of water and power has not incurred a present liability upon the execution of these contracts, and therefore the only effect of section 369 is to require the appropriation in each annual budget of sufficient funds from the water and power revenues to meet the obligations which will arise under and in connection with the performance of these contracts. Inasmuch as the Secretary of the Interior is clearly of the opinion that such funds will be available and ample for all such purposes, I see no reason for doubting the validity of the contract or for questioning its effect in securing payment to the United States of the amounts of money which will become payable under its terms.

"With reference to the validity of the obligation assumed by the Southern California Edison Co. (Ltd.), its execution of the original contract has been formally approved by its board of directors, and I am informed that the supplemental contract has been duly ratified by the board. There can be no question, therefore, as to the binding effect of this contract upon this corporation.

"By the supplemental agreement amending the original 'contract for lease of power privilege' all objections which might have been raised to the validity of this contract upon the ground that the city, the department of water and power, and the company were not bound to take or pay for any electrical energy except as they

might wish, have been removed. Mutuality of obligation is not lacking, and the city and its department are firmly bound to take and/or pay for certain percentages of firm energy as stated and defined in the supplemental contract and the company is similarly bound to take or pay for certain percentages of such energy which are also defined and stated in the supplemental contract.

"The 'contract for lease of power privilege' between the United States, the city of Los Angeles, its department of water and power, and the Southern California Edison Co. (Ltd.), is in my opinion a valid agreement binding upon the city and its department to the extent to which funds are available under the provisions of the charter to the department, and is in full compliance with section 4 (b) of the Boulder Canyon Project Act, since the revenues which it will provide out of such funds are, in the judgment of the Secretary of the Interior, adequate to meet the requirements of that section.

"Objection has been made to the Metropolitan Water District Power contract on the ground that the district has not yet voted bonds to provide funds to build the aqueduct on which this power would be used. It is unnecessary to consider which step must precede the other—provision for the aqueduct or provision for power and water—in view of the sufficiency of the city and company contracts to meet all requirements of the act. Even if the aqueduct financing were construed as being a prerequisite, the Secretary's reservation of energy for the district is within his authority under the second paragraph of section 5 (c) of the act.

"Giving consideration only to the city and company contract, I am of the opinion that all the requirements of section 4 (b) of the Boulder Dam project act which are made conditions precedent to the appropriation of money, the making of contracts, and the commencement of work for the construction of a dam and power plant in Boulder Canyon have been fully met and performed by the Secretary of the Interior in securing the contracts referred to in his letter.

Respectfully,

WILLIAM D. MITCHELL,
Attorney General.

The President,
The White House."

POWER

In determining the price to be charged for power at Boulder Dam three different methods or set-ups were followed:

(a) Government to build dam and construct power house, install machinery and operate power plant selling generated power at the switchboard.

(b) Government to build dam and construct power house, install machinery but lessee to operate power plant.

(c) Government to build dam and construct power house ready to receive machinery but lessee to install and operate machinery.

These three subdivisions might be roughly classified as follows:

(a) Electric power sold by the government at the switchboard at Boulder Dam power house.

(b) Units leased and operated by lessee.

(c) Power plant installed and operated by lessee, payment to be made for falling water.

Calculations were made to determine the price at which the power would have to be sold at Boulder Dam in order to repay the government investment. In setting up these costs it was assumed that the annual income should be enough to pay all—

(a) Operation, maintenance, and depreciation costs, and repay the government investment with interest within the 50-year period, excepting

(b) That the \$25,000,000 allocated to flood control with interest thereon, was to be repaid from "surplus." This "surplus" being the amount left in the revenue fund each year after the amounts required to meet the payments listed under "a" had been met. As Arizona and Nevada are each to receive $18\frac{3}{4}$ per cent of this "surplus" (last paragraph, Sec. 4 (b) of act) every year, a total of $37\frac{1}{2}$ per cent, only $62\frac{1}{2}$ per cent of this "surplus" would be available to meet interest and principal payments on the \$25,000,000. Thus in making the financial set-up an extra "overhead" of roughly one-half of the amount required to meet the amortization payments of \$25,000,000 had to be included.

To determine the price at which Boulder Dam power could be sold, the Department of the Interior made exhaustive investigations. As Dr. Mead states in his article (see under Contracts and Finance), the price had to be sufficiently high to protect the government and return the investment with interest, and low enough to justify purchase of the power and the enormous investment in transmission lines, switching equipment, etc., by the agency contracting for the power. In last analysis the problem reduced itself to the question of the cost of producing electrical energy by a steam plant on the Pacific Coast. The Reclamation Department made careful investigations, and to aid in arriving at the figures, records and reports from the Los Angeles Bureau of Power and Light, California Railroad Commission (responsible for the fixing of rates charged by public utilities in California), and the Southern California Edison Company were made available.

A number of tables were compiled based on various load factors, price of oil, number of transmission lines, etc. Results were embodied in a report of the Bureau of Reclamation dated September 10, 1929, with a supplement, October 4, 1929, by McClellan and Durand (unpublished). This report is some times called the McClellan report.

The final price to be charged of 1.63 mills per kilowatt hour was agreed upon and contracts were signed on this basis. As the total amount of power which will probably be available at Boulder Dam exceeds the amount originally estimated, the first estimated amount having been somewhat increased by increasing the height of the dam, the total revenue from the project will be in excess of that originally taken into consideration. This will provide an added element of safety in the financial set-up.

When the contracts were being formulated for the sale of the power, it was decided that these contracts would be drawn on the basis of the lessee installing, or paying for the installation of, the machinery and operating the power plant, the government operating only up to the control valves admitting the water to the turbines. The contracts as finally drafted provided that generating machinery would be actually "provided and installed" by the government but paid for by the lessees in 10 annual payments, these payments being in addition to the amount (1.63 mills for firm power) paid for falling water. In other words the lessees will pay a fixed amount for falling water for each kilowatt hour of power generated and in addition will pay the government a sufficient amount over a 10-year period to amortize the cost of the machinery, the title of the machinery and equipment to be at all times in the government.

In the following tabulations data is given which has to do with the assumptions adopted for arriving at the figures used as the basis for the contracts. These figures are taken from the McClellan report and references made to tables are the tables given in that report. (The complete tables are not given, some of the figures based on different assumptions than those finally adopted being omitted.) Some additional figures have been given from an analysis made through the courtesy of E. F. Scattergood, chief electrical engineer and general manager of the Bureau of Power and Light of Los Angeles, the compilation being made by the Bureau of Power and Light of Los Angeles. Great credit should be given Mr. Scattergood and his department for constructive work in connection with the power development of the project.

There were two determining elements in fixing the price at which the Boulder Canyon power was to be sold. The Secretary of the Interior was required under the terms of the Act to charge a sufficiently high price for power to guarantee repayment to the government of the investment. The cost of generating steam electric power at the Pacific coast practically fixed the maximum price that Pacific coast interests could pay for power.

Determinations to cover both of the above elements were made. See extracts from Interior Department Report (McClellan report) following.

Extracts from "McClellan" report:

"Under present conditions in southern California the value of Boulder Canyon power is determined by the cost of producing power in large modern steam generating stations using natural gas or fuel oil for fuel.

"It is believed that the price of fuel oil and natural gas in the vicinity of Los Angeles will have a tendency to increase in the future due to depletion of nearby fields, the conservation policy recently adopted and to improvement in processes for obtaining gasoline from crude oil.

"The Boulder Canyon Project Act provides for readjustment of rates for sale of power at the end of 15 years from the date of execution of contracts for power. Considering this readjustment provision it is considered fair to assume an average price of fuel oil for the initial period of 75 to 80 cents per barrel.

"The Boulder Canyon Project Act provides that the rates to be charged for power shall be justified by competitive conditions at distributing points or competitive centers. The total estimated cost of the Boulder Canyon development is \$121,000,000; of which \$25,000,000 is allocated to flood control. By deducting the \$25,000,000 allocated to flood control and adding \$50,000,000 for the cost of transmission lines and terminal substations it is found that the total estimated cost of the Boulder Canyon power development is in round figures \$146,000,000 for an installed capacity of 750,000 kilowatts, which is at the rate of \$195 per kilowatt.

"Under present economic conditions in southern California the value of Boulder Canyon power is determined not by the cost of competitive hydroelectric power but by the cost of producing power in large steam generating stations located at tide-water and operating on fuel oil or natural gas.

"The price of fuel oil (or natural gas) is the most important single factor affecting the cost of steam power in southern California. At present the large central stations which supply power to the southern California territory are using natural gas for fuel but they are equipped for burning fuel oil.

"Data derived from various sources representing conditions in southern California in June of the present year gave prices of fuel oil, or of gas equivalent to fuel oil, ranging from \$0.68 to about \$0.80 per barrel. Since that time it has been stated that the state conservation law which went into effect during the summer and requiring the beneficial use of natural gas as a condition to the working of wells for oil, has resulted in marked reductions in the price of gas for boiler fuel; in some cases down to the equivalent of oil at about \$0.50 per barrel.

"The Boulder Canyon Project Act provides for the readjustment of the rates for sale of power 15 years after the contracts are executed and every 10 years thereafter. With this provision for readjustment of rates the price of fuel oil is of concern only for the period beginning when Boulder Canyon power becomes available and ending with the first 15-year period, a matter of perhaps eight or nine years.

"Considering the present price of fuel oil and natural gas and that, as above noted, these prices are more likely to increase rather than decrease, it is considered fair to assume an average price of fuel oil for a period beginning six to seven years and ending 15 years from the present time, somewhere in the range between \$0.75 and \$0.80 per barrel.

"The price of fuel oil is a very important factor in determining the value of power at Boulder Canyon. A difference, for example, of 5 cents per barrel in the assumed price of oil will result in a difference of about \$325,000 per year in the value of power at Boulder Canyon, assuming a 60 per cent load factor.

"The amount of steam power which would be required as substitute for any particular installation at Boulder Canyon is determined by the losses in transmitting power from Boulder Canyon to the load centers and from the substitute steam plant to the same load centers. The installed capacity will depend on the amount of spare capacity in the substitute steam plant. The losses from generators to low voltage side of transformers at the terminal substation have been taken as follows:

	Boulder Canyon	Steam Plant
Step-up transformers-----	1.0%	1.0%
Line-----	7.5%	0.5%
Step-down transformers-----	1.0%	1.0%
Condensers for line regulation-----	2.5%	0.0%
Total-----	12.0%	2.5%

"Good operating practice would require some spare capacity in a steam power plant of the size necessary for a substitute for Boulder Canyon power. Such a plant would have probably six or seven units and sufficient capacity should be provided so that full plant output could be maintained with one unit out of service and without exceeding the safe overload or economical operating capacity of the machines remaining in service. For the purposes of this study it is assumed that each unit could operate economically when carrying an overload of 10 per cent continuously and the installed capacity of the substitute steam plant has been determined on this basis with one unit out of service.

"The largest and most efficient steam power plant in southern California at present is the Long Beach No. 3 plant of the Southern California Edison Company which is designed for an ultimate installation of four units of 100,000 kilowatts capacity each. The first unit of this plant was placed in service June 20, 1928, and a second unit is now being installed. The plant is equipped for using either natural gas or fuel oil and is arranged so that coal burning equipment can be installed if later found that such fuel is more economical than fuel oil or natural gas. Sea water is used for cooling purposes, the steam pressure is 400 pounds and the temperature of the steam is 700 degrees F. At 100 per cent load factor this plant produces a little better than 490 kilowatt hours net per barrel of fuel oil, corresponding to a fuel economy of 12,674 B.t.u. per kilowatt hour. Data obtained from the Railroad Commission of the State of California and from the Southern California Edison Company indicate that the cost of the Long Beach No. 3 plant, when the ultimate installation of 4 units is completed, will amount to \$77.50 per kilowatt of capacity. Data submitted by the Los Angeles Gas and Electric Corporation show that the Seal Beach steam plant, which has an installed capacity of 75,000 kilowatts cost \$78.20 per kilowatt of capacity. In these estimates the cost of a substitute steam plant has been taken at \$77.50 per kilowatt of installed capacity, the fuel consumption has been taken at 0.55 bbl. per kilowatt of installed capacity per year plus 1/500 bbl. per kilowatt hour generated, and the cost of operation and maintenance has been taken at \$2.25 per kilowatt of required capacity per year corresponding to the actual figures for the Long Beach No. 3 plant.

"The substitute steam power plant would be located at tidewater and it is assumed that power would have to be transmitted an average distance of 25 miles to reach the terminal substations. The normal capacity of each 220 kv. circuit from the substitute steam plant to the terminal substations has been taken at 200,000 kilowatts and one spare circuit has been included so as to afford the same factor of safety as is used in connection with Boulder Canyon transmission. The capital cost and the annual cost of operation of each circuit of the back transmission lines from the substitute steam plant have been estimated on the same assumptions as used for the Boulder Canyon transmission lines except that no condenser equipment has been included with the steam plant transmission, whereas with Boulder Canyon transmission there has been included sufficient condenser capacity for line regulation.

"Boulder Canyon power will be transmitted about 280 miles to reach the load centers in southern California and it is assumed that transmission will be at 220,000 volts. With several circuits operating in parallel the safe carrying capacity of each circuit will be about 110,000 to 120,000 kilowatts delivered, with ample margin for stability. The number of circuits required for any particular size of installation at Boulder Canyon is determined by dividing the total peak power delivered by 110,000 kilowatts. Switching equipment for cross-over and sectionalizing purposes at the mid point of the transmission lines is included.

"Terminal substations including sufficient condenser capacity for regulation of power factor would be required whether power is obtained from a steam plant or from Boulder Canyon and therefore the capital cost as well as the annual cost of these substations does not affect the value of Boulder Canyon power. Additional condenser equipment is required for line regulation, however, and the estimates of Boulder Canyon transmission include one kv-a. of condenser capacity for each kilowatt delivered.

"Right of way for Boulder Canyon transmission lines will be largely over public land which will cost nothing; but some very expensive right of way will be required for these lines in the vicinity of Los Angeles. It is assumed that 60 miles of lines will traverse semiimproved land, the right of way for which is estimated at \$250 per acre and 33 miles will pass through highly improved territory, the right of way for which is estimated at \$5,000 per acre.

"It is understood that the cost of operation and maintenance of the Big Creek 220 kv. lines of Southern California Edison Company amounts to \$150 per circuit mile per year. These lines pass through country which is very different from the desert country through which the Boulder Canyon lines will pass. The right of way of the Big Creek lines must be cleared of brush every year at considerable cost to prevent fires, whereas a large part of the Boulder Canyon lines will be free from brush. The Edison Company has in the past spent large amounts for the patrol of its Big Creek lines to find the cause of flashovers and after finding the cause, additional money has been spent on corrective measures, such as bird guards. The Boulder Canyon lines would be designed in the light of the experience gained from the Big Creek lines and the result would doubtless be improved reliability as well as a lower cost of operation and maintenance. The annual cost of operation and maintenance of the Boulder Canyon transmission lines has therefore been taken at \$125 per circuit mile per year.

"It is generally considered that some amount of steam stand-by should be provided in connection with long distance transmission, such as will be involved in the case of transmission of Boulder Canyon power of southern California, in order to provide reliable and satisfactory service. Several circuits will be required for the transmission of Boulder Canyon power and when one of these circuits is out of service for any reason it will be possible to transfer a part of the power normally carried by that circuit to other circuits. For the purposes of this study it is assumed that the circuits remaining in service can be operated at a capacity of 120,000 kilowatts delivered, at times when one circuit is out of service. The amount of steam stand-by is then determined by the normal capacity of one transmission circuit less the overload capacity of the circuits remaining in service.

"The cost of the steam stand-by plant has been taken at the same cost per kilowatt as used for the cost of the substitute steam plant. A steam plant build purely for stand-by service would sacrifice high efficiency for low capital cost and while the proposed stand-by plant is of relatively small capacity it is believed fair to assume that it could be built for the same unit cost as the larger plant. Actually the stand-by capacity would, no doubt, be provided as part of a large plant, in which case, the cost per kilowatt would be the same as for the substitute steam plant.

"The annual cost of the stand-by plant has been taken on the same unit basis as for the larger substitute steam plant except that operation and maintenance has been reduced 50 cents per kilowatt per year and fuel cost includes one barrel per kilowatt capacity for stand-by fuel only."

TABLE C-1

BOULDER CANYON POWER DEVELOPMENT ASSUMPTIONS USED IN STUDY

Transmission Losses from Boulder Canyon to Load Center, 280 Miles Distant

Step-up transformers.....	1.0%
Line.....	7.5%
Step-down transformers.....	1.0%
Condensers.....	2.5%
Total losses for line.....	12.0%

Transmission Losses from Equivalent Steam Plant to Load Center, 25 Miles Distant

Step-up transformers.....	1.0%
Line.....	0.5%
Step-down transformers.....	1.0%
Total losses for line.....	2.5%

Annual kw.-hrs. generated at Boulder Canyon.....			3,600,000,000
Annual kw.-hrs. delivered from Terminal substation, 12% loss.....			3,168,000,000
Annual kw.-hrs. generated at power plant, 2½% loss.....			3,249,000,000
Load factor in per cent.....	55	65	80
Kw. generated at Boulder Canyon, average.....	411,000	411,000	411,000
Kw. generated at Boulder Canyon, peak.....	747,000	632,000	514,000
Kw. delivered from Terminal substation, average.....	362,000	362,000	362,000
Kw. delivered from Terminal substation, peak.....	657,000	556,000	452,000
Kw. generated at steam plant, average.....	371,000	371,000	371,000
Kw. generated at steam plant, peak.....	674,000	571,000	464,000

Equivalent Steam Plant Capacity

Load factor	No. of units	Unit capacity	Total capacity
55%	7	102,100 kw.	714,700 kw. installed
---	6 (10% overload)	112,300 kw.	673,800 kw. required
65%	6	103,800 kw.	622,800 kw. installed
---	5 (10% overload)	114,200 kw.	571,000 kw. required
80%	5	105,500 kw.	527,500 kw. installed
---	4 (10% overload)	116,000 kw.	464,000 kw. required

Fuel:

Standby=0.55 bbls. per kw., installed capacity.
Generating=500 kw.-hrs. per bbl.

TABLE C-2

BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of Equivalent Steam Generated Energy. Public Development.

Data—Annual Kw.-Hrs. generated by Equivalent Steam Plant=3,249,000,000.

Cost of Fuel Oil per bbl.—dollars.....	.70	.75	.80
Load Factor—55% Capacity—674,000 Kw. required. Capacity—714,700 Kw. installed. Cost at \$77.50 per Kw.—\$55,389,000 Kw.-Hrs. per bbl.—471 Bbls. of Fuel Oil per annum=6,891,000 Annual Fixed Charges			
Interest—4.75%.....	2,631,000	2,631,000	2,631,000
Depreciation—2.25%.....	1,246,000	1,246,000	1,246,000
Amortization—1.107%.....	613,000	613,000	613,000
Annual Operating Charges			
O. & M.—\$2.25 per Kw. capacity required.....	1,516,000	1,516,000	1,516,000
Fuel Oil—6,891,000 bbls.....	4,824,000	5,168,000	5,513,000
Sub-total.....	10,830,000	11,174,000	11,519,000
General expense—2%.....	217,000	223,000	230,000
Total annual cost—dollars.....	11,047,000	11,397,000	11,749,000
Load Factor—65% Capacity—571,000 kw. required Capacity—622,800 kw. installed Cost at \$77.50 per kw.—\$48,267,000 Kw.-Hrs. per bbl.—475 Bbls. of Fuel Oil per annum=6,841,000 Annual Fixed Charges			
Interest—4.75%.....	2,293,000	2,293,000	2,293,000
Depreciation—2.25%.....	1,086,000	1,086,000	1,086,000
Amortization—1.107%.....	534,000	534,000	534,000
Annual Operating Charges			
O. & M.—\$2.25 per kw. capacity required.....	1,285,000	1,285,000	1,285,000
Fuel Oil—6,841,000 bbls.....	4,789,000	5,131,000	5,473,000
Sub-total.....	9,987,000	10,329,000	10,671,000
General expense—2%.....	200,000	207,000	213,000
Total annual cost—dollars.....	10,187,000	10,536,000	10,884,000

TABLE C-4
BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of 220-kv. Transmission Lines From Boulder Canyon to Load Center, 280 Miles Distant

Assumptions:

Contingencies 5%—Engineering & Inspection 6%—Superintendence & Accounts 1½%—General Expense 2½%=15%

		660,000	
Item	Unit Used	Six Circuits Quantity:	Cost—\$
Line—			
Towers.....	Tower	9,330	9,948,000
Conductors and fittings.....	Mi. Line	1,680	12,312,000
Insulators and fittings.....	Mi. Line	1,680	2,424,000
Telephone line.....	Mi. Line	280	284,000
Roads and bridges.....	Mi. Road	280	70,000
Patrol stations.....	Station	3	60,000
Sub-total.....			25,098,000
Contingencies, etc. (See Assumptions).....	Per cent	15	3,765,000
Sub-total.....			28,863,000
Interest during construction (6%—8 mo.).....	Per cent	4	1,155,000
Total cost of line.....			30,018,000
Sectionalizing station—			
Circuit.....	Circuit	6	924,000
Bldgs., oil system, camp, etc.....	Lot	1	103,000
Sub-total.....			1,027,000
Contingencies, etc. (See Assumptions).....	Per cent	15	154,000
Sub-total.....			1,181,000
Interest during construction (6%—8 mo.).....	Per cent	4	47,000
Total cost of sectionalizing station.....			1,228,000
Terminal substation—			
Station.....	Circuit	6	5,520,000
Terminal condenser equipment.....	Condenser	12	4,107,000
Sub-total.....			9,627,000
Contingencies, etc. (See Assumptions).....	Per cent	15	1,444,000
Sub-total.....			11,071,000
Interest during construction (6%—8 mo.).....	Per cent	4	443,000
Total cost of terminal substation.....			11,514,000
Right of way—Total cost.....	Circuit	6	5,500,000
Total cost of line.....			30,018,000
Total cost of sectionalizing station.....			1,228,000
Total cost of terminal substation.....			11,514,000
Total cost of right of way.....			5,500,000
Total cost of transmission system.....			48,260,000

TABLE C-5
BOULDER CANYON POWER DEVELOPMENT

Annual Operation Cost of a 220-kv. Transmission Line from Boulder Canyon to Load Center 280 Miles Distant.

Public development.

No. of circuits.....	6
Data:	
Cost of line.....	\$30,018,000
Cost of sectionalizing station.....	1,228,000
Cost of terminal substation.....	11,514,000
Cost of right of way.....	5,500,000
Total cost of transmission system.....	
\$48,260,000	
Public Development	
Fixed charges	
Interest—4.75%.....	\$2,282,000
Amortization—1.107%.....	534,000
Depreciation, excl. of rt. of way, 1.25%.....	534,000
Operation and Maintenance	
Line—\$125 per circuit mile.....	210,000
Sectionalizing station—\$5,000 per pair of circuits—2% of cost for maintenance.....	40,000
Terminal substation—2% of cost.....	230,000
Sub-total.....	
\$3,840,000	
General expenses—2%.....	77,000
Total annual cost.....	
\$3,917,000	

TABLE C-7

BOULDER CANYON POWER DEVELOPMENT

Estimated Costs of Transmission from Equivalent Steam Plant to Load Center.

Public Development.

Assumptions:

Length of line—25 miles
 Right of way—250 ft. approx. for 5 circuits—31 acres per mile
 Right of way—200 ft. approx. for 4 circuits—24.8 acres per mile

LOAD FACTOR—55%

Capacity delivered from Terminal Substation—657,000 kw.

Capital cost

Line—5 circuits (25÷280) x (cost 5 cets. Table C-4)..... \$2,241,000
 Right of way—\$5,000 per acre..... 3,875,000
 Terminal substation \$10 per kw. capacity..... 6,570,000

Total capital cost..... \$12,686,000

Annual cost

Interest—4.75%..... \$603,000
 Depreciation exclusive of right of way—1.25%..... 110,000
 Amortization—1.107%..... 140,000
 O. & M. of line—\$125 per circuit mile..... 16,000
 O. & M. terminal substation—2%..... 131,000

Sub-total..... \$1,000,000

General expense—2%..... 20,000

Total annual cost..... \$1,020,000

LOAD FACTOR—65%

Capacity delivered from Terminal Substation—556,000 kw.

Capital cost

Line—4 circuits (25÷280) x (cost 4 cets.—Table C-4)..... \$1,801,000
 Right of way—\$5,000 per acre..... 3,100,000
 Terminal substation—\$10 per kw. capacity..... 5,560,000

Total capital cost..... \$10,461,000

Annual cost

Interest—4.75%..... \$497,000
 Depreciation exclusive of right of way—1.25%..... 92,000
 Amortization—1.107%..... 116,000
 O. & M. of line—\$125 per circuit mile..... 12,000
 O. & M. of terminal substation—2%..... 111,000

Sub-total..... \$828,000

General expense—2%..... 17,000

Total annual cost..... \$845,000

TABLE C-8

BOULDER CANYON POWER DEVELOPMENT

Determination of Steam Standby Capacity Require

	Load Factor		
	.55	.65	.80
Kilowatts generated at Boulder Canyon—Average.....	411,000	411,000	411,000
Kilowatts generated at Boulder Canyon—Peak.....	747,000	632,000	514,000
Kilowatts delivered from Terminal Substation—12% loss—Average.....	362,000	362,000	362,000
Kilowatts delivered from Terminal Substation—12% loss—Peak.....	657,000	556,000	452,000
Number of transmission lines required.....	6	5	4
Kilowatts delivered per line—Peak.....	110,000	111,000	113,000
Total capacity with one line out on basis of 120,000 kw. delivered per line.....	600,000	480,000	360,000
Capacity in kw. of steam standby delivered from Terminal Substation.....	57,000	76,000	92,000
Capacity in kw. of steam standby generated at steam plant, 2½% loss.....	58,000	78,000	94,000

TABLE C-9

BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of Steam Standby Plant	Public Development.		
Cost of Fuel Oil per bbl.—dollars.....	.70	.75	.80
LOAD FACTOR—55%			
Installed capacity—58,000 kw.			
Cost at \$77.50 per kw.—\$4,495,000			
Annual Cost			
Interest—4.75%.....	\$214,000	\$214,000	\$214,000
Depreciation—2.25%.....	101,000	101,000	101,000
Amortization—1.107%.....	50,000	50,000	50,000
O. & M.—\$1.75 per kw. capacity.....	102,000	102,000	102,000
Fuel Oil—one bbl. per kw. capacity.....	41,000	44,000	46,000
Sub-total.....	\$508,000	\$511,000	\$513,000
General expense—2%.....	10,000	10,000	10,000
Total annual cost.....	\$518,000	\$521,000	\$523,000
LOAD FACTOR—65%			
Installed capacity—78,000 kw.			
Cost at \$77.50 per kw.—\$6,045,000			
Annual Cost			
Interest—4.75%.....	\$287,000	\$287,000	\$287,000
Depreciation—2.25%.....	136,000	136,000	136,000
Amortization—1.107%.....	67,000	67,000	67,000
O. & M.—\$1.75 per kw. capacity.....	136,000	136,000	136,000
Fuel oil—one bbl. per kw. capacity.....	55,000	58,000	62,000
Sub-total.....	\$681,000	\$684,000	\$688,000
General Expense—2%.....	14,000	14,000	14,000
Total annual cost.....	\$695,000	\$695,000	\$702,000

TABLE C-11

BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of Back Transmission from Steam Standby Plant to Boulder Canyon Terminal Substation.
Public Development

Assumptions—			
Length of line, 25 miles.			
One circuit used for all load factors.			
Width of right of way, 150 ft. approximately 18 acres per mile.			
Capital cost—			
Line, \$19,000 per mile.....			Public development \$475,000
Right of way, \$5,000 per acre.....			2,250,000
Total capital cost.....			\$2,725,000
Annual cost—			
Interest on investment, 4.75%.....			\$129,000
Depreciation, exclusive of right of way, 1.25%.....			6,000
Amortization, 1.107%.....			30,000
O. & M., \$125 per circuit mile.....			3,000
Sub-total.....			\$168,000
General expense, 2%.....			3,000
Total annual cost.....			\$171,000
Public Development.....	\$0.70	\$0.75	\$0.80
Load factor, 55%.....			
Total annual cost.....	\$689,000	\$692,000	\$694,000
Load factor, 65%.....			
Total annual cost.....	\$866,000	\$869,000	\$873,000
Load factor, 80%.....			
Total annual cost.....	\$1,008,000	\$1,012,000	\$1,018,000

TABLE C-12
BOULDER CANYON POWER DEVELOPMENT

Estimated Annual Value of Power at Boulder Canyon.		Public Development.		
Assumptions:				
	Kilowatt Hrs. generated annually at Boulder Canyon.....			3,600,000,000
	Kilowatt Hrs. delivered annually from Terminal substations.....			3,168,000,000
	Kilowatt Hrs. generated annually at Equivalent Steam Plant.....			3,249,000,000
Cost of Fuel Oil per bbl.—dollars				
LOAD FACTOR—55%				
Peak Kw. generated at Boulder Canyon Hydro-plant—747,000				
a	Annual Cost of Equivalent Steam Power.....	\$11,047,000	\$11,397,000	\$11,749,000
b	Annual Cost of transmission from equivalent Steam Plant to Load Center.....	1,020,000	1,020,000	1,020,000
c	Annual cost of equivalent steam power delivd. from Terminal Substation.....	\$12,067,000	\$12,417,000	\$12,769,000
d	Annual Cost of Transmission from Boulder Canyon to Load Center—6 cts.....	3,917,000	3,917,000	3,917,000
e	Annual Value of Power at Boulder Canyon without Steam Standby—Govt. Operation.....	\$8,150,000	\$8,500,000	\$8,852,000
f	Annual Cost O. & M. and Depreciation of Boulder Canyon Hydro-Plant.....	710,000	710,000	710,000
g	Annual Value of Power at Boulder Canyon without Steam Standby—Lessee Operation.....	\$7,440,000	\$7,790,000	\$8,142,000
h	Annual Cost of Steam Standby including transmission to Load Center.....	689,000	692,000	694,000
i	Annual Value of Power at Boulder Canyon with Steam Standby (e-h) Govt. Operation.....	\$7,461,000	\$7,808,000	\$8,158,000
j	Annual Value of Power at Boulder Canyon with Steam Standby (g-h) Lessee Operation.....	\$6,751,000	\$7,098,000	\$7,448,000
LOAD FACTOR—65%				
Peak Kw. generated at Boulder Canyon Hydro-Plant—632,000				
a	Annual Cost of Equivalent Steam Power.....	\$10,187,000	\$10,536,000	\$10,884,000
b	Annual Cost of Transmission from equivalent Steam Plant to Load Center.....	845,000	845,000	845,000
c	Annual Cost of Equivalent Steam Power delivd. from Terminal Substation.....	\$11,032,000	\$11,381,000	\$11,729,000
d	Annual Cost of Transmission from Boulder Canyon to Load Center—5 cts.....	3,275,000	3,275,000	3,275,000
e	Annual Value of Power at Boulder Canyon without Steam Standby—Govt. Operation.....	\$7,757,000	\$8,106,000	\$8,454,000
f	Annual Cost O. & M. and Depreciation of Boulder Canyon Hydro-Plant.....	589,000	589,000	589,000
g	Annual Value of Power at Boulder Canyon without Steam Standby—Lessee Operation.....	\$7,168,000	\$7,517,000	\$7,865,000
h	Annual Cost of Steam Standby including transmission to Load Center.....	866,000	869,000	873,000
i	Annual Value of Power at Boulder Canyon with Steam Standby (e-h) Govt. operation.....	\$6,891,000	\$7,237,000	\$7,581,000
j	Annual Value of power at Boulder Canyon with Steam Standby (g-h) Lessee Op'n.....	\$6,302,000	\$6,648,000	\$6,992,000

TABLE C-15
BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of Energy Assuming Entire Development Constructed by United States and Power Plant Operated by Lessee

Assumptions—	
Number of units installed in power plant.....	12
Installed capacity in kilowatts.....	750,000
Load factor in per cent.....	55
Output in millions of kw.-hrs. per year.....	3,600
Cost—	
Dam, intake works, tunnels and outlet works.....	\$86,720,907
Interest during construction on above items.....	10,969,259
Power plant, penstocks and switching station.....	22,975,133
Interest during construction on above items.....	584,759
Total cost including interest during construction.....	\$121,250,058
Flood control.....	25,000,000
Total cost including interest during construction, less flood control.....	\$96,250,058
Annual charges—	
Operation and maintenance of dam.....	\$133,993
Depreciation of dam.....	156,940
Annuity to cover interest and repayment of all except \$25,000,000 flood control.....	4,480,459
Sub-total (annual charges without surplus).....	\$4,771,392
Unit cost per kw.-hr.—mills.....	1.325
Unit cost per kw.-hr.—mills plus 10% for contingencies.....	1.458
Annuity to cover interest and repayment of \$25,000,000 flood control.....	\$1,163,755
Surplus to Nevada and Arizona (3/5 of above).....	698,253
Total annual charges.....	\$6,633,400
Unit cost per kw.-hr.—mills.....	1.843
Unit cost per kw.-hr.—mills plus 10% for contingencies.....	2.027

NOTE—Interest and repayment on flood control is taken out of 62½% of the annual surplus.

Supplement to Report of September 10, 1929

In this report, the value of power at Boulder Canyon and the minimum revenue required is based on the assumption that the dam and power house are constructed by the Government and the power plant, machinery and equipment are purchased, installed and operated by the lessee.

Value of Boulder Canyon Power

In Table C-16 is shown the estimated construction cost of Boulder Canyon hydro-plant to the Government and to the lessee, also the estimated annual cost to lessee for both public and private development.

In Table C-17 is shown the estimated value of power as determined by the value of substitute steam power, both with and without steam standby.

Table C-19 shows the estimated value of power at Boulder Canyon in mills per kilowatt hour for public development and is computed from annual costs in Table C-17.

TABLE C-16
BOULDER CANYON POWER DEVELOPMENT

Estimated Construction and Annual Cost of Boulder Canyon Hydro Plant, Assuming Power House Constructed by the Government, and Power Plant Machinery and Equipment Purchased, Installed and Operated by Lessee.
Public Development.

Number of units installed in power plant.....	12
Installed capacity in kilowatts.....	750,000
Estimated construction cost of power plant, penstocks, switching station, etc.....	\$22,975,133
Estimated cost of power plant building.....	2,679,162
Estimated cost power plant machinery and equipment to lessee.....	\$20,295,971
Interest during construction at 4% on power plant, penstocks and switching station.....	\$584,759
Interest during construction at 4% on power plant, building.....	79,640
Interest during construction at 4% on penstocks, power plant equipment and switching station.....	\$505,119
Interest during construction at 6% on penstocks, power plant equipment and switching station.....	757,678
Total estimated construction cost to lessee with interest during construction at 6%.....	\$21,053,649
Public Development—	
Interest, 4.75%.....	\$1,000,048
Amortization, 1.107%.....	233,064
Operation and maintenance.....	340,097
Depreciation.....	370,099
Estimated annual cost.....	\$1,943,308

TABLE C-17
BOULDER CANYON POWER DEVELOPMENT

Estimated Annual Value of Power at Boulder Canyon Assuming Dam and Power House Constructed by Government, and Machinery and Equipment Purchased, Installed and Operated by Lessee.
Public Development.

Assumptions:			
Kilowatt hours generated annually at Boulder Canyon.....	3,600,000,000		
Kilowatt hours delivered annually from Terminal Substation.....	3,168,000,000		
Kilowatt hours generated annually at Equivalent Steam Plant.....	3,249,000,000		
Cost of fuel oil per bbl.—dollars.....	.70	.75	.80
LOAD FACTOR—55%			
Peak kw. generated at Boulder Canyon hydro-plant—747,000			
a Annual cost of equivalent steam power.....	\$11,047,000	\$11,397,000	\$11,749,000
b Annual cost of transmission from equivalent steam plant to load center.....	1,020,000	1,020,000	1,020,000
c Annual cost of equivalent steam power deliv. from Terminal Substation.....	12,067,000	12,417,000	12,769,000
d Annual cost of transmission from Boulder Canyon to load center—6 cts.....	3,917,000	3,917,000	3,917,000
e Annual Value of power at Boulder Canyon without steam standby... ..	8,150,000	8,500,000	8,852,000
f Annual cost of Boulder Canyon hydro-plant (Table C-16).....	1,943,000	1,943,000	1,943,000
g Annual value of power at Boulder Canyon without steam standby—Lessee operation.....	6,207,000	6,557,000	6,909,000
h Annual cost of steam standby including transmission to load center..	689,000	692,000	694,000
i Annual value of power at Boulder Canyon with steam standby (g-h) Lessee operation.....	5,518,000	5,865,000	6,215,000

TABLE C-19
BOULDER CANYON POWER DEVELOPMENT

Estimated Value of Power at Boulder Canyon in Mills per Kilowatt Hour.
Public Development.

Assumptions:			
Kw.-hrs. generated annually at Boulder Canyon.....	3,600,000,000		
Cost of fuel oil per bbl.—dollars.....	.70	.75	.80
LOAD FACTOR—55%			
Value per kw. without steam standby—Lessee operation.....	1.724	1.821	1.919
Value per kw. with steam standby—Lessee operation.....	1.533	1.629	1.726
LOAD FACTOR—65%			
Value per kw. without steam standby—Lessee operation.....	1.689	1.786	1.883
Value per kw. with steam standby—Lessee operation.....	1.449	1.545	1.641
LOAD FACTOR—80%			
Value per kw. without steam standby—Lessee operation.....	1.660	1.756	1.852
Value per kw. with steam standby—Lessee operation.....	1.380	1.475	1.569

TABLE C-20

BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of Energy, Assuming Dam and Power House Constructed by the Government, and Power Plant Machinery and Equipment Purchased, Installed and Operated by Lessee

Assumptions—		
Number of units installed in power plant.....	11	12
Installed capacity in kw.....	687,500	750,000
Load factor in per cent.....	60	55
Output in millions of kw.-hrs., per year.....	3,600	3,600
Cost—		
Dam, intake works, tunnels and outlet works, etc.....	\$86,720,907	\$86,720,907
Interest during construction on above items.....	10,969,259	10,969,259
Power plant building and inclined railway.....	2,505,471	2,679,162
Interest during construction on above items.....	76,166	79,640
Total cost including interest during construction.....	\$100,271,803	\$100,448,968
Flood control.....	25,000,000	25,000,000
Total cost, including interest during construction, less flood control.....	\$75,271,803	\$75,448,968
Annual charges—		
Operation and maintenance of dam.....	\$133,993	\$133,993
Depreciation of dam.....	156,940	156,940
Annuity to cover interest and repaying of all except \$25,000,000 flood control.....	3,503,917	3,512,165
Sub-total (annual charges without surplus).....	\$3,794,850	\$3,803,098
Unit cost per kw.-hr.—mills.....	1.054	1.056
Unit cost per kw.-hr.—mills plus 10% for contingencies.....	1.160	1.162
Annuity to cover interest and repayment of \$25,000,000 flood control.....	\$1,163,755	\$1,163,755
Surplus to Nevada and Arizona (3/5 of above).....	698,253	698,253
Total annual charges.....	\$5,656,858	\$5,665,106
Unit cost per kw.-hr.—mills.....	1.571	1.574
Unit cost per kw.-hr.—mills, plus 10% for contingencies.....	1.728	1.731

NOTE—Interest and repayment on flood control is taken out of 62½% of annual surplus.

TABLE C-23

BOULDER CANYON POWER DEVELOPMENT

Estimated Cost of Energy, Assuming Entire Development Constructed and Operated by Government

Assumptions—		
Number of units installed in power plant.....	11	12
Installed capacity in kw.....	687,500	750,000
Load factor in per cent.....	60	55
Output in millions of kw.-hrs. per year.....	3,600	3,600
Cost—		
Dam, intake works, tunnels and outlet works.....	\$86,720,907	\$86,720,907
Interest during construction on above items.....	10,969,259	10,969,259
Power plant, penstocks and switching station.....	21,579,623	22,975,133
Interest during construction on above items.....	558,888	584,759
Total cost including interest during construction.....	\$119,828,677	\$121,250,058
Flood control.....	25,000,000	25,000,000
Total cost including interest during construction, less flood control.....	\$94,828,677	\$96,250,058
Annual charges—		
Operation and maintenance of dam.....	\$133,993	\$133,993
Depreciation of dam.....	156,940	156,940
O. & M. and depreciation of Boulder Canyon hydro plant.....	639,254	710,196
Annuity to cover interest and repayment of all except \$25,000,000 flood control.....	4,414,294	4,480,459
Sub-total (annual charges without surplus).....	\$5,344,481	\$5,481,588
Unit cost per kw.-hr.—mills.....	1.485	1.523
Unit cost per kw.-hr.—mills plus 10% of contingencies.....	1.633	1.675
Annuity to cover interest and repayment of \$25,000,000 flood control.....	\$1,163,755	\$1,163,755
Surplus to Nevada and Arizona (3/5 of above).....	698,253	698,253
Total annual charges.....	\$7,206,489	\$7,343,596
Unit cost per kw.-hr.—mills.....	2.002	2.040
Unit cost per kw.-hr.—mills, plus 10% for contingencies.....	2.202	2.244

NOTE—Interest and repayment on flood control is taken out of 62½% of annual surplus.

The following compilations were furnished by the Bureau of Power and Light of the city of Los Angeles. Under the present contracts with the Interior Department for power this bureau will generate and transmit not only the power used by Los Angeles but will also generate and transmit the power used by the other municipalities, and will in addition generate the energy used for pumping by the Metropolitan Water District of Southern California.

LOS ANGELES BUREAU OF POWER AND LIGHT, TABLE 1-X

Summary of Government Price of Boulder Canyon Power in Mills Per K.W.H., Corresponding to the Generally Quoted Figure of 1.63 Mills Per K.W.H., Based on the "McClellan Report" of September 10, 1929, with Supplements of October 4, 1929, Based on 550,000 Firm H.P. Generated at Boulder Dam Power Plant—January 18, 1930.

	Assuming a revenue of \$375,000 per year from domestic water	Assuming no revenue from domestic water	McClellan Report Table No. Ref.
A. For a 750,000 k.w. plant operating at 55% Load Factor.			
(a) If government installs machinery and government operates power plant.....	2.140	2.244	C-23
(b) If government installs machinery and lessee operates power plant.....	1.923	2.027	C-15
(c) If lessee installs machinery and lessee operates power plant.....	1.630 (1.627)	1.731	C-20
B. For a 687,500 k.w. plant operating at 60% Load Factor.			
(d) If government installs machinery and government operates plant.....	2.098	2.202	C-23
(e) If government installs machinery and lessee operates power plant.....	1.902	2.006	C-15
(f) If lessee installs machinery and lessee operates power plant.....	1.624	1.728	C-20

NOTE—Reduction in price of power due to an annual revenue of \$375,000 from domestic water equals \$375,000 divided by 3,600,000,000 k.w.h., or .104 mills per k.w.h. from the figures assuming no revenue from domestic water.

LOS ANGELES BUREAU OF POWER AND LIGHT, TABLE 2-X

January 18, 1930

Summary of Estimated Cost of Steam-electric Power at Los Angeles, Reduced to Boulder Canyon Power at Boulder Canyon, in Mills per K.W.H.

1. Generating and transmitting entire 550,000 firm h.p. to Los Angeles over 6 transmission circuits.
 2. Generating 550,000 firm h.p., but transmitting only 200,000 firm h.p. to Los Angeles over two transmission circuits.
- (See Tables 4-X and 5-X.) All to correspond to McClellan Report estimates for government requirements for 550,000 firm h.p. generated at Boulder Canyon at 60% load factor in McClellan Report.

	Same basis as statement of Bureau of Power and Light to Reclamation Service		Based on information given in letter of September 19, 1930 from California R.R. Commission	
	Mills per k.w.h.	Mills per k.w.h.	Mills per k.w.h.	Mills per k.w.h.
Price of oil per bbl.....	\$0.80	\$0.70	\$0.80	\$0.70
A. Assuming 550,000 firm h.p. transmitted to Los Angeles at approximately 60% load factor over six transmission circuits with 594,000 k.w. peak load and 19% steam standby.				
1. If government installs machinery and government operates power plant.....	2.13	1.95	1.93	1.75
2. If government installs machinery and lessee operates power plant.....	1.98	1.80	1.78	1.60
3. If lessee installs machinery and lessee operates power plant.....	1.69	1.50	1.47	1.29
B. Assuming 200,000 firm h.p. transmitted to Los Angeles at 60% load factor over two circuits with 220,000 k.w. peak load and 44% steam standby.				
4. If government installs machinery and government operates power plant.....	1.84	1.67	1.64	1.47
5. If government installs machinery and lessee operates power plant.....	1.68	1.51	1.4	1.31
6. If lessee installs machinery and lessee operates power plant.....	1.37	1.20		1.00

January 18, 1930

Cost of Providing for 664,000 K.W. Demand from Steam Plant Operating at 55% Load Factor as a Substitute for Boulder Canyon Power, Corresponding to 550,000 Firm Horsepower Generated at Boulder Canyon and Transmitted to Los Angeles at 61% Load Factor With Auxiliary Steam Power for Peak Load and Standby

(a) As estimated in statement of Bureau of Power and Light to the Reclamation Service. (See appendix, McClellan Report.) (This portion of report not given here.—J.L.B.)
 (b) As estimated from information given in letter of September 19, 1929, from California Railroad Commission.

As estimated in statement of Bureau of Power and Light to Reclamation Service. (See appendix of McClellan Report)

As estimated according to information given in letter from California R. Commission of September 19, 1929

	(1)	(2)	
1. Cost of oil per bbl.....	\$0.80	\$0.70	\$0.80
2. Capacity of station in kw.....	664,000	664,000	664,000
3. Millions kw-hrs. per year produced.....	3,252	3,252	3,252
4. Investment Cost—			
(a) Steam plant at \$7.50.....	\$58,131,000	\$58,131,000 at \$7.50 (plus land)	\$58,560,000
(b) Trans. line at \$6.70.....	4,500,000	4,500,000 at \$6.70	4,900,000
(c) Rec. Station at \$15.80.....	10,409,000	10,409,000 at \$15.80	10,409,000
Annual Cost—	\$73,040,000	\$73,040,000	\$69,159,000
5. Steam Electric Power—Net Station sendout.			
Interest.....	4.750%	(Int.....	4.750%
Amortization.....	.884%	Amort.....	.884%
Depreciation.....	2.400%	Dep.....	2.400%
			8.034%
Operation.....	2.000%		
Standby.....	1.250%		
(a) Fixed Charges { Total on item 4a.....	11.284%		
(b) Fuel and Maintenance at 1.79 mills per kw-hr.....			
Fuel and Maintenance at 1.59 mills per kw-hr.....		5,170,600	
6. Transmission from Steam Plant, to Receiving Station.			
Interest.....	4.750%		
Amortization.....	.884%		
Depreciation.....	1.250%		
Operation.....	1.000%		
Total on item 4b.....	7.884%		
7. Receiving Station Costs.			
Interest.....	4.750%		
Amortization.....	.884%		
Depreciation.....	1.900%		
Operation.....	1.000%		
Total on item 4c.....	7.650%		
8. Total Annual cost steam elec. pr. at Los Angeles—Receiving Station output.....	\$13,625,000	\$12,972,600	\$12,911,400
9. Cost, mills per kw-hr. (3,252,000,000 kw-hr.).....	4.19	3.99	3.97
Total Annual Cost.....	\$112,380,000	\$111,729,600	\$111,668,400
Annual Cost.....	355,000	355,000	355,000
Total on item 4d.....	888,000	888,000	888,000
Total Annual cost steam elec. pr. at Los Angeles—Receiving Station output.....	\$12,911,400	\$12,911,400	\$12,911,400
Cost, mills per kw-hr. (3,252,000,000 kw-hr.).....	3.97	3.97	3.97

LOS ANGELES BUREAU OF POWER AND LIGHT, TABLE 4-X
January 18, 1930

Estimated Cost of Steam Electric Power at Los Angeles Reduced to Boulder Canyon Power at Boulder Canyon
Based on entire 565,000 firm horsepower generated at Boulder Canyon and transmitted to Los Angeles over six transmission circuits at 61% load factor.

(a) As estimated in statement of Bureau of Power and Light to the Reclamation Service (see appendix, McClellan Report).
(b) As estimated from information given in letter of September 19, 1929, from California Railroad Commission.
All to correspond to McClellan Report estimates for government requirements for 550,000 firm horsepower generated at Boulder Canyon at 60% load factor.

	As estimated in statement of Bureau of Power and Light to Reclamation Service (See Table 3-X)	As estimated according to information given in letter of September 19, 1929, from California Railroad Commission (See Table 3-X)
Price of oil per bbl.....	\$0.80	\$0.70
1. Total annual cost steam electric power at Los Angeles—receiving station output.....	\$13,623,000	\$12,972,600
2. Cost, mills per k.w.h. (3,252,000,000 k.w.h.).....	4.19	3.99
3. Annual cost of auxiliary steam power.....	\$2,013,350	5,940,350
Annual transmission cost.....	3,943,000	5,956,350
4. Annual cost steam power reduced to Boulder Canyon switchboard if government installs machinery and operates power plant.....	\$7,666,650	\$7,032,250
5. Cost, mills per k.w.h. (3,600,000,000 k.w.h.).....	2.13	1.95
6. Annual cost of operation and maintenance.....	312,210	543,850
Annual depreciation reserve at 1.17%.....	231,640	543,850
7. Annual cost steam power reduced to Boulder Canyon if government installs machinery and lessee operates power plant.....	\$7,122,800	\$6,488,400
8. Cost, mills per k.w.h. (3,600,000,000).....	1.98	1.80
9. Annual interest and amortization of machinery, \$19,798,285 at 5.634%.....	1,115,400	1,115,400
10. Annual cost steam power reduced to Boulder Canyon if lessee installs machinery and lessee operates power plant.....	\$6,007,400	\$5,373,000
11. Cost, mills per k.w.h.....	1.69	1.50
	\$0.80	\$0.80
	\$12,911,400	\$12,911,400
	3.97	3.76
	5,956,350	5,956,350
	\$6,955,050	\$6,284,050
	1.93	1.75
	543,850	543,850
	\$6,411,200	\$5,740,250
	1.78	1.60
	1,115,400	1,115,400
	\$5,296,800	\$4,624,850
	1.47	1.29

LOS ANGELES BUREAU OF POWER AND LIGHT, TABLE 5-X
January 18, 1930

Estimated Cost of Steam Electric Power at Los Angeles Reduced to Boulder Canyon Power at Boulder Canyon
Based on 555,000 firm horsepower generated at Boulder Canyon but only 200,000 firm horsepower transmitted to Los Angeles over two circuits at 60% load factor.

(a) On same basis as estimated in statement of Bureau of Power and Light to Reclamation Service.
(b) Based on information given in letter of September 19, 1929, from California Railroad Commission.
All to correspond to McClellan Report estimates for government requirements for 550,000 firm horsepower generated at Boulder Canyon at 60% load factor.

	Same basis as statement of Bureau of Power and Light to Reclamation Service	Based on information given in letter of September 19, 1929, from California Railroad Commission
Price of oil per bbl.	\$0.80	\$0.70
1. Millions of k.w.h. per year at Boulder Canyon	1,300	1,300
2. Millions of k.w.h. per year at Los Angeles (12% transmission loss)	1,150	1,150
3. Cost of steam power at Los Angeles—receiving station output, mills per k.w.h. (see Table 4-X)	4.19	3.99
4. Annual cost of 1,150,000,000 k.w.h.—receiving station output	\$4,816,500	\$4,588,500
5. Transmission Cost— \$50,000,000 divided by 3.....		\$16,700,000
\$16,700,000 multiplied by 7.884%—		1,316,600
6. Auxiliary Steam Cost— Standby capacity for six circuits.....		112,000 k.w.
Proportionate standby capacity for two circuits.....		37,000 k.w.
Added capacity because two circuits.....		60,000 k.w.
Total steam standby capacity.....		97,000 k.w.
Investment at \$103.20—\$10,010,000		
Fixed charges at 9.684%.....		\$968,600
Fuel cost at \$0.80 bbl. (40,000,000 k.w.h., plus standby fuel)		150,000
Total steam standby cost.....	\$2,435,200	\$2,417,200
7. Annual cost steam power reduced to Boulder Canyon switchboard—if government installs machinery and operates power plant.....	\$2,381,300	\$2,171,300
8. Cost, mills per k.w.h. (1,300,000,000 k.w.h.).....	1.84	1.67
9. Proportional annual cost O. & M. and depreciation of Boulder Canyon power plant (200,000 x \$870,150 ÷ 550,000)	\$199,600	\$199,600
10. Annual cost steam power reduced to Boulder Canyon if government installs machinery and lessee operates power plant.....	2,181,700	1,971,700
11. Cost, mills per k.w.h. (1,300,000,000 k.w.h.).....	1.68	1.51
12. Proportional annual interest and amortization on machinery (200,000 x \$1,115,400 ÷ 550,000)	405,600	405,600
13. Annual cost steam power reduced to Boulder Canyon if lessee installs machinery and lessee operates power plant.....	\$1,776,100	\$1,566,100
14. Cost, mills per k.w.h. (1,300,000,000 k.w.h.).....	1.37	1.20
	\$2,435,200	\$2,435,200
	\$2,381,300	\$2,171,300
	1.84	1.67
	\$199,600	\$199,600
	2,181,700	1,971,700
	1.68	1.51
	405,600	405,600
	\$1,776,100	\$1,566,100
	1.37	1.20
	\$2,435,200	\$2,435,200
	\$1,906,800	\$1,906,800
	1.47	1.47
	\$199,600	\$199,600
	1,707,200	1,707,200
	1.48	1.31
	405,600	405,600
	\$1,525,100	\$1,525,100
	1.17	1.17

COST OF BOULDER DAM POWER AT TERMINAL SUBSTATION NEAR LOS ANGELES

Following compilation is based on preceding tables of the McClellan report. The number of the McClellan report table from which figures are taken is given in parenthesis in each case. Assumptions:

- Power generated at dam—3,600,000,000 kw.-hrs.
- Power at terminal substation (12% loss)—3,168,000,000 kw.-hrs.
- 6 Circuit transmission line.
- Cost of falling water at dam (as per contracts)—1.63 mills per kw-hr.
- Load Factor—55%.
- Cost of fuel oil—\$0.70 per bbl.
- All power transmitted by one agency.

ANNUAL COST, BOULDER POWER AT PACIFIC COAST TERMINAL SUBSTATIONS

Cost falling water—under contract—3,600,000,000 kw.-hrs. at 1.63 mills-----	\$5,868,000
Generating plant costs (12 unit plant) based on cost of plant including interest during construction (C-15) (C-16) \$21,053,649 (estimated interest, amortization, O. & M., depreciation)-----	1,943,308
Transmission Costs—	
Based on total cost of line, equipment and terminal sta- tion (C-5) (C-4) \$48,260,000-----	3,917,000
Steam Stand-by—	
Based on installed capacity 58,000 kw. \$0.70 oil, 55% load factor (C-9) \$4,495,000-----	518,000
Transmission Line from Steam Stand-by—	
To terminal substation (C-11) total cost \$2,725,000-----	171,000
Total annual cost at terminal substation-----	\$12,417,308
Amount of Power at Terminal Substation—12% loss from Boulder (C-1) 3,168,000,000 kw.-hrs.—	
Cost per kilowatt-hour-----	3.92 mills

(NOTE.—Above figures are based on assumption that entire output was handled by one agency, under contracts as drawn the power is split up among several lessees, which will not tend to quite as economical handling, with a consequent increase in the cost of the power delivered at the terminal substation end of the line. See L. A. Bureau of Power and Light tables.)

COST OF STEAM GENERATED ELECTRIC POWER GENERATED AT PLANT AT TIDEWATER AND TRANSMITTED TO SAME TERMINAL SUBSTATION USED IN CONNECTION WITH BOULDER HYDROELECTRIC

Annual Costs—

Steam plant, generating 3,249,000,000 kw.-hrs. based on total cost (C-2) \$55,389,000, oil \$0.70 bbl., 471 kw.-hrs. per bbl., load factor 55%. Annual cost (C-2)-----	\$11,047,000
Transmission cost, plant to terminal station based on five circuits, 25 miles length of line 55% load factor including right of way and terminal substation (C-7) total cost \$12,686,000. Annual cost-----	1,020,000
	\$12,067,000

Amount of power at terminal substation (2½% loss) 3,168,000,000 kw.-hrs. Cost at terminal substation per kw.-hr. -----	3.81 mills
With \$0.80 oil above annual figures would be increased by \$702,000 to a total of \$12,769,000, making cost per kw.-hr. (C-2)-----	4.03 mills

NOTE.—On the basis of the McClellan report a variation of 10 cents per barrel in the price of oil makes approximately .2 mills difference in the price of power at the substation (C-2).

POWER FOR CALIFORNIA MUNICIPALITIES

One of the questions brought up in connection with the allocation of the Boulder Dam power in California was that of the participation of the smaller cities in the power program, as the only apparent market for such a large amount of power was in southern California. Having in mind the fact that the cost of the transmission lines was a very considerable element and that in order to have these transmission lines economically operated, a very large block of power would have to be transmitted over each line, the smaller cities in and around Los Angeles held a series of conferences in an effort to reach an agreement by which they might receive power. The outcome of these conferences was two agreements, one of March 20, 1930, and the other April 7, 1930, copies of which are given below. (Ref.: Hearings House Committee on Appropriations, second Deficiency Appropriation Bill for 1930, pages 1114, 1115, 1116.)

“(An agreement by the Metropolitan Water District of southern California, the Board of Water and Power Commissioners of the city of Los Angeles, and the Southern California Edison Company, on March 20, 1930.)

“Resolved, That we recommend to the Secretary of the Interior that 64 per cent of total firm power from the Boulder Canyon project available to California interests under his allocation, be divided, upon terms hereinafter set forth as follows:

Of the total firm power—	Per cent
To the Metropolitan Water District-----	36
To the city of Los Angeles and other municipalities which have filed application -----	19
To the Southern California Edison Company-----	9
	64
Total (exclusive of unused firm power)-----	64

"Further resolved, That we recommend to the Secretary that the Metropolitan Water District be given the first call upon all unused firm power and all unused secondary power up to their total requirements for pumping into and in the aqueduct, and that any unused power of the municipalities be allocated to the city of Los Angeles, and that any remaining unused firm power or unused secondary power be divided one-half to the city of Los Angeles and one-half to the Southern California Edison Co.;

"Further resolved, That all parties hereto agree to cooperate to the fullest extent to make the Boulder Canyon project a success in all its phases; and

"Further resolved, That this agreement is based upon the resolution already passed by the Metropolitan Water District of Southern California and accepted by the Board of Water and Power Commissioners of the City of Los Angeles, whereby that district requests the city of Los Angeles at cost to generate its power requirements and to operate its transmission lines, which lines are to be paid for and owned by the Metropolitan Water District.

"The above resolution was approved March 20, 1930, by representatives of the Metropolitan Water District of Southern California, the Board of Water and Power Commissioners of the city of Los Angeles, and the Southern California Edison Co.

"(An agreement of April 7, 1930, between the municipalities of Anaheim, Beverly Hills, Burbank, Colton, Fullerton, Glendale, Newport, Pasadena, Riverside, San Bernardino, and Santa Ana.)

"At a meeting of representatives of the municipalities of Anaheim, Beverly Hills, Burbank, Colton, Fullerton, Glendale, Newport, Pasadena, Riverside, San Bernardino, and Santa Ana, with Northcutt Ely, executive assistant to the Secretary of the Interior, on April 7, 1930, at 10 a.m. in the offices of the Metropolitan Water District, the following action was taken:

"1. Pursuant to resolution unanimously adopted March 31, 1930, which allocated Boulder Dam primary energy available to the above municipalities (6 per cent of the total generated) among them in proportion to their 1929 consumption, and which directed a committee consisting of representatives of Pasadena, Beverly Hills, and San Bernardino to determine the respective figures for the 11 municipalities' 1929 consumption, this committee, under the chairmanship of Mr. B. F. DeLanty, of Pasadena, reported as follows:

BOULDER DAM POWER—SMALLER CITIES

City	1929 consumption kilowatt hours (substation data)	Percentage of total	Switchboard power available, millions of k.w.h.	Recommended horsepower at switchboard		Estimated proportional cost of two transmission lines at \$20,000,000
				Firm	Peak at 45 per cent L.F.	
Burbank	13,143,901	6.12	15.55	2,386	5,304	\$367,200
San Bernardino	25,275,440	11.76	29.87	4,586	10,192	705,600
Pasadena	57,616,480	26.82	68.12	10,450	23,245	1,609,200
Glendale	34,567,200	16.09	40.87	6,276	13,945	965,400
Riverside	21,300,341	9.91	25.18	3,865	8,588	594,600
Santa Ana	14,280,355	6.65	16.89	2,594	5,763	399,000
Newport	1,570,127	.73	1.85	285	633	43,800
Beverly Hills	21,519,303	10.01	25.42	3,904	8,675	600,600
Colton	11,801,850	5.50	13.97	2,145	4,767	330,000
Anaheim	6,684,268	3.11	7.90	1,213	2,695	186,600
Fullerton	7,083,744	3.30	8.38	1,287	2,860	198,000
Totals	214,843,009	100.00	254.00	39,000	86,667	\$6,000,000

"The committee explained that the last column, referring to pro rata of cost of the city of Los Angeles transmission line, was a rough estimate.

"It was moved, seconded, and unanimously carried that the proposed allocation as presented by this committee be approved.

"2. The following resolution was unanimously adopted:

"Resolved, that the allocation reported (full text attached hereto) be adopted; that is, of the power allocated to the 11 municipalities, each receives as follows:

City	Percentages of totals
Burbank -----	6.12
San Bernardino-----	11.76
Pasadena -----	26.82
Glendale -----	16.09
Riverside -----	9.91
Santa Ana-----	6.65
Newport -----	.73
Beverly Hills-----	10.01
Colton -----	5.50
Anaheim -----	3.11
Fullerton -----	3.30
Total-----	100.00

"Further resolved, That generation of Boulder Canyon power for the municipalities be performed by the city of Los Angeles, and that the municipalities designate the city of Los Angeles as the agent for transmitting any Boulder Canyon power for which they contract over the main transmission lines constructed by the City for carrying Boulder Canyon power, subject to the understanding that, if on further investigation before April 15, 1932, it shall prove to be materially more economical for any municipality to make a different arrangement, it may do so; and,

"Further resolved, That in case of any disagreement over the question of cost of transmission of Boulder Canyon power, such disagreement will be adjusted by the Secretary of the Interior; and,

"Further resolved, That any municipality desiring to reserve the right to contract with the United States for power, in accordance with the allocation approved April 7, shall take formal action indicating such desire on or before May 15, 1930, and shall transmit advice of such action to the secretary, and to a committee consisting of the general manager of the light department of the city of Pasadena, who shall transmit such advice to the other municipalities, thereafter, on or before April 15, 1931, such municipality shall enter into a final contract with the government. Any power allocated to a municipality, but not reserved or contracted for under the two foregoing time limitations, shall be included in the allocations to those municipalities who do make such reservation and contract, in the ratio that their present allocations bear to each other; and,

"Further resolved, That these municipalities pledge their cooperation to make the Boulder Canyon Project a success in all its phases.

"In attendance were the following representatives:

- H. H. Coffman, supervisor, Burbank.
- J. H. McCambridge, superintendent public service, Burbank.
- A. H. Lowe, city engineer, San Bernardino.
- M. W. Edwards, director electrical engineering, Pasadena.
- Paul E. Schwab, mayor, Beverly Hills.
- Arthur Taylor, construction engineer, Beverly Hills.
- J. W. Price, city manager, Anaheim.
- Grover L. Walters, superintendent water and lighting, Fullerton.
- L. E. Miller, mayor, Santa Ana.
- C. A. Hutchinson, city engineer, Colton.
- J. W. Charleville, city manager, Glendale.
- C. E. Kinlin, mayor, Glendale.
- P. Diederich, superintendent light and water, Glendale.
- R. L. Boulden, superintendent electrical department, Riverside.
- Joseph S. Long, mayor, Riverside.
- B. F. DeLanty, general manager, light and power department, Pasadena.
- John L. Bacon, chairman, Colorado River Commission, San Diego.
- E. F. Scattergood, chief electrical engineer, Los Angeles.
- W. C. Mullendore, vice president, Southern California Edison Co.
- W. B. Mathews, attorney, Los Angeles.
- S. H. Finley, director, Metropolitan Water District, Santa Ana."

CONSTRUCTION AND GENERAL DATA**BOULDER CANYON PROJECT DAM**

(HOOVER DAM)

**Historical Physical and Construction Data,
Brief Chronology**

1928. Dec. 21. Bill authorizing construction approved. (Boulder Canyon Project Act.)
1930. April 24. Contract for delivery of water to Metropolitan Water District of Southern California.
1930. April 26. Contract signed with Metropolitan Water District of Southern California for electrical energy. Amended May 31, 1930.
1930. April 26. Contract for lease of power privilege signed with City of Los Angeles and Southern California Edison Company Amended May 28, 1930.
1930. June 9. Attorney General of United States renders opinion on validity of contracts.
1930. July 3. Second Deficiency Appropriation Bill for 1930 passed and approved, containing item of \$10,660,000 to start work on the Boulder Canyon Project.
1930. July 5, 8.10 a.m. Telegram from Chief Engineer R. F. Walter received at Las Vegas ordering starting of work. Work started before noon on aerial photographic surveys. (New Reclamation Era, October, 1930, p. 177.)
1930. July 7. Secretary Wilbur (Order No. 436) issued order to Commissioner Mead, "You are directed to commence construction on Boulder Dam today."
1930. Aug. 1. Contract executed with Los Angeles and Salt Lake Railroad for construction of 29.84 miles of railroad connecting main line of L. A. & S. L. R. R. with dam site. (New Reclamation Era, October, 1930, p. 176.)
1930. Sept. 17. Secretary Wilbur issues department order officially naming dam "Hoover Dam."
1930. Sept. 17. Secretary Wilbur drives spike starting branch of railroad to Boulder Canyon Project Dam, officially starting construction work on Hoover Dam.
1930. Oct. 15. Contract for power for construction awarded to Southern Sierras Power Company. (Estimated cost in excess of \$1,730,000.)

BRIEF FACTS, BOULDER CANYON PROJECT

Following are brief facts concerning the project, taken from a series of questions and answers issued in mimeograph form by the Bureau of Reclamation, October 1, 1930.

Location, Hoover (formerly Boulder) Dam, in upper Black Canyon on the Colorado River about 30 miles southeast of Las Vegas, Nev., one end of dam in Arizona, one in Nevada.

Hoover Dam, name designated by official order of Secretary Wilbur, September 17, 1930.

Project includes construction of a dam and power plant in Black Canyon and of the All-American Canal.

Purposes of the project, flood control and general river regulation, irrigation, silt control, power development, and domestic water supply.

Project cost, 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.

Height of dam, preliminary plans call for a maximum height of about 727 feet above foundation rock which would raise the water surface of the river 582 feet.

Type of dam being considered, the arch-gravity type, in which the water load is carried by both gravity action and horizontal arch action.

Length of dam along the crest, about 950 feet.

Widths of dam up and down stream, about 45 feet at the top and 650 feet at the base.

Volume of concrete masonry, about 3,600,000 cubic yards in the dam, or 4,500,000 cubic yards in the dam, power plant, and appurtenant works, according to preliminary estimates. For comparison, the Bureau of Reclamation has placed in dams and structures a total of 4,392,000 cubic yards of concrete up to June 30, 1930.

Cement required, about 5,500,000 barrels. The Bureau of Reclamation has used 4,926,000 barrels in 26 years of construction activities.

Reinforcement steel to be used, about 19,000,000 pounds.

Geologic conditions at the dam site, foundation and abutments are rock of volcanic origin, geologically termed "andesite breccia," hard and very durable.

Time to build, about seven years after work on the project is started.

Men to be employed, anticipated not more than 1000 men will be employed on the job at any one time.

Reservoir capacity about 30,500,000 acre-feet when full. Water in the reservoir would cover the state of Connecticut to a depth of 10 feet.

Area of reservoir 145,000 acres or 227 square miles. For comparison, Lake Tahoe in California-Nevada, has an area of 193 square miles.

Length and width of reservoir, 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 eight miles.

Length of shore line about 550 miles.

Elevation of high water line, 1229 feet above sea level, according to present plans. It is proposed to retain for reservoir purposes all lands below elevation 1250.

Utilization of reservoir capacity, 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.

Silt, estimates of amount that will be deposited 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.

Salt deposits, effect on water, 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.

Annual evaporation on the reservoir estimated at 600,000 acre-feet.

Private lands in the reservoir site, a number of mining claims, but most of the area is government land. All the land is withdrawn from entry for construction purposes.

River diverted during dam construction, 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.

Length of the four tunnels, total length of about 16,300 feet or 3.1 miles.

Tunnels may be utilized after their use for river diversion, two as penstock tunnels to connect the reservoir to the power plant, and two for spillway outlets.

Outlet works proposed, two of the diversion tunnels and two power penstock tunnels will act as main supply tunnels for forty 72-inch needle-valve outlets located in the canyon walls. All valves will receive water through 28-foot diameter power intake towers.

Openings through the dam, the only openings proposed are eight metal lined conduits, 6 feet 9 inches in diameter, for carrying the low flow of the river when the diversion tunnel plugs are being poured. Each of these sluiceways will be controlled by a pair of 6 x 6-foot slide gates.

Plans for spillways, two glory-hole type spillways discharging through 50-foot diameter vertical shafts into the outside diversion tunnels.

Spillways will discharge 200,000 cubic feet per second without overtopping the dam.

Installed capacity of the power plant at Hoover dam, 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).

Continuous firm power output, about 663,000 horsepower, based on 83 per cent plant efficiency, and 10 per cent maximum shortage.

Electrical energy available yearly, four billion three hundred and thirty million (4,330,000,000) 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.

Income from sale of power will be used 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: 62½ per cent to flood control (\$25,000,000) repayment and 18¾ per cent to Arizona and 18¾ per cent to Nevada.

Power plant located 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.

Water to turbines to be carried through four pressure tunnels, two on each side of the river, each provided with shut-off gates and trash racks.

Machinery installation, tentative plans for a 1,000,000 horsepower installation call for twelve 85,000 horsepower hydraulic turbines, twelve 11 x 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.

Turbines will operate with maximum head, 582 feet; minimum head, 422 feet; average head, 520 feet.

Power development, estimated cost, \$38,200,000 not including interest.

Primary or firm power, charge to be made of one and sixty-three one-hundredths mills per kilowatt-hour, delivered at transmission voltage. (1.63 mills.)

Secondary or dump power, available yearly, one billion five hundred and fifty million (1,550,000,000) kilowatt-hours on completion of the dam (1938) and this amount decreasing each year by 8,600,000 kilowatt-hours.

Secondary or dump power, charges to be made of one-half mill per kilowatt-hour, delivered at transmission voltage.

Adjustment of rates, at the end of 15 years from date of execution of lease and every 10 years thereafter the rates may be readjusted.

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

Power plant will be operated and maintained by 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.

Power allocation, 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 Company, 9 per cent.

Machinery in plant paid for, the government will 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.

Transmission of power cost, paid for by contractors who purchase the power.

Town for Boulder Canyon Project to be located about six miles due west of the dam site, at the summit and near the terminus of the Union Pacific section of the branch railroad.

Name of town, not yet determined, although several names have been proposed. It is usually referred to as Boulder City.

Town water supply, two plans are under consideration: (1) To pump from the Colorado River a distance of six miles, with a lift of about 1,850 feet, with settling basins and filtration system similar to those in use at Yuma, Arizona; (2) To obtain a supply from the underground flow in the Las Vegas Valley about 25 miles distant.

Town improvements necessary, a sewerage system must be installed. Sidewalks and curbs must be provided and streets surfaced.

Town building program, government employees, principally engineers, inspectors, and clerks will require an office building and a number of houses for living quarters.

Contractors' employees will be quartered in town, it is planned to set aside a portion of the town for contractors' camps. The contractors will arrange for the housing of their workmen, with building regulations subject to government approval.

Ownership of townsite lands, government owns the land, which is vacant public land and under first form withdrawal.

Town lots for business purposes, a plan under consideration is to lease the land on 20-year leases, the government to retain ownership and supervisory control. Continuation of the leases will be contingent upon good behavior of the tenant. A model town is the objective.

Population of town, according to present estimates, from 3000 to 4000 during the construction period.

Town to be permanent, it will no doubt be permanent because the 727-foot dam and 115-mile lake will be a great attraction for tourists. There are also many scenic wonders close by, including three national parks—Grand Canyon, Zion, and Bryce Canyon.

Town, immediate plans for, field engineering parties are at work laying out the townsite and making necessary surveys. Contracts will soon be let for waterworks, sewerage system, street surfacing, sidewalks, and curbs; also for a highway from the town to the dam site.

Boulder Canyon Project townsite, in appropriation for the first year's operations, \$525,000 is provided for the town and highway.

Provisions are being made for erecting buildings suited to the climatic conditions in that section. A town planner has been engaged, who is well acquainted with the type of building construction required. The Bureau of Reclamation encountered somewhat similar conditions on the Yuma and Salt River projects in Arizona.

Average temperatures in that locality vary from 20° to 120°.

Town will be about 25 miles from Las Vegas.

Elevation of townsite, about 2500 feet above sea level.

All public lands open to homestead entry in the areas below Hoover Dam susceptible of irrigation have been withdrawn from entry.

Lands will not be opened to settlement until the dam is completed and water can be furnished for irrigation purposes, which will not be before 1938.

Lands will be opened under the provisions of the reclamation law and similar to openings on the federal irrigation projects.

Preference right of entry will be given to ex-service men for a period of three months after date of opening.

Federal projects having climatic and crop conditions similar to those prevailing on the Boulder Canyon project, the Salt River in Arizona, Yuma in Arizona-California, and Orland in California.

Principal crops to be grown, alfalfa, cotton, grain, melons, citrus and other fruits, vegetables.

Surveys have not been made to determine the irrigable areas. Surveys are in progress in California, and will soon be undertaken in Arizona.

NOTE.—The figures used in the above are taken from preliminary plans, studies and estimates and may be materially changed when final plans are approved and irrigable area surveys are made.

CONSTRUCTION

The following is taken from a statement by Mr. Raymond F. Walter, Chief Engineer of the Bureau of Reclamation, in the *Engineering News-Record* of February 6, 1930:

"Before work can be started at the dam site it will be necessary to build the construction railroad, to provide adequate housing facilities and to secure electric power for construction purposes. The first step in the program will be the construction of the railroad. The next step will be the building of a complete town with all modern improvements, including sewer and water-supply systems, the water supply being obtained from the Colorado River. Construction of a temporary power plant, or of a transmission line from some outside power source, can proceed simultaneously with the building of the railroad and the town.

"As soon as transportation, housing and power facilities are available, the driving of diversion tunnels will be started. On completion of the tunnels, the river will be diverted and the upstream and downstream cofferdams built so that the foundation for the dam can be unwatered and the foundation excavation made. Stripping of loose rock on the canyon walls, excavation of highway approaches and such abutment excavation as may be required will be carried on while the cofferdams are being built. As soon as the foundation excavation is made, pouring of mass concrete will be started. Concrete work in the spillway, power tunnels and outlet works can proceed simultaneously with the pouring of mass concrete in the dam. It is estimated that all work can be completed within seven years."

Plate IV is a general drawing showing the principal features of the Boulder Canyon Dam construction.

Plate V shows a cross section of the river at the dam site. Plates IV and V are from Reclamation Department drawings.

Mr. Walter in the same article mentioned above gives a description of the dam site and other interesting data in connection with the dam as follows:

"Dam site—The proposed dam will be located in Black Canyon about 25 miles southeast of Las Vegas, Nevada, Black Canyon being about 20 miles downstream from Boulder Canyon. The site adopted is about one and one-half miles below the upper end of the canyon. The rock formations in Black Canyon are volcanic flows and tuff-breccias, primarily of andesitic composition; the material exposed in the canyon walls, from the upper end to a point at least a quarter of a mile below the dam site, is mainly andesitic tuff-breccia. Although the formation is somewhat jointed, the rock is well cemented, tough, durable, impervious, and an excellent material for tunneling as well as for the foundations and abutments of a high dam. Some faults are exposed on the canyon walls near the dam site, but none of them shows any evidence of recent movement. Undisturbed potholes, crossed by faults, exist on the Arizona side, about 900 feet above the river, thus indicating no movement along the faults during the period in which the river channel was lowered 900 feet by erosion. These faults are not located so as to impair the safety of a high dam.

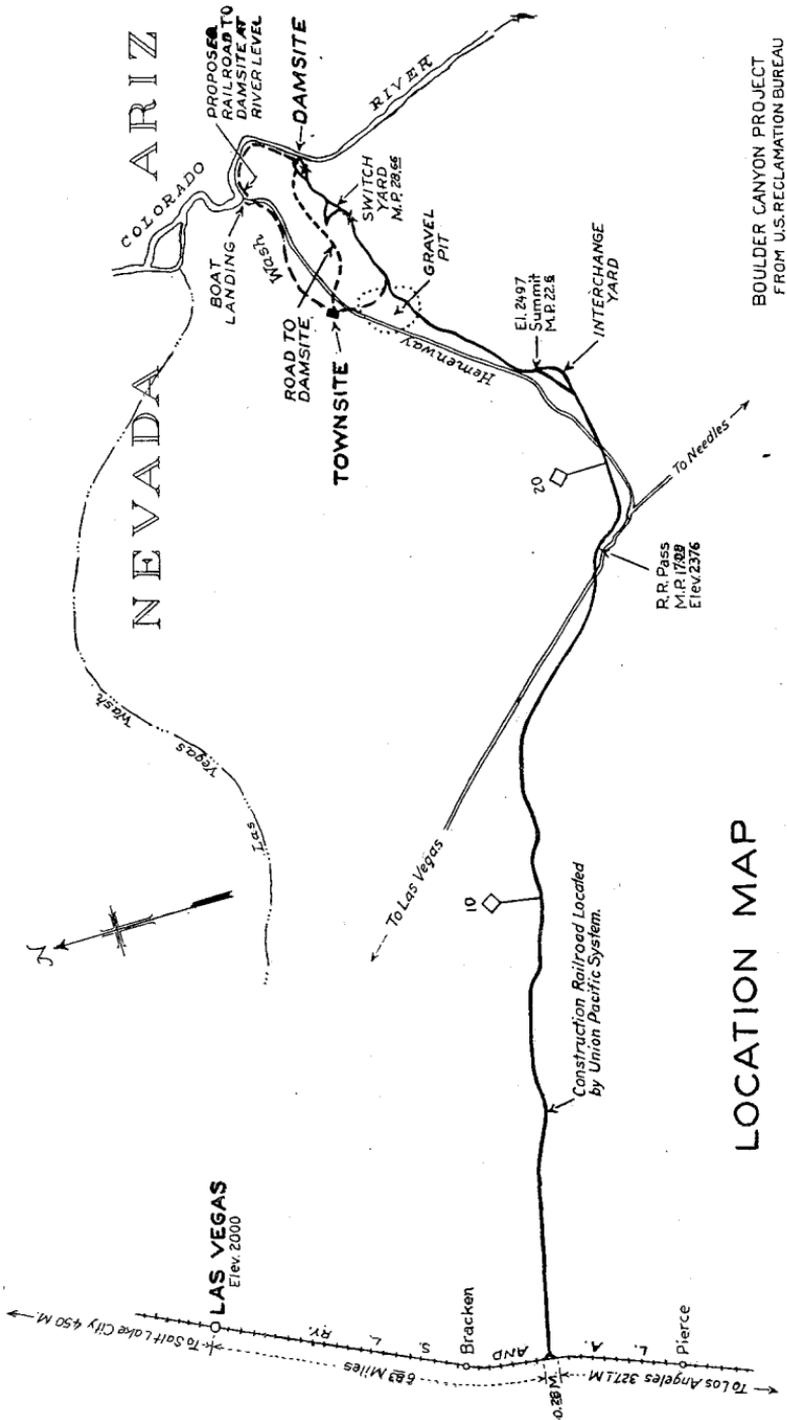
"Boulder Dam—Boulder Dam will be more than 700 feet high and will contain approximately three and one-half million cubic yards of concrete, of which about half a million yards will be below low water surface, the lowest point of the base being approximately 125 feet below low water. After the river is diverted and the foundation and abutment excavation is completed, the construction problem will be simply a huge mass-concrete manufacturing job, probably the largest ever undertaken, considering the vertical height and limited horizontal area involved. The time required to complete the mass concrete work is estimated at about two years and eight months.

"The dam will be a curved gravity structure, designed for a maximum stress of 30 tons per square foot, as recommended by the Colorado River Board. The stresses in the section are being determined by the trial load method of analysis, the method developed in the Denver office of the Bureau of Reclamation during the past five years. The first stages in the development of this method were described in the Transactions of the American Society of Civil Engineers for 1929, in an article by C. H. Howell and the late A. C. Jaquith, entitled 'Analysis of Arch Dams by the Trial Load Method.'

"The trial load method, as developed thus far, takes into account uplift at the base of the dam and within the concrete; radial sides of the cantilever elements; temperature changes in concrete, as produced by both setting heat and exterior air and water temperature variations; transverse shear in both arch and cantilever elements; tangential shear between the arches; the effect of twist; and the effect of foundation and abutment deformations in both arch and cantilever elements. Other problems being comprehensively investigated in connection with the design of Boulder dam are the effects of water-soaking of the concrete near the upstream face of the dam, flow of concrete, Poisson's ratio, variations in modulus of elasticity and the nonlinear distribution of stress between the two faces of the dam. Although the studies are far from complete at the present time, the indications are that some of the above-mentioned effects, especially the last, are of relatively great importance in the design of so high a dam.

Plans for Outlet Works

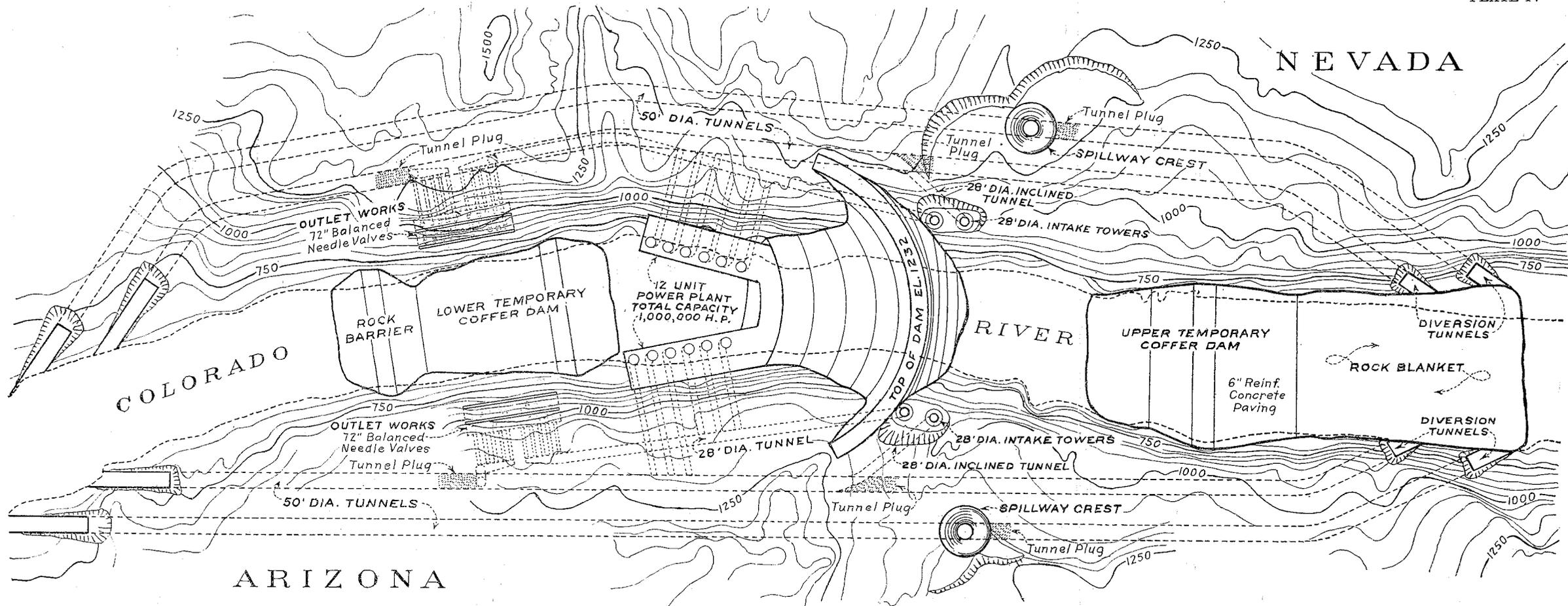
"Outlet Works—For the discharge and regulation of irrigation water it is proposed to install in both canyon walls needle valves connected by tunnels to the reservoir above the dam. Because of the unusual head of water, the needle valve is the most satisfactory method of regulating the outflow. Part of the needle valves will be connected to the inside diversion tunnels and the remainder to the penstock tunnels, but all valves will receive water through the power intake towers. The size of valves, size of feeder tunnels and total capacity of valves are tentative under



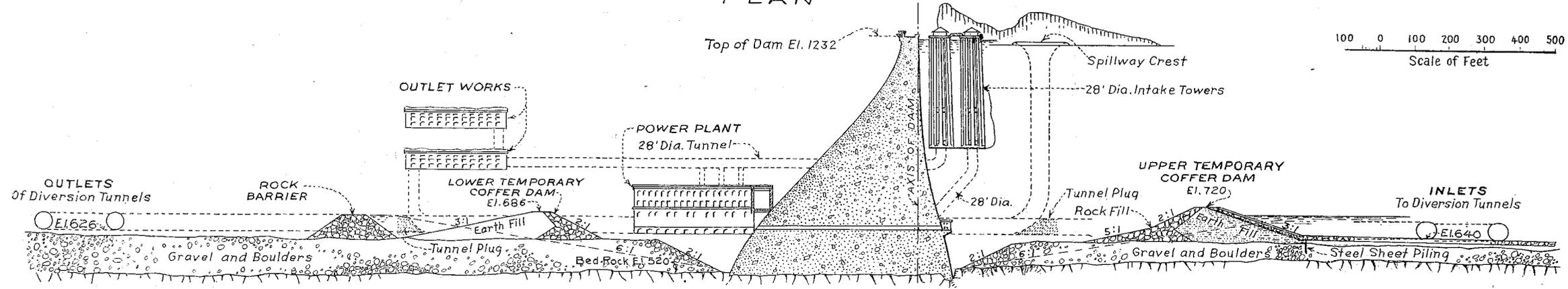
LOCATION MAP

BOULDER CANYON PROJECT
FROM U.S. RECLAMATION BUREAU

NEVADA

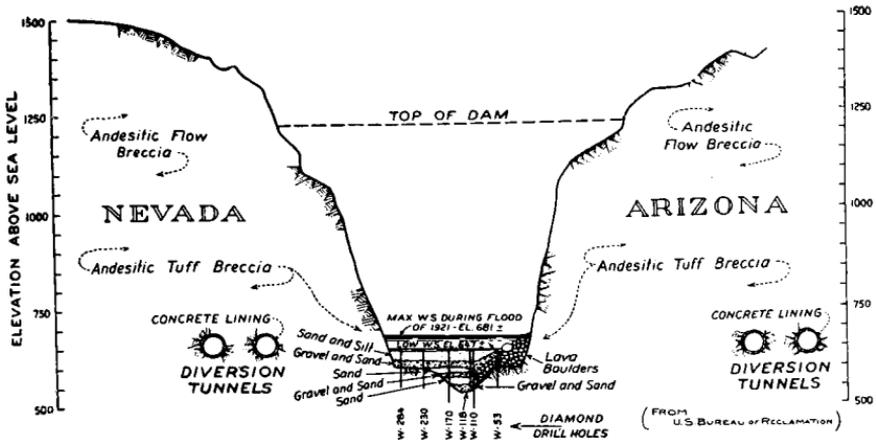


PLAN



LONGITUDINAL SECTION

BOULDER CANYON PROJECT DAM
 FROM
 U.S. BUREAU OF RECLAMATION
 DRAWING



PROFILE AT DAMSITE, LOOKING UPSTREAM

PLATE V

the present scheme and may be materially altered when the final designs are completed. As now planned, the only openings through the dam will be the outlets at river level, for passing the low water flow of the river while the diversion tunnels are being plugged.

"Spillway—Under the present plan of flood regulation a spillway of only nominal size would be required, but because of the location of the power plant, the great height of the dam and the damage which might result should an abnormally large flood overtop the dam, spillways of ample capacity will be provided. The exact type, location and maximum capacity have not been definitely determined. Further study and comprehensive model experiments will be required before final designs can be made. The interests of the delta region will be best served by limiting the flood discharge to a very nominal flow, but the safety of the dam and power plant demands that provision be made to prevent overtopping of the dam by any considerable depth of water.

"The glory-hole type of spillway shown in the accompanying drawings discharges through 50-foot diameter vertical shafts into the outside diversion tunnels. They are of ample capacity to discharge any flood that may be anticipated without overtopping the dam.

"Power Plant—Tentative plans for the proposed power plant contemplate an installation of approximately a million horsepower. The power plant will be located immediately below the dam, one-half on the Nevada side of the river and the other half on the Arizona side, forming a U-shaped structure with the base of the U resting on the downstream toe of the dam.

"Two of the large diversion tunnels of the four which are to be excavated through the rock walls of the canyon for use in the construction period, each controlled by an intake tower equipped with shut-off gates and trash racks, will deliver water to the penstocks, which will connect with the turbines. Each pressure tunnel will serve a group of turbines independently of the others, which will make it possible to take any one of the pressure tunnels out of service for inspection or maintenance purposes without affecting the power output of the remaining 75 per cent of the plant capacity. Due to the value of the power generated, it is quite probable that storage of water and the operation of the plant will be started before the construction of the dam is finished and the project formally completed."

The following is taken from *New Reclamation Era*, December, 1930:

"To divert the Colorado River at the site of Hoover Dam it will be necessary to construct four tunnels 50 feet in diameter through the rock of the canyon walls. There will be two tunnels on the Arizona side and two on the Nevada side of the river. The Arizona tunnels will be 3650 and 4140 feet in length and the Nevada tunnels 4540 and 3930 feet long. Construction of these tunnels will be included in the contract for the dam and appurtenant works to be let early in 1931. These diversion tunnels are larger than any tunnel ever driven anywhere, with but one exception—the Rove ship tunnel in France. This tunnel has a square invert 58 feet wide by 15 feet deep, with a semicircular arch of 36 feet radius. It has an area of 2930 square feet, a length of four and one-half miles and its construction involved 2,800,000 cubic yards of excavation. Each of the Hoover Dam tunnels has a sectional area of 1980 square feet, but they are four in number, with a combined length of 3.1 miles, and 1,900,000 cubic yards of excavation will be required.

"The specifications for the construction of the Hoover Dam, including the four 50-foot diameter diversion tunnels, the cofferdams, power plant except the installation of machinery, and the dam itself, have been completed and invitations for bids for the construction work have been issued. The principal items and approximate quantities involved are as follows:

- "1,800,000 cubic yards all classes of open cut excavation;
- "1,900,000 cubic yards of tunnel and shaft excavation;
- "1,200,000 cubic yards of earth and rock fill in cofferdams and river channel protection;
- "4,400,000 cubic yards of concrete;
- "228,000 cubic feet of grout;
- "Placing 5,500,000 pounds of reinforcement bar;
- "Drilling 190,000 linear feet of grout and drainage holes;
- "Installing 1,900,000 pounds of small metal pipe and fittings;
- "Installing 32,500,000 pounds of large metal conduits;
- "Installing 10,600,000 pounds of structural steel; and
- "Installing 20,000,000 pounds of gates, hoists, and other metal work.

"Specifications have been issued and bids will be opened January 12 for the construction of the government portion of the railroad leading to the dam site, together with side tracks and other facilities. This portion of the railroad is about ten and one-half miles long and runs from the summit or the end of the railroad now being constructed by the Los Angeles and Salt Lake (Union Pacific) Railroad Co., down to the dam site. The principal items and approximate quantities involved are as follows:

- "115,000 cubic yards of common excavation;
- "364,000 cubic yards of rock excavation;
- "163,000 cubic yards of unclassified borrow;
- "803,000 station cubic yards of overhaul;
- "287,000 cubic yards of long haul unclassified borrow 'loaded into hauling equipment';
- "705,000 yard-miles of hauling and spreading 'long haul unclassified borrow';
- "29,000 cubic yards of tunnel excavation;
- "200 M. feet b.m. of permanent tunnel timbering;
- "800 cubic yards of structure excavation, common;
- "1200 cubic yards of structure excavation, rock;
- "6000 cubic yards of back fill;
- "220 cubic yards of concrete;
- "16,000 pounds of reinforcement steel;
- "2100 cubic yards of rock riprap;
- "2600 cubic yards of concrete cribwall;
- "1600 linear feet of 24-inch corrugated pipe;
- "120 linear feet of 30-inch corrugated pipe;
- "180 linear feet of 36-inch corrugated pipe;
- "280 linear feet of 42-inch corrugated pipe;
- "200 linear feet of 48-inch corrugated pipe;
- "600 linear feet of 60-inch corrugated pipe;
- "30 M. feet b.m. of bridge or trestle timbering;
- "200 pounds of rail stringers in rail top trestle;
- "2000 linear feet of piling;
- "80 pile-point shoes;
- "22,800 cubic yards of ballasting;
- "7 miles of laying track (tie plated); and
- "10 miles of laying track (not tie plated).

"Specifications have been completed and bids will be opened January 7 for the construction of a highway from Boulder City to the Hoover Dam. The highway will be about eight miles long and will involve a large amount of solid rock excavation. The principal items and the approximate quantities involved are as follows:

- "113,000 cubic yards of common excavation;
- "266,000 cubic yards of rock excavation;
- "40,000 cubic yards of unclassified borrow;
- "250,000 station cubic yards of overhaul;
- "6000 cubic yards of tunnel excavation;
- "30 M. feet b.m. of tunnel timbering;
- "1200 cubic yards of structure excavation, common;
- "600 cubic yards of structure excavation, rock;
- "2100 cubic yards of back fill;
- "170 cubic yards of concrete;
- "8,500 pounds of reinforcement steel;
- "2500 cubic yards of riprap;
- "5000 cubic yards of concrete cribwall;
- "140 linear feet of 18-inch corrugated metal culverts;
- "1380 linear feet of 24-inch corrugated metal culverts;
- "720 linear feet of 36-inch corrugated metal culverts;
- "1,100 linear feet of 48-inch corrugated metal culverts;
- "970 linear feet of 60-inch corrugated metal culverts;
- "420 linear feet of 72-inch corrugated metal culverts;
- "60 M. feet b.m. of bridge timbering;
- "40,000 cubic feet of gravel surfacing placed;
- "80,000 station cubic yards of gravel surfacing in stock piles;
- "8.6 miles of highway treated with oil; and
- "2700 linear feet of guard rail.

"Plans and specifications are being prepared for the construction of the water works, sewer system, lighting system, administration building, residences for government employees and other buildings of a public nature for the Boulder City town-site. Invitations for bids will be issued as soon as the plans and specifications can be completed."

The following statement regarding the present condition of construction on the Boulder Canyon Project is taken from *New Reclamation Era*, December, 1930.

"Work at the site of the Hoover Dam will be under way early in 1931, according to present plans. This is the answer of the Bureau of Reclamation to President Hoover's appeal for the speeding up of construction work in order to provide relief for unemployment. The construction program on the Boulder Canyon Project has been advanced about six months. In the Denver office, the engineering force is putting in long hours on preparation of the plans and specifications for the dam, power plant, and appurtenant works. Chief Engineer Walter proposes to forward the specifications and drawings to the Washington office for printing soon after December 1. At the same time mimeographed copies of the specifications are to be made available to prospective bidders, so that they may have additional time to study the project and to prepare their bids. These specifications can be obtained at either the Washington, Denver, or Las Vegas office. It will take about one month to get the printing work done, and therefore the printed specifications will be available for distribution early in January, 1931, and bids can be opened in February. With no delays in this program, the successful contractor should be on the ground installing his camp and equipment and preparing for starting work on the diversion tunnels about April 1.

"The estimated cost of the dam, power plant, and appurtenant works, according to the Sibert Board report, is \$108,800,000, of which \$70,600,000 is for dam and appurtenant works and \$38,200,000 for the power plant. This amount includes labor and materials furnished by the contractor and materials to be furnished by the government. The items covered by this estimate are the dam, diversion works (tunnels and cofferdams), spillways, outlet works, power plant, construction railroad and reservoir right of way; the construction railroad is being handled by separate contracts. All principal materials, such as cement and steel, will be furnished by the government.

"In initiating work on the Hoover Dam and power plant, the most important features of the project, the contractor will be able to give early employment to a large number of men. But outside of the construction job itself, the cement mills, steel companies, and manufacturers of pipe, gates, valves, and electrical and hydraulic equipment will see renewed activity in their factories, and can give work to hundreds of men now seeking employment.

"The Merritt, Chapman, Scott Corporation subcontract on the 22.7-mile section of the construction railroad, which covers the grading and structures, is scheduled for completion the latter part of December. Track will then be laid by the Los Angeles and Salt Lake Railroad Company which will complete its contract early in 1931. It is planned to open bids in January for the remaining 10.5 miles of the construction railroad and also for about eight miles of highway from Boulder City to the dam site. This will be followed by asking bids for constructing the inclined railroad from the top of the canyon to the power plant site.

"Plans are being prepared for the administration building, dormitory, garage, and several residences for government employees in Boulder City; also for a water works system to pump water from the Colorado River to a reservoir in the town with a lift of 2000 feet. This will include a modern plant with all up-to-date facilities for clarifying and purifying the water. The Southern Sierras Power Company is proceeding with the construction of a 132,000-volt single-circuit transmission line from its main substation at San Bernardino, California, to the dam site, a distance of about 235 miles, and expects to have power for construction purposes ready for delivery about June 1."

WATER

Water Available.

The flow of the water in the Colorado River varies through a wide range during the year. A large portion of the water comes down in a great flood and then during other seasons of the year the flow is so diminished that present irrigation needs are not always satisfied.

As an example, the entire flow of the Colorado River at Andrade (the diversion point for the Imperial Canal) was diverted into the Imperial Irrigation District's canal during the following periods:

- "1922, October 2d to October 29th, inclusive,
 - "1924, August 7th to October 15th, inclusive,
 - "1926, August 29th to October 2d, inclusive,
 - "1928, August 23d to October 18th, inclusive,
 - "1930, September 29th to October 3d, inclusive."
- (From records of Imperial Irrigation District.)

During a portion of this time there was an actual shortage of water.

With the storage of the flood water and consequent regulation of the stream to a steady flow throughout the year, additional agricultural development would be warranted, but under present conditions no more land can be brought under irrigation on account of the depleted flow of the river during the dry season. To eliminate this shortage during the dry season and to provide for the proper development on the river there must be a means of holding back the flood water and making it available during the dry months when the flow is naturally very small. This the Boulder Dam will do. By creating the immense storage reservoir at Boulder capable of holding an entire year's run-off of the river, the water can be controlled so that stream flow below the dam will be regulated to the amount of water actually needed. During the dry summer months the flow can be increased to meet the needs, and in the season when ordinarily water would run to waste, the flow can be regulated and water stored up behind the dam to be released when needed.

There has been considerable discussion and dispute regarding the actual amount of water available for use. Figures differ by several million acre-feet. A dry period occurred in the river basin just prior to 1905 while after that date there was a term of considerably increased flow. In some reports the recorded flow of the river since 1905 has been used, disregarding the flow previous to that date. If the records are taken back as far as 1878 a much lower figure results as this longer term takes into consideration a very dry period.

The following figures are taken from a report rendered by Engineer A. L. Sondregger dated December 19, 1905, and compiled for the Imperial and Coachella Valley Irrigation Districts from official records. The figures given are for the undiminished flow of the Colorado River at Laguna Dam, the assumption being that all the water was permitted to flow down the river and that none was diverted for use at any point above Laguna Dam. These figures were arrived at by taking the actual flow at Laguna Dam and adding to it the amount of water used above

the point of measurement. It is what would be called the reconstructed flow, or what the flow of the river in its natural state would be.

Average for 48 years, 1878-1925, inclusive.....15,614,000 acre-feet
 Average critical period, 1878-1905, inclusive.....13,500,000 acre-feet
 Average wet period, 1906-1925, inclusive.....18,700,000 acre-feet

To arrive at water available in the lower basin it is of course necessary to subtract present and probable future use in the upper basin. Data respecting the estimated water available is given here from several sources.

In June, 1929, a conference was held in Washington by the Lower Basin States and during this conference a questionnaire was submitted to the Interior Department in order to determine the Interior Department's opinion of the amount of water available in the Colorado River system. The following is taken from the answers given by the Reclamation Bureau to the questions asked. (Communication from Commissioner of Reclamation, June 3, 1929.) The dates given are inclusive: Average annual flow at Lee Ferry 1922-1928, from U. S. G. S.

records -----	14,586,000	acre-feet
Average annual "reconstructed," undepleted flow, equaling measured discharge plus upstream consumptive use, estimated, 1850-1928 -----	15,900,000	acre-feet
Average annual flow at Topock 1918-1928, from U. S. G. S. records -----	16,120,000	acre-feet
"Reconstructed" average annual flow at Topock under same assumptions used for Lee Ferry, estimated -----	17,100,000	acre-feet
Present consumptive use in Utah, Colorado, Wyoming and New Mexico, Reclamation Bureau replied insufficient data to furnish accurate figures but estimates 1928 acreage as 1,700,000 and quotes Weymouth report giving $1\frac{1}{2}$ acre-feet water use -----	2,550,000	acre-feet
Discharge at Laguna Dam, estimated by taking measured discharge in river at Yuma, deducting inflow from Gila and adding diversions of the Yuma main canal 1902-1927 -----	15,920,000	acre-feet
Weymouth report gives figure for 1899-1922 -----	16,540,000	acre-feet
Estimated amount of water available at Lee Ferry under present conditions of development -----	13,400,000	acre-feet
Estimated amount available at Lee Ferry under future conditions if Upper Basin limited to 7,500,000 acre-feet beneficial consumptive use -----	8,400,000	acre-feet
If future development indicated in Weymouth report takes place (reply stated that "there is grave doubt whether all projects mentioned in Weymouth report will be found feasible")—available at Lee Ferry -----	7,900,000	acre-feet
Inflow to river between Lee Ferry and Boulder Dam, accurate data not available, estimated at -----	1,570,000	acre-feet
River losses between Lee Ferry and Laguna Dam assuming river developed, estimated at -----	1,200,000	acre-feet
Amount of water in the Gila and its tributaries was stated as follows: "Average run-off of the Gila, just above Florence, Arizona; at Salt River, just above junction with the Verde River; Verde River at its junction with the Salt River; and the minor streams entering the Salt River just west of Phoenix, total an average of -----	2,400,000	acre-feet
Prior to construction of the Coolidge Dam, the average annual flow of the Gila River at Yuma was about -----	1,000,000	acre-feet
Following full operations under the Coolidge Dam and the additional storage developments contemplated it is anticipated the average discharge of the Gila at mouth will probably not exceed -----	300,000	acre-feet
Prior to irrigation development in the Gila watershed, annual discharge at mouth probably approximated -----	2,000,000	acre-feet
Gila River development as indicated by above figures will probably develop consumptive use of roughly -----	1,700,000	acre-feet

Water Supply paper No. 556, page 112, gives the mean flow of Colorado River at Lee's Ferry for the year 1895 to 1922, inclusive:

"Flow as measured.....	15,200,000 acre-feet
Flow corrected for past depletion.....	14,400,000 acre-feet
Flow corrected for past and future depletion.....	8,880,000 acre-feet"

This last figure is the one that has been commonly accepted in making calculations for future water supply.

Through discussion and comparison of figures a result has been arrived at which has been commonly accepted as being fairly indicative of the amount of water available for use in the lower basin. This result is given in Table W-1.

TABLE W-1.

Colorado River System Water Available for Use in Lower Basin

Water available at Lee Ferry after use 7,500,000 acre-feet in upper basin.....	8,880,000 acre-feet
River losses (evaporation and loss to sands, etc.) between Lee Ferry and Laguna Dam.....	1,240,000 acre-feet
Available at Laguna Dam from water passing Lee Ferry..	7,640,000 acre-feet
Inflow—various tributaries—Lee Ferry to Laguna.....	1,460,000 acre-feet
Net available at Laguna Dam.....	9,100,000 acre-feet
Estimated Gila River water.....	2,500,000 acre-feet
Total water available in lower basin.....	11,600,000 acre-feet
Apportioned (III a) water.....	7,500,000 acre-feet
Surplus or excess (including 1,000,000 (b) water).....	4,100,000 acre-feet

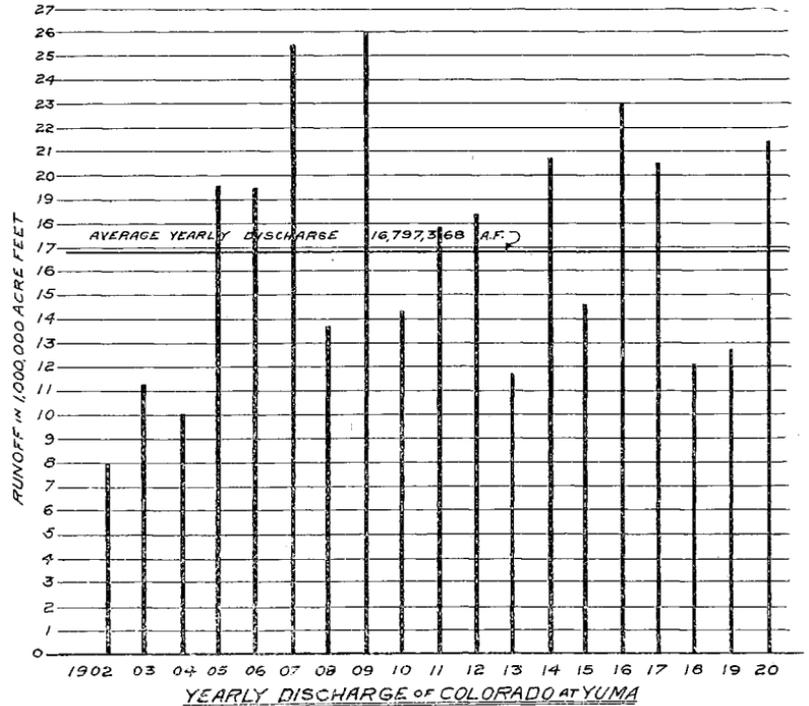
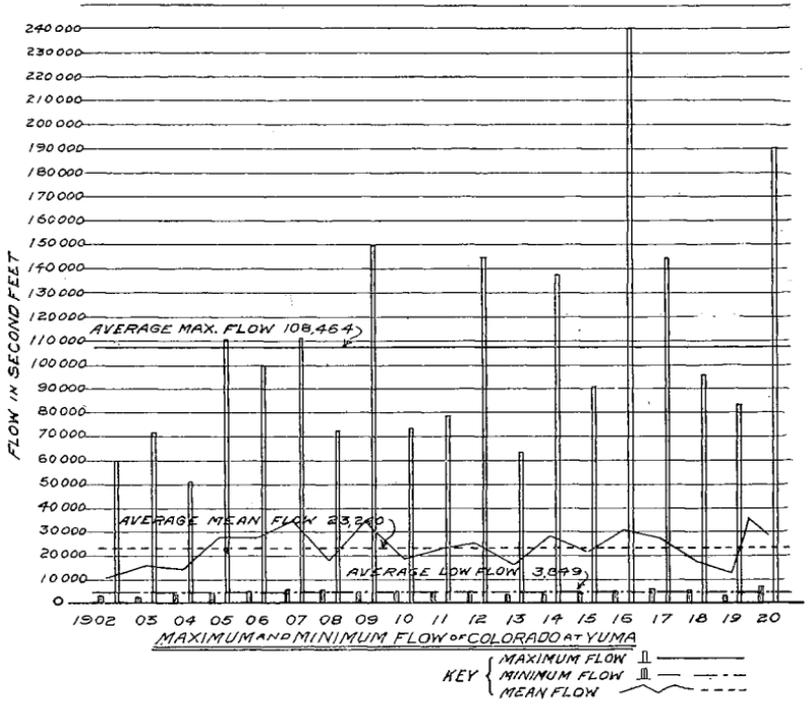
Table W-2 is of interest in showing the irregular flow of the Colorado. The figures given are for actual yearly discharge (total amount of water for year) at Yuma, Arizona. The figures given for the Colorado are for the discharge at a point below the mouth of the Gila and thus include the Gila flow.

Plate VI is a graph of these same figures. Considerable water is used above the point of measurement, both from the main stream and from the Gila, and this amount must be taken into consideration in determining the total water in the basin that can be used. Table W-1 takes all these elements into consideration. Table W-2 is merely a record of existing conditions at a certain point (Yuma).

Under the terms of the Seven-State Compact the upper basin is given the right to use 7,500,000 acre-feet per year. The use in the upper basin was estimated by the Reclamation Department in 1928 at somewhere in the neighborhood of 2,500,000 acre-feet; thus under the terms of the compact they would be permitted an increased use of 5,000,000 acre-feet although there appears to be grave doubt that such maximum use will be realized.

In passing it should be noted that the pact does not guarantee that 8,880,000 acre-feet of water will come down the river, as the upper basin states are only required to let down 75,000,000 acre-feet of water during a period of ten years, or an average amount of 7,500,000 acre-feet per year.

COLORADO RIVER AND BOULDER CANYON PROJECT



DATA FROM FALL-DAVIS REPORT CALIFORNIA COLORADO RIVER COMMISSION

TABLE W-2

Discharge of the Colorado River at Yuma, Arizona

From Senate Document 142, 67th Congress

Year	Minimum flow		Maximum flow		Mean	Total discharge for year—acre-feet	
	Date	Second-feet	Date	Second-feet			
1902	Oct. and Nov.	3,140	May	59,200	10,970	7,960,000	
1903	Jan.	2,694	June	72,219	15,600	11,300,000	
1904	Feb.	3,340	June	51,200	13,900	10,100,000	
1905	Jan.	3,750	March	111,000	27,300	19,710,000	
1906	Jan.	4,620	June	99,200	26,900	19,500,000	
1907	Dec.	5,800	June	115,000	35,100	25,500,000	
1908	Jan.	5,600	Dec.	72,500	18,900	13,700,000	
1909	Dec.	4,100	June	149,500	35,800	26,000,000	
1910	Oct.	4,300	May	70,300	19,700	14,300,000	
1911	Jan.	3,700	June	78,300	24,600	17,800,000	
1912	Jan.	3,400	June	144,000	25,300	18,400,000	
1913	Jan.	2,600	June	62,500	16,200	11,700,000	
1914	Jan.	3,300	June	137,000	28,500	20,700,000	
1915	Sept.	2,700	Feb.	90,000	20,200	14,600,000	
1916	Jan.	3,800	Jan.	240,000	31,600	22,940,000	
1917	Jan.	5,300	July	143,000	28,400	20,600,000	
1918	Sept.	4,100	July	94,300	18,100	12,150,000	
1919	Jan.	1,800	Nov.	82,600	14,800	10,740,000	
1920	Dec.	5,100	June	190,000	29,700	21,450,000	
Average for 19 Yrs.		3,849	Av. for 19 Yrs.		108,464	23,240	16,797,368

Division of Lower Basin Water.

According to the terms of the compact there is available in the lower basin what might be termed three kinds of water (see Colorado River Compact), paragraph III (a) water, i. e. 7,500,000 acre-feet, paragraph III (b) water, i. e., 1,000,000 acre-feet, and physical water actually present in the system over and above (a) and (b) water. For the purpose of discussion this might be termed (c) water.

From this (c) water must be taken any water used to satisfy any Mexican obligation that must be met, the balance is available for use in the lower basin. In making an estimate of the water available for use in the lower basin it is assumed that the upper basin use may reach, but not exceed, the 7,500,000 acre-feet apportioned to that basin by paragraph III (a) of the pact.

The pact defines Colorado River System as the Colorado River and its tributaries within the United States. The water considered in the pact is all the water in the *system* and the division of water is that of the *system*. The pact proceeds to divide the system into the Upper Basin and the Lower Basin, the point of division being Lee Ferry. No mention is made in the pact of dividing main stream water, but in every case it is the water of the *system*.

A terse, clear explanation of the meaning of the pact in connection with the above points is given in the replies by Secretary of Commerce Herbert Hoover, who was chairman of the commission which drew up the Colorado River Compact, to questions submitted by Congressman Carl Hayden of Arizona, and published in the Congressional Record under the extension of remarks of Congressman Hayden, January 30, 1923. (See section on Colorado River Compact.)

The figures given in Table W-1 have been accepted as being reasonably indicative of the amount of water that may be counted on.

The water actually physically present in the Lower Basin must meet four demands—water uses in

1. Arizona.
2. California.
3. Nevada.
4. Mexico.

Any water passing Lee Ferry, under the terms of the pact, in excess of 7,500,000 acre-feet per year, must be used to satisfy the Mexican demand before the Upper Basin can be called on to meet a further obligation. Under the terms of the pact the Lower Basin is allowed the "Firm title" use of 8,500,000 acre-feet out of all water in the Lower Basin *system*. As there is approximately 3,000,000 acre-feet of water in the Lower Basin system more than this allowed use, it is inconceivable that the Upper Basin could ever be called on to supply any deficiency, hence this assumption that the Lower Basin must meet all of the Mexican demands.

There is no treaty between the United States and Mexico affecting the use of water of the Colorado River. There is an agreement or contract between the owners of the Imperial Irrigation District's canal in Mexico and the Mexican government which permits Mexican lands to take one-half of the water flowing in the canal.

Water used in Mexico from the canal system during the last few years has represented a diversion from the Colorado River of approximately 750,000 acre-feet annually.

The Mexican situation is treated more in detail in a separate section under that heading. (See Mexican Situation.)

Under the terms of the Boulder Canyon Project Act not over 4,400,000 acre-feet of III (a) water may be used by California each year. The use of water in Nevada from the Colorado River system is limited by nature. The water is only available at the bottom of deep canyons and the agricultural lands that it is practical to water from these deep canyons is limited by the topography. It has been generally conceded that Nevada could never use more than 300,000 acre-feet and probably such use would never exceed 200,000 acre-feet.

Arizona would naturally receive, after deducting 4,400,000 acre-feet for California and the 300,000 acre-feet for Nevada, the balance of the 7,500,000 acre-feet, or 2,800,000 acre-feet.

Careful study of the Boulder Canyon Project Act is necessary in order to determine the status of the extra 1,000,000 acre-feet that the Lower Basin is allowed to use each year under the compact (Article III (b)).

The act lays down only one definite limitation on water and that condition is briefly as given above, i.e. California to restrict her use to 4,400,000 acre-feet of water apportioned by Article III, paragraph (a) of the Colorado River Compact, plus one-half of the excess or surplus waters unapportioned.

The act also outlines a suggested possible Tri-State compact between Arizona, California and Nevada. This suggested compact is not binding on anyone and is not suggested as the "will of Congress" (Congressional Record, 70th Congress, 2d Session, page 484 et seq.)). This suggested Tri-State compact does not apportion any water to California but apportions 300,000 acre-feet to Nevada, and 2,800,000 acre-feet to Arizona and then states that Arizona may have one-half of the excess or surplus waters.

No mention is made in either the California limitation laid down in the act or in the suggested Tri-State compact of the 1,000,000 acre-feet of water mentioned in Article III (b) of the compact. Arizona contends that because this 1,000,000 acre-feet is not mentioned in the Act that the State of Arizona would automatically be given the right to use the entire 1,000,000 acre-feet. In the suggested Tri-State compact in the act, Arizona is limited to 2,800,000 acre-feet of water from the 7,500,000 acre-feet and is allowed to use one-half of the excess or surplus (exactly the same language as used in connection with California's limitation in the preceding paragraph of the Act). If Arizona's assumption regarding the California limitation is correct, then the use of the same language in the suggested Tri-State compact would in that case prohibit Arizona's use of the 1,000,000 acre-feet of Article III (b) water.

From the above it would seem logical to suppose that Congress had no intention of making any effort to even suggest a division of this 1,000,000 acre-feet but that it was to be considered a part of the surplus and excess water and would be open to appropriation by either State. This assumption is further borne out by the debate which took place in the Senate at the time the Act was adopted, it being the evident intention to have the California limitation and the suggested Tri-State compact, if adopted, tie up together and leave all water in the lower basin system over and above the 7,500,000 acre-feet to be considered as surplus or excess water. No other interpretation than this will work out consistently when both paragraphs of the Act are considered. The same assumption must of course be used in interpreting both paragraphs of the act and if the assumption is made that 1,000,000 acre-feet is not included in the surplus or excess water then one paragraph of the act, if taken alone, gives California 1,000,000 extra acre-feet and the other paragraph, if taken alone, would give Arizona 1,000,000 extra acre-feet and the two would not be consistent. By considering 1,000,000 extra acre-feet as being a portion of the excess or surplus water and water to which simply a firmer or more certain title would attach, then there is no trouble in making the two clauses of the Act read consistently.

Table W-3 gives the division of water that would result from the assumption of interpretation given above.

Under the provisions of the Boulder Canyon Project Act and the seven-State compact it would seem that the division of water between the three lower basin states would be practically as follows:

TABLE W-3

California Water—

Apportioned III (a) water-----	4,400,000	acre-feet
One-half surplus or excess (Tab. W-1)	2,050,000	acre-feet

6,450,000 acre-feet

(Assuming Arizona and Nevada use
balance of water on basis of proposed
tri-State compact in Act.)

Arizona Water—

Apportioned III (a) water-----	2,800,000	acre-feet
One-half surplus or excess (Tab. W-1)	2,050,000	acre-feet

4,850,000 acre-feet

Nevada Water—

Apportioned III (a) water-----	300,000	acre-feet
--------------------------------	---------	-----------

11,600,000 acre-feet

Note:

From above amounts any water going to Mexico must be deducted. Present use in Mexico approximately 750,000 acre-feet. This divided equally between Arizona and California would make net figures as follows:

Arizona -----	4,475,000	acre-feet
California -----	6,075,000	acre-feet
Nevada -----	300,000	acre-feet
Mexico -----	750,000	acre-feet

11,600,000 acre-feet

Accurate soil surveys are not available in connection with all the projects on either the California or the Arizona side of the river. Absolutely accurate estimates of the amount of water required can not be made at this time on this account.

An effort is made below to give as accurate an approximation of the probable water use from the Colorado River as can be formulated at this time. As a check on the amount given the following table and information from Water Supply Paper No. 556 is included. This paper was published in 1925 and since that date more data has been available which has been used in connection with the two tables of water uses in Arizona and California. For more detailed information regarding the individual projects the reader is referred to the section on "Projects." In the case of some of the projects which are as yet unsurveyed or unincorporated, in describing the individual projects the same land has sometimes been included in two different projects, as for instance, on the Arizona side of the river the Parker project forms part of the larger Parker-Gila project. This duplication has been taken into consideration in formulating the tables given for net water use in Arizona and California and in the areas listed there under the separate headings the effort was made to exclude all duplications so that the totals of the individual projects would give the totals of the areas in the separate States.

The following is taken from Water Supply Paper No. 556, p. 122-123:

"Irrigable areas and water needed for ultimate development in the United States below Parker, Arizona.

Area	Irrigable areas Acres	Water diverted	Return	Water consumed Acre-feet
		(gross duty 4.5 acre-feet per acre) Acre-feet	flow (1.5 acre-feet per acre) Acre-feet	
Parker-Gila Valley Project:				
Between Parker and Palo Verde Valley	50,000	225,000	75,000	150,000
Palo Verde Valley, gravity	79,000	355,500	118,500	237,000
Palo Verde Mesa, gravity	20,000	90,000	30,000	60,000
Palo Verde Mesa, pump	25,000	112,500	37,500	75,000
Chucawalla Valley, pump	136,000	612,000	0	612,000
Parker Mesa, gravity	4,000	18,000	6,000	12,000
Parker Mesa, pump	8,000	36,000	12,000	24,000
Parker bottom land, gravity	104,000	468,000	156,000	312,000
Cibola Valley, gravity	16,600	72,000	24,000	48,000
Gila Valley, pump	632,000	2,844,000	*948,000	2,844,000
Yuma Project:				
Gravity	69,000	310,500	*103,500	310,500
Pump	61,000	274,500	*91,500	274,500
Imperial Irrigation District	515,000	2,317,500	0	2,317,500
Imperial Valley Extension:				
Gravity	385,000	1,732,500	0	1,732,500
Pump	200,000	900,000	0	900,000
	2,304,000	10,368,000	—	9,909,000

*Return flow available to lands in Mexico only.

Annual Supply and Demand in acre-feet for Colorado River water below Parker, Arizona.

	Demand	Supply
Regulated supply at Parker ultimate irrigation development in the upper basin	—	10,093,000
Loss in channel below Parker	500,000	—
Total ultimate demand in United States	9,909,000	—
Return flow from Gila Valley	—	948,000
Return flow from Yuma project	—	195,000
Present demand for irrigation of 190,000 acres in Mexico at 4.5 acre-feet per acre	855,000	—
	11,264,000	11,236,000

"As shown in the preceding tables the total ultimate demand in the United States below Parker, plus the loss in the river channel below Parker, will exceed the total supply at Parker by about 300,000 acre-feet. If 60,000 or 70,000 acres in the lower part of the Imperial Valley should receive a water supply from the return flow and waste water from lands higher in the valley, this apparent shortage for lands within the United States might be eliminated.

"When the Yuma project is completed and when 600,000 acres are irrigated in the lower Gila Valley, the return flow from these lands should be ample to irrigate about 200,000 acres in Mexico. This is approximately the area in that country irrigated from Colorado River in 1924. The total area in Mexico upon which it is feasible to use Colorado River water is estimated at 1,000,000 acres. If all of this land should be irrigated, the deficiency in the water supply for lands within the United States would amount to about 3,600,000 acre-feet, or enough to irrigate 800,000 acres.

"It is recognized that the use of water by municipalities for domestic purposes is a higher use than that of irrigation. There are over 50 cities in the coastal region of southern California, most of which within a few years will have outgrown their local water supplies. If the population of this region continues to increase, a new source of domestic water must be found. The city of Los Angeles is planning to carry 1500 second-feet of Colorado River water across the desert and through the mountains for the use of its citizens. The diversion of 2000 second-feet from the river for domestic consumption in southern California may be an accomplished fact before ultimate irrigation development shall have been attained in the upper basin of the Colorado. This use of water may further deplete the supply for irrigation in the lower basin by 1,450,000 acre-feet annually."

Total Arizona Uses

. Assuming the Parker-Gila project developed, and on the basis of the net figures given under "Arizona Projects," assuming a water duty of three acre-feet per acre, which takes into consideration and allows for the return flow, the total water use in Arizona would figure as follows:

Probable Arizona Net Acreage and Water Use

<i>Project</i>	<i>Acres</i>	<i>Water duty feet per acre</i>	<i>Acre- feet water</i>
Opposite El Dorado Canyon-----	300	3.0	900
Three miles below El Dorado Canyon--	200	3.0	600
Cottonwood -----	4,000	3.0	12,000
Bulls Head -----	500	3.0	1,500
Hardyville unit -----	2,300	3.0	6,900
Ft. Mohave Mesa-----	6,300	3.0	18,900
Parker-Gila Project--			
Parker Valley (Colorado River In- dian Reservation) -----	104,000	3.0	312,000
Parker Mesa -----	12,000	3.0	36,000
Cibola -----	16,000	3.0	48,000
Miscellaneous tracts -----	3,400	3.0	10,200
Lands north of Gila River-----	121,200	3.0	363,600
Lands south of Gila River-----	258,000	3.0	774,000
Yuma Project (Arizona land)-----	100,000	3.0	300,000
Use on Gila (estimated) -----	-----		1,800,000
	628,200		3,684,600

NOTE

El Dorado and Cottonwood Valley lands. Both of these areas will probably be flooded by the Bullshead Dam which may be constructed in the future.

Blankenship and Chemehuevis Valleys. Both of these valleys would be flooded by a proposed Parker Dam.

Cibola Valley. The proposed higher diversion dam for the All-American Canal would flood this valley unless diversion is made at Laguna Dam.

California Net Acreage and Probable Net Water Requirements

<i>Project</i>	<i>Net acreage</i>	<i>Net water duty feet per acre</i>	<i>Net water acre-feet</i>
Mohave Valley-----	1,000	3.0	3,000
Chemehuevis Valley-----	2,300	3.0	6,900
Parker Valley-----	4,000	3.0	12,000
Palo Verde Valley—present district	89,000	3.0	267,000
Palo Verde Valley—			
Other gravity land-----	15,500	3.0	46,500
Palo Verde Mesa—low area-----	20,000	3.0	60,000
Palo Verde Mesa—intermediate area	22,450	3.0	67,350
Palo Verde Mesa—high area-----	12,400	3.0	37,200
Chucawalla Valley—			
North side-----	43,000	4.3	184,900
South side-----	42,000	4.3	180,600
First high level-----	45,000	4.3	193,500
Second high level-----	32,400	4.3	139,320
Yuma (California land)-----	15,000	3.0	45,000
Imperial Irrigation District, present	585,000	4.5	2,632,500
All-American Canal in addition to			
above—Coachella Valley-----	137,100	4.5	616,950
Exclusive of Coachella Valley----	388,340	4.5	1,747,530
Domestic water Coastal Plain Cities—			
Metropolitan Aqueduct-----			1,100,000
San Diego-----			110,000
	1,454,490		7,450,250

NOTE.—In the above table water uses of 4.3 and 4.5 acre-feet per acre are taken where there is no return flow.

California Domestic Water.

The use of water in California falls roughly under two headings, water for agricultural use and water for domestic use by the Coastal Plain cities. In the section under California Projects a detailed description is given of each of the agricultural projects in California that now appear to be feasible of development from Colorado River water; in fact, these projects so listed can be developed from no other source and if water is not supplied from the Colorado River for the purpose, either some of the projects or portions of projects must remain undeveloped.

It is not the intention here to in any way express an opinion regarding the individual water rights, but an effort has been made to give certain facts in connection with each of the projects to enable the reader to form his own conclusion. All of the records, of course, can not be given in a publication of this size.

The domestic water required by the Coastal Plain cities for the supply of which the Colorado River appears to be the only available source might be considered roughly under two groupings. At the time the Metropolitan Water District of Southern California was first being discussed it was suggested that all of the Coastal Plain cities

would go together and form one large metropolitan district, taking in all the Coastal Plain cities from Los Angeles to San Diego, inclusive, but as further investigations were made it appeared to be more practicable to supply the total area through two aqueducts rather than one. The area in and around Los Angeles would be supplied by a large aqueduct constructed by the Metropolitan Water District of Southern California and serving such cities as should join that district, the area around San Diego to be supplied from the smaller aqueduct taking water either from one of the canals in the Imperial Irrigation District or from an extension of the All-American Canal.

It is contemplated that the Los Angeles district aqueduct will require a water supply of 1500 second feet, or approximately 1,100,000 acre-feet annually. The San Diego aqueduct is expected to require about 150 second-feet or approximately 110,000 acre-feet annually.

A brief outline is given in the following pages of these two contemplated water developments.

Metropolitan Water District of Southern California.

This district was formed for the purpose of bringing water from the Colorado River to Los Angeles city and the cities adjacent thereto. The district was formed under the Metropolitan Water District Act of California, approved May 10, 1927, and amended June 10, 1929. This Metropolitan Water District Act authorized the incorporation and maintenance of a water district anywhere within the state and is a general act under which any district similar to the Metropolitan Water District of Southern California can be organized.

For the sake of brevity in the following pages the Metropolitan Water District of Southern California will be referred to as the Metropolitan District.

The Metropolitan District has carried on extensive surveys and investigations for several years. Numerous routes for aqueducts have been carefully checked over and November 10, 1930, F. E. Weymouth, the Chief Engineer of the district, rendered a report to the board of directors making recommendation of the route to be accepted. The route recommended was that taking water from the river at the so-called Parker site and this route was finally approved by the board of consulting engineers to the district. Plate VII shows the location of this route.

The following facts are taken from an article by F. E. Weymouth in the monthly publication of the Los Angeles section of the American Society of Civil Engineers:

The total construction cost of the project with interest during construction is estimated at----	\$217,115,000
The average cost of water for a 40-year period is estimated at -----	\$26.56 per acre-foot
Average cost for 100-year period, estimated at---	21.88 per acre-foot
Average perpetual cost, estimated at-----	21.60 per acre-foot

The tunnels will be approximately 16 feet 2 inches in diameter. Several power drops are available along the canal sections and it is expected that some revenue will be made available from recaptured

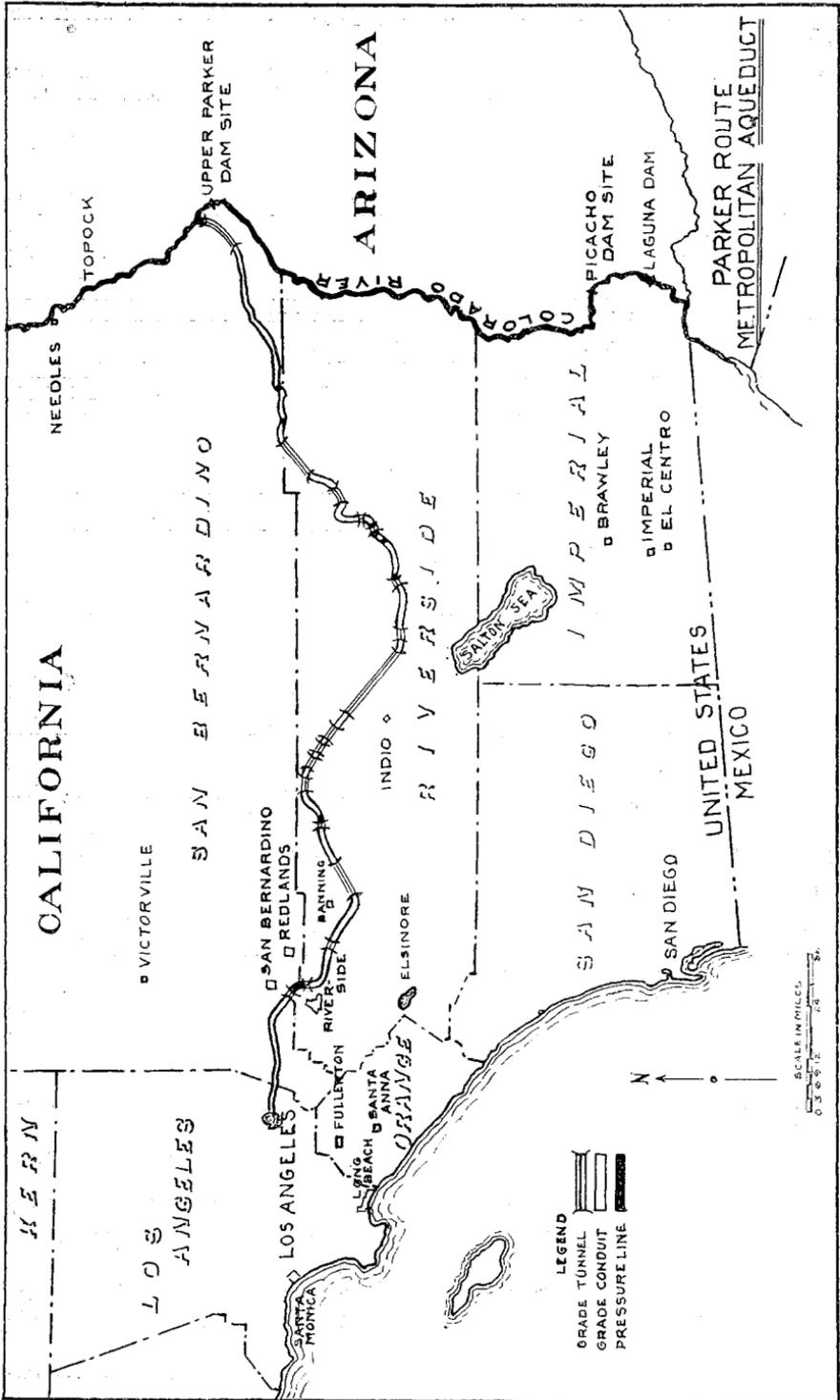


PLATE VII

power due to these drops. The following physical data are given in Mr. Weymouth's article.

Average diversion.....	Second-feet.....	1,500
Estimated seepage and evaporation losses.....	Acre-feet.....	99,245
Net delivery at terminal.....	Acre-feet.....	986,705
Height of diversion dam.....	Feet.....	72
Initial elevation.....	Feet.....	450
Terminal elevation.....	Feet.....	1,000
Number of pumping plants.....		4
Total pump lift.....	Feet.....	1,523
Number of return power plants.....		1
Total power drop.....	Feet.....	406
Power chargeable to diversion from B. C. reservoir.....	Kilowatts.....	0
Power in water for hydraulic units.....	Kilowatts.....	0
Electric power required for pumping.....	Kilowatts.....	291,040
Total power required for pumping.....	Kilowatts.....	291,040
Power produced at point of diversion-Hyd.....	Kilowatts.....	0
Power produced at point of diversion-Elec.....	Kilowatts.....	29,100
Return power produced.....	Kilowatts.....	38,430
Total power produced.....	Kilowatts.....	67,530
Open canal (lined or unlined).....	Miles.....	74.12
Closed surface conduit.....	Miles.....	80.26
Pressure tunnel.....	Miles.....	2.20
Grade tunnel with shafts.....	Miles.....	22.65
Grade tunnel without shafts.....	Miles.....	67.75
Steel delivery lines.....	Miles.....	1.36
Steel penstocks.....	Miles.....	0.60
Steel siphons.....	Miles.....	0.51
Concrete pipe lines.....	Miles.....	15.91
Total, all tunnels.....	Miles.....	92.60
Total, all pipe lines.....	Miles.....	18.38
Total, length of aqueduct.....	Miles.....	265.36
Longest tunnel.....	Miles.....	12.95
Second longest tunnel.....	Miles.....	9.70
Greatest distance between shafts.....	Miles.....	5.02
Number of shafts.....		4
Deepest shaft.....	Feet.....	1,430
Second deepest shaft.....	Feet.....	615
Total depth of shafts.....	Feet.....	2,860
Transmission line, 220 K. V.....	Circuit-miles.....	424
Transmission line, 66 K. V.....	Circuit-miles.....	14
Years to construct.....		6

The Metropolitan District has signed two contracts with the Secretary of the Interior; one is a contract for the delivery of water dated April 24, 1930, under which the United States (Sec. 6 of contract) "shall deliver to the district each year from the Boulder Canyon reservoir at a point in the Colorado River, immediately below Boulder Canyon Dam, or as provided in Article X hereof, up to but not to exceed 1,050,000 acre-feet of water."

For this water the district agrees to pay 25 cents per acre-foot "during the Boulder Dam cost repayment period." Provision is also made in the contract that if the water is diverted above the dam then the district shall pay an additional amount to the government to recom-

pense for the loss of power due to the water being so diverted above the dam.

The district has also entered into a contract, April 26, 1930 (amended May 31, 1930), for electrical energy for an amount of energy equal to 36 per cent of the total firm energy plus all secondary energy that the district may desire to use. For the firm energy the district is to pay 1.63 mills per kilowatt hour and for the secondary energy .5 mills per kilowatt hour. This price is a charge for falling water and the actual generation of the energy will be affected by the City of Los Angeles operating through its Bureau of Power and Light.

At present the Metropolitan District is made up of the following cities:

Los Angeles	San Marino
Santa Monica	San Bernardino
Beverly Hills	Colton
Pasadena	Glendale
Santa Ana	Burbank
Anaheim	

San Diego Water.

San Diego, through its hydraulic engineer, Mr. H. N. Savage, made preliminary investigations of two possibilities of bringing Colorado River water to that city. One was by joining with the Metropolitan District, and the second was by bringing the water into the city through an independent line connecting with Imperial Valley. As San Diego would be some 100 miles from the main line of the Metropolitan aqueduct the more economical method appeared to be to bring water for San Diego through an independent line connected up with Imperial Valley.

Plate VIII shows the contemplated route of an aqueduct from the Imperial Valley to San Diego. Mr. Savage's investigations pointed out that this latter method of bringing in water to San Diego had the very great advantage of permitting a gradual development as the water demand increased.

Application has been made to the Secretary of the Interior for 155 cubic feet of water per second from the Colorado River and sufficient electrical energy from the Colorado River development to pump this water through the aqueduct contemplated.

The development suggested by Mr. Savage contemplates the construction of tunnels to lessen the pump head when the demand for water is sufficient to warrant this additional expenditure.

The following extract is given from the hearings of the Subcommittee of the House Committee on appropriations on the Second Deficiency Appropriation Bill for 1930, page 961. The statement was made by Mr. Ely, Executive Assistant to the Secretary of the Interior who had represented the Secretary in the drawing up of the contract with the Metropolitan District for water and the contracts with the District and with others for power. The statement of Mr. Ely was made in reply to a question of one of the members of the committee as to whether there had been any denial of water because of the Metropolitan Water District contract.

"Mr. Ely. No, sir; no denial of an application for a contract for water. You realize, of course, that because of the conflicting views of Arizona and California as to their comparative water rights in the river, that that question may some time arise, but to date there has been no conflict in applications made to us.

"I may say that the only other definite application for a water contract with which I am familiar is an application by the city of San Diego; and while I was in Los Angeles I held conferences with the San Diego people, and there is no conflict between this water contract and the San Diego application, which is the only other application for a water contract.

"Mr. Cramton. If San Diego were to use the water, where would they get it?

"Mr. Ely. They are not yet certain. There are two possibilities.

"Mr. Cramton. They would not think of bringing it from this point where the metropolitan district proposes to take it?

"Mr. Ely. Only if they joined the metropolitan water district as a member city. Otherwise they would probably take it either by an aqueduct running directly to the Colorado River at some place in southern California, or by pumping it from some place in Imperial Valley. That is my understanding.

"Mr. Cramton. And if they did take it as a constituent member of the metropolitan water district—how far is it from Los Angeles to San Diego?

"Mr. Ely. The length of the branch aqueduct which would be required—and which, of course, would divert not at Los Angeles, but in the mountains—would run from 90 miles to considerably over a hundred, depending on which of the routes the metropolitan water district adopts; and the right of way would run through some very valuable farm country. That has been one important element in San Diego's consideration of the question."

That San Diego is considered as having made a definite application for water is also shown by Series of Questions and Answers issued by the Bureau of Reclamation in connection with the Boulder Canyon Project. This was issued October 30, 1930. The following is an extract from page 8 of the mimeographed document.

"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.

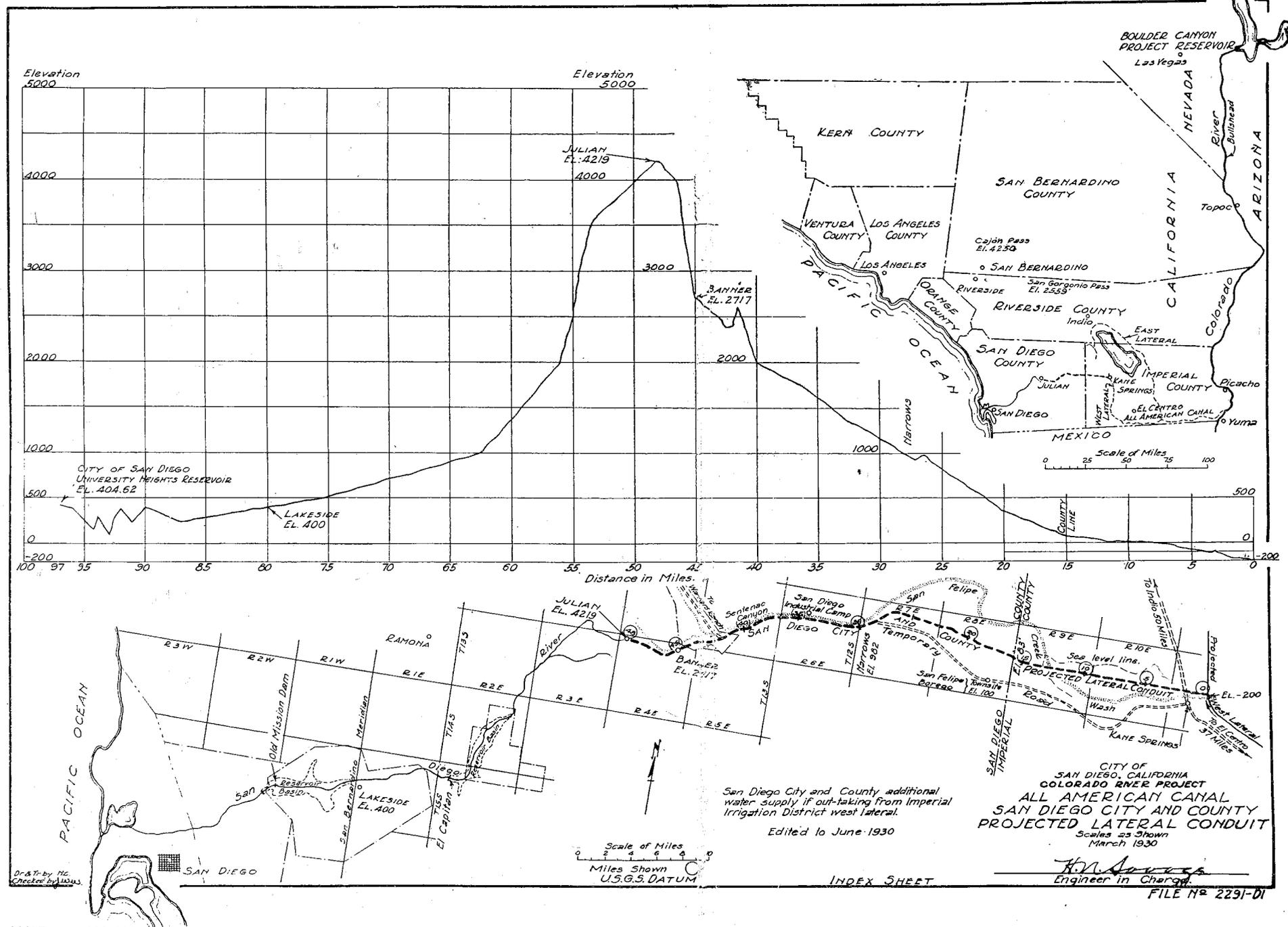
"Q. How much water is San Diego asking for?

"A. 155 cubic feet of water per second, together with the necessary energy to lift this water and deliver it to the coastal plain in San Diego county. The pumping lift is over 4000 feet."

California Water Agreement Between Agricultural Groups and Metropolitan District.

Considerable fear has been felt by the various interests in California that the State might be forced into a water agreement that would unreasonably limit development. There has been considerable feeling between the agricultural interests and those desiring water for domestic use in the Coastal Plain cities. The feeling has been that if sufficient water were used by the agricultural interests to develop to their full capacity, the Coastal Plain cities would be deprived of domestic water. On the other hand the agricultural interests have felt that if Coastal Plain cities were given all the domestic water asked for, there would be a shortage of water for agricultural purposes which would prevent the development of areas otherwise capable of agricultural use.

Driven by the fear outlined above several conferences have been held between various interests and as the outcome of these conferences various agreements have been drawn up. The first of these agreements was one dated February 21, 1930, a facsimile of which is appended to



this section. This agreement was afterwards ratified by various resolutions of the interested parties and copies of these resolutions follow the agreement.

Briefly this agreement was based upon the limitation that California has accepted under the Boulder Canyon Project Act, *i. e.*, that California's use should be limited to 4,400,000 acre-feet of so-called Class A, or firm title water, plus one-half of the surplus water. Under the terms of this agreement water was to be divided as follows (the signatures to this agreement do not represent all possible California users) :

"Class A Water—

Agricultural groups.....	3,850,000 acre-feet per annum
Metropolitan Water District.....	550,000 acre-feet per annum
 Total	 4,400,000 acre-feet per annum
Next 550,000 acre-feet per annum available for California use	
Metropolitan Water District.....	550,000 acre-feet per annum

All water in the river available for California's use in excess of above 4,950,000 acre-feet per annum—Agricultural group all."

Later in 1930 another agreement was drawn up between these interests, at Los Angeles. A copy of this agreement is also appended to this section. This agreement was dated June 21, but was drawn up at a conference between the various interests earlier in the month, about June 6.

Still later, November 14, 1930, a further agreement or understanding was entered into. A conference was being held in Los Angeles between the Metropolitan Water District and the various agricultural interests in an effort to obtain a modification of the water contract between the Department of the Interior and the Metropolitan District in order to make effective the agreements of February 21 and June 21, by having a recognition of these agreements written into the Metropolitan Water District's contracts. At the Los Angeles meeting a committee of attorneys was appointed to determine the language to be used in modifying the contract between the Federal Government and the Metropolitan Water District. This special committee reported back to the conference and their report was accepted. This report of the committee was then signed by the directors of the various interests represented at the conference, the understanding being that by so signing the report of the committee the committee report became in effect an agreement and the directors of the various boards present thus pledged themselves to the adoption by their various boards of the subject matter contained in the report. A copy of this accepted report is given at the end of this section.

Following are the names of the signers of the agreement in the order in which they appear, with the official status of each of the signers:

Wm. J. Carr, Member of Railroad Commission, State of California.

H. L. Carnahan, Lieutenant Governor, Chairman of meeting and special representative of Governor Young.

John L. Bacon, Chairman of California-Colorado River Commission and President of Boulder Dam Association.

W. B. Mathews, Attorney for Metropolitan Water District of Southern California, Member, Colorado River Commission.

Earl C. Pound, President, Imperial Irrigation District, Member, Colorado River Commission.

S. C. Evans, Executive Director, Boulder Dam Association.

W. P. Whitsett, Chairman, Board of Directors, Metropolitan Water District of Southern California.

Harry L. Heffner, Member Board of Directors, Metropolitan Water District of Southern California.

F. E. Weymouth, Chief Engineer of Metropolitan Water District of Southern California.

L. A. Hauser, Director, Palo Verde Irrigation District.

John G. Bullock, Member of Board of Directors, Metropolitan Water District of Southern California.

Franklin Thomas, Member of Board of Directors, Metropolitan Water District of Southern California.

S. H. Finley, Member of Board of Directors and Secretary, Metropolitan Water District of Southern California.

W. O. Blair, Member Board of Directors, Imperial Irrigation District.

R. W. Blackburn, President of Coachella Valley County Water District.

Thos. C. Yager, Attorney for Coachella Valley County Water District.

Mark Rose, Member Board of Directors, Imperial Irrigation District.

M. J. Dowd, Chief Engineer, Imperial Irrigation District.

Chas. L. Childers, Attorney for Imperial Irrigation District.

This agreement, drawn February 21, 1930, was afterward ratified by resolutions adopted by the boards of directors of the various districts. Copies of the resolutions adopting this agreement are printed below.

RESOLUTION No. 36

WHEREAS, Representatives of The Metropolitan Water District of Southern California, the Imperial Irrigation District, and Coachella Valley County Water District, and the Palo Verde Irrigation District, met at Los Angeles, on the 21st day of February, 1930, and agreed, in which agreement the Colorado River Commissioners of California and representatives of the Governor of California concurred, that the water of the Colorado River to which California, its inhabitants, agencies, and owners of land situate within said state now have the title or right to use and that which they or any of them may hereafter acquire title or right to use (hereinafter referred to as the title or right of California) under the Colorado River Compact, the Boulder Canyon Project Act and the Act of the Legislature of California, approved March 21, 1929, should be apportioned as follows:

1. To Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District and the lands of the Yuma Project in California (without any intent hereby to apportion the same between themselves) the first and primary right to 3,850,000 acre-feet per annum of the water apportioned to the lower basin by paragraph A of Article III of the Colorado River Compact.

2. To The Metropolitan Water District of Southern California, the remaining 550,000 acre-feet of water per annum of the water apportioned to the lower basin

by paragraph A of Article III of the Colorado River Compact, and the first 550,000 acre-feet of the remainder of the water of the Colorado River to which California may have or hereafter acquire title or the right to use.

3. To Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District and the lands of the Yuma Project in California and other persons or agencies in California, for agricultural and domestic uses within the Colorado River Basin (without any intent hereby to apportion the same between themselves) the remainder of the water of the Colorado River to which California may have or hereafter acquire title or the right to use; and

WHEREAS, it appears that said agreement is equitable and just and ought to be approved,

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of The Metropolitan Water District of Southern California, that said agreement above in the preamble of this resolution set out is hereby ratified, approved and confirmed; and

BE IT FURTHER RESOLVED, that this District cooperate with the other districts and agencies involved in the presenting said agreement, and other data to all those in authority, to the end that the rights hereby recognized may be confirmed to the respective parties involved; and

BE IT FURTHER RESOLVED, that this resolution shall become effective and binding upon this District when each of the four districts in the preamble above named, including this one, shall have adopted this or a similar resolution.

I HEREBY CERTIFY, that the foregoing resolution was introduced at the meeting of the Board of Directors of The Metropolitan Water District of Southern California held April 25, 1930, and was passed by the said Board of Directors at the meeting held on said 25th day of April, 1930, by the following vote, to-wit:

Ayes:
Total 62 votes.

Noes:
None.

Absent:
Total 22 votes.

I FURTHER CERTIFY, that the foregoing is a full, true and correct copy of said resolution adopted by the Board of Directors of The Metropolitan Water District of Southern California at its meeting held April 25, 1930.

S. H. FINLEY,

Secretary of the Board of Directors of
The Metropolitan Water District of
Southern California.

The Imperial Irrigation District, Coachella Valley County Water District, the Palo Verde Irrigation District each adopted identical resolutions with the exception that the proper name of the district adopting the resolution was inserted in lieu of The Metropolitan Water District of Southern California in the resolution setting out that the agreement given in the preamble was ratified, approved and confirmed. The certificate of adoption of each of these separate districts is given below.

I, the undersigned secretary of the Coachella Valley County Water District, do hereby certify that the foregoing is a true and correct copy of Resolution of said District, introduced and adopted at meeting of said Board held March 26, 1930, and that said Resolution was adopted by the following vote:

Ayes:
Directors: Clary, Metzler, Russel and Sparey.

Noes:
Directors: None.

I further certify that said Resolution was thereupon signed by the president of the Board of Directors of said District.

Attest: MABEL CRAIG, Secretary of said District.

(SEAL)

Certificate

The undersigned, O. W. Malmgren, Assistant Secretary of the Palo Verde Irrigation District, hereby certifies that the above and foregoing resolution was adopted

by a majority vote of the Trustees of the said Palo Verde Irrigation District at the regular monthly meeting of the Board of Trustees held at its regular place of meeting in Blythe, California, at 10 o'clock a.m. on Tuesday, April 8th, 1930; that the foregoing resolution was adopted upon the following vote:

Ayes: David Darling, L. A. Hauser, Tony Seeley, W. G. Shollenberger, L. H. Van Hoorebeke.

Noes: A. E. Pettit, Walter Scott.

Absent: None.

Dated at Blythe, California, this fourteenth day of April, 1930.

(SEAL)

O. W. MALMGREN,

Assistant Secretary of Palo Verde Irrigation District.

IMPERIAL IRRIGATION DISTRICT }
 OFFICE OF SECRETARY }
 }ss

THIS IS TO CERTIFY that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of the said District at its regular adjourned meeting on Tuesday, April 22, 1930.

IN WITNESS WHEREOF I have hereunto set my hand and the SEAL of said District this 22d day of April, 1930.

(SEAL)

F. H. McIVER, Secretary.

After the adoption of the resolutions authorizing the acceptance of the agreement of February 21, 1930, some discussion arose regarding the interpretation and the conditions laid down in the agreement. Early in June, 1930, further meetings were held between representatives of the Agricultural Group and The Metropolitan Water District and a second agreement was drawn up which was signed June 21, 1930. This agreement was as follows:

THIS AGREEMENT made and entered into this 21st day of June, 1930, by and between representatives of The Metropolitan Water District of Southern California, first party, and Imperial Irrigation District, Coachella Valley County Water District and Palo Verde Irrigation District, hereinafter sometimes referred to as the Agricultural Group, second parties,

WITNESSETH:

WHEREAS, the said parties did heretofore enter into an Agreement, dated February 21, 1930; and

WHEREAS, said Agreement was approved by Resolution No. 36, passed by the first party and by similar resolutions passed by each of the second parties; and

WHEREAS, it is the intent of the parties hereto to provide hereby for the ratification and approval of said agreement and said resolution with certain added agreements as hereinafter contained,

NOW, THEREFORE, first party does hereby agree to reaffirm and abide by said Resolution No. 36, heretofore adopted by said first party and said agreement of February 21, 1930.

First party further covenants and agrees to ask the Secretary of the Interior of the United States of America to incorporate in the water contract between the United States of America and The Metropolitan Water District of Southern California, dated April 24, 1930, the following additions, to-wit:

By inserting in paragraph 6, page 3, line 14, after the words, "Flood Control," the following language:

"and/or rights of other parties which the District has recognized or may recognize by contract with others than the United States (including that certain agreement with the Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District (made for the benefit also of lands of the Yuma Project in California) made on the 21st day of February, 1930, as embodied in and approved by resolution No. 36 of the Board of Directors of The Metropolitan Water District, adopted April 25th, 1930)."

And also inserting in paragraph 6, following the words "Colorado River Compact," line 21, page 3, the following language:

"IT IS AGREED that the United States does not by anything contained in this instrument become bound by or a party to the aforesaid agreement of February 21st, 1930, or any other contract or contracts between the District and others than the United States, but, nevertheless, the Secretary reserves the right to make any disposition of the water to which the District thereby has relinquished or may relinquish claim."

And also by inserting in said water contract a provision granting to said first party the right to accumulative storage of water in the Boulder Canyon Reservoir out of The Metropolitan Water District's allocation, not exceeding at any one time a total of five million (5,000,000) acre-feet which the said first party shall have the right to store in said reservoir and the exclusive right to withdraw as needed.

The second parties do each hereby mutually covenant and agree that they will support and abide by, in all particulars, the said agreement of February 21, 1930, and the said resolutions approving and interpreting the same, said resolutions being similar in form to resolution No. 36, of first party, and that they will limit their claims to water rights as against The Metropolitan Water District of Southern California to such limitations as are set up by said resolution No. 36 of The Metropolitan Water District of Southern California and the similar resolutions by the second parties.

The second parties hereby further mutually covenant and agree that they will immediately withdraw the protests which any of said second parties may have heretofore filed with the Division of Water Rights of the State of California against the filing of the City of Los Angeles and/or The Metropolitan Water District of Southern California for water from the Colorado River upon the proviso that said combined filings shall not be allowed for any amount in excess of one million one hundred thousand (1,100,000) acre-feet per annum and with the further proviso that any such permit or permits be issued in accordance with and subject to the said agreement of February 21, 1930, the said resolution No. 36 of first party and this agreement.

Each and all of the second parties do hereby further covenant and agree not to file any further protest or protests and not to oppose the said water filing of the City of Los Angeles and/or said The Metropolitan Water District of Southern California subject to the foregoing provisos.

The second parties do hereby further mutually covenant and agree that they will immediately request the Secretary of the Interior of the United States of America to amend the said water contract between the United States of America and said The Metropolitan Water District of Southern California, dated April 24, 1930, so as to grant to first party the right to accumulative storage of water in the Boulder Canyon Reservoir out of The Metropolitan Water District's allocation, not exceeding at any one time a total of five million (5,000,000) acre-feet which the said first party shall have the right to store in said reservoir and the exclusive right to withdraw as needed; and second parties do hereby mutually covenant and agree that so far as their rights are concerned first party shall have the full right to said accumulative storage in said Boulder Canyon Reservoir, and the exclusive right to withdraw any water so stored as first party may require.

The parties hereto do hereby agree that it is the intention of the parties hereafter to amplify or replace this agreement by a fuller and more detailed contract but that until such instrument has been entered into and executed by all of the parties hereto this instrument shall be in full force and effect and binding upon all of the parties hereto.

In Witness Whereof, the said first and second parties have caused this agreement to be executed by their respective officers thereunto duly authorized, the day and year first above written. Executed in quadruplicate original.

THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA.

By W. P. Whitsett,
Chairman of the Board of Directors.

Approved as to form: Chas. C. Cooper, Jr., Assistant General Counsel.

(SEAL)

Attest: Paul E. Schwab, Assistant Secretary of the Board of Directors.

IMPERIAL IRRIGATION DISTRICT.

By Ira Aten,
President pro tem of the Board of Directors.

Attest: F. H. McIver, Secretary of the Board of Directors.

(SEAL)

COACHELLA VALLEY COUNTY WATER DISTRICT.

By R. W. Blackburn, President.

Attest: W. P. Britton, Secretary.

(SEAL)

PALO VERDE IRRIGATION DISTRICT.

By Tony Seeley, Its President.

Attest: O. W. Malmgren, Its Assistant Secretary.

(SEAL)

This agreement was drawn early in June of 1930 and was formally signed by the authorized representatives of the four districts June 21, 1930. Resolutions accepting the agreement and authorizing its signing by the officials of the various districts were adopted by these districts prior to June 21, 1930. The text of the resolutions authorizing the accepting and signing of the agreement are given herewith.

RESOLUTION No. 46.

WHEREAS, The Metropolitan Water District of Southern California, the Imperial Irrigation District, the Coachella Valley County Water District and the Palo Verde Irrigation District did on February 21, 1930, negotiate an agreement of settlement of water rights in the Colorado River; and

WHEREAS, it was intended by Resolution No. 36, passed by the Board of Directors of said The Metropolitan Water District of Southern California, to express and approve said agreement of settlement of February 21, 1930; and

WHEREAS, draft of proposed contract between the aforesaid Districts, providing for the ratification and approval of said agreement of February 21, 1930, and of said Resolution No. 36, with certain added agreements as set forth in said proposed contract, has been presented to the Board of Directors of said The Metropolitan Water District of Southern California at its meeting held this 7th day of June, 1930, which said draft of proposed contract has been ordered filed by said Board of Directors;

NOW, THEREFORE, BE IT RESOLVED, that The Metropolitan Water District of Southern California, as first party, shall enter into a contract with said Imperial Irrigation District, Coachella Valley County Water District and Palo Verde Irrigation District, as second parties, providing for the ratification and approval of the aforesaid agreement of settlement of water rights in the Colorado River dated February 21, 1930, and of said Resolution No. 36, with certain added agreements, the said contract so to be entered into by said The Metropolitan Water District of Southern California to conform to the aforesaid draft presented to the Board of Directors of said District and filed by order of said Board of Directors under date of June 7, 1930; *provided*, that said contract before execution by said District shall be approved as to form by the General Counsel or the Assistant General Counsel; and

BE IT FURTHER RESOLVED, that the Chairman of the Board of Directors, and the Vice Chairman of the Board of Directors, or either of them, be, and they hereby are, authorized and directed to sign and execute said contract on behalf of said District, and that the Secretary of the Board of Directors, and the Assistant Secretary of the Board of Directors, or either of them, be, and they hereby are, authorized and directed to attest the execution of said contract and to affix the corporate seal of said District thereto.

I HEREBY CERTIFY, that the foregoing resolution was introduced at a meeting of the Board of Directors of The Metropolitan Water District of Southern Cali-

ifornia, held June 7, 1930, and was passed by said Board of Directors at said meeting held on said 7th day of June, 1930, by the following vote, to-wit:

Ayes:

Los Angeles—Bullock	
Johnson	
Richards	
Whitsett	42 votes
Pasadena—Thomas	12 votes
San Marino—Heffner	1 vote
Total	55 votes

Noes:

Beverly Hills—Schwab	6 votes
Total	6 votes

Absent:

Anaheim—Steward	1 vote
Burbank—Bruce	3 votes
Colton—Hutchinson	1 vote
Glendale—Fox	8 votes
San Bernardino—Harris	2 votes
Santa Ana—Finley	2 votes
Santa Monica—Hutton	6 votes
Director Honnold of Los Angeles	— votes
Total	23 votes

I FURTHER CERTIFY, that the foregoing is a full, true and correct copy of said resolution of the Board of Directors of The Metropolitan Water District of Southern California adopted at its said meeting held June 7, 1930.

(SEAL)

Paul E. Schwab,

Assistant Secretary of the Board of Directors
of The Metropolitan Water District of Southern California.

ORDINANCE No. 453

Coachella Valley County Water District Resolution

WHEREAS, an agreement has been reached as to water rights on the Colorado River between representatives of The Metropolitan Water District of Southern California, on one hand and the Imperial Irrigation District, Coachella Valley County Water District and the Palo Verde Irrigation District, on the other hand, and

WHEREAS, the other parties to said agreement have, or are about to execute a contract embodying said agreement, and

WHEREAS, the Board of Directors of the Coachella Valley County Water District find it is to the best interests of said district and to the tax payers thereof that said contract be executed by said Coachella Valley County Water District,

NOW, THEREFORE, BE IT ORDAINED BY THE BOARD OF DIRECTORS OF THE COACHELLA VALLEY COUNTY WATER DISTRICT, that the President and Secretary of the said Board of Directors of the Coachella Valley County Water District be and they are hereby authorized and directed to execute on behalf of the said Coachella Valley County Water District that certain contract, dated June __, 1930, in words and figures as follows, to wit:

"THIS AGREEMENT made and entered into this _____ day of June, 1930, by and between representatives of The Metropolitan Water District of Southern California, first party, and Imperial Irrigation District, Coachella Valley County Water District and Palo Verde Irrigation District, hereinafter sometimes referred to as the Agricultural Group, second parties,

Witnesseth:

WHEREAS, the said parties did heretofore enter into an agreement, dated February 21, 1930; and

WHEREAS, said Agreement was approved by Resolution No. 36, passed by the first party and by similar resolutions passed by each of the second parties; and

WHEREAS, it is the intent of the parties hereto to provide hereby for the ratification and approval of said agreement and said resolution with certain added agreements as hereinafter contained.

NOW, THEREFORE, first party does hereby agree to reaffirm and abide by said Resolution No. 36, heretofore adopted by said first party and said agreement of February 21, 1930.

First party further covenants and agrees to ask the Secretary of the Interior of the United States of America to incorporate in the water contract between the United States of America and The Metropolitan Water District of Southern California, dated April 24, 1930, the following addition, to-wit:

By inserting in paragraph 6, page 3, line 14, after the words "Flood control," the following language:

"and/or rights of other parties which the District has recognized or may recognize by contract with others than the United States (including that certain agreement with the Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District (made for the benefit also of lands of the Yuma Project in California) made on the 21st day of February, 1930, as embodied in and approved by resolution No. 36 of the Board of Directors of The Metropolitan Water District, adopted April 25th, 1930)."

And also inserting in paragraph 6, following the words "Colorado River Compact," line 21, page 3, the following language:

"IT IS AGREED that the United States does not by anything contained in this instrument become bound by or a party to the aforesaid agreement of February 21st, 1930, or any other contract or contracts, between the District and others than the United States, but nevertheless, the Secretary reserves the right to make any disposition of the water to which the District hereby has relinquished or may relinquish claim."

And also by inserting in said water contract a provision granting to said first party the right to accumulative storage of water in the Boulder Canyon Reservoir out of The Metropolitan Water District's allocation, not exceeding at any one time a total of five million (5,000,000) acre-feet which the said first party shall have the right to store in said reservoir and the exclusive right to withdraw as needed.

The second parties do each hereby mutually covenant and agree that they will support and abide by, in all particulars, the said agreement of February 21, 1930, and the said resolutions approving and interpreting the same, said resolutions being similar in form to resolution No. 36, of first party, and that they will limit their claims to water rights as against The Metropolitan Water District of Southern California to such limitations as are set up by said resolution No. 36 of The Metropolitan Water District of Southern California and the similar resolutions by the second parties.

The second parties hereby further mutually covenant and agree that they will immediately withdraw the protests which any of said second parties may have heretofore filed with the Division of Water Rights of the State of California against the filing of the City of Los Angeles and/or The Metropolitan Water District of Southern California for water from the Colorado River upon the proviso that said combined filings shall not be allowed for any amount in excess of one million one hundred thousand (1,100,000) acre-feet per annum and with the further proviso that any such permit or permits be issued in accordance with and subject to the said agreement of February 21, 1930, the said resolution No. 36 of first party and this agreement.

Each and all of the second parties do hereby further covenant and agree not to file any further protest or protests and not to oppose the said water filing of the City of Los Angeles and/or said The Metropolitan Water District of Southern California subject to the foregoing provisos.

The second parties do hereby further mutually covenant and agree that they will immediately request the Secretary of the Interior of the United States of America to amend the said water contract between the United States of America and said The Metropolitan Water District of Southern California, dated April 24, 1930, so as to grant to first party the right to accumulative storage of water in the Boulder Canyon Reservoir out of The Metropolitan Water District's allocation, not exceeding at any one time a total of five million (5,000,000) acre-feet which the said first party shall have the right to store in said reservoir and the exclusive right to with-

draw as needed; and second parties do hereby mutually covenant and agree that so far as their rights are concerned first party shall have the full right to said accumulative storage in said Boulder Canyon Reservoir, and the exclusive right to withdraw any water so stored as first party may require.

The parties hereto do hereby agree that it is the intention of the parties hereafter to amplify or replace this agreement by a fuller and more detailed contract but that until such instrument has been entered into and executed by all of the parties hereto this instrument shall be in full force and effect and binding upon all of the parties hereto.

IN WITNESS WHEREOF, the said first and second parties have caused this agreement to be executed by their respective officers thereunto duly authorized, the day and year first above written. Executed in quadruplicate original.

COACHELLA VALLEY COUNTY WATER DISTRICT }
OFFICE OF SECRETARY } ss

This is to certify that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of the Coachella Valley County Water District at its regular meeting on Monday, June 9, 1930.

IN WITNESS WHEREOF, I have hereunto set my hand and SEAL of said District this 16th day of June, 1930.

[SEAL]

W. P. Britton, Secretary.

PALO VERDE IRRIGATION DISTRICT

Resolution

WHEREAS, an agreement has been reached as to water rights on the Colorado River between representatives of the Metropolitan Water District of Southern California, on one hand and the Imperial Irrigation District, Coachella Valley County Water District and the Palo Verde Irrigation District, on the other hand, and

WHEREAS, the other parties to said agreement have, or are about to execute a contract embodying said agreement, and

WHEREAS, the Board of Trustees of said Palo Verde Irrigation District find and do hereby declare that it is to the best interest of said District and the assessment payers thereof that said contract be executed by said Palo Verde Irrigation District,

NOW, THEREFORE, IT IS HEREBY RESOLVED by the Board of Trustees of said Palo Verde Irrigation District that the President and Secretary or the President and Assistant Secretary of the Board of Trustees of said Palo Verde Irrigation District be, and they are hereby, authorized and directed to execute on behalf of said Palo Verde Irrigation District that certain contract dated June ---, 1930, in words and figures as follows, to-wit:

* * * * *
(Agreement signed June 21, 1930, and as set out in Ordinance 453 of Coachella Valley County Water District embodied at this point.)
* * * * *

PALO VERDE IRRIGATION DISTRICT }
OFFICE OF SECRETARY } ss

I, O. W. Malmgren, Assistant Secretary of the Board of Trustees of Palo Verde Irrigation District, do hereby certify that I am authorized by resolution of said Board of Trustees to do and perform all acts that may be done by the Secretary of said Board.

I do further certify that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Trustees of said Palo Verde Irrigation District at its regular meeting held on June 10, 1930.

IN WITNESS WHEREOF, I have hereunto set my hand and the seal of said District this 21st day of June, 1930.

O. W. Malmgren,
Assistant Secretary of the Board of Trustees
of said Palo Verde Irrigation District.

[SEAL]

IMPERIAL IRRIGATION DISTRICT

Resolution

WHEREAS, an agreement has been reached as to water rights on the Colorado River between representatives of the Metropolitan Water District of Southern California, on one hand and the Imperial Irrigation District, Coachella Valley County Water District and the Palo Verde Irrigation District, on the other hand, and

WHEREAS, the other parties to said agreement have, or about to execute a contract embodying said agreement, and

WHEREAS, the Board of Directors of the Imperial Irrigation District find that it is to the best interest of said district, and the assessment payers thereof, that said contract be executed by said Imperial Irrigation District,

NOW, THEREFORE, BE IT RESOLVED that the President pro tem and Secretary of the Board of Directors of Imperial Irrigation District, be and they are hereby authorized and directed to execute on behalf of the Imperial Irrigation District, that certain contract dated June 21, 1930, and in words and figures as follows, towit:

* * * * *
(Agreement signed June 21, 1930, and as set out in Ordinance 453 of Coachella Valley County Water District embodied at this point.)
* * * * *

IMPERIAL IRRIGATION DISTRICT }
OFFICE OF SECRETARY } ss

This is to certify that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of the said District at its regular adjourned meeting on Monday, June 9, 1930.

IN WITNESS WHEREOF I have hereunto set my hand and the SEAL of said District this 12th day of June, 1930.

[SEAL] F. H. McIVER, Secretary.

THIS AGREEMENT made and entered into this 21st day of June, 1930, by and between representatives of the Metropolitan Water District of Southern California, first party, and Imperial Irrigation District, Coachella Valley County Water District and Palo Verde Irrigation District, hereinafter sometimes referred to as the Agricultural Group, second parties,

Witnesseth:

WHEREAS, the said parties did heretofore enter into an Agreement, dated February 21, 1930; and

WHEREAS, said Agreement was approved by Resolution No. 36, passed by the first party and by similar resolutions passed by each of the second parties; and

WHEREAS, it is the intent of the parties hereto to provide hereby for the ratification and approval of said agreement and said resolution with certain added agreements as hereinafter contained.

NOW, THEREFORE, first party does hereby agree to reaffirm and abide by said Resolution No. 36, heretofore adopted by said first party and said agreement of February 21, 1930.

First party further covenants and agrees to ask the Secretary of the Interior of the United States of America to incorporate in the water contract between the United States of America and The Metropolitan Water District of Southern California, dated April 24, 1930, the following additions, to wit:

By inserting in paragraph 6, page 3, line 14, after the words "Flood Control," the following language:

"and/or rights of other parties which the District has recognized or may recognize by contract with others than the United States (including that certain agreement with Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District (made for the benefit also of lands of the Yuma Project in California) made on the 21st day of February, 1930, as embodied in and approved by Resolution No. 36 of the Board of Directors of the Metropolitan Water District, adopted April 25th, 1930)."

And also inserting in paragraph 6, following the words "Colorado River Compact", line 21, page 3, the following language:

"IT IS AGREED that the United States does not by anything contained in this instrument become bound by or a party to the aforesaid agreement of February 21st, 1930, or any other contract or contracts, between the District and others than the United States, but nevertheless, the Secretary reserves the right to make any disposition of the water to which the District thereby has relinquished or may relinquish claim."

And also by inserting in said water contract a provision granting to said first party the right to accumulative storage of water in the Boulder Canyon Reservoir out of The Metropolitan Water District's allocation, not exceeding at any one time a total of five million (5,000,000) acre-feet which the said first party shall have the right to store in said reservoir and the exclusive right to withdraw as needed.

The second parties do each hereby mutually covenant and agree that they will support and abide by, in all particulars, the said agreement of February 21, 1930, and the said resolutions approving and interpreting the same, said resolutions being similar in form to Resolution No. 36, of the first party, and that they will limit their claims to water rights as against The Metropolitan Water District of Southern California to such limitations as are set up by said Resolution No. 36 of The Metropolitan Water District of Southern California and the similar resolutions by the second parties.

The second parties hereby further mutually covenant and agree that they will immediately withdraw the protests which any of said second parties may have heretofore filed with the Division of Water Rights of the State of California against the filing of the City of Los Angeles and/or The Metropolitan Water District of Southern California for water from the Colorado River upon the proviso that said combined filings shall not be allowed for any amount in excess of one million one hundred thousand (1,100,000) acre-feet per annum and with the further proviso that any such permit or permits be issued in accordance with and subject to the said agreement of February 21, 1930, the said Resolution No. 36 of first party and this agreement.

Each and all of the second parties do hereby further covenant and agree not to file any further protest or protests and not to oppose the said water filing of the City of Los Angeles and/or said The Metropolitan Water District of Southern California subject to the foregoing provisos.

The second parties do hereby further mutually covenant and agree that they will immediately request the Secretary of the Interior of the United States of America to amend the said water contract between the United States of America and said The Metropolitan Water District of Southern California, dated April 24, 1930, so as to grant to first party the right to accumulative storage of water in the Boulder Canyon Reservoir out of The Metropolitan Water District's allocation, not exceeding at any one time a total of five million (5,000,000) acre-feet which the said first party shall have the right to store in said reservoir and the exclusive right to withdraw as needed; and second parties do hereby mutually covenant and agree that so far as their rights are concerned first party shall have the full right to said accumulative storage in said Boulder Canyon Reservoir, and the exclusive right to withdraw any water so stored as first party may require.

The parties hereto do hereby agree that it is the intention of the parties hereafter to amplify or replace this agreement by a fuller and more detailed contract but that until such instrument has been entered into and executed by all of the parties hereto this instrument shall be in full force and effect and binding upon all of the parties hereto.

IN WITNESS WHEREOF, the said first and second parties have caused this agreement to be executed by their respective officers thereunto duly authorized, the day and year first above written. Executed in quadruplicate original.

THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA

By W. P. WHITSETT
Chairman of the Board of Directors

Approved as to form :

CHAS. C. COOPER, Jr.
Assistant General Counsel

Attest:

PAUL E. SCHWAB
Assistant Secretary of the Board of
Directors

IMPERIAL IRRIGATION DISTRICT

By IRA ATEN
President pro tem of the Board of Directors

Attest:

F. H. McIVER
Secretary of the Board of Directors

COACHELLA VALLEY COUNTY WATER DISTRICT

By R. W. BLACKBURN
President

Attest:

W. P. BRITTON
Secretary

PALO VERDE IRRIGATION DISTRICT

By TONY SEELEY
Its President

Attest:

O. W. MALMGREN
Its Secretary

The foregoing agreement was adopted by the parties hereto as follows:

Metropolitan Water District.....	June 7, 1930
Imperial Irrigation District.....	June 9, 1930
Coachella Valley County Water District.....	June 9, 1930
Palo Verde Irrigation District.....	June 10, 1930

RECOMMENDATION FOR CHANGE OF WORDING IN
METROPOLITAN WATER DISTRICT CONTRACT

November 14, 1930.

Your Special Committee recommends that the following language be approved for the purpose of amending the Contract of April 24, 1930, between the United States of America and The Metropolitan Water District of Southern California:

By inserting in paragraph 6, page 3, line 14, after the words "flood control," the following language:

"and/or rights of other parties which the District has recognized or may recognize by contract with others than the United States, including that certain agreement with the Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District (made for the benefit also of lands of the Yuma Project in California) made on the 21st day of February, 1930, as embodied in and approved by resolution No. 36 of the Board of Directors of The Metropolitan Water District, adopted April 25, 1930."

Also, by inserting in paragraph 6, following the words "Colorado River Compact," line 21, page 3, the following language:

"IT IS AGREED that the United States does not by anything contained in this instrument become bound by or a party to the aforesaid agreement of February 21, 1930, or any other contract or contracts between the District and others than the United States, but, nevertheless, the Secretary reserves the right to make any disposition of the water to which the District thereby has relinquished or may relinquish claim."

Also, by inserting in said contract a new paragraph to be designated as paragraph 6½, and to read as follows:

6½—"That subject to the provision of paragraph 6 of this contract, and the rights which the District has recognized in others, the District shall have

the right to accumulative storage of water in the Boulder Canyon Reservoir out of said District's allocation (as in said paragraph 6 defined), not exceeding at any one time a total of five million (5,000,000) acre-feet which the said District shall have the right to store in said reservoir. That said District shall have the full and exclusive right to withdraw said accumulative storage as needed or required by said District. It is specifically understood that the provisions of this paragraph shall in no manner limit or interfere with the United States in the exercise of full and complete control, management, or operation of said Boulder Canyon Reservoir or Dam."

Respectfully submitted.

W. P. Whitsett
W. Turney Fox
Harry L. Heffner
Earl C. Pound
F. H. McIver
W. O. Blair
Robbins Russel
Chester A. Sparey
L. H. Van Hoorebeke
L. A. Hauser
Tony Seeley

Mark Rose
W. B. Mathews
F. E. Weymouth
J. R. Richards
Ira Aten
Chas. L. Childers
Thos. C. Yager
Ben L. Clary
V. E. Metzler
W. G. Schollenberger
A. E. Pettit
J. W. Stewart

COLORADO RIVER PROJECTS

In the following pages data are given relative to projects already developed or projects for which development is possible by using water from the Colorado River.

In many instances very incomplete surveys have been made and it is difficult to form an accurate opinion of the actual land that could be placed under irrigation. In many instances where development has been carried through in the past it has been found that after the project actually took shape that the final surveys would show that the acreage had been underestimated. An example of this kind is the Imperial Irrigation District. This district, lying as it does in the heart of the desert region, originally placed under irrigation only that land easily developed and when the All-American Canal was projected made estimates of the amount of land that could be brought under development. As soil and actual canal surveys were made it was found that considerably more land was capable of irrigation than was at first contemplated.

In order to permit the formation of a fairly accurate opinion of the land capable of irrigation in the various projects, figures are given from several different reports. Where one survey has been entirely replaced by more recent work, references to these preliminary surveys are omitted. The following abbreviations are used in referring to the various reports mentioned.

Weymouth Rpt. Unpublished report dated February, 1924, by F. E. Weymouth, Chief Engineer, Bureau of Reclamation, U. S. Dept. of the Interior.

Sen. Doc. 142. Senate Document 142, 67th Congress, 2d Session, entitled "Problems of Imperial Valley and vicinity." A report rendered February, 1922, by A. P. Davis, director, U. S. Reclamation Service.

Sonderegger Rpt. A report rendered by A. L. Sonderegger, December, 1925, to the Imperial and Coachella valleys on Colorado River water supply and requirements.

W. S. 556. Water Supply Paper 556, by E. C. LaRue, "Water Power and Flood Control of Colorado River below Green River, Utah," U. S. Geological Survey, 1925.

Ariz. Eng. Com. A report rendered by the Arizona Engineering Commission July, 1923, on Arizona land irrigable from the Colorado River. This commission was appointed by the state of Arizona under an act of the legislature.

Dowd Sur. Under this reference the figures are given from surveys made under supervision of M. J. Dowd, Chief Engineer, Imperial Irrigation District, most of the work being done in 1929 and 1930.

Occasional references are given to other sources of information and in each case the authority for such information is quoted.

For general location of the various projects mentioned reference is made to Plate IX.

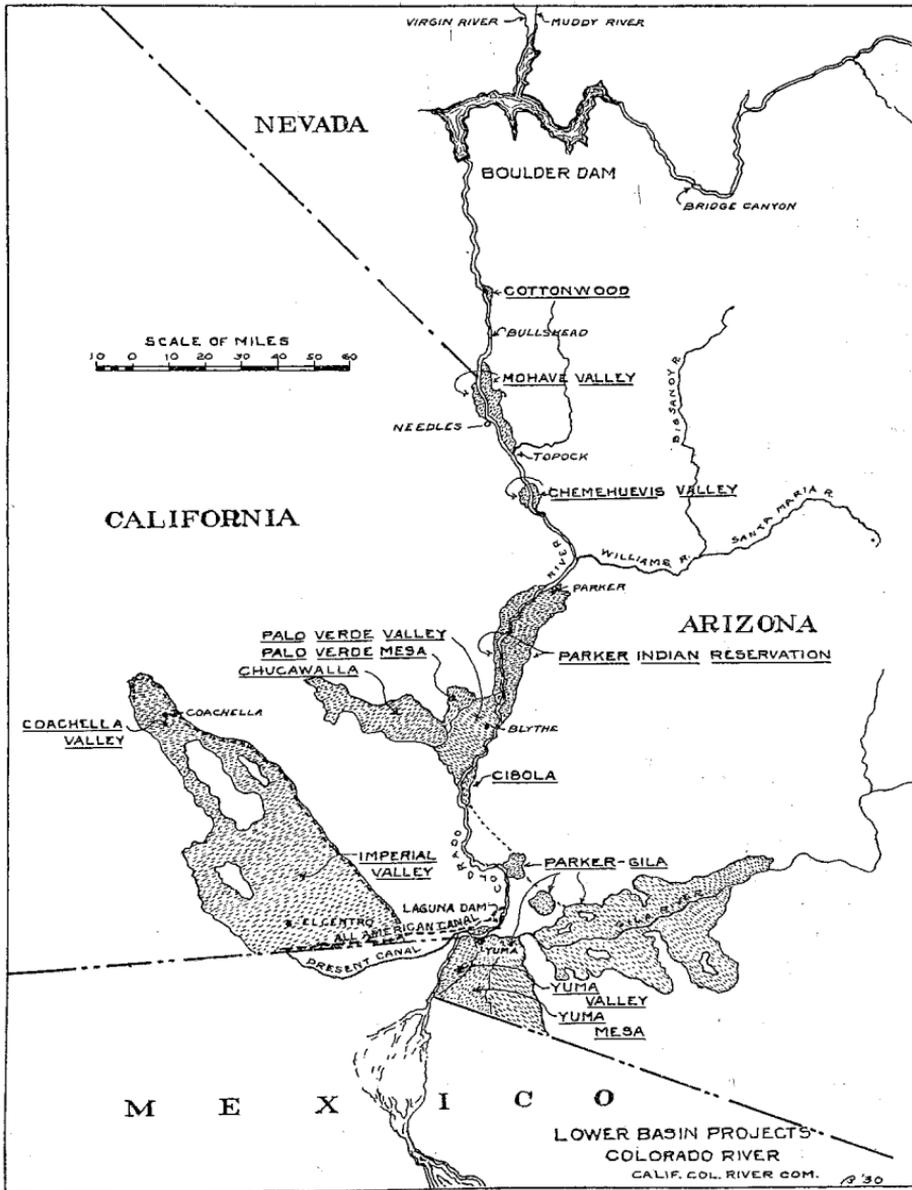


PLATE IX



COLORADO RIVER BASIN

A general map of the Colorado River basin is given in Plate X, showing the boundaries of the entire basin and the boundary line between the upper and lower basins.

In listing the various projects, development of which has been considered in connection with use of Colorado River water, a general division under two headings has been made—California Projects and Arizona Projects. Some projects lie in both states and in such cases the project is listed under the state in which the larger area of the project is located, thus the Yuma Project is described under Arizona Projects although 15,000 acres is in California.

At the end of the section on "Water" the net irrigable areas in both states are compared on an attempted equal basis. Exact surveys have not been made in every case, but by using the figures and estimates available, and giving in each instance the authority for such figures, it is believed that the approximation arrived at is fairly close.

CALIFORNIA PROJECTS

IMPERIAL VALLEY

Imperial Irrigation District

A map showing both the present district and also the areas to be brought under the proposed All-American Canal is given in Plate XI.

The following is from Bulletin 21, Division of Engineering and Irrigation, State of California, 1929, page 334:

Gross area of district.....	605,000 acres
Area assessed in 1927.....	585,000 acres

The following from report Imperial Irrigation District for 1928:

Gross area of district.....	605,000 acres
Irrigable area	515,000 acres
Total water diverted from Colorado River, 1928...	3,271,529 acre-feet
Water delivered to Mexican lands.....	712,255 acre-feet
Water delivered to American lands (based on "gate measurements" which tests show to be 10% low) ..	1,494,831 acre-feet
Maximum monthly diversion (July).....	390,172 acre-feet
Minimum monthly diversion (January).....	141,475 acre-feet
Mexican acreage in cultivation during year 1928...	191,446 acres

The following is from records of Imperial Irrigation District:

Water diverted, 1929.....	3,423,511 acre-feet
Water delivered to American lands.....	1,636,187 acre-feet
Water delivered to Mexican lands.....	615,934 acre-feet
Mexican acreage in cultivation during year 1929...	165,039 acres

The following is from recent surveys made by Imperial Irrigation District and map prepared under supervision of M. J. Dowd, Chief Engineer, 1929. Plate XI taken from this map.

Additional net acreage under All-American Canal—

Gravity	305,920 acres
125 ft. pump lift.....	155,520 acres
150 ft. pump lift.....	22,400 acres
200 ft. pump lift.....	23,040 acres
250 ft. pump lift.....	10,880 acres
400 ft. pump lift.....	7,680 acres
Total	525,440 acres

Coachella Valley lands are included in the above figure as follows:

Gravity	108,000 acres
100 ft. pump lift.....	16,900 acres
200 ft. pump lift.....	9,700 acres
250 ft. pump lift.....	2,500 acres
Total	137,100 acres

Net acreage, exclusive of Coachella Valley lands in Riverside County, 388,340 acres.

The above acreage is determined from a survey which excluded areas which, due to alkali, washes, or other reasons, were termed unsuitable for agricultural purposes. A recent soil survey has been made of this area by the government but the report has as yet not been issued.

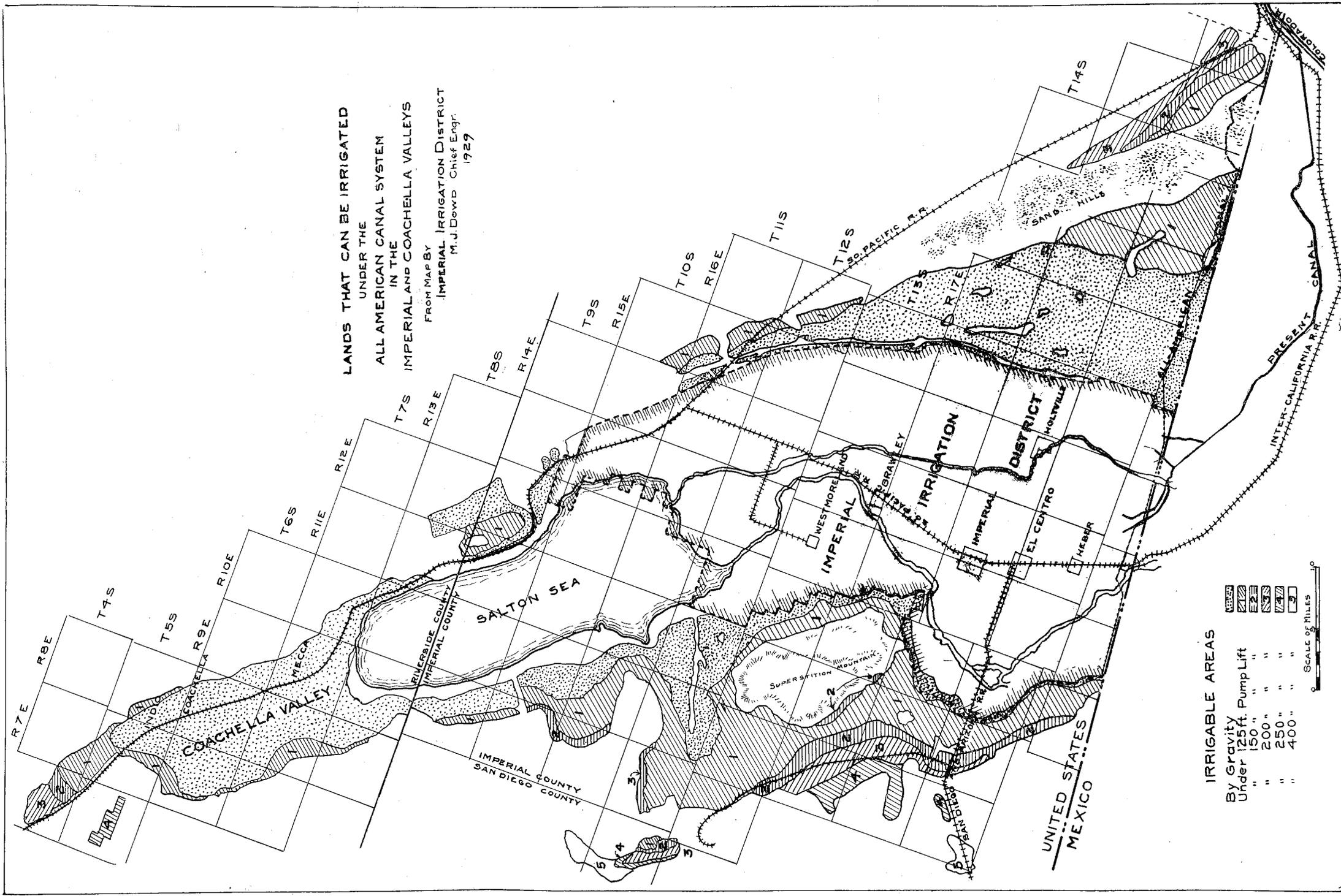
At present, all the water reaching Imperial Valley is brought around through Mexico by a canal following approximately the old river bed of the Alamo River. When the All-American Canal is constructed it is proposed to hook up the present canals in the valley with the new main canal and, in addition, run other canals at a higher elevation around the east and west sides of the valley.

Chronology

The following is a brief record of some of the most important events having to do with the discovery and development of the Imperial Valley.

Many of the dates given are taken from data furnished the Colorado River Commission by the Bureau of Reclamation of the United States Department of the Interior, through the courtesy of the Commissioner of Reclamation, Dr. Elwood Mead.

1782. Foges, Don Pedro. Made the first record trip from the Colorado River to San Diego, Cal.
1828. Flood waters into Salton Sink.
Ref: Colorado River, L. R. Freeman, p. 386.
The Salton Sea by D. T. McDougal, The Carnegie Institute, Washington, 1913.
1840. Flood water in Salton Sink.
Ref: Colorado River, L. R. Freeman, p. 386.
The Salton Sea, D. T. McDougal.
1849. Wozencraft, Dr. O. M. Discovered the key route and conceived the idea of bringing the water to Imperial Valley in a journey across the Sink in spring of 1849. This was later worked out in collaboration with Ebenezer Hadley, Surveyor of San Diego County.
Ref: Heroes of California, Geo. W. James.
Colorado River, L. R. Freeman, p. 386-388.
1849. Flood water in Salton Sink.
Ref: Colorado River, Freeman, p. 386.



LANDS THAT CAN BE IRRIGATED
 UNDER THE
 ALL AMERICAN CANAL SYSTEM
 IN THE
 IMPERIAL AND COACHELLA VALLEYS
 FROM MAP BY
 IMPERIAL IRRIGATION DISTRICT
 M.J. Dowd Chief Engr.
 1929

IRRIGABLE AREAS

By Gravity	Under 125 ft. Pump Lift
"	" 150 "
"	" 200 "
"	" 250 "
"	" 400 "



- 1850-53. Bartlett, J. R. Boundary survey U. S. and Mexico. Explorations of the Colorado desert, Colorado River and country near Yuma, and the facility of irrigation in connection with the surveys of the United States and Mexican Boundary Commission in the states of Texas, New Mexico, California, and in Sonora and Chihuahua.
Ref: Report on the explorations and incidents in Texas, New Mexico, California, Sonora and Chihuahua, connected with the United States and Mexican boundary commission, during years 1850-52. (Gives a resume of early explorations and discoveries of the Colorado, the basin of the Gila, the character of the country and its inhabitants.)
1852. Flood water, Colorado River to Salton Sink.
Ref: Colorado River, L. R. Freeman, p. 386.
1859. Flood waters in Salton Sink.
Ref: Colorado River, L. R. Freeman, p. 386.
1862. Flood water, Salton Sink.
Ref: Colorado River, L. R. Freeman, p. 386.
1867. Flood waters, Colorado River in Salton Sink.
Ref: Colorado River, L. R. Freeman, p. 386.
1876. Bergland, Lieut. Eric. Investigations flood conditions, Lower Colorado. Surveys were confined to portion of river embraced between foot of Lower Grand Canyon and vicinity of Needles, with a view to determining the feasibility of diverting the Colorado River for purposes of irrigation. One of the purposes of this survey was the investigation of an All-American Canal route to irrigate Imperial Valley.
Ref: 1st Reclamation Annual Report, p. 123.
War Dept. Annual Report C. E. 1876-77, V. 2, Pt. 3, p. 329-345, Ex. Doc. 1, Pt. 2; serial No. 1745.
Unpublished report by F. E. Weymouth, Dept. of Interior, Feb., 1924, vol. 3.
1886. Imperial Valley. Dr. Wozencraft's plans for reclaiming Imperial Valley revived by John C. Beatty, who organized the Colorado River Irrigation Co., with C. R. Rockwood as Engineer. Failed, and plans bought by Dr. Heffernan of Los Angeles.
- 1892-93. Rockwood, C. R., Engineer. An engineer sent to the lower Colorado to report on an irrigation scheme in northern Sonora (Mexico). Rockwood on own responsibility made tour along old Alamo River to Salton Sink and visioned this means of irrigating Imperial Valley. Rockwood and his associates organized the Colorado River Irrigation Company in 1892. This company failed and was succeeded in '96 by California Development Company.
Ref: Colorado River, L. R. Freeman, p. 388-389.
Sen. Doc. 142, 67th Cong., 2d Sess., p. 72.
1895. May 16. E. I. Rockwell filed on 10,000 second-feet Colorado River water for Imperial Valley irrigation. Same filing by California Development Company, Dec. 15.
Ref: Sen. Doc. 142, p. 74.
1895. July 15, Nov. 12 and July 14, 1896. W. T. Gonder filed on 10,000 second-feet of Colorado River water for diversion to Imperial Valley.
Ref: Sen. Doc. 142, p. 74.
1895. Sept. 13. W. T. Heffernan filed on 10,000 second-feet Colorado River water.
Ref: Sen. Doc. 142, p. 74.
1896. Imperial Valley. California Development Company organized to develop the Imperial Valley and arrangements made for nine mutual water companies to purchase water at 50 cents an acre-foot, with C. R. Rockwood, promoter of old Colorado River Irrigation Company, in charge of engineering and construction. Mr. A. H. Heber was head of the company.
Ref: Sen. Doc. 142, 67th Cong., 2d Sess. "Problems of Imperial Valley and vicinity," p. 72.
Irrigation Districts in California. Bulletin 21, 1929, State of California, Dept. of Public Works, p. 335.
1896. May 18. W. T. Heffernan filed on 10,000 second-feet Colorado River water.
Ref: Sen. Doc. 142, p. 74.
1897. Jan. 23 and July 24. W. T. Heffernan filed on 10,000 second-feet Colorado River water.
Ref: Sen. Doc. 142, p. 74.
1897. Mar. 27. W. T. Donder filed on 10,000 second-feet Colorado River water. (Sen. Doc. 142, p. 74.)

1898. Dec. 15. California Development Company filed on 10,000 second-feet Colorado River water. (Sen. Doc. 142, p. 74.)
1898. Dec. 21. C. N. Perry for himself and California Development Company filed on 10,000 second-feet Colorado River water. (Sen. Doc. 142, p. 74.)
1899. Jan. 25 and April 25. W. T. Gonder filed on 10,000 second-feet Colorado River water. (Sen. Doc. 142, p. 74.)
1899. Feb. 20 and April 25. C. N. Perry for himself and California Development Company, filed on 10,000 second-feet of Colorado River water. (Sen. Doc. 142, p. 74.)
1900. Chaffey, Geo. Made contract in April, 1900, for construction of Imperial canal for California Development Company, and in May, 1901, water was flowing into Imperial Valley, and in 22 months 400 miles of canal and laterals built. Ref: Heroes of California, Geo. W. James. Colorado River, L. R. Freeman, p. 390.
- 1900-04. Imperial Valley. 1900, construction work begun by California Development Company; in March, 1902, water was turned into the main canal; September, 1904, 700 miles of canal under operation, with 8000 settlers and 75,000 acres cropped.
1902. Irrigation began in Imperial Valley.
- 1903-06. Imperial Valley break. Imperial Valley at this time was receiving its water through a headgate into the Colorado River about 100 yards north of the international boundary line. From this point a canal ran down into Mexico approximately parallel with the river, carrying water to the old channel of the Alamo and thence through Mexico back across the boundary line into the Salton Sink. During 1903 and 1904 there was a water shortage, and headgate was obstructed by silt deposit making it difficult to divert water. A concession was obtained from the Mexican government early in 1904, a dredger cut was made from the river about four miles below the boundary line into the canal. December, 1904, an unusual winter flood came, washing out the temporary diversion works and deflecting the river into the canal. In May and June, 1905, attempts were made to close the break, but failed. In 1906 the break was closed by the Southern Pacific Company. December 7, 1906, the river broke through again, but the break was closed in two months.
Ref: Sen. Doc. 142, 67th Cong., 2d Sess., p. 72.
Report of All-American Canal Board, June 17, 1919, printed 1920, p. 19.
1904. Yuma project. Construction recommended by Board of Engineers April 8, 1904, authorized by Secretary May 10, 1904. First irrigated by Reclamation Service, season of 1907. Laguna Dam completed March, 1909. Colorado River siphon completed June 29, 1912. Gravity water from Laguna Dam to Yuma Valley through siphon June 29, 1912.
Ref: Sen. Doc. 142, 67th Cong., 2d Sess., p. 62.
1904. May 17. Contract between Mexican government and Sociedad de Riego y Terrenos de la Baja California, S. A., permitting building of canal and carrying Colorado River water through Mexican territory for use in Imperial Valley. Signed in Mexico City on May 17, 1904. (Sen. Doc. 142, p. 74.)
- 1905-07. Floods and overflows in Imperial Valley. Break in levees 15 months—about February, 1905, to Nov. 4, 1906, but Dec. 7 flood from Gila broke through again to Feb. 14, 1907. Area of Salton Sea, 285,000 acres. Men who worked on closure of this break were: A. H. Heber, C. R. Rockwood, engineer; F. S. Edinger, a bridge engineer of S. P. R. R.; H. T. Cory, engineer; E. H. Harriman.
Ref: Colorado River, L. R. Freeman, pp. 395-397.
The Story of the First Decade of Imperial Valley, Edgar F. Howe and Wilbur J. Hall (Imperial, 1910).
Geographical Review, April, 1926, v. 16, p. 246, article by Godfrey Sykes on The Delta and Estuary of Colorado.
The Desert Basins of the Colorado Delta, by D. T. McDougal, Bull. Amer. Geogr. Soc., v. 39, pp. 705-729.
A Decade of the Salton Sea, by D. T. McDougal, Geogr. Review, v. 3, 1917, pp. 457-473.
- 1906-07. Flood, Imperial Valley. Oct. 11, 1906, the Colorado broke through again and was closed off Nov. 7, 1906, a flash flood from the Gila came down the river and the levees were again broken, $\frac{3}{4}$ mile south of the November closure and in thirty-six hours the entire river was again flowing through the break. President Roosevelt requested E. H. Harriman to make closure at government

- expense and on Feb. 14, 1907, the break was closed again.
 Ref: The Colorado River, Freeman, pp. 399-400.
1909. Ockerson Levee built. Congress appropriated a million dollars for a levee to confine the Colorado to a reasonably straight channel and the Government built the Ockerson Levee running about parallel with the mesa along the eastern side of the delta. This levee was built in 1909 but the summer floods of 1911 breached it and the river meandered back and forth through the levee destroying about 15 miles of the southern portion. This is now abandoned, only about 10 miles of the northern portion being now maintained.
 Ref: Colorado River, Freeman, p. 403.
 Map, Colorado Delta, Imperial Irrigation District, 1927.
1911. Flood through Ockerson Levee. Fifteen miles of levee destroyed and abandoned. Total length of levee about 25 miles.
 Ref: The Colorado River, Freeman, Chap. IV, pp. 339-358.
 Map, Colorado River Delta, Imperial Irrigation District, 1927.
1911. July 12. Imperial Irrigation District authorized by election.
 July 25. Imperial Irrigation District organized under California state law then known as Wright act, nor part of California Irrigation District Act.
 Ref: Eng. News, March 11, 1915, v. 73, p. 509.
 Annual Report Imperial Irrigation District, 1927, p. 4.
1911. August 15. E. I. Rockwell transferred filing for 10,000 second-feet water to California Development Company.
 Ref: Sen. Doc. 142, p. 74.
1916. Feb. 8. Imperial Valley Irrigation System sold at auction and bought by the Southern Pacific Company for \$3,875,000. The *Irrigation Canal System* of the Imperial Valley, California, was bought at auction on Feb. 8th by the Southern Pacific Company for \$3,875,000. This is a step in the transfer of the property of the California Development Company to the Imperial Irrigation District. It is expected that the transfer will be completed soon. Col. William H. Holabird is receiver, and Chester Allison is chief engineer for the California Development Company, C. R. Rockwood, El Centro, Calif., is chief engineer of the Imperial Irrigation District. The properties of the California Development Company and its subsidiary company, the Compania de Terrenos y Aguas de la Baja California, S. A., were purchased June 22, 1916, by the Imperial Irrigation District from the Southern Pacific Company who had acquired title by foreclosure and receivers sale of Feb. 8, 1916.
 Ref: Eng. News, Feb. 24, 1916, p. 390.
 Annual Report, Imperial Irrigation District, 1923, p. 5.
1916. Aug. 1. Temporary restraining order issued by Superior Court of Yuma County, Arizona, restraining Imperial Irrigation District from building diverting weir in river. (See p. 237.)
1916. Aug. 3. Modified restraining order issued by same court as August 1st order requiring Imperial Irrigation District to post \$100,000 bond conditioned to protect Yuma District and United States against damage and requiring removal of weir upon proper notice. (See p. 237.)
1917. March. Mead, Henny and Jacobs report on irrigation and flood control. Imperial Valley.
1918. Oct. 23. Contract between Interior Department and Imperial Irrigation District providing for an All-American canal connection with Laguna Dam for which the Imperial District agreed to pay \$1,600,000 as share of dam cost, provided also for an All-American Canal survey to Imperial Valley and for proportioning power benefits from hydroelectric plants on canal from Laguna Dam. (See p. 240.)
1919. Apr. 9. Grunsky's report on problems of Lower Colorado River.
1919. June 17. All-American Canal. First bill introduced in Congress by Congressman Kettner authorizing construction of canal.
 Ref: H. R. 6044, 66th Cong., 1st Sess., June 9 to 14, 1919.
1919. August. Dr. Elwood Mead's plan for reclaiming and peopling mesa lands bordering the Imperial Irrigation District. Printed as Agricultural Experiment Station Bulletin of the College of Agriculture, University of California. Six pages. (Headings: Need for a more social land settlement policy; objections to proposed sale of the lands; and settlement should be aided and directed by the government.)
1919. June 17. All-American Canal report issued. Board consisted of Elwood Mead, W. W. Schlecht, C. E. Grunsky. Also report of engineer in charge of surveys and examinations, Porter J. Preston,

- Ref: Report All-American Canal Board, published by Dept. of Interior, 1920.
1919. June 16. Permit issued by War Department permitting Imperial Irrigation District to construct weir in Colorado River upon posting of \$500,000 bond required by agreement with Yuma Association and additional bond of \$25,000 to U. S. guaranteeing proper removal of weir. Permit was required under Act of Congress, March 3, 1899, as affecting a navigable stream (p. 238).
1919. July 5. Agreement between Imperial Irrigation District and Yuma County Water Users' Association by which the Imperial Irrigation District was permitted to construct weir upon posting of \$500,000 and to remove weir within year or upon notice of Yuma Association. This agreement has now developed into a yearly arrangement, the bond being posted each year.
1920. Jan. 7. Second All-American Canal Bill. Bill introduced by Congressman Kettner provided for "canal and necessary works, entirely within the United States, connecting the present irrigation system of the Imperial Irrigation district with Laguna Dam."
Ref: H. R. 11553, 66th Cong., 2d Sess., 1920.
1920. May 18. Congress appropriated money for investigation (41 Stats. 600). This was "Kinkaid Act" appropriating \$20,000 for investigation of irrigable lands in Imperial Valley and instructed that Secretary of Interior render report giving costs and plans, Imperial Valley interests were required to pay at least one-half of cost of investigation. The final report rendered under authority of this act was the Fall-Davis Report. (Sen. Doc. 142, 67th Cong., 2d Sess., 1922.)
Ref: Act of May 18, 1920, 41 U. S. Stat. 600.
1920. Dec. Preliminary report Imperial Valley issued. "Problems of Imperial Valley." Preliminary report made to comply with time limit in Kinkaid Act.
Ref: Sen. Doc. 142, 67th Cong., 2d Sess., p. 236.
1921. May 26. Report on Boulder Canyon Dam, Colorado River, by a Board of Engineers consisting of S. J. Wiley, James Munn, J. L. Savage and W. R. Young. (8 pages.)
1922. Report Imperial Valley issued. This is the "Fall-Davis" report—"Problems of Imperial Valley and vicinity"—issued as Senate Document 142, 67th Congress, 2d Session. This report is sometimes referred to as the "Bible" of the Colorado River and is the report on which subsequent proceedings leading to the construction of the Boulder Canyon Dam were based.
1922. Bill for development Lower Colorado River Basin. First Swing-Johnson bill and first bill to authorize construction Boulder Canyon Dam introduced by Congressman Phil D. Swing, April 25th. This bill was introduced to carry out the recommendations of the Fall-Davis report.
Ref: H. R. 11449, Hearings Committee on Irrigation of Arid Lands, House of Representatives, 67th Cong., 2d Sess. June, 1922.
1922. Construction plans by Ray Carberry and Frank Higley for levees on Lower Colorado to Pescadero Cut.
Ref: Colorado River, Freeman, p. 405-407.
1923. Dec. 10. Bill for development Lower Colorado River Basin. 2d Swing-Johnson bill introduced as H. R. 2903 by Congressman Phil D. Swing of California. Companion bills to the Swing bills were introduced in the Senate by Senator Hiram W. Johnson. The four bills, all of which provided for the construction of Boulder Canyon Dam were introduced in the House by Congressman Phil D. Swing and in the Senate by Senator Hiram W. Johnson. The bills were known as the Swing-Johnson bills on this account. These successive bills were introduced in the 67th, 68th, 69th and 70th Congresses, the reason for the successive introduction of these bills was that all of the bills, with the exception of the one introduced in the 70th Congress, failed to come to a vote in both houses, thus requiring their reintroduction at each successive session of Congress. All of the bills were introduced with the purpose of carrying out the recommendations in Senate Document 142 (Fall-Davis Report).
Ref: Hearings before House Committee on Irrigation and Reclamation on H. R. 2903, 1924.
1924. February. Weymouth, F. E. Report on the Colorado River consisting of nine volumes in manuscript, which had not been printed up to the fall of 1930. (Eight Vols. original and one Supp.) Part of this report was afterward printed in Senate Document 186, 70th Congress, 2d Session.
1926. Feb. 27. Boulder Canyon Project Act. H. R. 9826 introduced February 27th by Congressman Phil D. Swing. Companion bill was introduced in the Senate by Senator Johnson. This was the third bill introduced for the con-

- struction of Boulder Canyon Dam. This later failed to come to a vote in both houses and was succeeded by a similar bill in the 70th Congress which passed. Ref: Hearings, House Committee on Irrigation and Reclamation, 69th Congress, 1st Session, page 1.
1926. Apr. 19. Boulder Canyon Reclamation Project. S. Report 654 in 2 parts, 69th Congress, 1st Session. Part 1. 28 pages; part 2, 88 pages.
1927. Dec. 5-6. Boulder Canyon Project Act. Bill authorizing construction of Boulder Canyon Dam and All-American Canal was introduced in the 70th Congress, December 5, 1927, by Congressman Phil D. Swing as H. R. 5773. A companion bill was introduced in the Senate by Senator Hiram W. Johnson December 6, 1927, as S. 728. This is the bill which finally passed both houses and was approved December 21, 1928, and became the act under which the Boulder Dam construction is authorized. This was the fourth of the Swing-Johnson bills, the preceding bills having died through failure to come to a vote in both houses during the sessions of Congress in which they were introduced.
1929. May 25. Boulder Canyon Project Act, Swing-Johnson bill (H. R. 5773), passed House with amendments. The Senate in the meantime had under consideration the companion bill, S. 728, and had held extensive hearings. Upon the passage by the House of the amended bill and reference to the Senate, the House bill was substituted, December 5, 1928, for S. 728. The Senate then amended the House bill, H. R. 5773, by "striking out all after the enacting clause and inserting in lieu thereof the language of the Senate bill (S. 728)," and further amendments were made on the floor of the Senate. The bill thus amended was passed by the Senate on December 14, 1928. On December 18th the Senate amendment to the bill was taken up in the House and agreed to. The bill, having thus passed congress, was referred to the President of the United States for approval, and President Coolidge approved the bill December 21, 1928.

The following is taken from Bulletin No. 21, Irrigation Districts in California, issued by the Department of Public Works, State of California, 1929, page 334 *et seq.*:

"History: The history of this irrigation district and its predecessor, the California Development Company, constitutes the history of the irrigation development of Imperial Valley.

"In briefly outlining the history of irrigation development in Imperial Valley, it might be said that the first effort to bring water from Colorado River to this desert area was made about the time of the Civil War. At that time Dr. O. M. Wozencraft, as principal promoter, and Ebenezer Hadley, county surveyor of San Diego County, worked out a development and colonization project to be financed largely by the sale of government land which it was proposed should be granted, in the amount of 3,000,000 acres, to the State of California. The legislature of California approved the proposed grant, but it failed to pass Congress.

"Later, in 1876, the Corps of Engineers of the United States Army made a study of the proposal and reported unfavorably upon a canal location entirely within the United States, but, as others had done previously, called attention to the physical feasibility of carrying water from Colorado River into Imperial Valley along the natural drainage line through Mexico. The first important effort to do this was made by C. R. Rockwood and his associates, who, in 1892, organized Colorado River Irrigation Company. A canal was surveyed which would divert water north of the international boundary and carry it south of the boundary to Alamo River, a natural channel draining back into California and finally into Salton Sink, which lies below sea level at the northern end of Imperial Valley.

"Efforts to finance Colorado River Irrigation Company were not successful, and it was succeeded in 1896 by the California Development Company, with Rockwood still in charge of engineering and construction. Between 1896 and 1902 this company laid out the Imperial canal system and began construction. The head of the canal was located at Hanlon's, about 500 feet north of the international boundary, where a wooden head gate, known as the Chaffey head gate, was built. A small amount of water was delivered to lands in Mexico in 1901 and water was made available to Imperial Valley the following year.

"On May 17, 1904, the California Development Company, through a Mexican subsidiary company, known as La Sociedad de Riego y Terrenos de la Baja Cali-

ifornia, was granted the right by the Mexican government to divert 10,000 cubic feet per second (284 cubic meters per second) below the international boundary, or receive that amount diverted in California, and to transport it through Mexican territory. Under the authority thus granted, but without yet having received specified permission therefor, two dredger cuts were made from Colorado River to Imperial Canal to facilitate diversion, the first just below and the second about four miles below the international boundary. Pending approval of application to the Mexican government for the right to construct a controlling gate at this cut, none was constructed. Unprecedented floods from Gila River in Arizona during the winter of 1905 indicated the necessity for closing the lower cut, but efforts to do so were unavailing. This cut, originally 60 feet wide, was greatly enlarged by the river, as was also Imperial Canal below. By August the entire river was running through the cut and canal and through Imperial Valley into Salton Sink.

"In June, 1905, as a result of a loan of \$200,000 to California Development Company by Southern Pacific Company, the latter company took over the management of the canal and other properties of the company. The Southern Pacific Company was interested not only in the development of Imperial Valley, but also in the protection of its railroad around the northern end of Salton Sea. Throughout the years 1906 and 1907 strenuous but unsuccessful efforts were made to turn Colorado River permanently back into its old channel toward the Gulf of California, and thus prevent its further continued flow down the channels of Alamo and New rivers and into Salton Sink. The river had been turned down its old channel on November 4, 1906, following the completion of Hind Dam, but on December 7 a second break occurred. On December 20, at the request of President Roosevelt, Southern Pacific Company started work on a second closure. This was accomplished February 10, 1907, by the completion of Clarke Dam. It has been estimated that the cost of twice turning the river back into its own channel exceeded \$2,000,000.

"This, however, was not to be the entire cost of protecting Imperial Valley from Colorado River. For a number of years no other agency than the government or Southern Pacific Company was financially able to carry the burden. The California Development Company was thrown into receivership in December, 1909, but the funds available to the receiver were inadequate. About the time of the beginning of the receivership, Congress appropriated \$1,000,000 for protective works, and this was mainly spent in unsuccessful endeavor to keep the river from flowing southwesterly down the channel of Bee River and into the old bed of Volcano Lake, which it was doing by the end of the flood season of 1909. In 1912 President Taft recommended an additional Congressional appropriation of \$1,000,000, but this appropriation was not made. Since then the entire burden of controlling the river has been borne by the people of the valley, at first mainly through California Development Company, and in recent years mainly by Imperial Irrigation District, with some expenditures made directly by the Mexican government and by land interests in Mexico.

"By 1910 the irrigated area exceeded 180,000 acres, exclusive of about 15,000 acres in Mexico which was being supplied from the Imperial system.

"The final step to form an irrigation district was taken July 25, 1911, by a vote of 1304 to 360. When formed, the district included 523,600 acres. Opposition to the district continued after its formation, the opponents, however, being unsuccessful in attacking the first district assessment in the courts.

"Shortly after the district was organized, an engineering report was made and a bond issue of \$3,500,000 was recommended, of which \$3,000,000 was to be used for purchasing the works of California Development Company and \$500,000 was to be used for betterments, particularly in connection with flood protection along Colorado River. On October 29, 1914, this bond issue was authorized by a vote of 3278 to 330. The Southern Pacific Company had acquired the entire system, including that portion lying within Mexico, at receiver's sale on February 8, 1916, but it was not until June 22, 1916, that the purchase of the California Development system by the district was finally consummated, the district at that time turning over to Southern Pacific Company for its interest in the system \$3,000,000 in 5 per cent bonds at par. This purchase included the properties of a new subsidiary Mexican company, Compania de Terrenos y Aguas de la Baja California, S. A., to which the works of the Imperial canal system in Mexico originally owned by the California Development Company had passed."

The following is taken from Senate Document 142, page 72; All-American Canal Report, 1919, page 19.

"The canal of the California Development Company as originally constructed, had its head in California at Hanlons or Hanlons Crossing, about 100 yards north of the international boundary. The canal was cut from the river at an oblique angle, and its flow was controlled by a timber structure. On a falling river the head of the canal and the headgate were obstructed by silt deposit, and it became difficult to keep the water flowing from the river into the canal. The water shortages due to this cause in 1903 and 1904 and the failure of various remedial measures prompted the application to Mexico for a concession under which a diversion would be allowed on Mexican territory. This concession was granted in 1904, and operating thereunder the dredger cut was made about 4 miles below the boundary line in Mexico, which caused the river a year later to turn for a time inland away from its course to the gulf.

"The concrete headgate of the Imperial Canal at Hanlon, which was constructed in 1906, has a sill at elevation 100.7 feet above mean sea level. (U. S. Geol. Survey datum.) This was at that time believed to be low enough to accomplish diversion of the desired amount of water at any stage of the river. The large amount of sand which has annually been carried into the canal and the depression of the water surface in the river below the assumed minimum elevation have combined to make the diversion of an adequate quantity of water at the river's low stages impossible. This is true despite the fact that a few years ago a 25-foot section of the headgate sill was lowered 5 feet. Imperial Irrigation District has, therefore, found it necessary to construct temporary weirs across the river of rock and brush. Such a weir was constructed in 1910 and annually since 1915. (See data under Diversion Weir.)

"There is some water obtained for the irrigation of lands in the Imperial Irrigation District and in Mexico from Volcano Lake through the Cerro Prieto Canal. This is only a temporary expedient. The connection of the Cerro Prieto Canal with Volcano Lake was made in 1916. Water has thus been made obtainable from the Volcano Lake region while the river is high. As this water is drawn from an extensive ponded area it is comparatively clear, and its use has materially reduced the difficulty with silt in the west-side canal system. The maximum amount of water obtained from this source has exceeded 800 second-feet. This source of supply will be available only so long as the river is allowed to send its flood waters against the Volcano Lake Levee. The time will come when the river is put back upon a direct course to the gulf, and thereupon this source of supply will no longer be available." (Volcano Lake is now [1930] filled up with silt and the river has been diverted and flows east of that area.—J. L. B.)

Senate Document 142, page 72, gives an extract from a report of Mead, Henny and Jacobs, on "Irrigation and flood-protection problems of Imperial Valley, California, March, 1917":

"* * * In 1891 so much water flowed over the western bank that it found its way through the dense bordering growth of brush and weeds and reached the lowest part of the Salton Sink; not, however, for a long enough time or in sufficient volume to effect a permanent channel change.

"Concentrated flow, carrying the entire Colorado River, occurred, however, in 1905 and again in 1906, when the river left its normal course by breaking through the lower Mexican heading of the Imperial Canal, gathered in the Alamo and New River Channels, and flowed then to the Salton Sink, which it transformed into a great inland sea. The cost of closing these breaks and restoring the river to its old channel was in excess of \$2,000,000.

"No doubt many diversions of the Colorado River to the Salton Sink mark the past history of that stream, but in recent times we have only the record of 1891, when a lake of 100,000 acres, and of 1905 and 1906, when a lake of 285,000 acres was formed.

"In order to insure against a recurrence of such a channel change in the Colorado River, levees have been constructed. These levees are necessary for the protection of Imperial Valley lands both in Mexico and in the United States, although their location is entirely on Mexican soil. They include the following:

"(a) The C. D. Levee, built by the California Development Co., extending from the present Imperial Canal intake, southerly along the right bank of the Colorado River a distance of 10 miles: thence southwesterly an additional distance of 17 miles.

"(b) The Volcano Lake Levee, extending from Cerro Prieto, a rock mountain at the northwesterly corner of Volcano Lake, a distance of 16½ miles to a connection

with the Inter-California Railroad embankment; thence north $1\frac{1}{2}$ miles to a connection with the south embankment of the Imperial Main Canal.

"(c) The Ockerson Levee, constructed in 1911 by the United States for the primary purpose of returning the flow of the Colorado from the Bee River Channel, which it has assumed two years before, back into its previous and more easterly channel along the base of the Sonora Mesa. During the summer flood of 1911 it was breached at numerous points, the largest breach occurring at the Bee River Channel, which widened until the entire river flowed down this channel to Volcano Lake, which continues to be its course to the present time. (1919) (The construction of the Pascadero Levee turned the river away from this channel.—J. L. B.) Due to the lack of maintenance a few additional breaches have occurred, but the major part of the levee is intact.

"The total expenditure incurred to date in the above levee construction, including closures, has been estimated at about \$5,000,000. Aside from the Ockerson Levee, these levees have thus far fairly accomplished their object, but not without actual and threatened breaks that might have precipitated a calamity at any time."

Since 1917 additional levees have been constructed.

Saiz Levee (C. D. Levee). Extension of the C. D. Levee was known as the Saiz Levee. In 1919 this was extended for 6 miles into the Volcano Lake area and in June, 1922, 6 miles of this extension was destroyed. The levee was realigned and in 1922, 8 miles of additional levee was built, connecting it up with the Volcano Lake levee.

Bee River Levee. In 1911 some 15 miles of the Ockerson Levee was destroyed. A new levee was constructed known as the Bee River Levee, starting at a point about $18\frac{1}{2}$ miles down the river on the Ockerson Levee. This levee was approximately 5 miles long.

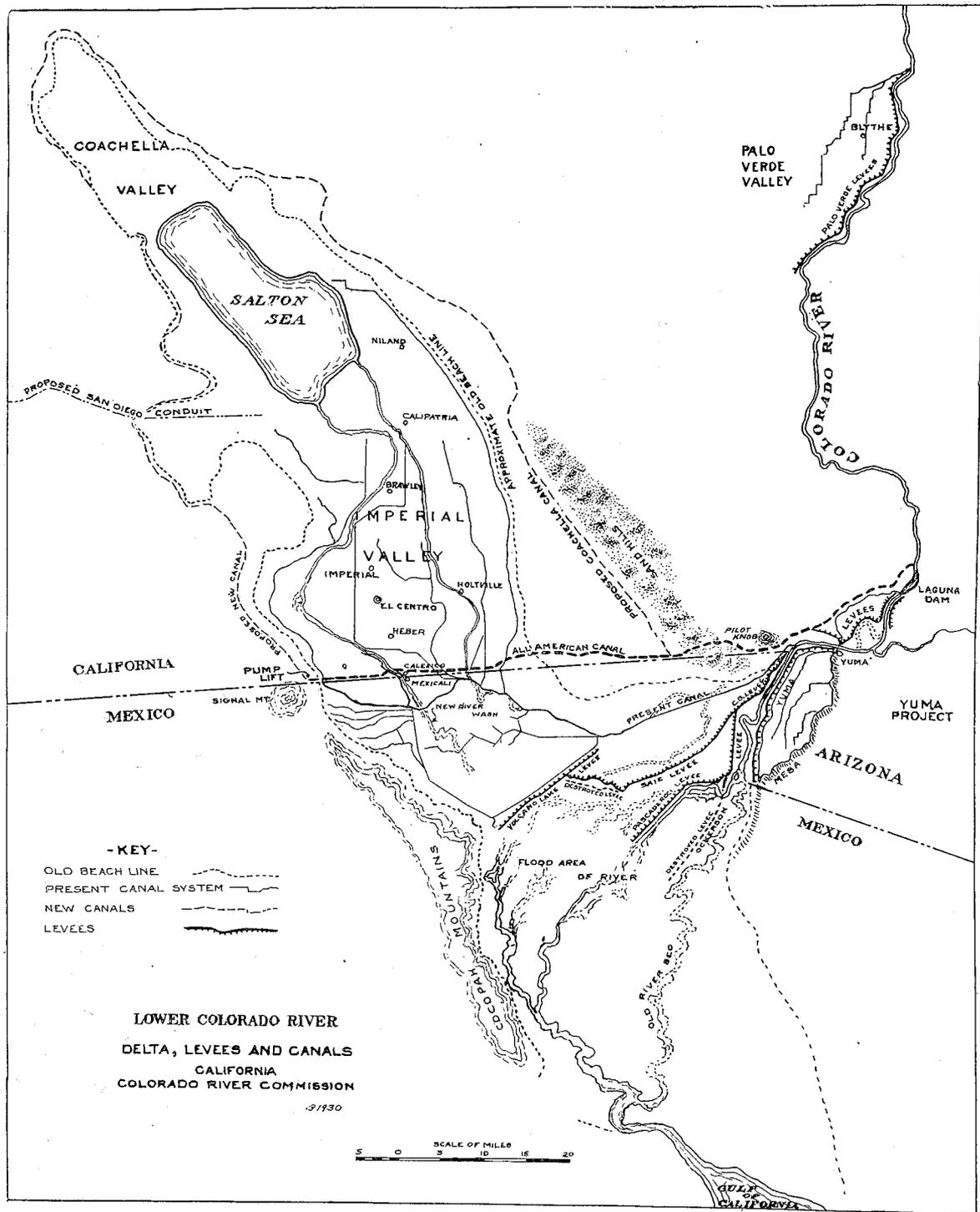
Pascadero Levee. Extending in a southwesterly direction from the end of the Bee River Levee, the Pascadero Levee was constructed in 1921 and 1922, and up to 1927 had been extended for a distance of 8 miles farther. There have been additions to the Pascadero Levee since that date. When the Pascadero Levee was built two dredger cuts were made parallel with and a few hundred yards east of the levee to divert the water through a high spot that had silted up into an area of lower elevation some 3 or 4 miles south. The ensuing high water scoured out these cuts and a new river channel was temporarily formed, in and between the cuts.

Imperial Irrigation District Levees

From map of Colorado River Delta, Imperial Irrigation District, January, 1927.

	<i>Levees, miles</i>	<i>Destroyed, miles</i>	<i>Now effective, miles</i>
C. D. Levee (Saiz)-----	27	0	27
Volcano Lake Levee-----	18	0	18
Ockerson Levee -----	24	15	9
Bee River Levee -----	5	0	5
Pascadero Levee -----	8	0	8
Saiz Levee -----	14	6	8
-----	—	—	—
	96	21	75

Up to and including 1929 Imperial Irrigation District has spent \$3,767,156 upon levee construction and maintenance, including \$675,000 for the purchase of 15 miles of C. D. Levee from C. D. Company.



(Financial statement from Imperial Irrigation District 1930.) Plate XII shows the levee system of the Lower Colorado.

Some effort was made by Mexican interests in 1929 to bring an area of land under irrigation by constructing a levee extending east of the Bee River Levee to the Mesa that formerly was the eastern bank of the Colorado. A canal was constructed with the intake through this newly built levee, but the first high water cut down the intake of the canal and the river used the canal as a new river channel. The flow of the river is now (1930) some distance east of and parallel with the Pascadero Levee.

Mead, Henny and Jacobs (Senate Document 142, page 73) continue:

"The political obstacles encountered in constructing and operating the system have been almost as serious as the physical difficulties and have at times jeopardized the integrity of the enterprise. From its inception the project has been financed by American capital and built with American equipment, although practically all of the main canal and the flood-protection works and about one-third of the irrigable area are in Mexican territory. The customs and other regulations of Mexico governing movement of persons and materials across the border often cause serious and costly delays, which, in cases of emergency, might be disastrous. The situation is at times so critical and the ability to act promptly is so vital to the safety of the enterprise that these restrictions should be abolished. The present Mexican concession is unsatisfactory because inadequate in several respects. It does not establish equality of irrigation charges on the two sides of the boundary; it does not authorize enlargement of the main canal or construction of any higher canal; it does not provide for any flood-protection works. The unstable political conditions in Mexico add to the gravity of this situation."

The following is a list of water filings upon which the right of the Imperial Irrigation District to divert water from the Colorado River is based. The table is taken from Senate Document 142, page 74:

APPROPRIATIONS—WATER SUPPLY

(Joseph Jacob's Report, April, 1917.)

<i>Claimant</i>	<i>Date of filing</i>	<i>Amount claimed, sec.-ft.</i>	<i>Remarks</i>
E. I. Rockwell-----	May 16, 1895	10,000	Diversion point 1¼ miles north of boundary.
California Development Co.	Dec. 15, 1895	10,000	do.
E. I. Rockwell to the California Development Co.	Aug. 15, 1911	10,000	Rockwell conveys to California Development Co. all his interests in his original filing of May 16, 1895.
W. T. Gonder-----	July 15, 1895	10,000	Diversion point 1½ miles north of boundary.
W. T. Heffernen-----	Sept. 13, 1895	10,000	do.
W. T. Gonder-----	Nov. 12, 1895	10,000	do.
do.	Jan. 14, 1896	10,000	Diversion point 1¼ miles north of boundary.
W. T. Heffernen-----	March 18, 1896	10,000	do.
do.	do.	10,000	do.
do.	Jan. 23, 1897	10,000	do.
W. T. Gonder-----	March 27, 1897	10,000	do.
W. T. Heffernen-----	July 24, 1897	10,000	do.
California Development Co.	Dec. 15, 1898	10,000	do.
C. N. Perry, for himself and California Development Co. -----	Dec. 21, 1898	10,000	do.

<i>Claimant</i>	<i>Date of filing</i>	<i>Amount claimed, sec.-ft.</i>	<i>Remarks</i>
W. T. Heffernen-----	Jan. 17, 1899		Assigns all his claims to California Development Co.
W. T. Gonder-----	Jan. 25, 1899		do.
do.	April 25, 1899	10,000	Diversion point 1½ miles north of boundary.
C. N. Perry, for himself and California Development Co.-----	Feb. 20, 1899	10,000	do.
C. N. Perry, for himself and California Development Co.-----	April 25, 1899	10,000	Diversion point 1½ miles north of boundary.
do.	do.	10,000	Diversion point 3000 feet north of boundary.

Mexican Use of Water

A concession was granted by Mexico in 1904 for rights of way for the Imperial Canal. Regarding water for Mexican lands, this concession provides as follows: (For text of agreement see p. 319.)

"The Sociedad de Riego y Terrenos de la Baja California, S. A., is authorized to carry through the canal which it has built in Mexican territory, and through other canals that it may build, if convenient, water to an amount 284 cubic meters per second from the waters taken from the Colorado River in territory of the United States by the California Development Co. and which waters this company has ceded to the Sociedad de Riego y Terrenos de la Baja California, S. A. It is also authorized to carry to the lands of the United States the water, with the exception of that mentioned in the following article.

"From the water mentioned in the foregoing article, enough shall be used to irrigate the lands susceptible of irrigation in Lower California with the water carried through the canal or canals, without in any case the amount of water used exceeding one-half of the volume of water passing through said canals. (All-American Canal Board Report, p. 20.)"

Present Status

"The present (1922) constructed works of the Imperial project are briefly as follows:

"There is a new heading about 6000 feet above the old or Hanlon Heading, constructed in 1918. This is a concrete structure, with its face parallel to the river bank. It consists of 75 gates, 8 feet center to center, 27 of which have a sill elevation of 98.6 feet above sea level and 48 have a sill elevation of 106.7 feet. The height of the structure above the higher sill gates is 21 feet. The piers are 18 inches thick, and there is a 24-foot pier between the high and the low sill gates.

"The main canal from the Rockwood heading through Mexico is about 55 miles long and mainly follows an old channel of the river known as Alamo River. Portions of the channel have been straightened by constructing cutoffs, and these portions especially will require enlarging for the carrying of sufficient water for the entire project. Also the old channel, due to silting, has in places spread out over considerable areas and will require dredging or reconstruction for full development of the project. The maximum amount carried in the canal to date has been about 6000 second-feet. There are about 70 miles of distributaries operated by the district in Mexico and about 61 miles constructed and operated by the district in the United States. Other distributing canals and laterals in the United States were built, and are operated by 14 separate water companies, the distributaries of these companies aggregating approximately 2300 miles in length." (Sen. Doc. 142, p. 75.) (The water companies were later bought up and absorbed into the Imperial Irrigation District.—J. L. B.)

Colorado River Diversion Weir

As stated in the All-American Canal report the alternate scouring and silting up at the intake of the Imperial Irrigation District's canal

created such a condition as to make it impossible during certain portions of the year to divert a sufficient quantity of water to supply the demand, and it was found necessary to use some artificial means to raise the water level in the river in order to permit proper diversions. This was accomplished by construction of a temporary weir across the Colorado River. Such a weir (All-American Canal Report) "Was constructed in 1910 and annually since 1915."

By placing this artificial barrier across the river, there was danger that during the annual high water period the water level might rise to such height as to endanger the Yuma project, and in 1916 the Yuma County Water Users Association asked for an injunction restraining the Imperial Irrigation District from constructing the weir. On August 3, 1916, in the superior court of Yuma County, Arizona, the following modified restraining order was issued:

"In the Superior Court, Yuma County, State of Arizona. Yuma County Water Users' Association et al., plaintiffs, vs. Imperial Irrigation District et al., defendants.

Modified Restraining Order

In the above-entitled action, the parties hereto having agreed to the same, the temporary restraining order heretofore issued is hereby modified and made to read as follows:

On reading the verified amended complaint herein and the stipulation of the parties herein, it is hereby ordered as follows: Upon the defendants giving bond in the sum of \$100,000 for the faithful observance hereof.

That the defendants are permitted to construct their proposed dam or weir, but in the construction of the same they are hereby commanded, enjoined, and restrained from using any rock in the construction of the said weir, except such rock as may be loaded upon the cars with the steam shovel now in use by said defendants, or another of similar size, and from using any rock larger in size than one-half of one cubic yard; and they are further commanded to commence the removal of any piles or trestle placed by them in the said river not later than October 1, 1916, and thereafter to remove the same with diligence, and in all events to remove the same not later than November 1, 1916, and also thereafter to remove the other obstructions placed by the defendants in the said river at the time and in the manner directed by the project engineer of the Yuma project of the United States Reclamation Service, and in any event, shall remove the same prior to January 1, 1916.

Done in open court this 3d day of August, 1916.

Baxter, Judge of said Court."

Later in 1919 an agreement was entered into between the Imperial Irrigation district and the Yuma County Water Users' Association under the terms of which the Imperial Irrigation District was to be permitted to construct this temporary weir but were required to remove it by July 1, 1920, or at an earlier date if the project manager of the Yuma project should deem the maintenance of such dam to in any way endanger the works of the Yuma project. One of the provisions of the agreement was to the effect that a bond of \$500,000 should be provided by the Imperial Irrigation District to protect the Yuma District against any possible losses to be suffered through the construction of a weir.

This weir has been constructed in the river from year to year and removed during the high water season under practically the same conditions as under the 1919 agreement, a \$500,000 bond being posted every year.

The weir as now constructed consists of a series of wedge-shaped brush mats anchored by wire cable bridles to a string of piles driven

across the river and the removal is effected by blowing out with dynamite.

In order to maintain this weir it has been necessary to obtain a permit from the War Department each year. Copy of the permit for 1919-20 follows:

PERMIT.

"Whereas by section 10 of an act of Congress approved March 3, 1899, entitled 'An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes,' it is provided that it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river or other water of the United States outside established harbor lines or where no harbor lines have been established except on plans recommended by the Chief of Engineers and authorized by the Secretary of War; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of any port, roadstead, haven, harbor, canal, lake harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same;

And whereas application has been made to the Secretary of War by the Imperial Irrigation district, of California, for authority to repair and rebuild its temporary diversion dam or weir (originally constructed under authority of War Department permit dated February 14, 1917), located in the Colorado River at or near Hanlon's Heading at the site shown on the map hereto attached, and to maintain said structure until July 1, 1920, as recommended by the Chief of Engineers;

Now therefore, This is to certify that the Secretary of War hereby authorizes the said work of repairing and rebuilding the Imperial Irrigation district's temporary diversion dam or weir, in the Colorado River at or near Hanlon's Heading and maintaining the same until July 1, 1920, upon the following conditions:

1. That it is to be understood that this authority does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining State assent to the work authorized. It merely expresses the assent of the Federal Government so far as concerns the public rights of navigation. (See *Cummings vs. Chicago*, 188 U. S. 410.)

2. That the work shall be subject to the supervision and approval of the district engineer, engineer department at large, in charge of the locality, who may temporarily suspend the work at any time if, in his judgment, the interests of navigation so require.

3. That if any pipe, wire, or cable is herein authorized, it shall be placed and maintained with a clearance not less than that shown by the profile on the plan attached hereto.

4. That so far as any material is dredged in the prosecution of the work herein authorized it shall be removed evenly, and no large refuse piles shall be left. It shall be deposited to the satisfaction of the said district engineer and in accordance with his prior permission or instructions, either on shore above high water or at such dumping ground as may be designated by him, and where he may so require, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material into the waterway; and so far as the pipe, wire, or cable is laid in a trench, the formation of permanent ridges across the bed of the waterway shall be avoided and the back filling shall be so done as not to increase the cost of future dredging for navigation. If the material is to be deposited in the harbor of New York, or in its adjacent or tributary waters, or in Long Island Sound, a permit therefor must be previously obtained from the supervisor of New York Harbor, Army Building, New York City.

5. That there shall be no unreasonable interference with navigation by the work herein authorized.

6. That if inspections or any other operations by the United States are necessary in the interests of navigation, all expenses connected therewith shall be borne by the permittee.

7. That the permittee assumes all responsibility for damages to the work or structure herein authorized, and for damage caused by it or by work of the permittee in connection therewith to passing vessels or other craft, and shall not attempt in any way to prevent free use by the public of the area at or adjacent to the work or structure.

8. That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of War, it shall cause unreasonable obstruction to the free navigation of said water, the permittee will be required, upon due notice from the Secretary of War, to remove or alter the structural work or obstructions caused thereby without expense to the United States so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this permit the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the permittee shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of War may require, remove all or any portion of the uncompleted structure, or fill and restore to its former condition the navigable capacity of the watercourse. No claim shall be made against the United States on account of any such removal or alteration.

9. That if the display of lights and signals on any work hereby authorized is not otherwise provided for by law, such lights and signals as may be prescribed by the Bureau of Lighthouses, Department of Commerce, shall be installed and maintained by and at the expense of the permittee.

10. That the permittee shall notify the said district engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said district engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work, if for a period of more than one week, resumption of work, and its completion.

11. That before this permit shall become operative the said district shall give a good and sufficient bond satisfactory to the Secretary of War, in the penal sum of \$25,000, conditioned for the prompt and complete removal of the said diversion dam or weir at any time on the order of the said district engineer, and in any event on or before July 1, 1920; and also a bond in the penal sum of \$500,000 satisfactory to the Secretary of the Interior, to reimburse the United States and the Yuma County Water Users' Association for any damage caused by the said structure to lands, works, or property of the United States or members of the said association.

12. That adequate measures satisfactory to the district engineer shall be taken by the permittee for furnishing him prompt warnings of floods and for maintaining by the site of the said structure material and equipment sufficient for its prompt removal.

13. That arrangements satisfactory to the Secretary of War shall be continued to dispense as speedily as possible with the necessity for placing diversion dams in said river, and that the said district shall report in detail to the said district engineer on the first and fifteenth days of each month while this authorization continues in force what measures are proposed for that purpose and the progress made thereon.

14. That unless previously revoked or specifically extended, this authorization shall expire July 1, 1920.

Witness my hand this 16th day of June, 1919.

NEWTON D. BAKER,
Secretary of War."

Full copies of all the documents having to do with the construction of this weir and other official documents affecting Imperial Valley are found in a pamphlet compiled by Thos. C. Yager, Esq., of Coachella, under the title "Compilation of Official Documents Relating to the Problems of the Lower Colorado River."

CONTRACT BETWEEN THE UNITED STATES AND THE IMPERIAL
IRRIGATION DISTRICT

Agreement of October 23, 1918, providing for the extension of Imperial Canal to the Laguna Dam and committing the Imperial Irrigation District to the construction of an All-American Canal.

This agreement, made the 23d day of October, A.D. 1918, by and between the United States of America acting in this behalf by Franklin K. Lane, Secretary of

the Interior, hereinafter styled the United States, party of the first part, and the Imperial Irrigation District, a corporation duly organized and existing under and by virtue of the laws of the State of California, hereinafter styled the district, party of the second part,

Witnesseth:

2. Whereas, in connection with the Yuma project, Arizona-California, under the provisions of the Reclamation Act of June 17, 1902 (32 Stat. 388), and acts amendatory thereof and supplementary thereto, and particularly section 25 of the act of April 21, 1904 (33 Stat. 224), the United States Reclamation Service has constructed on the Colorado River a dam known as the Laguna Dam and certain auxiliary works situate about 10 miles northeast of Yuma, Ariz., together with a main supply canal extending from said dam southwesterly to a point known as Siphon Drop, situate in section 10, township 16 south, range 22 east, S. B. M.; and

3. Whereas, under the aforesaid act of Congress the United States contemplates the reclamation of 120,000 acres of irrigable land, more or less, under the Yuma project with water from Colorado River diverted at Laguna Dam, and the district desires to change its point of diversion and secure the right to divert water at said dam for the irrigation of all irrigable land within the boundaries of the district; and

4. Whereas, the district is authorized under chapter 160 of the Statutes of California, 1917, page 243, to contract with the United States for a supply of water for irrigation:

5. Now, therefore, in consideration of the mutual covenants and agreements to be kept and performed and considerations to be paid, as hereinafter provided, it is hereby agreed as follows, to wit:

6. That immediately on the execution of this contract the district shall proceed with diligence to secure data, which, together with other available data and data to be gathered under the existing cooperative contract dated February 16, 1918, will constitute a complete detailed survey with specifications and estimates of cost for the following:

(a) All necessary works and structures for the diversion of water from the Colorado River at Laguna Dam, thence through said existing main canal of the Yuma project, and sufficient enlargement and modification, including such works or devices as the Secretary of the Interior may require for the purpose of maintaining as near as may be the efficiency of the desilting and sluicing works at Laguna Dam, as such efficiency would be were the Yuma project fully developed, to divert and carry all water needed by the district for the irrigation of its lands above referred to, without impairing the utilization of said Laguna Dam, main canal, and auxiliary works to the full extent necessary to irrigate the Yuma project when fully developed.

(b) A main canal entirely within the United States, with all necessary appurtenant structures for the practical operation thereof, of sufficient capacity and proper construction to irrigate all lands in Imperial County, State of California, susceptible of economic irrigation from said canal. Such canal to connect with said main canal of the United States at a point described as Siphon Drop, and thence to connect with the canal system of said district in the United States upon the line located and approved as provided by the terms of the cooperative contract of February 16, 1918, above referred to.

7. Upon the approval by the Secretary of the Interior of the said survey, specifications, and estimates, district will provide for beginning and carrying to completion with due diligence, at the cost of the district, the work of construction and installation at the Laguna Dam and on the main canal, described in and contemplated by this agreement, and the district shall provide proper pecuniary support for the same in advance in a manner satisfactory to the Secretary of the Interior. All such work shall be carried on in such manner as not to interfere with the proper operation of the Yuma project by the United States, and the district will promptly carry out any measures required by the United States or its authorized agents to avoid or relieve any interference with the delivery of water to the Yuma project during and due to such construction, and will save the United States harmless as to any claims for damages that may be presented by reason thereof.

8. All work of construction and installation, and the materials used therein, shall at all times be subject to the approval of the Secretary of the Interior, and be under the supervision and inspection of his authorized agents and engineers, to the end that the works shall conform strictly with said surveys and specifications, and such modification thereof as the Secretary of the Interior may approve in writing.

In case any of said works are constructed under contract made by the district and are not in accordance with said surveys and specifications, the Secretary may, at his option, replace such unsatisfactory construction work at the expense of the district, or stop said work of construction or cancel this contract, or resort to any other lawful remedy, and the decision of the Secretary of the Interior whether said surveys and specifications or modifications thereof have been complied with shall be final and conclusive. The district shall make complete detailed progress reports of the said construction work upon demand of the Secretary of the Interior. The cost of the inspection on the part of the United States provided by this section shall be paid by the district to the United States upon demand.

9. For the right to use the Laguna Dam, the main canal, and appurtenant structures, and divert water, as herein provided, the district agrees to pay to the United States the sum of \$1,600,000 in twenty installments, the first of which shall become due and payable December 31, 1919, and subsequent installments annually thereafter. The first four installments shall each be 2 per cent, the next two installments each 4 per cent, and the next fourteen each 6 per cent of the total amount. Upon failure of the district to make any such payment at the time and in the amount specified, then all rights under this contract shall be at an end, and all payments theretofore made shall become forfeited to the United States as liquidated damages; and as a further consideration for entering into this contract on the part of the United States, the district hereby releases and relinquishes any and all claims whatsoever for said moneys or any portion thereof so forfeited and paid as liquidated damages: *Provided*, That the Secretary of the Interior may in his discretion extend the time for any such payment upon the payment of 7 per cent interest in advance.

10. Subject to the provisions of the Reclamation Act of June 17, 1902 (32 Stat. 388), and acts amendatory thereof and supplementary thereto, the United States shall have and retain perpetually the title to and the complete control, operation, and management of said Laguna Dam, auxiliary works, and enlarged main canal from the dam to and including the siphon drop with appurtenant structures as enlarged, including the diversion works at siphon drop for the diversion and delivery of water to the Yuma project and the district. The district shall pay the United States, quarterly, on demand, April 1, July 1, October 1, and December 31, its proportionate share of the cost of operation and maintenance of said dam, auxiliary works, and enlarged main canal for the preceding quarter, such payment by the district to bear the same ratio to the total cost of such operation and maintenance as the amount of water received by the district at the point of delivery to the district's canal at siphon drop bears to the total amount of water carried in said main canal at that point plus the amount of water diverted from the canal above the siphon drop for use on the Yuma project lands: *Provided*, That such extraordinary expense as may be caused by the operation of such desilting works as may be necessary to, as nearly as may be, maintain the efficiency of the desilting works at Laguna Dam, as such efficiency would be were the Yuma project fully developed, shall be borne by Imperial Irrigation District. Such extraordinary expense, if any, shall be determined by the Secretary of the Interior. If the district fails to pay to the United States within thirty days after rendition of bill, all operation and maintenance charges as determined by the Secretary of the Interior as they become due, the Secretary of the Interior, in addition to any other remedy which may be available to him for recovery of such charges, is authorized to shut off water from the intake of the district until such time as all sums due have been paid, with interest thereon at the rate of 7 per cent per annum, from rendition of bill.

11. The United States reserves the right to arrange for the connection with and use of Laguna Dam on such terms as the Secretary of the Interior may deem expedient, by any other irrigation enterprise, district, corporation, or individual; also of the headworks and main canal and other governmentally constructed works and works constructed jointly by these parties, after proper enlargement and modification, on terms herein stipulated, without, however, impairing the utilization of said dam, canal, and other works to the extent necessary to irrigate the lands within the boundaries of Imperial Irrigation District.

12. The United States reserves the right to develop power with the water in the enlarged main canal down to and including siphon drop. All other power possibilities in the main canal down to and including some convenient power site near Pilot Knob shall be developed by the United States to the extent deemed expedient by the Secretary of the Interior, at the joint expense and for the joint benefit of the Yuma project and the Imperial Irrigation District as herein provided. The apportionment of the cost of canal and headworks alterations and enlargement, and of

canal extension from the Laguna Dam to the site selected for power development near Pilot Knob, shall be made to the United States (for the Yuma project) and to the Imperial Irrigation District, in the proportion that 2000 second-feet bears to the total canal enlargement, less 2000 second-feet. The cost of constructing power plants, transmission lines, and other power-plant accessories shall be also apportioned to Yuma project and the district, respectively, in the ratio that 8500 water horsepower bears to the aggregate water horsepower capacity of the plant installed.

The operation and maintenance of any such power plant or plants constructed for joint benefit and the sales of power therefrom shall be under the control of the Secretary of the Interior, and charges for commercial power shall be upon rules adopted by the Secretary of the Interior applying equally to both valleys. Such power as in the judgment of the Secretary of the Interior is necessary for pumping and other operation and maintenance purposes shall be delivered to the Yuma project and to the Imperial Irrigation District at the cost of development thereof, plus 10 per cent, said cost to include interest at 5 per cent per annum on the capital invested in power plants, transmission lines, and power-plant accessories, and also a proportional part of the headworks and canal enlargement from Laguna Dam to Pilot Knob, determined by the relation that 2000 second-feet bears to the total enlarged canal capacity and reasonable depreciation as may be determined by the Secretary of the Interior. The preference right to purchase power developed at the price herein specified shall be given over other uses of power, to the requirements of the Yuma project (limited to an area not exceeding 120,000 acres) for power to be used in pumping irrigation water. The profits from power sales or power leases shall be divided between the Yuma project and the Imperial Irrigation District in the proportion of their respective investments in power plants, transmission lines, and power-plant accessories, and in the canal and headworks alterations, canal enlargement, and canal extensions from the Laguna Dam to and including the power-house site near Pilot Knob, to be determined by the Secretary. In case capacity be also provided by enlargement for the irrigation of lands in the United States outside of the Imperial Irrigation District, then the cost of enlargement computed as above as chargeable to the Imperial Irrigation District shall be borne "by such district and such" other lands in the ratio of the respective irrigable acreages. The cost of any works used jointly by several irrigation enterprises below the point near Pilot Knob where power is developed shall be apportioned "equitably" by the Secretary of the Interior. No water shall be diverted for power purposes from such main canal below siphon drop at any time when such water shall be required for irrigation of lands being irrigated therefrom in Imperial County.

13. It is understood and agreed that the connection with Laguna Dam herein provided for is to be constructed as a part of an All-American Canal, which the district hereby agrees to build at as early a date as possible and within reasonable time, and "when" the district shall have completed said All-American Canal it shall have the right to drop water at some other point than the vicinity of Pilot Knob for power development, and in this event agrees to place at the disposal of the United States at Pilot Knob, or some other point to be agreed upon, such power in addition to that generated at Pilot Knob, as in the judgment of the Secretary of the Interior is necessary for pumping and other irrigation operation and maintenance purposes of the Yuma project or any auxiliary thereof, not in excess of 8500 water horsepower in the aggregate, at the cost of development thereof at the power house, plus 10 per cent, said cost to include interest at 5 per cent and reasonable depreciation as determined by the Secretary of the Interior. All power development, operation, and maintenance of power plants on the All-American Canal, and sales of power shall be under the control of the Secretary of the Interior, and charges for commercial power shall be upon rules adopted by the Secretary of the Interior, applying equally to both Imperial and Yuma valleys. The profits from commercial power shall be divided between the Imperial Irrigation District and the Yuma project in ratio of their respective investments in power, including the enlargements, alterations, and extensions of the headworks and main canal down to and including the power-house site near Pilot Knob, plus investments in the power plants, power house, transmission lines, and other accessories. In dividing profits, the district shall be credited with the net revenue from the amount of power by which the total power output is increased by the All-American Canal west of Pilot Knob, which shall be determined by the Secretary of the Interior. Power delivered to Imperial Irrigation District for pumping and other irrigation operation and maintenance purposes shall be delivered on the same terms as power delivered to the Yuma project for said purposes.

14. It is understood and agreed that the Secretary of the Interior shall control the division of water and shall divert for use of the Yuma project or any auxiliary thereof as heretofore or hereafter undertaken by the United States within the present boundaries of the United States and not exceeding 120,000 acres sufficient water to secure the permanent and economical reclamation thereof, not exceeding, however, one-quarter of the water in the river above Laguna Dam. The foregoing applies only to the natural flow of the Colorado River, and not to storage water, which shall be delivered to the party entitled thereto.

The United States makes no guaranty or representation as to the quantity of water that may be available without storage for delivery to the district under this contract, and shall not be responsible for failure to deliver water under this contract caused by insufficient supply of water in the Colorado River, hostile diversion, or drought, interruption made necessary by repairs, nor on account of any valid order or decree of a competent court; nor for any damages by floods, acts of hostility, or unavoidable circumstances; nor for loss of crops or other damage caused by non-delivery of water.

15. It is understood and agreed that the district shall have the right at any time to extend its boundaries within the United States and water additional lands upon payment of same amount per acre as irrigable lands in present Imperial Irrigation District are to pay under terms of this contract. This right to be also available on same conditions to Yuma project, additional to 120,000 acres herein mentioned. All proceeds from payments on account of initial connection charges assessed to and collected from such new lands shall be used under the direction of the Secretary of the Interior for the construction of storage works for the benefit of the lands contributing.

16. This contract shall not become effective until the same shall have been duly ratified and confirmed, in accordance with law, by a vote of the people of the Imperial Irrigation District, and unless it shall be so ratified within six months from the date of execution hereof by the Secretary of the Interior it shall become void and of no further effect.

17. In case of failure on the part of the district to provide for beginning the work of enlargement of the Yuma main canal within two years from the date hereof, the Secretary of the Interior shall have the right to abrogate this contract.

18. No Member of or Delegate to Congress, or Resident Commissioner after his election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the government shall be admitted to any share or part of this contract or agreement, or to any benefit to arise thereupon. Nothing, however, herein contained shall be construed to extend to any incorporated company, where such contract or agreement is made for the general benefit of such incorporation or company, as provided in section 116 of the act of Congress approved March 4; 1909 (35 Stat. L., 1109).

In witness whereof the parties hereto have caused the execution of these presents as of the day and year first above written.

THE UNITED STATES OF AMERICA,

By FRANKLIN K. LANE,
Secretary of the Interior.

IMPERIAL IRRIGATION DISTRICT,
By LEROY HOLT, President.

Attest:

F. H. McIVER, Secretary.

Contract Permitting Construction of Diversion Weir Imperial Irrigation District and Yuma County Water Users' Association.

1. This Indenture, made this 28th day of May, 1925, between Imperial Irrigation District, a municipal corporation, duly organized and existing under the laws of the State of California, hereinafter called and referred to as the District, and Yuma County Water Users' Association, a corporation duly organized and existing under the laws of the State of Arizona, and doing business at Yuma, State of Arizona, acting for and on behalf of its, and all of its, constituent members and shareholders, hereinafter called and referred to as the Association:

Witnesseth:

2. Whereas, the District is engaged in the business of appropriating and diverting irrigation waters from the flow of the Colorado River at a point in said river

known as Hanlon's Heading at, or near, Fractional Sections Thirty-five and Thirty-six (35 and 36 township sixteen (16) South, Range twenty-one (21) East, S. B. M., in Yuma County, State of Arizona, for the irrigation and reclamation of many hundreds of thousands of acres in Imperial Valley, Imperial County, State of California, known as Imperial Valley Irrigation Project; and

3. Whereas, in order to secure a sufficient flow of irrigation water to properly irrigate and reclaim said lands, and to prevent the same from returning to their original desert condition, it is now necessary to erect, and temporarily maintain, during low water periods in said river, a dam, or weir, in said river, at or near said Hanlon's Heading; and

4. Whereas, the installation and maintenance of said dam tends to create such a condition in the flow of the waters of said Colorado River as to endanger the works of the Yuma Project of the United States Reclamation Service, and the lands and property of the Association, and its constituent members and shareholders; and

5. Whereas, the Association has granted its permission that a weir, or dam, may be constructed and maintained at said point in said river, from July 1, 1925, until July 1, 1926, subject to certain conditions, provisions and exceptions hereinafter more fully set forth; and has stipulated and agreed that a certain temporary restraining order heretofore issued out of the superior court of the State of Arizona, in case No. 2429, and now in force and effect in said court, wherein the said Association and others are plaintiffs, and the said District and others are defendants, restraining and enjoining the District herein from erecting and maintaining any weir or dam at said point, shall be so modified as to permit the erection and maintenance of a weir or dam therein during the said last mentioned period; and not to further prosecute said suit during such period.

6. Now Therefore, the said District in consideration of the foregoing, does hereby promise, undertake and agree that, if it becomes necessary, for the accomplishment of said purposes, to erect and temporarily maintain a dam, or weir, in and across the Colorado River, at or near said Hanlon's Heading as hereinbefore described, that it shall construct the same out of brush, without the use of any rock whatsoever, and that said brush shall be erected and maintained on the top of the crest of the rock dam and weir heretofore erected by said District so as to hold the water at no greater height than is necessary for the diversion of the amount of water actually required for the irrigation of the lands of said District and that such brush weir, or dam, and the materials composing the same, shall be held and maintained in place by a system of piling driven through, and erected upon the crest of said rock dam or as near thereto as practicable; if necessary said system of piling to be used in conjunction with certain guy ropes and ties made fast to certain dolphin anchors erected in said river immediately above said rock dam; the height to which the dam is to be maintained and the extent of said system of piling to be subject to control by the Project Manager of the Yuma Project, and the District further promises, agrees and undertakes to remove all of said brush dam or weir, from out of said river, on or prior to July 1, 1926, and at any other time between said July 1, 1925, and July 1, 1926, that Porter J. Preston, Project Manager of the Yuma Project of the United States Reclamation Service, or Fred Blohm, President of the Association, or Major E. D. Ardery, District Engineer, U. S. A., or their successors in office, shall deem the maintenance of said dam to, in any way, endanger any of the works of said Yuma Project, or any of the lands or property of the Association, or its shareholders or constituent members, or any land within said Yuma Project on either side of said Colorado River; and the District hereby undertakes and agrees to keep and maintain at, or near, said dam a sufficient amount of explosives to immediately blow out and remove said dam to such an extent as will permit the free flow of the Colorado River to the southward, so that the same will not endanger any of said property.

And the said District further stipulates and agrees that the permission so given to erect and temporarily maintain such a dam or weir in the Colorado River at said point, and the permission heretofore given for the erection and maintenance of dams and weirs across the Colorado River, at or near, said point, and their erection and maintenance, and the giving, in the future, of permission to erect and maintain such dams and weirs, shall not be taken, held or deemed, nor shall either of them be taken, held or deemed not to be of irreparable injury to the Association, its shareholders and constituent members; and the granting of said permission, and the erection and maintenance of said dams or weirs, shall be without prejudice to the right of the Association, its shareholders and constituent members, to have entered in said suit No. 2429, or any other proceedings, in any other court of competent

jurisdiction, upon due and sufficient evidence, and decree permanently restraining the District from constructing and maintaining such weir, or weirs, or any weir, dam or dams, across the river.

8. And the District, in consideration of the premises as hereinbefore set forth, does hereby further promise, agree and undertake to pay to the Association, its shareholders and constituent members all damages that may result to them, or to either, or any of them, from injury to their person or property because of the erection or maintenance of said brush dam or weir, or the maintenance of the rock base upon which the same shall be constructed as hereinbefore described, and the District further promises, undertakes and agrees to pay the Association, its shareholders and constituent members, any and all damages that may result to them or either of them or any of them, because of the erection or maintenance of the remaining portions of all, or any, of the rock dams or weirs heretofore placed in said Colorado River, at or near said point, including what is known as the Clark Dam or weir.

9. And it is further stipulated and agreed that the Association, or either, or any, of its constituent members or shareholders, may sue hereunder in their own right, and without joining any other party hereto as party plaintiff; provided, however, that if more than one of said shareholders or constituent members should separately sue the District for such damages, all of said actions so brought in the same court may be consolidated and tried as one action, each plaintiff recovering the amount of damage that he or she shall have suffered, as finally determined by such court.

10. The District, for and in consideration of the premises, covenants and agrees to entirely remove from out of the bed of the Colorado River, on or before December 30, 1926, all, and all parts of any, and all dams and weirs, piles and piling, rock and brush, anchors, guys, ties and all other material whatsoever, placed, or caused to be placed therein by the District or its predecessors in the ownership and operation of said Imperial Valley Irrigation Project, at any time whatsoever for the purpose of impeding the flow of said river, and raising the height of the waters thereof so that the same would more freely flow into the irrigation canals of the District, or any of its predecessors, and to the extent that all of the waters of the Colorado River shall flow freely to the southward as said waters did flow prior to the placing of any obstructions in the bed thereof by the District, or any of its said predecessors.

11. It is understood and agreed that the District shall furnish a satisfactory surety bond in the sum of five hundred thousand dollars (\$500,000.00), to the United States of America, and the Association, as joint and several obligees, to reimburse them for any damage resulting from the erection or maintenance of said dam, or weir, and conditioned for the removal of all of said obstructions from said river; and that a recovery or recoveries, on said bond shall not be a bar to any action, or actions, by the Association, or its constituent members, or any of them, in the event that they or either of them, should be damaged greater because of the District's breach of any of the terms or covenants of this agreement, it being understood and agreed that the District undertakes, promises and agrees to pay all the damage that may result because of its breach of any, or all, of the terms, conditions and covenants of this agreement, notwithstanding the execution and delivery of any bond, or bonds, or any recovery thereon. And in the event of damage accruing, and said bonds becoming exhausted in whole or in part, during the life of this agreement, the District agrees to furnish additional security and assurance so that there will always be during the life of this agreement security against damage to the Association in the sum of five hundred thousand dollars (\$500,000.00).

12. In consideration of the foregoing premises the District hereby agrees to hold the Association harmless in the event that it may be required or compelled to pay the rent payable on April 1, 1926, and April 1, 1927, and April 1, 1928, reserved in that certain lease for the term of three years entered into under date of February 2, 1925, between Agnes C. Heineman and husband, and the Association for certain lands lying west of the United States Reclamation Service levees in section 36, Township 16 South, Range 21 East, S. B. M., in Yuma County, Arizona, and the District further agrees to hold the Association free and harmless from all costs, expense, liability and damage accruing or resulting to the Association because of any lease, license or permit given or granted, expressly or impliedly, by this instrument, or by assignment of, or subletting under, said lease, or otherwise by the Association to the District for the erection or maintenance of said temporary dam, or weir, or for the erection, or maintenance of any structure, or structures, on said land for the erection or maintenance of said dam or weir.

The District further agrees, as a condition subsequent, to promptly, and with diligence and in good faith, take the necessary steps to procure funds sufficient for the procuring and constructing of another heading, and diversion structure with a sufficient aqueduct, on the Colorado River, at Laguna Dam, in accordance with the terms of the contract between the District and the Secretary of the Interior, dated October 23, 1918. In event of the District failing to comply with the terms of this condition subsequent, the Association may, at its option, declare this agreement null and void, and revoke all license and permits granted hereunder. And in the event of the procuring said funds the said District further covenants and agrees, within three months after the procuring of said funds, to begin in good faith (strikes, injunctions, and acts of God excepted) the construction of the necessary works for the procuring of said other heading and diversion point for taking its irrigation water from the Colorado River, as set forth in this paragraph, and to diligently prosecute such construction to completion; otherwise, to pay the Association as a penalty the sum of five hundred dollars (\$500) per day for each day that there shall be default by the District in complying with the terms and conditions set forth in this paragraph; provided, however, that nothing in this paragraph contained shall be deemed, taken or held as being obligatory upon the Association to accept said penalty, but that upon such default the Association may revoke all permission license and leave granted by this contract as a whole; but in no event shall anything in this paragraph contained be deemed, taken or held to be any waiver of the right of the Association, or any of its constituent members or shareholders, to sue for and recover any damage accruing to it, or them, or either of them, because of the breach of any of the terms of this contract; and nothing in this paragraph contained shall be deemed, taken or held to relieve the District from liability because of the breach of the covenants of this contract.

14. It is agreed that during the erection and maintenance of said dam, or weir, the Association may employ and retain an inspector or inspectors, on said work to ascertain and determine if such erection and maintenance is being operated and maintained in accordance with the terms of this agreement, and said District agrees to reimburse the Association for such reasonable compensation as may be paid by it to such inspectors, not to exceed \$24 per diem. And the said project manager, or his successors in office, in person or by subordinates, may at any time during the life of this agreement enter upon said works or any portion thereof, for the purpose of ascertaining if the same, or any portion thereof, are being constructed and maintained in accordance with the terms and conditions of this agreement, and in the event of their being constructed or maintained in violation of said terms or conditions, to assume control and direction of such works and their construction and maintenance, and to operate the same, in whole or in part, as by this agreement prescribed; provided always, that such control, direction or operation shall not result in denying to the District a sufficient supply of irrigation water for the needs of said Imperial Valley Irrigation Project, except in the emergency contemplated and provided for in paragraph 6 hereof.

15. It is further understood and agreed that should the maintenance of the dam be deemed a menace to the city of Yuma, or any of the lands of the Yuma Valley or endanger the same by seepage or flood, and its removal be ordered by Project Manager Porter J. Preston, Major E. D. Ardery, district engineer, U. S. A., or Fred Blohm, president of the association or their successor or successors in office, the District agrees to immediately proceed with the removal of said dam and should the District refuse to do so or neglect to act promptly, it is further agreed that Project Manager Porter J. Preston, or his successor in office, in person or by a representative or representatives appointed by the Board of Governors may, at the demand or request of the Board of Governors of the Association enter upon any portion of the works of said District on either the Arizona or California side of the river and take possession of the same and proceed to assume control and direction of the work or removal of said diversion dam.

16. It is understood and agreed that owing to the fact that the District is a municipal corporation of the State of California, it may be necessary or appropriate, in the event of the breach of any of the terms or covenants of this agreement, for the Association to sue hereunder, or under said reimbursement bond, in the State of California, and that such proceedings, if had, will result in additional cost and expense to the Association.

Wherefore, the District in consideration thereof and said premises, hereby promises and agrees to pay to the Association, in the event of action being brought here-

under, or under said reimbursement bond, in the State of California, the sum of one thousand (\$1,000) dollars to reimburse the Association for the additional cost and expense to it of suing in the State of California, and such additional sum for attorney's fees as may be deemed reasonable by the court trying such action.

In witness whereof, the said corporation have, by order of their respective governing bodies, caused these presents to be executed in their respective corporate names, by their presidents and secretaries, and attested by their seals, the day and year first above written, in duplicate.

IMPERIAL IRRIGATION DISTRICT,
By EARL C. POUND
President

Attest:
F. H. McIVER
Secretary

YUMA COUNTY WATER USERS' ASSOCIATION,
By FRED BLOHM
President

Attest:
C. W. INGHAM
Secretary

Legal Features Approved:
CHAS. L. CHILDERS
Attorney

Coachella Valley

Coachella Valley County Water District—

Following from Irrigation Districts in California, Bulletin 21, 1929, State of California, Division of Engineering and Irrigation (p. 374):

Gross area, 992,320 acres.

"This large district was formed primarily for the purpose of gathering data regarding the water supply available to Coachella Valley from the streams, especially Whitewater River, which enter that valley from the San Bernardino, San Jacinto, and other surrounding mountain drainage areas. While a large amount of information regarding this water supply has been obtained through studies by the district, the principal activity of the district in recent years has been in connection with the promotion of the Boulder Canyon bill in Congress.

"Agricultural development in Coachella Valley has taken place mainly since 1900. The water supply comes almost entirely from the artesian basin underlying Coachella Valley. The realization, about 1918, that the underground supply was being drawn upon in excess of annual replenishments convinced landowners that action to safeguard and increase that water was essential to the future development of the valley.

"Within the large area of the district it is estimated that some 260,000 acres is irrigable if water can be made available to it. The present irrigated area approximates 16,000 acres, and is said to be increasing at the rate of about 1000 acres per year.

"Coachella Valley County Water District has obtained permits 536 and 3011 from the Division of Water Rights for spreading and sinking of 119,000 acre-feet of water annually from Whitewater River and tributaries for the benefit of landowners within the district."

Following is taken from letter and maps furnished by Mr. W. P. Britton, Secy-Mgr. of the District, under date of Sept. 10, 1930:

Present acreage under irrigation, approximately----	16,000 acres
Water obtained entirely by pumping from wells.	
Present water supply sufficient for only-----	10,000 acres
Maximum feasible acreage under All-American Canal development:	

Main valley—

Gravity -----	108,000 acres
50-ft. pump lift-----	12,400 acres
	120,400

Myoma area—	
100-ft. pump lift-----	4,500
Edom area—	
200-ft. pump lift-----	9,700
Deep Canyon Cone—	
250-ft. pump lift-----	2,500
Total -----	137,100 acres
Water duty—estimated -----	4.5 acre-feet

Map of proposed development is given in Plate XIII.

Palo Verde Irrigation District

Following from letter of C. P. Mahoney, manager of district, dated March 13, 1930:

“Total acreage in district -----	89,000 acres
Total acreage when district expanded to take in all lands irrigable by gravity-----	104,500 acres
Acreage on first Palo Verde Mesa—	
Under 100-ft. pump lift-----	20,000 acres
Acreage on second Palo Verde Mesa—	
Subject to approximately 200-ft. pump lift-----	25,000 acres
Total acreage as above-----	238,500 acres

Water used in past—

<i>Year</i>	<i>Acres in cultivation</i>	<i>Acre-feet used</i>	<i>Remarks</i>
1926	36,135	203,106	Mild water shortage
1927	36,000 (Approx.)	209,102	Mild water shortage
1928	33,020	168,104	Severe water shortage
1929	32,393	203,170	Ample water”

On the basis of the water used in 1929, the water required for the project when irrigating an area of 79,000 acres, would be 495,000 acre-feet gross diversion.

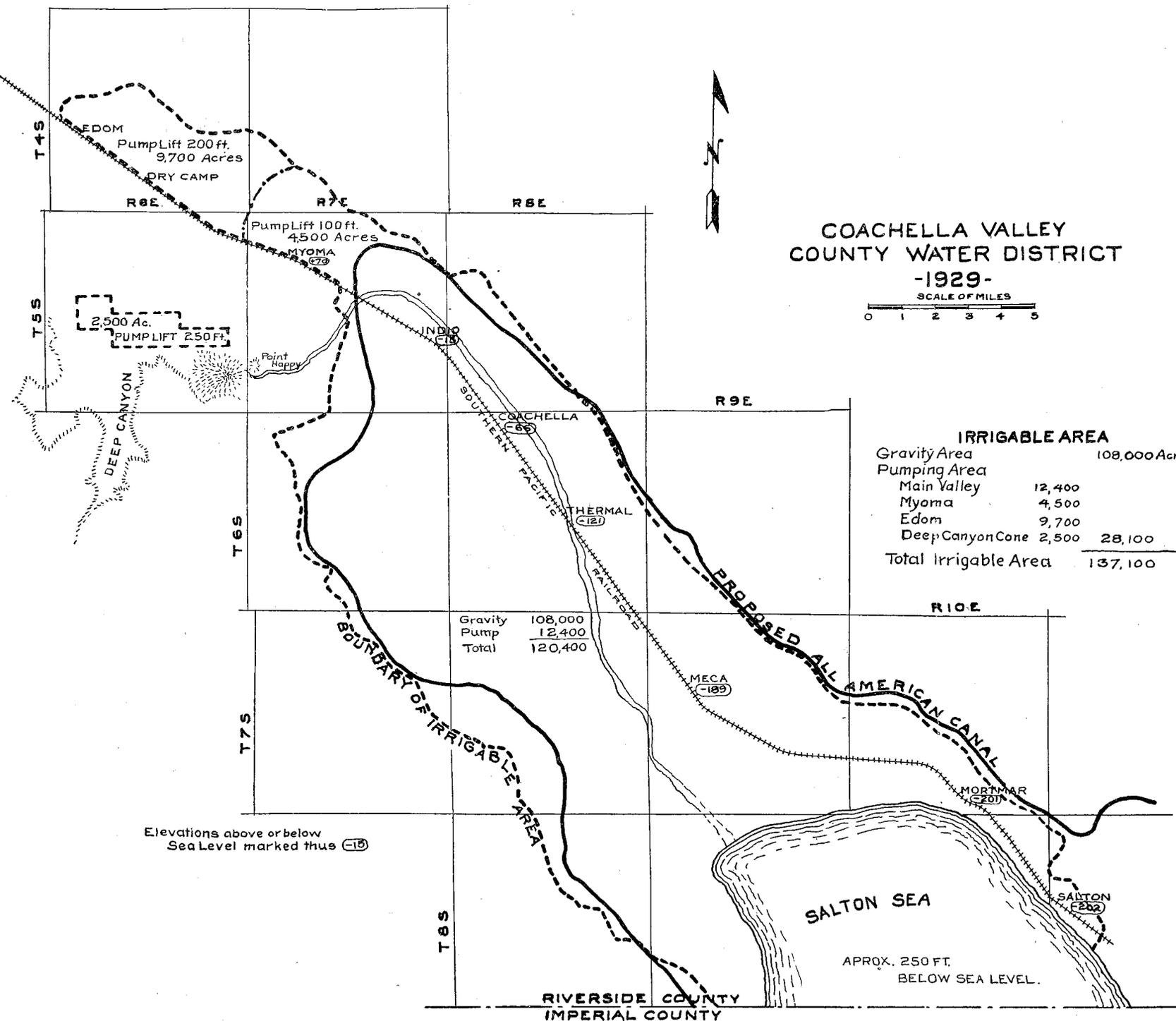
Plate XIV gives map of this district.

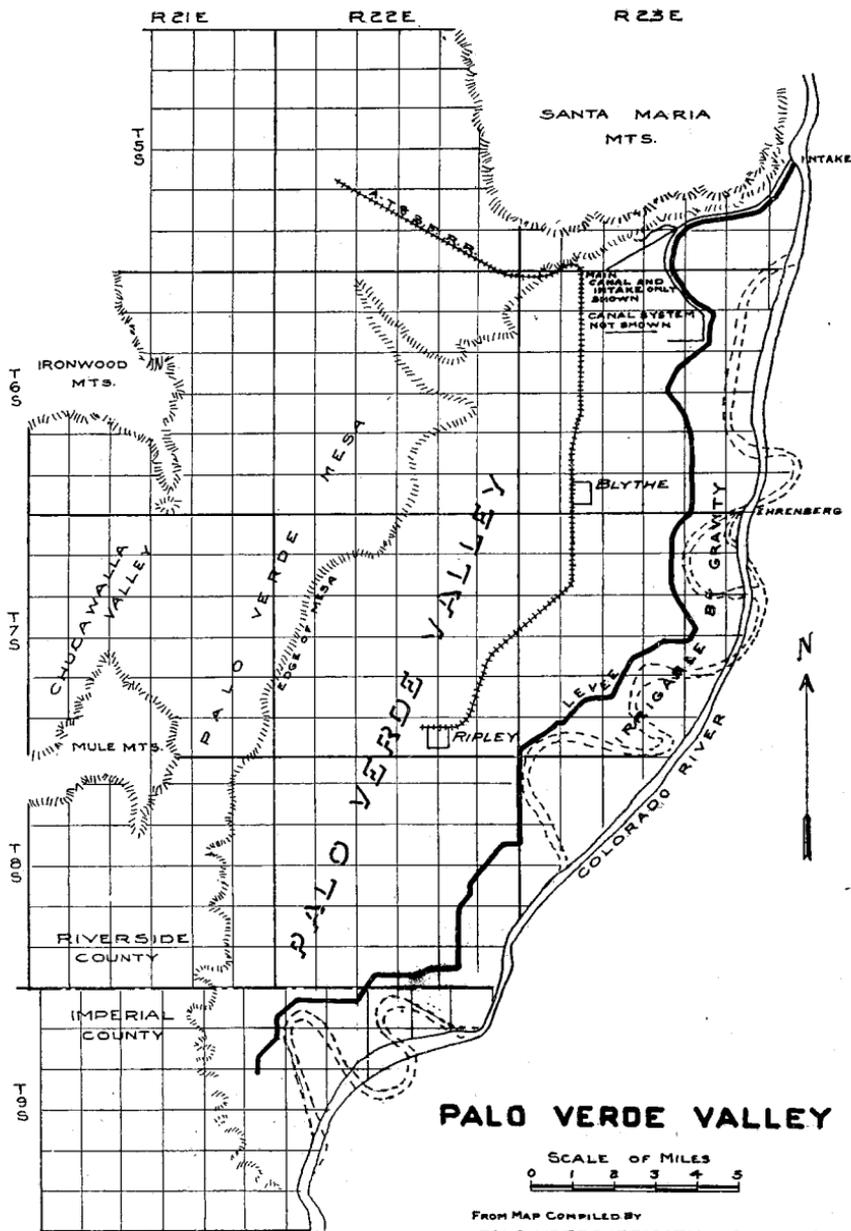
Plate XV of the Palo Verde Mesa and Chucawalla Valley also shows the two mesas referred to above.

The Palo Verde Irrigation District is located along the Colorado River in California mainly in southeastern Riverside County with a small area extending into Imperial County. The date of organization was October 27, 1923. The gross area of the district is 88,693 acres; area assessed 1927, 78,504 acres.

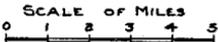
History: Palo Verde Irrigation District Act creating Palo Verde Irrigation District was passed by the California Legislature in 1923 and amended in 1925 and 1927. (Statutes 1923, Chap. 452, amended, Statutes 1925, Chap. 353, and 1927, Chap. 583.) The election approving the organization of the district was by voters qualified on the basis of one vote for each \$100 valuation of property affected.

The district took over the properties and functions of Palo Verde Joint Levee District, Palo Verde Drainage District, and the Palo Verde Mutual Water Company.





PALO VERDE VALLEY



FROM MAP COMPILED BY
PALO VERDE IRRIGATION DISTRICT
1923

The special Palo Verde Irrigation District was approved June 21, 1923, and organization was ratified by the landowners October 27, 1923, and in December, 1924, the legality of the organization was sustained by the Supreme Court.

Early development in Palo Verde Valley dates from about 1877 or 1878 when Samuel Blythe acquired about 40,000 acres in the valley under the Swamp and Overflow Act. The first Blythe water filing was made at Black Point July 17, 1877. Little development seems to have occurred until about 1904 and a disastrous flood in 1905 wiped out most of the settlers' developments. In 1908 the irrigation properties of Palo Verde Land and Water Company were taken over by Palo Verde Mutual Water Company and unentered government land was rapidly filed on, but there seems to have been no marked increase in development until after the completion into the valley of the branch line of the Santa Fe Railway in 1915.

Practically the entire valley is included within Palo Verde Irrigation District with a maximum width of about 10 miles between the river levees and the Palo Verde Mesa on the west. The length of the valley is about 30 miles along the eastern edge and elevations range from 240 feet to 275 feet. The channel of the Colorado River is higher than most of the valley lands, the river banks in places being about ten feet above the valley lands immediately below Palo Verde Mesa on the west.

Water Supply: The water rights of Palo Verde District are based on the oldest filings on Colorado River in California. The first filing is for 95,000 miners inches dated July 17, 1877. Subsequent filings were made December 15, 1878, for 90,000 miners inches; February 20, 1883, for 100,000 miners inches; April 2, 1904, for 300,000 miners inches; September 14, 1908, for 200,000 miners inches; August 5, 1911, for 200,000 miners inches.

Obviously the filings are duplicates or enlarged filings rather than cumulative. The first filings are prior to any others of which record has been found. There has never been a deficiency in the supply in the river, but there has been difficulty in diverting the required amount because of silt deposits in the intake canal and lowering of the river channel at the headgate caused by scouring.

Reference: Bulletin No. 21, Irrigation Districts in California, Department of Public Works, State of California, page 327 *et seq.*

Palo Verde Mesa and Chuawalla Valley Project

The following acreages are taken from a map furnished by the Palo Verde Mesa and Chuawalla Valley Development Association. The map carries the statement that it was compiled by James E. Sellers, Consulting Engineer, Los Angeles, January 1, 1929, with a note contours were taken from a map of James D. Schuyler, on file in the U. S. Land Office, under Serial No. 012672 "F." M. M., March 31, 1911. Plate XV is taken from this map.

The scheme of development proposes to take water from the dam at or near Parker. This could be the same dam as proposed by the Arizona Engineering Commission for the Parker-Gila project. The Arizona Engineering Commission in their report states that 310,000 acres could be irrigated in California from the Parker Dam.

Palo Verde Mesa and Chucawalla Valley Project

Unit	Gravity	Pump	Total
Palo Verde Mesa—			
Low area-----	20,000*	-----	20,000
Intermediate area-----	22,450*	-----	22,450
High area (95 ft. lift)-----	-----	12,400	12,400
Chucawalla Valley—			
North side-----	43,000	-----	43,000
South side-----	42,000	-----	42,000
First high level (123 ft. lift)-----	-----	45,000	45,000
Second high level (228 ft. lift)-----	-----	32,400	32,400
Totals-----	127,450	89,400	217,250

* 42,500 acres above is a duplication of area listed under Palo Verde District.

Plate XV shows the areas as given above.

The above gravity lands are based on the assumption that water will be diverted and reach the project at an elevation of 480 feet above sea level.

The following is from a statement rendered to California-Colorado River Commission in 1930 by the Palo Verde and Chucawalla Valley Development Association.

"The Palo Verde Mesa and Chucawalla Valley project is located in the eastern part of Riverside County, California.

"The Palo Verde Mesa lies adjacent to and west of the Palo Verde Valley. The elevation of the mesa is from 320 to 450 feet above sea level and from 70 to 200 feet above the adjacent valley.

"West of the Palo Verde Mesa is a low pass between the McCoy Mountains and Mule or Hodges Mountain. Through this pass is the Chucawalla Valley, extending northwesterly for a distance of about 30 miles and with a maximum width of about 12 miles. The valley is a large inland basin or sink, with no surface drainage outlet. There are two dry lakes in the bottom of the basin; Palen Lake, elevation 450 feet, near the west end of the basin, and Ford Lake, the lower point of the basin, elevation 360 feet, near the east end.

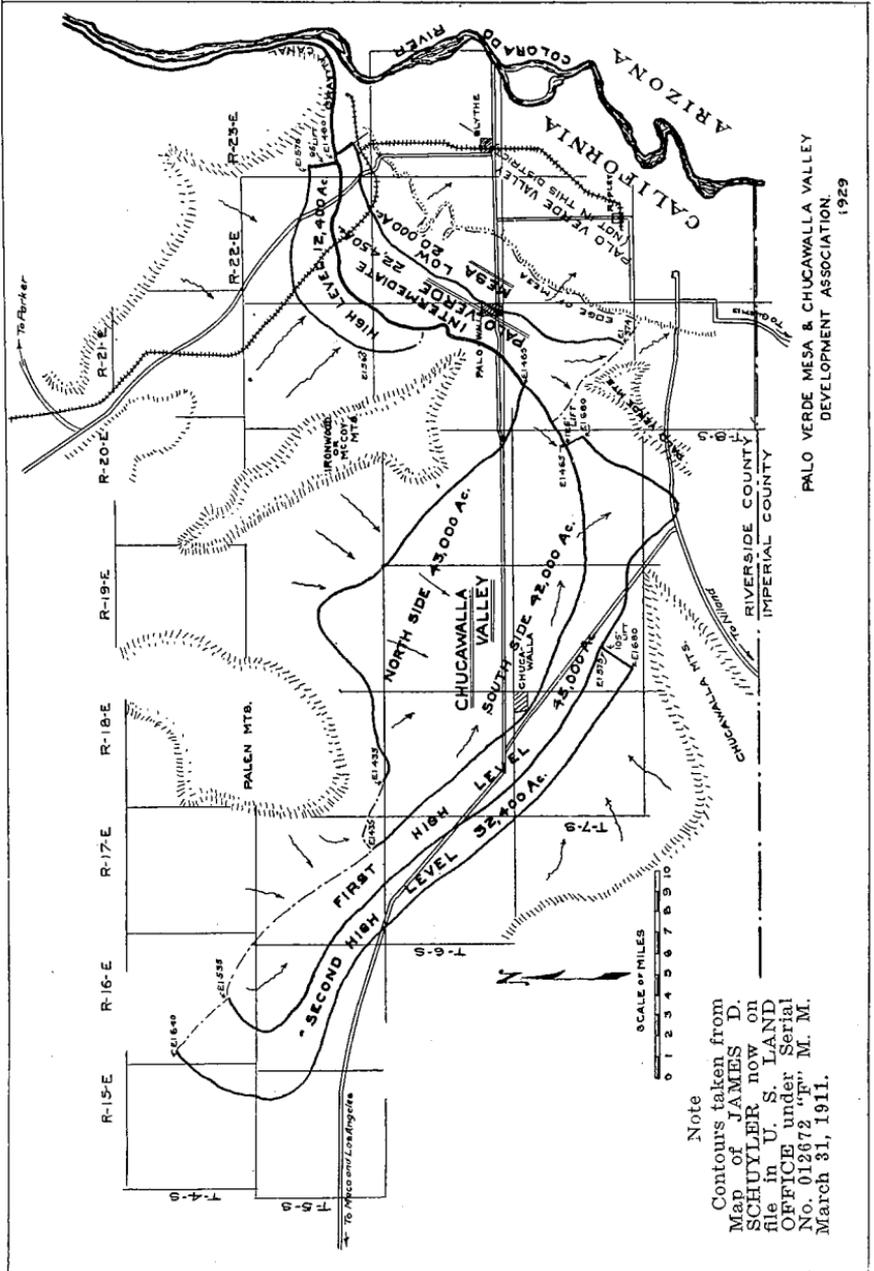
"About the year 1908 the Chucawalla Development Company was organized for the purpose of supplying water from the Colorado River to an extensive area of desert land. The lands to be covered by this irrigation project known as the Palo Verde Mesa and Chucawalla Valley, and embrace an area of nearly 200,000 acres. Practically all of the lands proposed to be irrigated by the project were filed on in the United States Land Office, either by homestead or desert land claimants, the far greater number being under the Desert Land Law, and the filings made under the encouragement offered by the proposed irrigation plan. The company made preliminary surveys of canal lines, investigations and borings at dam sites, situated 8 miles above Parker, Arizona, below Bill Williams Fork and at Pyramid Canyon, 30 miles above Needles, California. Also surveys of the reservoir sites were made in connection with the dam sites mentioned. Further preliminary surveys were made for a transmission line for conveying electric power to the pumping plants near the diversion dam and reservoir at Black Point.

"An Act of Congress was passed and approved February 15, 1911, entitled: 'An act to authorize the Chucawalla Development Company to build a dam across the Colorado River at or near the mouth of Pyramid Canyon, also a diversion intake dam at or near Black Point, Arizona, and Blythe, California.'

"We are unable to give you the total cost of the work done, but we are informed by Mr. R. M. Teague, of San Dimas, California, that he personally spent more than \$100,000 in said work.

"About this time it was determined that during the low water season, the Colorado River did not supply enough water for the irrigation of all of the lands along its banks, and that the Palo Verde, Yuma and Imperial projects were taking all of the available supply. It was apparent that a much larger dam would be necessary to conserve the storm waters of the river, before it would be safe to develop such a large acreage. While plans were being worked over, the World War came on, and effectively put a stop to activities.

"In the meantime the Government, recognizing the equities of the entryman, and the possibilities of reclaiming the lands involved, has by successive Acts of Congress, granted extensions of time within which to complete the reclamation of the lands.



PALO VERDE MESA & CHUCAWALLA VALLEY
DEVELOPMENT ASSOCIATION.
1929

Note
Contours taken from
Map of JAMES D.
SCHUYLER now on
file in U. S. LAND
OFFICE under Serial
No. 012672 Tr. M. M.
March 31, 1911.

"It is generally recognized that there is no possibility of obtaining water from the Colorado River until storage facilities are provided. When storage is provided, we feel that this district is one which can be reached by water at a less cost per acre than any other major project along the river.

"In the earlier stages of the proposed development, it was proposed to build a storage dam, a diversion dam, and provide electric pumping equipment, all of the cost of which was to be met by the land itself.

"Also that it is almost necessary for the Arizona irrigation interests if they are to take water at all, to have a diversion dam somewhere near Parker, and that such a dam must be located at a point on the river where it can deliver water by gravity to much of the lands of our project.

"Our plans for diversion, therefore, call for taking water from the river, at a diversion dam to be built in the river north of Parker. Such dam to be constructed by ourselves if necessary, or in conjunction with other interests if found advisable.

"No part of the area is now under irrigation, but a few years ago a small area on the North Mesa was irrigated from a well and provided amazing crops.

"The soil surveys of the United States have not been extended to our area, but soil tests secured by individuals have indicated that the soils of the area are extremely fertile, free from salts, and suitable for all crops grown in similar regions.

"Beside the money spent in surveys along the river, the cost to the entrymen in reclamation work on their claims, has, at a conservative figure, exceeded a half million dollars.

"An association of the entrymen of the area has been formed for the purpose of encouraging cooperation, protecting established rights, securing new rights and providing ways and means of effecting the reclamation of the lands involved.

"The association has secured the assignments of the rights of former water appropriators and dam site claimants, as well as having made application to the State of California Division of Water Rights for water from the river.

"There are at this time active steps being taken toward the formation of an irrigation district."

The following is taken from the Arizona Engineering Commission report, 1923, pp. 24, 27:

California Lands.

"The Commission did not investigate in the field, the possibilities for development by irrigation on the California side. However a study of available reports indicates that a canal on the California side would reach the Palo Verde Mesa at elevation 420 feet above sea level. It is, therefore, apparent that a part of the Palo Verde Mesa could be irrigated by gravity and the remainder of these lands and all lands included in the Chucawalla Valley project could be irrigated with a maximum pump lift not exceeding 130 feet. It is known that some lands between the proposed Parker diversion dam and the Blythe intake could be irrigated. We have estimated that a total of 50,000 acres could be irrigated from the main canal on the California side above the Blythe intake. The data given in the following table show in a general way the possibilities for irrigation development on the California side, providing a diversion dam should be built at the Parker dam site.

Parker-Gila Valley Project Lands Irrigable on California Side

Unit	Area irrigable		Total acres
	Gravity acres	Pumping ¹ acres	
Between diversion dam and Blythe intake-----	50,000	0	50,000
Palo Verde Valley-----	79,000	0	79,000
Palo Verde Mesa-----	20,000	25,000	45,000
Chucawalla Valley-----	0	136,000	136,000
Totals-----	149,000	161,000	310,000

¹ Maximum pump lift, 130 feet.

"It, therefore, seems that a canal leading from the Parker diversion dam could be made to serve about 310,000 acres on the California side."

Chemehuevis Valley

This project with a gross acreage of 2900 acres in California and (according to the Arizona Engineering Commission) 4400 acres in

Arizona is described under the Arizona projects as the greater area lies in that state.

This project would not be developed if the Arizona scheme of a dam at Parker is carried out, as the land would fall in the reservoir area.

Mohave Valley

This project is described under Arizona Projects as the greater area of land is in Arizona.

Senate Document 142, page 51, gives acreage as follows:

	Indian lands	Total gross	Irrigable		
			Gravity	Pump	Total
Mohave Valley, East side-----	20,000	39,000	22,500	2,400	24,900
North of Ft. Mohave—					
East side -----		3,000		800	800
West side -----	2,500	6,000	1,000	---	1,000
Total gross-----	<u>22,500</u>	<u>48,000</u>	<u>23,500</u>	<u>3,200</u>	<u>26,700</u>
Total net irrigable-----	12,500	---	---	---	26,700

This would make division between California and Arizona as follows:

	California	Arizona	Total
Gross acreage -----	6,000	42,000	48,000
Net irrigible acreage-----	1,000	25,700	26,700

Yuma Project

This project is described under Arizona Projects, the area being divided between Arizona and California as follows:

	Arizona	California
Gross acreage -----	112,000	18,000
Net acreage -----	93,000	15,000

The above figures are for the *entire* project.

ARIZONA PROJECTS

For the purpose of determining the amount of Arizona land feasible of irrigation from the Colorado River, The Arizona Engineering Commission was created by State Water Commissioner W. S. Norviel. For authority of State Water Commissioner, see Session Laws of Arizona, 1922 (Special Session), chapter 42, section 43.

The report of the commission was submitted to Gov. Geo. W. P. Hunt under date of July 5, 1923, and was signed by E. C. LaRue, Chairman, Porter J. Preston and H. E. Turner. The opening paragraph of the report states "the purpose of this report is to show how much land in the state of Arizona can be irrigated with the waters of the Colorado River." The report further states that it is a reconnaissance report, the amount of money available for the commission being too small to permit of topographical surveys covering the large region affected.

One of the projects considered was the so-called High Line project by which it was proposed to divert water from a point on the Colorado River at some point between Boulder Canyon and Diamond Creek. The proposers of the project had a scheme by which it was suggested that water be diverted by a high dam on the Colorado River and carried through a tunnel some 90 miles long, store the water in a regulating reservoir and then carry the water through another tunnel

some 24 miles long before the irrigated areas were reached. Under the proposal of the High Line advocates some 2,000,000 acres were to be developed. The commission reported unfavorably on the High Line project as follows (Arizona Engineering Commission report, 1923, page 38):

“This commission agrees that the High Line Canal Project is not feasible at the present estimated cost of \$225 per acre, and that no funds should be appropriated for a detailed survey of the project as a whole.” It might be stated in passing that in addition to the difficulties and cost of tunnel work mentioned above, the water would have to be carried almost 140 miles before any irrigable land was reached, and of this 140 miles over 110 miles would be in tunnels. The end of the main canal would be some 370 miles from the intake.

The following figures are based on the Arizona Engineering Commission’s report.

The Arizona Engineering Commission gives tabulated figures of *net* irrigable areas, but according to the maps published in its report this term *net* seems to be used in the sense that areas of mountains and high hills, too high in elevation to be reached by water, have been excluded. The term *net* does not appear to be used as designating only agricultural lands, but *includes all lands* lying below contours reachable by water.

Mr. A. T. Strahorn, in an unpublished report to the Interior Department in 1919, reports on much of the area which would be covered by the so-called Parker-Gila project. The area covered by the Strahorn survey was some 633,000 acres located in Yuma and Maricopa counties, Arizona, in about the area in which the Gila River portion of the Parker-Gila project is located. At the time the survey was made the area covered by the Strahorn report was known as the Sentinel project. The report seems to cover all areas lying below certain contours; in other words, the areas taken as *gross* in the Strahorn report seem to correspond to the areas taken as *net* in the Arizona Engineering Commission’s report.

Taking only the area covered by the Strahorn survey the percentages of agricultural land figures as follows:

Agricultural -----	369,343	58.3%
Nonagricultural -----	264,167	41.7%
Totals-----	633,510	100.0%

On the basis of the Strahorn report it would seem to indicate that the Arizona Engineering Commission figures on this particular area should be corrected by taking about 60 per cent of the net figure given. The Strahorn report eliminates land as nonagricultural which is too rough to be susceptible of irrigation, land which is incapable of drainage, underladen with hardpan, or where the soil is too shallow to support a crop.

The Arizona Engineering Commission figures as given in its report are as follows (Arizona Engineering Commission Report, 1923, pages 23 and 24):

Summary of Net Irrigable Areas in Arizona Below Boulder Canyon
(Low lands adjacent to the river)

<i>Unit</i>	<i>Irrigable areas</i>		
	<i>Gravity acres</i>	<i>Pumping acres</i>	<i>Total acres</i>
Opposite El Dorado Canyon-----	0	300	300
3 miles below El Dorado Canyon-----	0	200	200
Cottonwood Valley-----	0	4,000	4,000
Mohave Valley--			
Bulls Head Unit-----	0	500	500
Hardyville Unit-----	0	2,300	2,300
Ft. Mohave Mesa-----	0	6,300	6,300
Mohave Valley Bottoms-----	24,000	0	24,000
Blankenship Valley-----	0	800	800
Chemehuevis-----	0	4,400	4,400
Parker Valley-----	104,000	6,000	110,000
Cibola Valley-----	0	16,000	16,000
Miscellaneous tracts between Cibola Valley and Laguna Dam-----	0	3,400	3,400
Yuma project-----	54,000	61,000	115,000
Totals -----	182,000	105,200	287,200

Net Irrigable Areas Under Parker-Gila Valley Project, Arizona Side

<i>Unit</i>	<i>Irrigable areas</i>		
	<i>Gravity acres</i>	<i>Pumping acres</i>	<i>Total acres</i>
Parker Mesa-----	4,000	8,000	12,000
Colorado River Indian Reservation (bottom)-----	104,000	0	104,000
Cibola Valley-----	16,000	0	16,000
Lands north of Gila River-----	0	202,000	202,000
Lands south of Gila River-----	0	430,000	430,000
Totals -----	124,000	640,000	764,000

The above tables give some areas which are duplications, as for instance the Parker Valley is given as 110,000 acres in the first table and in the second table the Colorado Indian Reservation is given as 104,000 acres, which is the gravity land included in the Parker Valley project in the first table. Also construction of a dam as proposed under the Parker-Gila project would flood certain areas given in the first tabulation as these areas would be flooded by the impounded water and thus rendered unusable, the lands thus flooded would deduct from the area given in the first table in the following amounts:

Mohave Valley-----	24,000 acres
Blankenship Valley-----	800 acres
Chemehuevis Valley-----	4,400 acres
Total -----	29,200 acres

The duplications in the two tables, assuming that the Parker-Gila project would be constructed, and using the figures given by the Arizona Engineering Commission, are as follows:

Parker Valley-----	110,000 acres
Cibola Valley-----	16,000 acres
Yuma project (land in California)-----	15,000 acres
	141,000 acres
Lands in the two tables—	
First table-----	287,200 acres
Second table-----	764,000 acres
Total -----	1,051,200 acres

Less duplications -----	141,000	
Areas flooded in reservoir-----	29,200	
	<hr/>	170,200 acres
		<hr/>
		881,000 acres

On the basis of the Strahorn report the acreage given would seem to be modified. Using the Strahorn figures for the lands around the Gila River, we would have net acreages as follow :

Corrected Net Acreage—Arizona Land—(Exclusive of Land Irrigated from Gila)

	<i>Gross</i>	<i>Net</i>
Opposite El Dorado Canyon-----	-----	300
Three miles below El Dorado Canyon-----	-----	200
Cottonwood -----	6,000	4,000
Bulls Head -----	-----	500
Hardyville unit -----	-----	2,300
Ft. Mohave Mesa -----	-----	6,300
Parker-Gila project—		
Parker Valley (Colorado River Indian Reser- vation) -----	121,000	104,000
Parker Mesa -----	-----	12,000
Cibola -----	18,000	16,000
Miscellaneous tracts -----	-----	3,400
Lands north of Gila River-----	202,000	121,200
Lands south of Gila River-----	430,000	258,000
Yuma project (Arizona land)-----	130,000	100,000
	<hr/>	<hr/>
Totals-----	907,000	628,200

(NOTE—The net acreage given above for the Parker-Gila project for lands north and south of Gila River are based on the figures given in the Strahorn report, 60 per cent of land given in the Arizona Engineering Commission report—J. L. B.)

There appears to be no accurate information available for acreage irrigated directly from the Gila River and its tributaries, but the use of Gila water for such land has been taken as 1,800,000 acre-feet per year based on statement of Reclamation Bureau. (See statement under section on "Water," page 194.)

The Arizona Engineering Commission in estimating the amount of land irrigable under the Parker-Gila project includes 310,000 acres in California, the expectation being that if Parker Dam was built water would be available for use on the California side of the river and these California lands would be expected to bear their proportionate share of the cost of construction. The Arizona Commission on page 27 of their report give the estimated cost of Parker Dam as \$4,700,000, of which \$2,000,000 is charged to California projects as their proportion of the cost. Under the Arizona set up California lands would thus be expected to pay for over 40 per cent of the cost of the dam.

The Arizona Engineering Commission on the same page of their report gives the following table:

Parker-Gila Valley Project—Lands Irrigable on California Side

Unit	Irrigable areas		
	Gravity acres	Pumping acres	Total acres
Between diversion dam and Blythe intake-----	50,000	0	50,000
Palo Verde Valley-----	79,000	0	79,000
Palo Verde Mesa-----	20,000	25,000	45,000
Chucawalla Valley-----	0	136,000	136,000
Totals -----	149,000	161,000	310,000

It is interesting to note that in no proposal that Arizona has ever made to California has there been sufficient water allowed California to bring these lands under irrigation, although it seems to be expected that they will bear their proportionate cost of constructing a dam at Parker.

Gila River Development

The development on the Gila River has been one of the points over which there has been considerable controversy. Arizona has contended that she should be entitled to full use of the Gila River water. California has always conceded that whenever an agreement was entered into between the two states, California would be agreeable to waiving her claims against the Gila River water (based on a diversion and use below the mouth of the Gila), but has also contended that under the terms of the Seven-State Compact such use of water on the Gila River falls within uses within the basin, and would have to be considered as part of Arizona's share of lower basin waters.

At a conference held in Washington during June of 1929, certain questions were asked the Bureau of Reclamation and one of the questions and the answer thereto was the following:

"Question: Total amount of water in the Gila and its tributaries.

"Answer: (By Bureau of Reclamation.) The average annual run-off of the Gila River just above Florence, Arizona; at Salt River, just above its junction with the Verde River; Verde River at its junction with the Salt River and the minor streams entering the Salt River just west of Phoenix, total an average of 2,400,000 acre-feet annually. Prior to construction of the Coolidge Dam, the average annual flow of the Gila River at Yuma was about 1,000,000 acre-feet annually. Following full operations under the Coolidge Dam and the additional storage developments contemplated for an early date on the Verde and other streams, it is anticipated that the average discharge of the Gila River at the mouth will probably not exceed 300,000 acre-feet annually. Prior to irrigation development in the Gila River water shed, the discharge at its mouth probably approximated 2,000,000 acre-feet annually, indicating that past and future development in this water shed contemplate a consumptive use of roughly 1,700,000 acre-feet."

From these figures it has been assumed that the consumptive use of water on the Gila River would be about 1,800,000 acre-feet annually. The stream losses which are excessive during the flash floods occurring on the Gila can, of course, only be approximately estimated. The figure of 1,800,000 acre-feet is 100,000 acre-feet more than the rough figure of consumptive use given by the Bureau of Reclamation, the assumption being that by full development of the Gila there will be a slight reduction in stream losses.

Plate XVI shows the Parker-Gila project, the information being taken from the map accompanying the report of the Arizona Engineering Commission.

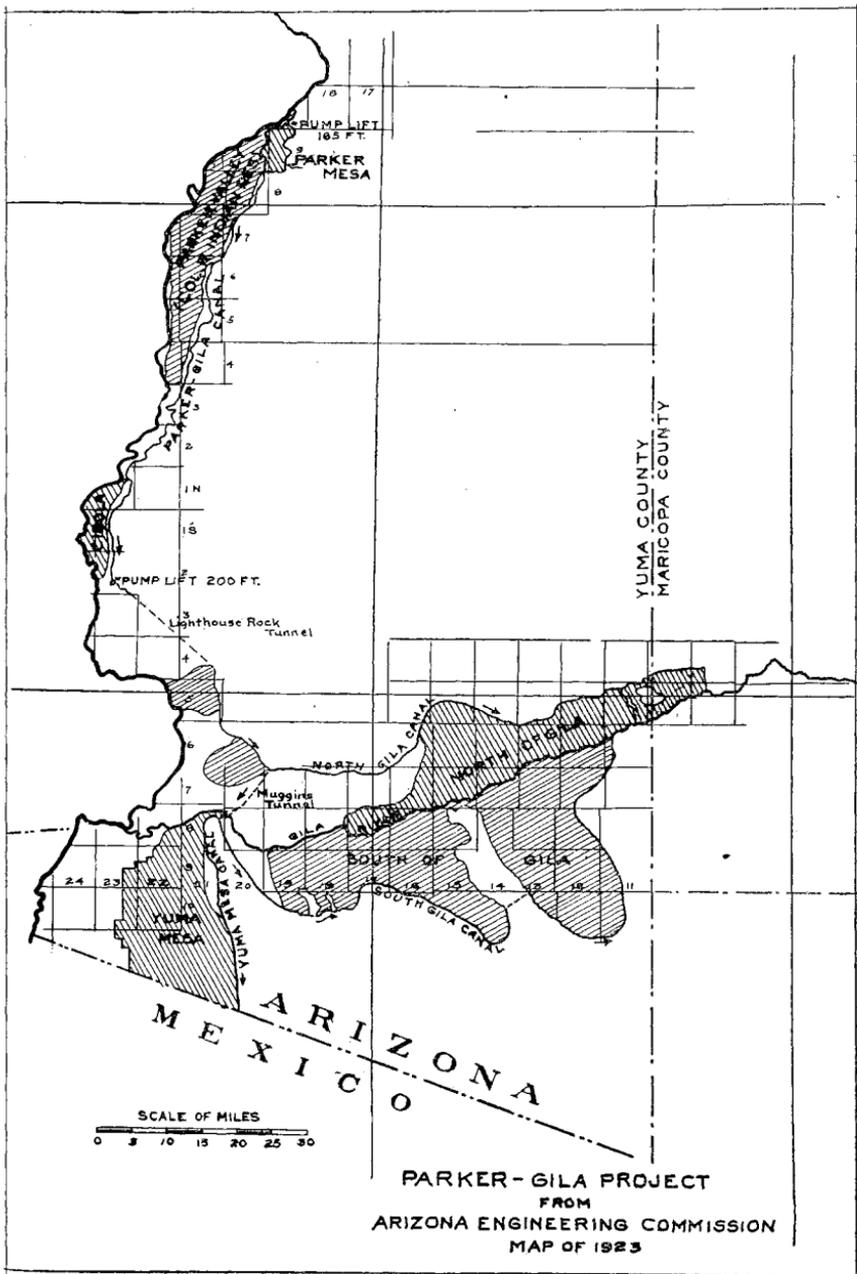


PLATE XVI.

Cottonwood

The following is taken from Senate Document 142, pp. 49-50.

"The Cottonwood Valley project, or what is generally known as Cottonwood Island, is located on both sides of the Colorado River in Clark County, Nevada, and Mohave County, Arizona. The nearest railroad point is Chloride, which is about 30 miles east.

"This tract is a small valley of river-bottom land through which the river meanders, changing its channel from time to time. There are generally two principal channels, which form the island, but the river is now all in the west channel. This tract will be submerged in case the Bulls Head reservoir is constructed.

"Ownership. There are no patented lands in the valley. The area was withdrawn under the reclamation act in 1903 for the proposed Bulls Head reservoir.

Area—	Acres
Gross -----	6,600
Irrigable—	=====
Gravity -----	1,600
Pumping (40-foot lift) -----	2,800
Total -----	4,400"

The following is taken from the Arizona Engineering Commission report, page 13:

"Considering Cottonwood Valley proper, below Eagle Rock Canyon, about 200 acres of bottom land are now being irrigated. By installing a pumping plant near the head of the valley to raise the water about 40 feet, approximately 3000 acres could be irrigated in this valley on the Arizona side. At the head of the valley, possibly 1000 acres could be irrigated on the mesa by lifting the water 80 feet. The remainder of the detrital wash plain bordering Cottonwood Valley is cut by many washes and is deemed unsuitable for agricultural purposes."

Mohave Valley Project

The following is from Senate Document 142, p. 50:

"Location and general description: Mohave Valley is located principally in Mohave County, Arizona, with a small area on the west side of the river, in Clark County, Nevada, and in San Bernardino County, California.

"The principal town, Needles, with a population of 2500, is located on the west bank of the river. The Atchison, Topeka & Santa Fe Railroad crosses the Colorado River at the lower end of the valley.

"The main valley extends from Fort Mohave on the north to Topock on the south, a distance of about 25 miles, with a maximum width of about 5 miles.

"The valley is subject to overflow, at least to some extent, for floods of 25,000 second-feet. It would appear, therefore, that even with storage for flood control a levee system will be required in order to reclaim these lands.

"All odd-numbered sections in the Mohave Valley on the east side of the river and outside of the reservation were granted by the United States to the Atlantic & Pacific Railroad, now the Atchison, Topeka & Santa Fe. In 1904 these lands were sold and are now held by the Cotton Land Company, which planned to reclaim 30,000 acres.

"All even-numbered sections in Mohave Valley east of the river—about 18,000 acres—were made part of the Indian reservation by executive order of February 2, 1911.

"In 1912 and 1913 the Indian Service constructed 5 miles of levee. This levee failed in 1914, as also did the levee of the Cotton Land Company. Since that date neither of these levees has been repaired.

CLASSIFICATION OF LANDS, MOHAVE VALLEY PROJECT

Tract	Ownership			Total	Gross	Area irrigable		Total
	Indian lands	Public lands	Private lands			Gravity	Pumping	
Mohave Valley, east side.....	20,000	----	19,000	39,000	39,000	22,500	2,400	24,900
North of Fort Mohave—								
East side	-----	1,000	2,000	3,000	3,000	-----	800	800
West side.....	2,500	1,700	1,800	6,000	6,000	1,000	-----	1,000
Total gross.....	22,500	2,700	22,800	48,000	48,000	23,500	3,200	26,700
Total, net irrigable.....	12,500	1,500	12,700	26,700	-----	-----	-----	-----

“Present Status. The only irrigation development in the Mohave Valley has been done by the Cotton Land Company and the United States Indian Service. The Cotton Land Company system comprises about 19½ miles of canal, with a capacity of about 100 second-feet. A concrete intake is installed about 2 miles below Fort Mohave which is at a point well protected from river action by a jutting point of mesa. No silting works or diversion structure other than an intake have been provided.

“The Cotton Land Company has also constructed about 10 miles of levee, with a crown width of about 6 feet and an average height of 4 feet. No riprap or slope protection has been done. This levee, as previously stated, was partly destroyed in 1914.

“The United States Indian Service afterwards constructed a levee running south from near the head gate of the Cotton Land Company’s canal. This levee was also partly destroyed in 1914 and has not since been repaired.”

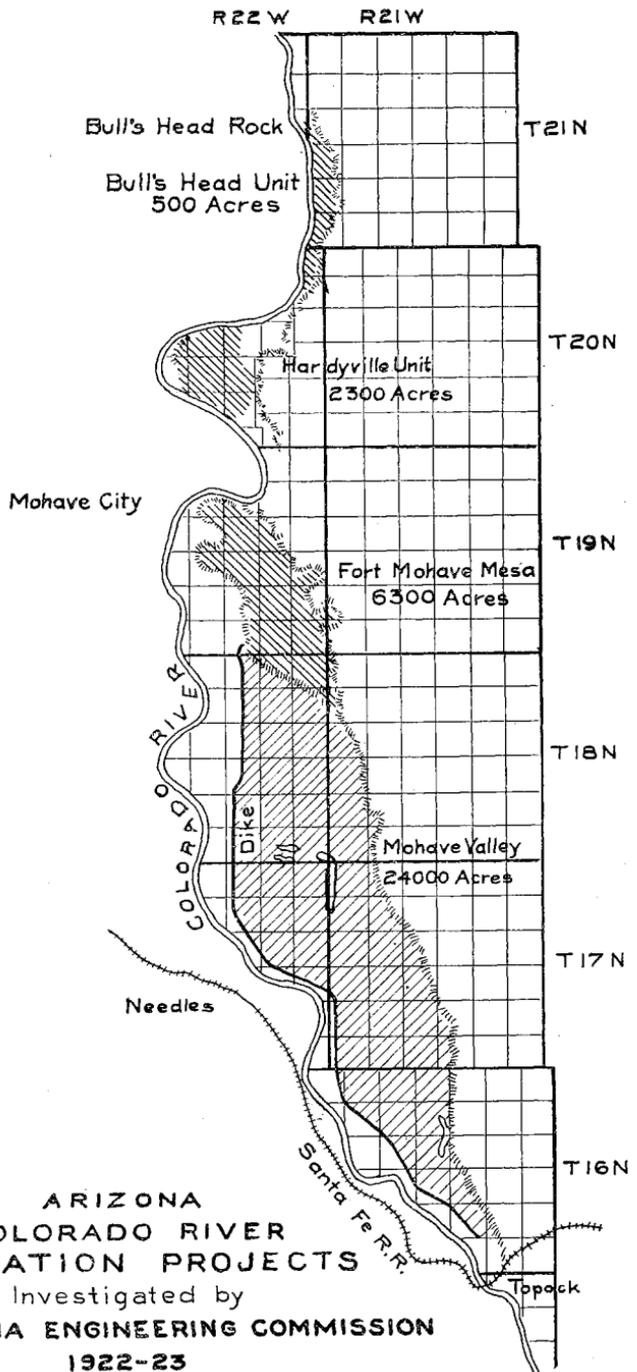
The Arizona Engineering Commission in its report, page 19, gives the following irrigable lands in Mohave Valley.

Unit	Irrigable by gravity system	Irrigable by pumping	
		Lift	Area
Bulls Head unit.....	0	25	500
Hardyville unit.....	-----	20-80	2,300
Fort Mohave Mesa.....	0	60-150	6,300
Mohave Valley bottoms.....	24,000		c
Totals	24,000		9,100

On the basis of the figures given in Senate Document 142, it is assumed that of the net total of 26,700 acres, 1000 acres lie outside of the State of Arizona on the west side of the river. Figures given in this table are the same as those given by the Arizona Engineering Commission in its report.

If the Parker-Gila project were constructed and a dam built at Parker, that would back up water to the elevation proposed by the Arizona Engineering Commission (El. 457), this water would flood a very appreciable portion of the bottom lands in the Mohave Valley project. As nearly as can be estimated from the maps and from the information given in Senate Document 142, this area flooded will be in the neighborhood of 24,000 acres, or the lands listed in the Arizona Engineering Commission report as Mohave Valley bottoms.

It is a little difficult to make a direct comparison between the Arizona Engineering Commission figures and those given in Senate Document 142. The Bulls Head unit and the Hardyville unit listed in the Arizona Engineering Commission report as Mohave Valley land is not included in the figures given in Senate Document 142.



ARIZONA
 COLORADO RIVER
 IRRIGATION PROJECTS
 Investigated by
 THE ARIZONA ENGINEERING COMMISSION
 1922-23

MOHAVE VALLEY
 Showing Irrigable Land

- Pumping
- Gravity

Plate XVII taken from page 17 of the Arizona Engineering Commission report shows the lands included in the project by that commission.

Bulls Head Unit

The following is taken from Arizona Engineering Commission report, p. 16:

"Beginning about one mile below Bulls Head Rock there is a narrow strip of land on the Arizona side of the river, about three and one-half miles long. About 500 acres could be irrigated with a pump lift of approximately 25 feet. For convenience we have called this Bulls Head unit."

Hardyville Unit

The following is taken from Arizona Engineering Commission report, p. 16:

"Immediately north of Fort Mohave at Hardyville, there is a tract of land comprising 2300 acres, which could be irrigated by a pump lift ranging from 20 feet to 80 feet."

Blankenship Valley

The following is taken from the Arizona Engineering Commission report, page 19:

"At the lower end of Mohave Canyon, 8 miles below Topock, there is a small basin on the Arizona side of the river known as Blankenship Valley. The head of the valley is marked by a large rock on the left bank of the river, 80 or 90 feet in height. Due to the many washes, the lands in Blankenship Valley are not first class. However, at some future time it may be feasible to reclaim possibly 800 acres in this valley by the installation of a pumping plant at Mohave Rock to raise the water 50 feet."

All of this land would be flooded if the Parker-Gila project were developed by building the dam as contemplated in the Arizona Engineering Commission report.

Plate XVIII taken from the Arizona Engineering Commission report, page 21, shows the lands included in the Chemehuevis and Blankenship projects.

Chemehuevis Valley Project

The following is taken from Senate Document 142, pp. 51-52:

"Location and description. The Chemehuevis Valley is located on both sides of the Colorado River, with the larger area on the west side. The portion on the east side is in Mohave County, Arizona. The portion on the west side of the river is in San Bernardino County, California.

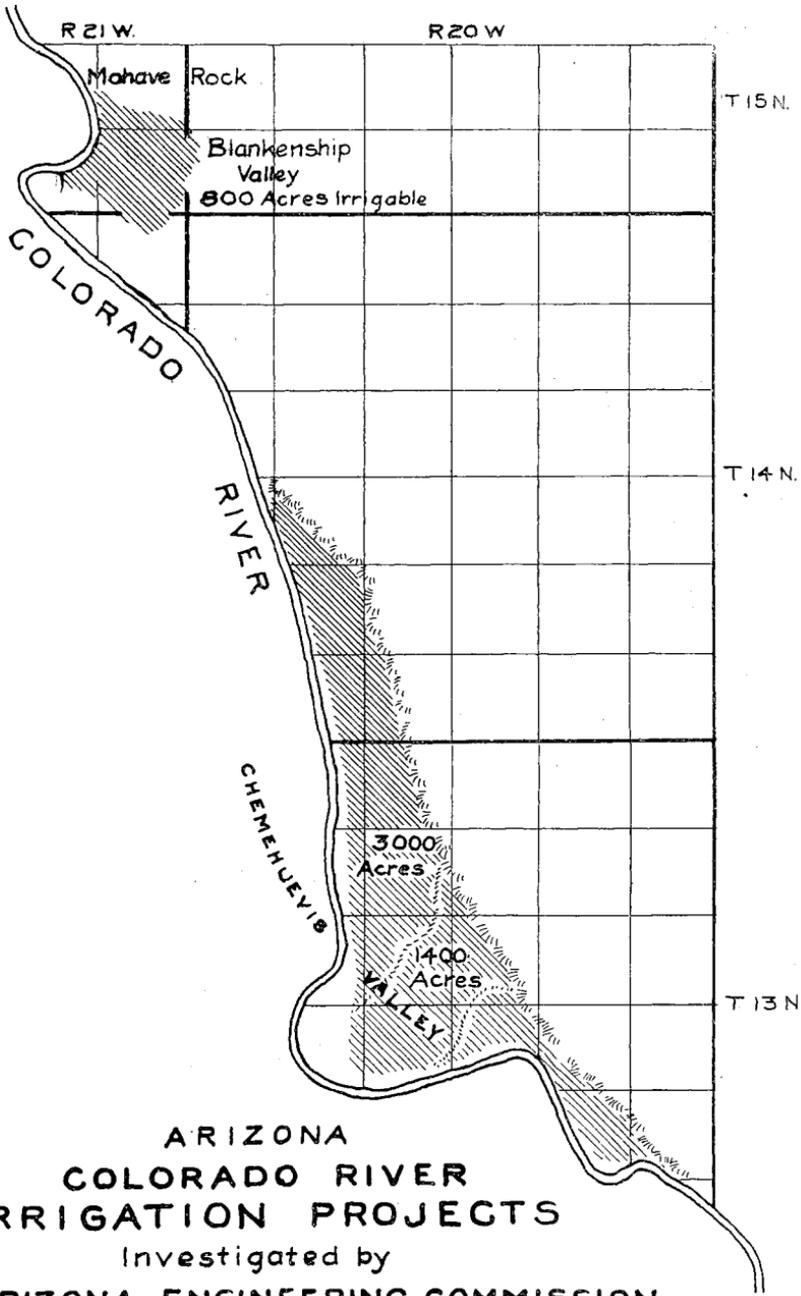
"The nearest town and railroad station is the station of Powell, on the Atchison, Topeka & Santa Fe Railroad, about 10 miles from the valley.

"The length of the valley north and south is about 6 miles and the maximum width 2 miles. The elevation is about 400 feet above sea level. The valley is all subject to overflow during normal high water. For this reason it is not feasible for irrigation development without the construction of levees on both sides of the river. Such levee construction may be reduced in cost by a partial flood control, and possibly could be eliminated with complete flood control by storage. The valley is small and is not attractive as an irrigation project.

"The valley on the west side of the river is in the Chemehuevis Indian Reservation. A few Indians (approximately 200) live on the reservation. Tentative allotments of 10 acres each have been made to these Indians, aggregating a total of about 2000 acres.

"There is no irrigation at the present time nor has there been in the valley. The Indians living here do some farming on a small scale on the overflow lands, the crops being planted after the receding of the high water.

"There are no private lands in the valley. The lands were all withdrawn under the reclamation act in 1903. The west side of the river is Indian reservation lands and the east side is public lands.



ARIZONA
**COLORADO RIVER
 IRRIGATION PROJECTS**

Investigated by
THE ARIZONA ENGINEERING COMMISSION
 1922-23

CHEMEHUEVIS VALLEY

Showing Irrigable Land

 Pumping

Classification of lands, Chemehuevis Valley project:

	Gross	Area Net
Indian lands-----	2,900	2,300
Public lands-----	1,700	1,400
Totals -----	4,600	3,700"

The following is from Arizona Engineering Commission report, page 19:

"Immediately below Blankenship Valley there is a comparatively large basin on both sides of the river known as the Chemehuevis Valley. Lying on both sides of the river near the lower end of this valley are several thousand acres of land, which may be reclaimed by irrigation. Near the head of Chemehuevis Valley the elevation of the water surface of the Colorado River at low water is 412 feet above sea level. This point is five miles by river below Mohave Rock. A pumping plant located near this point to raise the water to elevation 450 to 475 feet above sea level, would make possible the irrigation of 4400 acres of land on the Arizona side of the river. Of this area about 3000 acres are bottom lands and 1400 acres mesa land, all first class."

All of this land would be flooded if the Parker-Gila project were developed by building the dam as contemplated in the Arizona Engineering Commission report.

Plate XVIII taken from the Arizona Engineering Commission report, page 21, shows the lands included in the Blankenship and Chemehuevis projects on the Arizona side of the river.

Parker Project

The following is taken from Senate Document 142, p. 52 *et seq.*:

"Location and description. The Parker Valley, or Colorado River Indian Reservation project, lies on the east side of the Colorado River in Yuma County, Arizona. A small portion of the valley is on the west side of the river, in Riverside County, California. The principal town, Parker, at the head of the valley, with a population of 500, is located on The Atchison, Topeka and Santa Fe Railroad.

"The Parker Valley has a total length of about 37 miles, extending from Parker on the north to near Ehrenburg on the south. The maximum width of the valley is about 7 miles on the east side of the river. The river channel in this valley is somewhat more stable than in the Mohave Valley, though it is also subject to erosion and to shifting of its bed. The river is said to overflow the lower bottom lands with a flood exceeding 40,000 second-feet, and 95,000 acres are said to be subject to overflow during periods of maximum flood. It would appear, therefore, that for anything less than complete flood control by storage a levee system will be necessary, although with partial control the section of the levee and the riprapping could probably be reduced accordingly.

"On the west side of the river there are several separate small areas of bottom land aggregating about 4000 acres; but, owing to the small area and to the narrowness of the valley, this land could not be protected from overflow within reasonable cost by levees, and it will, therefore, not be considered as a part of the project. With complete flood control by storage, it would probably become attractive to individuals, either by irrigation through direct diversion or low-lift pumps.

"The bench lands considered as a part of the project consist of the Parker Mesa, at the head of the valley, surrounding the town of Parker. This is an attractive stretch of land, being quite smooth and level, with a gravelly and sandy soil. The bench is from 75 to 150 feet above the bottom lands.

"There is also a mesa on the west side of the river, namely, the Calzona Mesa. There has been no survey of this mesa, so no detail can be given of it. It is said, however, to be rather rough and unattractive. It is not here considered as a part of the project.

"Lands of the Parker project are all in the Colorado River Indian Reservation.

"Historical. A detailed survey and estimate of the Colorado River Indian Reservation project, consisting of the gravity system of the project proposed herein, was made by the United States Indian Service in 1918 and 1919. Topography was taken

on a scale of 400 feet to 1 inch covering the entire reservation, with a contour interval on the bottom lands of from 1 to 2 feet. Detailed estimates were prepared and the final report written by Mr. C. A. Engle, engineer in charge, under date of June 30, 1920. A soil report was also made by Mr. A. T. Strahorn, United States Department of Agriculture, dated 1920, which report is made a part of the Engle report.

"Ownership. All the lands in the proposed Parker project lie within the United States Indian reservation. Fifteen thousand acres is the maximum that will be needed for allotment to the Indians; the balance may be thrown open to settlement.

Area	<i>Acres</i>
Gross -----	<u>121,000</u>
Irrigable—	
Gravity -----	104,000
Pumping, lift approximately 135 feet-----	<u>6,000</u>
Total irrigable -----	110,000

Water Supply

"Appropriations. No water filings have been made for this project to the knowledge of the engineer in charge. The area irrigated in 1920, which is the maximum to date, is 4100 acres, and it is estimated by the engineer in charge that 7000 acres will be in cultivation in 1921. The present pumping plant, with the installation of another boiler which is planned in the near future, will be sufficient to cover about 7500 acres.

"The right to divert water from the Colorado River (a navigable stream) was authorized by act of Congress entitled 'An act making appropriations for the current and contingent expenses of the Indian Department and for fulfilling treaty stipulations with various Indian tribes for the fiscal year ending June 30, 1905, and for other purposes' (Act Apr. 21, 1904, ch. 1402, 33 Stat. 189). The portion authorizing the diversion of water reads as follows:

"That in carrying out any irrigation enterprise which may be undertaken under the provisions of the reclamation act of June 17, 1902, and which may make possible and provide for, in connection with the reclamation of other lands, the reclamation of all or any portion of the irrigable lands on the Yuma and Colorado River Indian Reservations in California and Arizona, the Secretary of the Interior is hereby authorized to divert the waters of the Colorado River and to reclaim, utilize, and dispose of any lands in said reservations which may be irrigable by such works in like manner as though the same were a part of the public domain."

"Storage required. On the assumption of complete development of lower Colorado River lands storage will be required for the use of the Parker Project for the undeveloped area of, say, 103,000 acres.

Present Status

"There is a pumping plant installed by the United States Indian Service, as above described, with a capacity for the irrigation of about 7500 acres. This pump is located on the bank of the river at the head of the valley. The water is pumped from a sump, into which the water enters from the river through five 7-foot gateways equipped with flashboards to keep out all but the top water. The lift of this plant is about 21 feet. Near the pumphouse a large settling basin has recently been constructed, with provision for sluicing the silt back into the river by means of a by-pass.

"The canal system consists of about 10 miles of canal of more than 50 second-foot capacity and 43 miles of laterals. The area under the present canal system is about 6000 acres.

"Nine miles of drainage canals have also been constructed."

The land in the Parker project is included by the Arizona Engineering Commission in the larger project known as the Parker-Gila Valley Project. This project was afterwards referred to in the Boulder Canyon Project Act as the "Parker-Gila" project. An authorization of an appropriation to investigate this project was made in section 11 of the Act. The Secretary of the Interior was instructed to report to Congress

not later than December 10, 1931, his "findings, conclusions, and recommendations regarding such project." The amount of land to be reserved for the use of the Indians in this and other projects has been fairly well defined by Federal Acts. An outline of this legislation is given under the heading "Indian Lands."

Plate XVI of the Parker-Gila project shows the location of these lands, all of which would be included in this larger Parker-Gila development.

Cibola Valley Project

The following is taken from Senate Document 142, page 61:

"Location and description: The Cibola Valley lies on the east side of the Colorado River in Yuma County, Arizona. It is about 20 miles south of the lower end of the Parker Valley and is adjacent to the lower end of the Palo Verde Valley, being separated from the latter only by the river.

"The valley lies north and south, with a length of 12 miles and a mean width of 3 miles.

"The Cibola Valley is but little above the bed of the stream, and the entire area is subject to overflow during normal high water. The valley could not be developed without complete storage control or without a levee for the full length of the river bordering the valley. There is no diversion dam site in the vicinity of the Cibola Valley.

"There has never been any irrigation development in this valley except a few attempts on a very small scale of individual pumping. Some farming on a small scale has been practiced on overflow lands.

"An irrigation district was formed by the landowners in 1913 for the purpose of developing an irrigation project. Detailed surveys of an irrigation and levee system were made for the district by R. L. Morton in 1914. From these surveys a complete system of canals, levees, and drains was designed and quantities computed, and a report and estimate were made covering the same by C. K. Clarke in 1914. The irrigation district voted bonds for the construction of the project as outlined and estimated by Mr. Clarke, but to the present date no market has been found for them.

"Ownership and area: The area of the project and the status of the lands, as of October, 1920, as shown by the records of the United States land office, are as follows:

Classification of Lands, Cibola Valley Project

	<i>Gross</i>	<i>Net</i>
Entered -----	3,000	2,550
Patented -----	8,000	6,800
Public -----	5,500	4,650
State -----	2,000	1,700
Totals -----	18,500	15,700"

The following is from Water Supply Paper No. 556, page 122.

Cibola Valley, Arizona—

Irrigable area—gravity ----- 16,000 acres

Water Needed—

Gross diversion @ 4.5 acre-feet----- 72,000 acre-feet
 Return flow @ 1.5 acre-feet----- 24,000 acre-feet
 Consumptive use ----- 48,000 acre-feet"

All of this project would be included in the larger Parker-Gila project, map of which is given in Plate XVI.

Miscellaneous Tracts Between Cibola Valley and Laguna Dam

The following is taken from Arizona Engineering Commission report, page 20:

"Between Cibola Valley and Laguna dam there are a number of small tracts of bottom land on the Arizona side, which may be reclaimed by low pump lifts, probably less than 20 feet. An estimate of the area of these tracts of bottom land is

based on a map prepared by the U. S. Reclamation Service in June, 1912. The aggregate area of bottom land on the Arizona side of the river, classed as irrigable between Cibola Valley and Laguna Dam is 3400 acres."

Yuma Project

The following is taken from Senate Document 142, page 62 *et seq.*:

"Location and description: The Yuma project is located in Yuma County, Arizona, and in Imperial County, California.

"The present constructed portion of the Yuma project comprises the valley lands of the Yuma Indian Reservation on the California side, extending from Yuma northeast about 10 miles to near the Laguna Dam, at which point the river flows between two rock hills. On the Arizona side the present constructed project comprises the Yuma Valley lands, extending from Yuma to the Mexican border, a distance of about 17 miles. The average width of the Yuma Valley is about 6 miles, and that of the reservation about 3 miles.

"The valley lands of the project were practically all subject to overflow in extreme high water, and it has been necessary to construct levees for their protection.

"The pumping unit of the project, or what is known as the Yuma auxiliary project, comprises the bench lands lying adjacent to and east of the Yuma Valley, at a general elevation of about 190 feet above sea level and about 80 feet above the valley lands.

"Historical: Reconnaissance made and preliminary surveys begun in 1902:

"Construction recommended by board of engineers, April 8, 1904.

"Construction authorized by Secretary, May 10, 1904.

"First irrigation by Reclamation Service, season of 1907.

"Laguna Dam completed March, 1909.

"Colorado River Siphon completed June 29, 1912.

"Gravity water from Laguna Dam furnished to Yuma Valley through siphon June 29, 1912.

"Yuma Mesa auxiliary reclamation project act passed January 25, 1917.

"Construction of first mesa unit approved June 8, 1920.

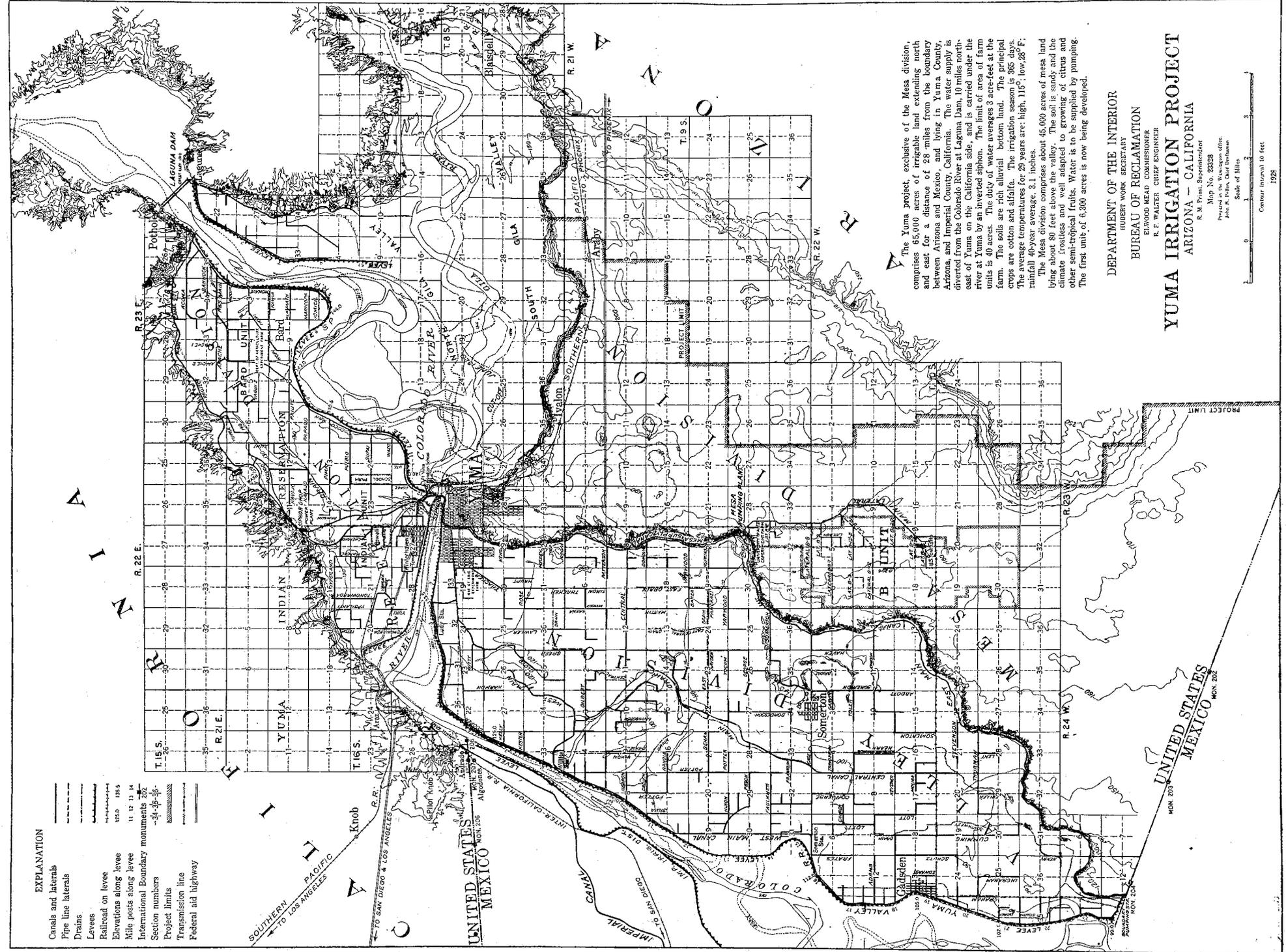
"Ownership and area: The status of the irrigable lands of the projects as of June 30, 1920, is as follows:

	Acres
Public land entered-----	19,000
Public land open-----	300
Public land withdrawn-----	37,900
State land unsold-----	1,800
Indian land-----	9,000
Private land-----	62,000
Total irrigable area-----	130,000

Water Supply

"Right to divert water from Colorado River: The right to divert water from the Colorado River (a navigable stream) was authorized by act of Congress entitled 'An act making appropriations for the current and contingent expenses of the Indian Department and for fulfilling treaty stipulations with various Indian tribes for the fiscal year ending June 30, 1905, and for other purposes' (act April 21, 1904, Ch. 1402, 33 Stat., 189). The portion authorizing the diversion of water reads as follows: 'That in carrying out any irrigation enterprise which may be undertaken under the provisions of the reclamation act of June 17, 1902, and which may make possible and provide for, in connection with the reclamation of other lands, the reclamation of all or any portion of the irrigable lands on the Yuma and Colorado River Indian Reservations in California and Arizona, the Secretary of the Interior is hereby authorized to divert the waters of the Colorado River and to reclaim, utilize, and dispose of any lands in said reservation which may be irrigable by such works in like manner as though the same were a part of the public domain.'

"Appropriations: Appropriations of water for diversion from the Colorado River to be used on the Yuma project are listed as follows:

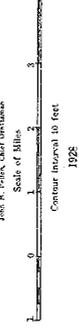


- EXPLANATION**
- Canals and laterals
 - Pipe line laterals
 - Drains
 - Levees
 - Railroad on levee
 - Elevations along levee
 - Mile posts along levee
 - International Boundary monuments
 - Section numbers
 - Project limits
 - Transmission line
 - Federal aid highway

The Yuma project, exclusive of the Mesa division, comprises 85,000 acres of irrigable land extending north and east for a distance of 28 miles from the boundary between Arizona and Mexico, and lying in Yuma County, Arizona, and Imperial County, California. The water supply is diverted from the Colorado River at Laguna Dam, 10 miles north-east of Yuma on the California side, and is carried under the river at Yuma by an inverted siphon. The limit of area of farm units is 40 acres. The duty of water averages 3 acre-feet at the farm. The soils are rich alluvial bottom land. The principal crops are cotton and alfalfa. The irrigation season is 365 days. The average temperatures for 29 years are: high, 115°; low, 28° F. rainfall 40-year average, 3.1 inches.

The Mesa division comprises about 45,000 acres of mesa land lying about 80 feet above the valley. The soil is sandy and the climate frostless and well adapted to growing of citrus and other semi-tropical fruits. Water is to be supplied by pumping. The first unit of 6,300 acres is now being developed.

DEPARTMENT OF THE INTERIOR
 ROBERT W. HEALD, SECRETARY
 BUREAU OF RECLAMATION
 EDWARD MEAD, COMMISSIONER
 R. F. WALTER, CHIEF ENGINEER
YUMA IRRIGATION PROJECT
 ARIZONA - CALIFORNIA
 R. M. FRENZ, SUPERINTENDENT
 Map No. 23328
 Prepared in the Washington office
 Jan. 11, 1916, Charles Hartman



Second-foot

Appropriated July 8, 1905, to be diverted from the left side of Colorado River at Laguna Dam, to be used on lands in Yuma County, Ariz., recorded July 10, 1905, at Yuma County recorder's office, Yuma, Ariz., (book 5, miscellaneous, p. 99)-----	3,000
Appropriated July 8, 1905, to be diverted from right bank of Colorado River at Laguna Dam, to be used on lands in Imperial Valley, Cal., recorded July 13, 1905, at Imperial County recorder's office at El Centro, Cal. (book 1, p. 106)-----	6,000

"Also in 1907 and 1908 the United States purchased for the benefit of the Yuma project the property and rights of the following old canals in Yuma Valley :

"Farmers' pump canal: Purchased from the Colorado Valley Pumping and Irrigation Company, March 15, 1907. This company was incorporated March 4, 1901. There was under irrigation in 1907 from 2000 to 3000 acres from this system.

"Farmers' gravity canal: Purchased from the Yuma Valley Union Land and Water Company, February 3, 1908. This company (originally the Yuma Canal Company) was incorporated June 26, 1897. Its plans involved practically all lands in the Yuma Valley.

"Rollins Ditch (including Ives heading, pumps, and ditches): Purchased from the Greene Land and Cattle Company, July 23, 1908. This system was constructed in 1892, and on January 20, 1893, an act of Congress was approved granting right of way for two ditch lines for the company.

Irrigation Plan

"The irrigation plan of the Yuma project provides for the diversion of water from the Colorado River at the Laguna Dam, 10 miles northeast of Yuma, Ariz., into a canal system heading on the California side, conveying water to the irrigable lands on that side of the river, including those in the Yuma Indian Reservation, crossing the river at Yuma through an inverted siphon and serving lands in the Yuma Valley below the town of Yuma. The plan also provides for large pumping plants below Yuma on the east main canal for raising water to irrigate 45,000 acres of mesa land. The lands adjacent to the Colorado River are protected from overflow by means of levees.

The Canal Headworks at Laguna Dam

(Extract from Report of All-American Canal Board, July 22, 1919.)

"The headworks of the Yuma project canal are to be so modified that the diversion into a common canal will be adequate to supply the irrigation demand of both this project and the Imperial Valley. At the point of diversion on the Colorado River, about 10 miles northeasterly from Yuma, the elevation of the water surface in the river is brought under control by the Laguna Dam. This is a broad, low structure of the weir type, which extends from solid rock on one side of the valley of the Colorado 4750 feet to solid rock on the other side. The crest of the structure is at a uniform height (elevation 151 feet.) At maximum flood stage the depth of water on the crest of the dam is 5.5 feet. This dam raises the water surface of the river about 10 feet at the river's low stage. At high water the fall of the water surface at the structure—that is, the fall from water above the dam to water below the dam—is only about five feet."

The following information was obtained from project manager's office at Yuma, Arizona. The figures given are for the year 1929 :

"Acreage under irrigation in Yuma project in 1929, 54,536, divided as follows :

"California side, 11,096.

"Arizona side, 43,440.

"Water duty on Yuma Mesa, 3.61 acre-foot.

"Water duty on Yuma gravity lands, 2.74 acre-foot.

"Actual diversion of the water from the river, 1,233,986 acre feet.

"Actual use on land, 149,463 acre feet.

"Water cost Yuma Mesa, \$15 per acre per year.

"(Allows three acre-foot use. Additional water, \$3 per acre-foot.) Cost per kilowatt hour for current at pumping plant, 8 mills. Height of pump lift (difference in elevations), 72 feet."

The following is from project map (Map No. 23328 issued by Bureau of Reclamation in 1928):

Yuma project, exclusive of Mesa division.....	65,000 irrigable land
Mesa division.....	45,000 irrigable land

This gives a total according to the map of 110,000 acres in the unit.

Of the above 110,000 acres, 15,000 is in California, leaving a net acreage in Arizona, including both the gravity and pump lands, of 95,000 acres. This information, taken from the Reclamation map issued in 1928, appears to be the most accurate available and the figures given in the summation of the net irrigable areas of land in Arizona are based on the net area of 95,000 acres of Arizona land.

Plate XIX gives the lands in the Yuma Irrigation Project and is a reproduction of the Bureau of Reclamation map No. 23328 mentioned above.

SILT

Silt presents the real problem in the control of the lower Colorado River; even the floods present no unsurmountable difficulties or extremely serious problems were it not for the vast amount of silt that the water carries with it.

Silt formed the Imperial Valley in the first place, then threatened to destroy it. The deposit of silt dammed off the Imperial Valley from the Gulf of California and formed the huge basin existing there today. During the forming of the valley, silt was deposited to a known depth of at least 1000 feet, and silt is still coming down the river. Silt fills up the river bed, necessitating higher levees and fills up the channels and diverts the river flow.

Overgrazing and depletion of the grass carpet along the upper reaches of the river has caused an increasingly rapid run-off of rainfall with consequent increased erosion, and this eroded matter is carried down the river in the form of silt. "While silt is the creator of much of the agricultural wealth of the lower Colorado River basin it is also the greatest menace to irrigation development and water control. When irrigation water containing silt is applied to fields the main portion of the silt is deposited near the upper end. From time to time the farmer is compelled to move the deposited silt to lower portions of the field in order to keep the land surface below the level of the irrigation ditch. It is estimated that the annual expense to the farmers of Imperial Valley on account of silt averages \$2 per acre." Reference: Technical Bulletin 67, February, 1928, U. S. Department of Agriculture.

Much of this silt is so fine in character that it might be compared to Portland cement in texture. When water carrying this fine silt in suspension is flowing on the lands during irrigation, as the water evaporates or settles, a coating of this fine almost impervious matter is left on the surface of the ground and the effect is to seal over the area with an almost waterproof coating. This has the effect when successive irrigations are attempted of practically preventing the percolating of the water and must be broken up or removed before proper irrigation is possible.

According to the report of the Agriculture Department the silt is divided into two groups—what is termed bed silt or heavy particles, and suspended silt or lighter particles.

Various estimates have been made of the annual amount of silt coming down the Colorado River and some of these estimates appear to be in error by giving too small a quantity of silt, measurements having been made in such a way as to account for practically only the suspended silt, while the heavier matter later classed as bed silt was not given enough consideration. This bed silt is deposited along the bed of the river at points where the velocity is retarded and during flood seasons is again picked up and forced on down the river by the scouring action of the water, and dropped in successive stages from season to season.

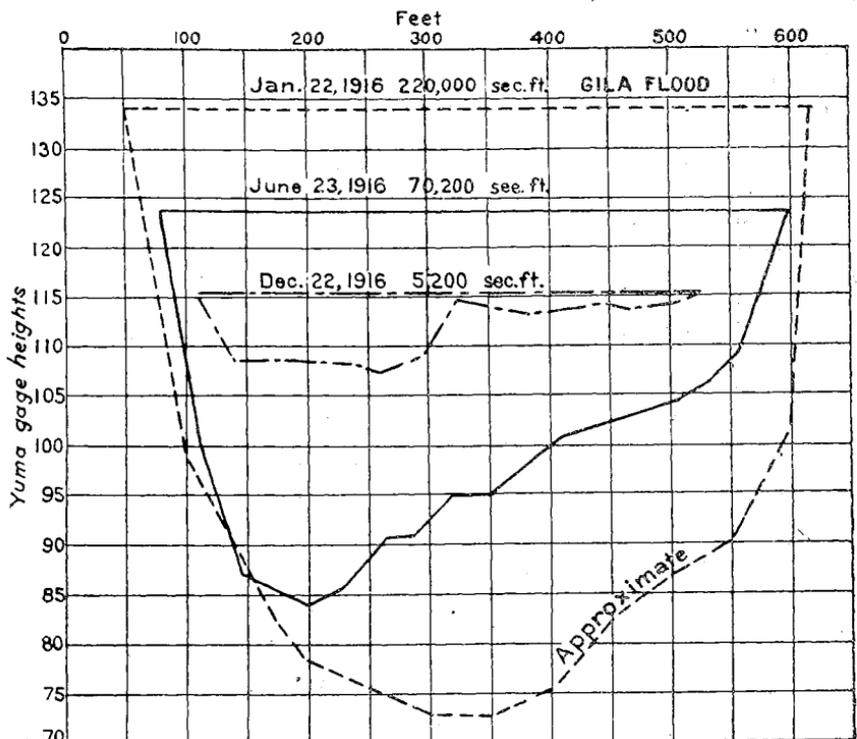


FIG. 8.—Maximum and minimum cross sections. Colorado River at Yuma, Ariz., 1916
(NOTE.—One hundred feet added to gauge heights to avoid minus readings)

This scouring action of the river and consequent transportation downstream of bed silt is well illustrated by the condition of the river at Yuma, Arizona, during high- and low-water periods. Plate XX shows this scouring action (Technical Bulletin 67, p. 54). Cross sections of the river during various stages of flow in the year 1916 are given. It will be noted that for every foot that the river rises there is a scouring out of the bed and a consequent carrying downstream of a vast quantity of material. There is a scouring of approximately $2\frac{1}{2}$ feet for every foot the river rises. Local conditions affect this scouring and the proportion of scour to rise of river is much greater in some cases and less in others.

For some years the amount of silt being brought down the river was estimated at approximately 100,000 acre-feet per year average. The result of careful investigations made by the Department of Agriculture and published in Technical Bulletin 67, February, 1928, fixes 138,000 acre-feet as the total annual silt load of the river at Yuma, exclusive of the Gila silt, or, it is estimated that a fair average would be 137,000 acre-feet at the lower end of the canyon section of the river. Reference: Technical Bulletin, 67, U. S. Department of Agriculture, page 62.

The question immediately arises as to what effect this silt will have upon the storage capacity of the Boulder Canyon Project Dam. In designing this dam consideration was given to the silt problem and in estimating the effective storage capacity, amount of power to be developed, and amount of water made available for use, allowance was made for a certain amount of storage capacity for silt.

If silt should continue to come down the river at its present rate, at the end of 100 years it would occupy somewhere in the neighborhood of 13,500,000 acre-feet of the 30,000,000 acre-feet of the storage behind the dam, but the construction of additional reservoirs along the upper river and its tributaries with the consequent regulation of the stream will cut down the amount of silt very materially and eventually probably eliminate it. Dr. Elwood Mead, Commissioner of Reclamation, states in an article in the *Engineering News-Record*, February 6, 1930, that 137,000 acre-feet per annum is the estimated rate of silt inflow to the reservoir under present conditions, but that construction of upstream reservoirs will greatly reduce this amount and it is estimated that the total amount of silt deposit will not exceed 3,000,000 acre feet at the end of fifty years. Allowance has been made in the estimates of storage capacity for this amount of silt.

The effect of silt on the irrigation ditches and canals in Imperial Valley is a serious one. It is necessary to carry on a continual dredging out of these ditches with the result that the points where formerly irrigation water was carried in ditches below the ordinary ground surface the deposit of silt and the building up along the ditch sides of dredged out accumulation has raised the top of the ditch banks in some cases 6 and 8 feet above the surrounding ground level. The disposal of this dredged out silt is fast becoming a serious problem.

With the construction of Boulder Dam it is expected that the settling effect will eliminate practically all of the silt at this point as construction of dams on the Gila River have already eliminated much of the silt from that source. It is expected that within 8 or 10 years after the

Boulder Canyon Dam is completed that the water in the lower river will run practically clear and the amount of silt carried will be insignificant. On the lower delta of the Colorado starting just below the international boundary line the river works back and forth across the built-up area. It will follow a channel during a portion of the year and as this channel is built up by the silt carried in the water the river gradually builds up a ridge from the depositing of the silt along its banks and runs along on top of this ridge, then when high water season comes it will break away from this ridge and form another channel. It is gradually building up its bed to a uniform slope and pushing this slope or cone southward toward the Gulf of California. If an attempt is made to confine the river by levees at a point beyond where this cone has been fully developed these levees must be raised each year.

At one point on the levee system where the construction work was pushed too far ahead of the river cone the river pushed its cone forward filling up its bed and necessitating the increase of height in its levees until today the river bed is about 6 feet higher than the land level on the land side of the levee.

Through years of experience it has been found that it is most practical to build levees after the river has fully developed its cone. The amount of silt carried by the river is not uniform throughout the year, the percentage varying to a considerable extent. With a low flow the percentage is less, while with a heavy flow there is a very great increase in the proportionate amount of silt. Plate XXI will give some idea of the silt percentages at Topock and Yuma as compared with the river discharge. This cut being taken from page 26, Technical Bulletin 67.

The following statements are taken from Technical Bulletin 67, U. S. Department of Agriculture:

"The silt transported by the Colorado River consists of finely pulverized rock with a variable proportion of organic matter. Its color and character vary more or less with the watershed and formation from which it is derived. Normally, the specific gravity of this silt is 2.65, but the weight per unit of volume varies within wide limits. After the river emerges from the canyon section and flows on flatter grades the heavier silt is deposited or transported as bed silt. The suspended silt transported into the lower basin of the Colorado River is fine in texture, and its particles are of fairly uniform size, fully 50 per cent passing a standard sieve of 200 meshes to the inch.

"The aggregate quantity of suspended silt in the main tributaries when supplemented by the estimated aggregate quantity in the smaller tributaries, falls far short of equaling the normal load of suspended and bed silt in the Colorado River at Yuma, Ariz., indicating the presence of bed silt in the tributaries and the formation of silt in the canyon section by the action of water and wind.

"The finer silt, or that which passes a 200-mesh sieve, may be transported long distances in both natural and artificial channels if the mean velocity of the current exceeds two-thirds of a foot per second, with a fair uniformity of silt content throughout any vertical section, although there is a tendency for the heavier particles to approach or reach the bed. Thus, any velocity that is practically for an irrigation canal will carry in suspension most of the finer silt of the Colorado River.

"While great quantities of silt are removed annually from the Imperial Valley canals by mechanical means it is mainly bed silt, the quantity of suspended silt deposited being a small portion of the total quantity carried in suspension. Usually the suspended silt entering the main canal of Imperial Valley is transported throughout the system. The water delivered to the irrigators retains most of this silt content, which is deposited in farm laterals or on the irrigated fields. The estimated average annual cost of silt disposal and control in its various forms in Imperial Valley canals is about \$1,000,000.

"By properly designed settling basins, sluiceways, and desilting structures at the intakes of diversion canals it is possible to rid the water of half its suspended silt and most of the bed silt.

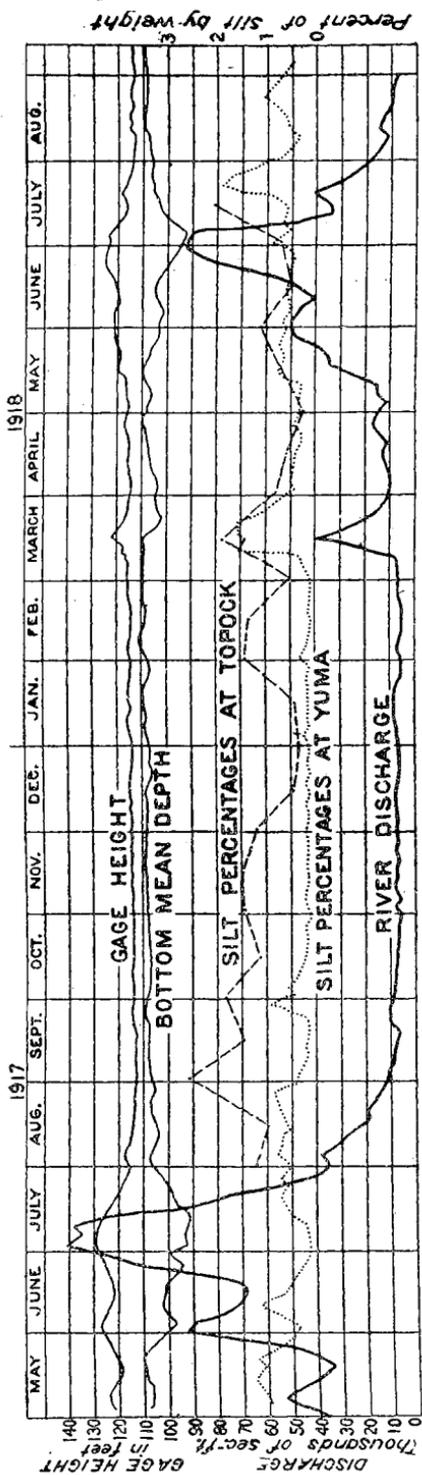


FIG. 6.—Gauge heights, semiweekly mean depths, discharge, and percentage of silt in Colorado River at Yuma, and percentages of silt at Topock in 1917-18

(NOTE.—One hundred feet added to gauge heights to avoid minus readings.)

"The dry weight per cubic foot of Colorado River sediment varies widely. Fine silt deposited in settling basins in Imperial Valley averaged 40 pounds per cubic foot. The average dry weight of silt freshly deposited on irrigated land and in farm laterals does not exceed 50 pounds per cubic foot. The average weight of suspended silt approaches that of water, or 62.5 pounds per cubic foot. The average unit weight of dry silt in a cubic foot of river deposits near Yuma and Laguna Dam was 84.5 pounds. Bed silt in the canals of Imperial Valley averaged 97 pounds per cubic foot.

"The average weight of silt deposited in a large reservoir would depend on the thoroughness with which the fine silt was mixed with the coarse. If the two grades were deposited separately in the proportions commonly carried by the stream, the mean weight of dry silt contained in a cubic foot of moist sediment would approach 70 pounds, whereas if mixed the weight would be greater by reason of greater density, but owing to the preponderance of the finer and lighter particles, the average weight would not exceed 85 pounds.

"As closely as it can be estimated, the normal quantity of silt annually transported to the lower end of the canyon section is 253,628,000 tons, or 137,000 acre-feet, on the basis of an average weight per cubic foot of 85 pounds. This figure is approximately 37 per cent higher than previous estimates have indicated.

"Preventing silt from entering canal systems is a prime factor in the success of irrigation enterprises in that it eliminates the present high annual expenditures for silt disposal and control in the canal system and upon the land, provides a freer passage of water through canals, renders structures serviceable and operative, and protects fields from depositions of fine silt which impairs the texture and productivity of the soil. Means to accomplish these purposes have so far consisted in (1) desilting structures at the intakes of canals; (2) wasteways discharging into settling basins; (3) mechanical removal of silt from canal beds; and (4) distribution of silt over the surface of cultivated fields; but experience has shown these to be temporary, unsatisfactory, or only partially effective.

"The most feasible and economical means of solving the silt problem of Imperial Valley is to impound the river silt behind a high dam such as is proposed at Boulder Canyon. Partial resiltng of the river undoubtedly will occur for some time below such a dam, but the regulation of the flow will permit the water users to divert the surface waters only, and as the channel scours, the quantity of silt entering diversion channels will become negligible in time.

Colorado River Basin

"In considering the formation and transportation of silt in Colorado River Basin, attention is drawn to certain physical features which cause erosion of surface material covering extensive areas. The aridity of the climate and the consequent lack of vegetation is one of the main causes. Because the territory is sparsely settled, relatively few climatic records have been kept, and in many parts the precipitation is not known accurately. Roughly estimated, 40 per cent of the total area of the basin has a precipitation of less than 10 inches a year, in 50 per cent the precipitation ranges from 10 to 17 inches, and in the remaining 10 per cent it is from 17 to 25 inches and higher in the high mountains. Fully one-half of the basin is either bare or but scantily covered with desert shrubs and grasses. In a more northerly latitude, with lower temperatures and less evaporation, the upper limit of annual precipitation of 10 to 17 inches might support a growth of nonmerchutable timber as well as shrubs and nutritious grasses, but in the lower and warmer portions of the basin much of the rainfall is speedily evaporated, leaving an inadequate supply of moisture for trees and a relatively short growing season for grasses. It is only in those areas where soil has been formed and the yearly precipitation approaches 20 inches or rises above it that a good growth of commercial timber exists.

"The greater part of the basin, and more particularly that part below the mouth of the Green River, is subject to sudden violent rainstorms, and resulting floods erode and carry off the unprotected surface soils. Most of these storms deluge small areas and their erosive action is proportionally limited, but occasionally extensive areas receive downpours causing floods in several streams, which transport large quantities of debris.

Character of Silt

"The silt in the lower reaches of the Colorado River is characterized by the uniform fineness of the particles. All silt-laden streams carry fine material, usually mixed, however, with coarse sand, gravel, and occasionally boulders. This is true of most of the tributaries of Colorado River. During flood periods, large quan-

ties of debris, including boulders weighing many tons, are rolled down steep stream channels. The main river not only transports this material but reduces it to fine silt. Through the action of the fast-moving water, sand, gravel, and boulders alike are ground to a fineness approaching that of Portland cement. In the thousands of samples of water which have been taken from the lower Colorado River and its diversions, little silt has been found which could be classified as coarse sand.

"The only classification of much significance in the present study is that which distinguishes between suspended silt and bed silt, the latter being characterized mainly by its larger and heavier particles. Suspended silt is transported within the water prism of the river or canal, its distribution throughout any cross section being fairly uniform, particularly as regards the finer particles. Bed silt is transported along or near the bed of the river or canal with a rolling motion or in sand waves or dunes.

"The value to agriculture of the soil-fertilizing ingredients of silt should not be overlooked or minimized. While nitrogen is found in solution in the river water, phosphoric acid, potash, and nitrogen are also found in the silt deposits.

"In approximate numbers, Forbes (R. H. Forbes, Ariz. Agr. Expt. Sta. Bul. 44, p. 147-214) found in the silt content of an acre-foot of water of the Colorado River at Yuma, Ariz., from 2 to 44 pounds of phosphoric acid, 15 to 445 pounds of potash, and from 1 to 17 pounds of nitrogen, the variations depending chiefly on the season. Long-continued irrigation with desilted water would doubtless somewhat decrease the productive capacity of the soil, but the nitrogen in solution, amounting to over 40 per cent of the total, would still be of considerable fertilizing value.

"Soils vary in weight from less than 30 pounds to over 110 pounds per cubic foot, and silt, being classified as soil, has likewise a wide variation in weight. The silt which is transported into the lower basin of the Colorado River may range from a minimum of 32 pounds to over 105 pounds per cubic foot, depending on such main factors as size of particles, composition, manner of mixing, consolidation, and more particularly moisture content.

"In the following table are given the average yearly percentage by weight of suspended silt in Colorado River at Yuma, the discharge of the river to the nearest thousand acre-feet, and the computed weight of silt in tons for each of the years 1911 to 1925, inclusive. To these items has been added a like summary of the silt determinations made by the United States Geological Survey at the same station during the years 1903 and 1905, and by R. H. Forbes for 1904. The silt content for these 18 years averages 183,759,000 tons a year. This average is used in this report to represent the normal load of suspended silt in the river at Yuma.

Amount of Suspended Silt in Colorado River at Yuma, Ariz., for 18 years

Year	Average yearly proportion of silt, by weight, per cent	Discharge, acre-feet	Suspended silt, tons
1903	---	11,328,000	110,746,000
1904	---	10,118,000	120,961,000
1905	---	19,712,000	308,728,000
1911	1.01	17,831,000	245,152,000
1912	.67	18,406,000	167,870,000
1913	.69	11,768,000	110,532,000
1914	1.00	20,655,000	281,166,000
1915	.93	14,641,000	185,350,000
1916	1.18	23,140,000	371,692,000
1917	.49	20,598,000	137,391,000
1918	.51	13,158,000	91,348,000
1919	.87	10,747,000	127,275,000
1920	.78	21,444,000	227,687,000
1921	.70	19,428,000	185,125,000
1922	.71	17,014,000	164,428,000
1923	.95	17,848,000	230,808,000
1924	.62	11,348,000	97,319,000
1925	.85	12,452,000	144,077,000
Total	-----	-----	3,307,665,000
Mean	-----	-----	183,759,000

The Silt Problem of the Lower Basin

"Owing to the high transporting power of the river in the canyon section, practically no silt is permanently deposited there. All the water-borne sediment and debris carried into the upper reaches of the main river and tributaries sooner or later pass through the Grand Canyon on their way to the lower portion of the basin and the Gulf of California.

"If Colorado River carried no silt there would be no delta and no rich farming lands. Where bountiful crops are now produced, high waves would roll over an arm of the Pacific Ocean or dash against a barren shore. On the other hand, many of the ways in which the silt injuriously affects the agriculture of the lower basin are so obvious as to require no more than brief mention.

"A high bed in the lower reach of the river renders control of the river expensive and hazardous. For ages the Colorado meandered over the delta without human interference. When one channel became too high for the passage of water, a new one was formed at a lower elevation until it in turn became clogged with silt. This natural process continued until about a quarter of a century ago when an attempt was made not only to utilize for irrigation purposes a part of the river's flow, but also, in a measure, to control its course to the gulf.

"The authors are indebted to M. J. Dowd, general superintendent of the Imperial Irrigation District, for the following tabulation giving the sums expended by the district in 1923 and 1924 in removing silt at the intake and throughout the canal system:

	1923	1924
Intake -----	\$36,965	\$33,343
Main canals -----	105,547	100,331
Secondary canals and waste ditches -----	436,990	394,463
New River and Salton Sea -----	-----	30,995
Total -----	\$579,502	\$559,132

"It is estimated that the annual expense to the farmers of Imperial Valley caused by silt averages \$2 an acre. Applying this cost to the acreage irrigated in 1924, and adding thereto the cost of canal cleaning, brings that year's cost of silt disposal and control in its various forms above \$1,333,000.

"Another problem has developed recently. Waste and drainage waters from Alamo and New rivers, upon merging with the still and salty waters of Salton Sea, immediately precipitate their silt load, forming deltas which obstruct the natural flow and cause the water to back up and flood the nearby farming lands. In 1924 the Imperial district spent about \$31,000 in dredging at New River outlet.

Silt at the Intakes

"Principally because of the deposition of silt, the location of the intake on the river has been changed from time to time, and new structures have been installed. In 1906, Hanlon heading was built at Andrade or Pilot Knob, near the right bank and about 2000 feet north of the boundary line; and 2000 feet of fore bay connected the intake with the river. The heading consists of seven openings, each 10 feet wide, controlled by gates. Rockwood heading, the present intake was constructed in 1918 at a point on the river 7000 feet above the Mexican boundary. This is a concrete structure over 700 feet long. Its face is parallel to the river bank, and there are 75 openings, 8 feet center to center, controlled by flashboards. The sills of 48 gates are 106.7 feet above sea level, and those of the remainder are 8.1 feet lower, the purpose of this arrangement being to divert the water by skimming the surface and thus prevent the heavier sediment from entering the canal system. The new intake is connected with the old Hanlon heading by a channel 6000 feet long, and the old fore bay has been abandoned. The distance from Yuma to the Rockwood intake is 8 miles. Depending on the volume and mean flow, it takes from one and one-half to six hours for the water to traverse this distance.

"In order to determine the grade and percentage of suspended silt by weight at the Hanlon and Rockwood intakes of the Imperial irrigation district and to compare the amount of silt found there with suspended silt passing Yuma in the Colorado River, investigations were carried on from time to time between 1917 and 1920.

"The general conclusions that may be drawn are as follows:

"(1) Prior to October, 1918, when operation of the Rockwood intake was begun, there was but a slight difference (less than 10 per cent) between the quantity of suspended silt entering the Alamo Canal and that in the river at Yuma.

"(2) With the Rockwood intake in operation the quantity of suspended silt entering the Alamo Canal decreased at times by as much as 47 per cent and also increased at other times in a greater ratio depending, seemingly, on the stage of the river and manner in which the intake flashboards were operated.

“(3) About 90 per cent of the suspended silt entering the Alamo Canal passed a 200-mesh sieve, and only one-third of one per cent was retained on a 60-mesh sieve.

“(4) The finer suspended silt, or that which passed a 200-mesh sieve, was fairly evenly distributed throughout any vertical section of the canal, but the small quantity of heavier silt present tended to gravitate toward the bottom.

“(5) Although not measured, large quantities of bed silt entered the Alamo Canal when the lower flashboards of the intake were removed.

Amount of Silt Carried to Irrigated Lands

“By far the greater part of the total silt in suspension in the irrigation canals of Imperial Valley is fine material that passes the 300-mesh sieve, which is the finest screen obtainable. The silt is finer than Portland cement. In all cases this material was found to be equally distributed throughout the vertical section for all velocities under which tests were made, including mean velocities of less than two-thirds foot per second in small ditches. In other words, any velocity that is practical for an irrigation canal will carry in suspension the greater part of the silt transported by the waters of Colorado River, and most of it, therefore, passes on to the irrigated land. The amount of suspended silt deposited in the canals is a very small proportion of the total amount in suspension, notwithstanding the fact that large quantities of bed silt are removed each year.

“The manner in which the silt is distributed on the land depends upon the kind of crops, the method of irrigation, and the slope of the field. If the grade is fairly flat, a large portion will be deposited near the point of diversion from the supply ditch or on the upper part of the field, while on the steeper slopes it will be distributed more uniformly.

The Silt Load in Imperial Valley Canals

“Experiments indicate that the flowing water in all the main and secondary canals of the Imperial Valley have sufficient velocity to keep in suspension the finer silt or that which passes a 200-mesh sieve, and that the distribution of this part of the silt load is practically uniform over the system and in any canal section. The usual percentage by weight of this suspended load varies from 0.05 to 1 per cent and depends primarily on the quantity of this kind of silt entering the canal system. It has been shown that for two years the proportion of suspended silt in the main canal was 90 per cent of the suspended silt content found in the Colorado River at Yuma. Assuming that this ratio holds true over a period of years and that a cubic foot of suspended silt contains 62½ pounds of dry material. The following table has been prepared to show the annual load of suspended silt entering the Imperial Valley Canal system from 1912 to 1925, inclusive:

Estimated Suspended Silt Load Entering Imperial Valley Canal System 1912 to 1925, Inclusive

Year	Total water diverted at Imperial heading from Colorado River, acre-feet	Proportion of silt by weight (estimated), per cent	Suspended silt, acre-feet
1912	1,433,800	0.60	8,600
1913	1,667,300	0.62	10,300
1914	1,863,500	0.90	16,800
1915	1,912,900	0.84	16,100
1916	2,236,200	1.06	23,700
1917	2,412,500	0.44	10,600
1918	2,876,800	0.46	13,200
1919	2,854,200	0.78	22,300
1920	3,096,000	0.70	21,700
1921	2,535,000	0.63	16,000
1922	2,890,300	0.64	18,500
1923	3,275,400	0.86	28,200
1924	3,078,300	0.57	17,500
1925	3,158,700	0.77	24,300
Mean			17,700

“The results show that the maximum suspended load during the period was 28,200 acre-feet, the minimum 8600 acre-feet, and the average 17,700 acre-feet.

“To describe bed silt as sand which rolls along the stream bed, would be misleading. It would be more nearly correct to state that bed silt moves down stream in several ways and combinations of ways, one of which is by rolling along the bed.

If the paths of individual particles could be traced it would probably appear that few had not at one time been bed silt and at another time suspended silt.

"The total silt load in a stream or canal may be divided into three general classifications in accordance with the method of transportation of each: (1) The suspended load, (2) the traction load carried by the vertical components of the upward currents rising from the bottom, and (3) the load which is carried along on the bottom by rolling or by short skips, forming either plane beds or dunes. The finer silt is naturally separated and forms the first group, while the heavier and coarser particles of sand form the other two groups. With this classification in mind, it may be stated that with very few exceptions the canals of Imperial Valley are 'silting up.' Water, with its load of silt, is diverted from the Colorado River, but as its velocity in the river is greater than in the canals, deposition begins at the intake and continues throughout the entire system so long as the velocity is decreasing and there is heavy silt to drop. A canal that is 'silting up' is always dropping the largest particles first. With diminishing velocities all the so-called sand may be dropped.

Desilting Processes

"Desilting the waters of the Colorado River may be said to begin on tributary basins and in tributary streams. The so-called cloudburst, an intensive rainfall covering relatively small areas and usually lasting only an hour or two, is a common occurrence throughout the greater part of the Colorado River Basin. As a result, small streams are suddenly swollen to a high flood stage, and while flowing bankfull at a high velocity, pick up and transport large quantities of debris. However, as a general rule the flood subsides nearly as quickly as it rises, and the debris is deposited to await a similar flood or one of longer duration.

"It has likewise been pointed out that the two classes of silt herein considered—suspended silt and bed silt—are to a large extent interchangeable and consequently do not remain constant under changing hydraulic conditions.

"Experiments were carried on to determine the effect of desilting and sluicing at Laguna Dam on the suspended silt and flow of water in the Colorado River at Yuma, 12 miles below. The summarized results are given below:

Effect of Sluicing at Laguna Dam on Silt Content and Discharge of Colorado River at Yuma, October 7, 1916, to January 13, 1917.

<i>Measurements of Colorado River at Yuma</i>						
<i>Date</i>	<i>Sluice gates opened at Laguna Dam, hour</i>	<i>Time of measurement, hour</i>	<i>Discharge, sec. ft.</i>	<i>Area, sq. ft.</i>	<i>Velocity, feet per second</i>	<i>Proportion of silt by weight, per cent</i>
Oct. 7, 1916-----	12 M.	1 P.M.	7,900	2,503	3.16	0.40
		5 P.M.	12,300	2,715	4.53	0.67
Nov. 3, 1916-----	9 A.M.	9.30 A.M.	15,800	2,748	5.75	1.33
		1 P.M.	21,000	3,105	6.77	1.40
		4 P.M.	18,200	2,901	6.27	1.39
Nov. 10, 1916-----	9 A.M.	9.30 A.M.	13,100	2,375	5.52	0.73
		1 P.M.	17,800	2,681	6.64	1.11
		3.30 P.M.	15,300	2,477	6.18	1.22
Jan. 12, 1917-----	9 P.M.	2 P.M.	6,400	1,542	4.15	0.20
Jan. 13, 1917-----		9 A.M.	8,600	1,606	5.35	0.38

"In 1918 the division of agricultural engineering made experiments on the efficiency of desilting operations at Laguna Dam. Top and bottom samples were taken in both the river and the canal. The river samples were taken in about the center of the main stream before the water enters the channel leading to the sluiceway and overpour gates. The samples in the canal were taken in the center below the intake. The results are summarized below. The amount of desiltation ranged from 33 to 72 per cent and averaged about 57 per cent.

Amount of Desiltation at Potholes Headgates in August and October, 1918.

<i>Date</i>	<i>Average proportion of silt (by weight)</i>		<i>Proportion of desiltation</i>	
	<i>Colorado River per cent</i>	<i>Main canal per cent</i>	<i>Actual per cent</i>	<i>Comparative per cent</i>
Aug. 1-----	.502	0.320	0.182	36
Aug. 2-----	.682	.252	.430	63
Oct. 8-----	.250	.071	.179	72
Oct. 9-----	.242	.080	.162	67
Oct. 10-----	.233	.098	.135	58
Oct. 12-----	.275	.077	.198	72
Oct. 17-----	.468	.314	.154	33

"The desilting efficiency of the headwork at Laguna Dam was determined for the Bureau of Reclamation by Raymond A. Hill, who carried on experiments and collected data at intervals during several years. The amount of desiltation ranged from 18 to 70 per cent, with an average of 50 per cent. See following table:

Comparison Between Silt Content in Colorado River at Laguna Dam and in Project Main Canal.

Average proportion of silt (by weight)		Proportion of desiltation	
Colorado River, per cent	Main canal, per cent	Actual, per cent	Comparative, per cent
0.53	0.41	0.12	22.7
.30	.09	.21	70.0
.48	.21	.27	56.5
.45	.37	.08	18.0
1.55	.97	.58	37.4
1.17	.76	.41	35.1
.93	.51	.42	45.2
.84	.40	.44	52.4
.77	.49	.28	36.4
.72	.40	.32	44.5
.63	.30	.33	52.5
.57	.19	.38	66.7
.52	.23	.29	55.8
.50	.18	.32	64.0
.54	.21	.33	61.2
.59	.25	.34	57.7
.50	.27	.23	46.1
.33	.11	.22	66.7
.21	.10	.11	52.3
.34	.12	.22	64.7
.46	.21	.25	54.5
.48	.16	.32	66.7
.43	.25	.18	41.9
.44	.35	.09	20.4
.44	.22	.22	50.0
.32	.16	.16	50.0
.31	.15	.16	51.7
.30	.12	.18	60.0

Quantity of Silt Transported by Colorado River.

"From a practical standpoint, the quantity of silt transported is of more importance than the manner in which it is transported. Some of the data previously presented are reviewed in the following paragraphs with the object of forming an approximate estimate or the normal quantity of silt which is transported annually into the lower basin of the Colorado River, and a like estimate of the normal quantity of bed silt annually transported in the river at Yuma.

"The quantity of suspended silt during a 12-month period ending July 31, 1918, in the River at Topock, was, in round numbers, 205,763,000 tons. During the same period the quantity of suspended silt in the river at Yuma, 206 miles downstream, was 113,943,000 tons. The methods used in taking the samples and determining the silt content were practically the same at both points. The diversions for irrigation during the period about equal quantities of inflow water derived from the Williams River, Gila River, and other sources. The flow of the river at Topock was 1,716,000 acre-feet more than at Yuma. While a small part of this difference may be due to evaporation, it is believed the major part is due to infiltration in the porous material forming the bed of the channel and flood plain. That this condition is not confined to the period under consideration is shown by the fact that the average annual flow of the river at Topock for eight years ended September 30, 1925, is 1,269,000 acre-feet more than at Yuma. It is likewise true that the greater silt load found at Topock can not be accounted for in any large measure by the greater discharge.

"At first glance, one would be led to conclude that the normal silt load in the Colorado River at Yuma, including suspended and bed silt, would be greater than it is at Topock, inasmuch as the Gila River dumps its load into the main channel a few miles above Yuma and desilting processes are applied to most of the water diverted into the canals above Yuma. On the other hand, reasoning from the data available, it would appear that the greater load of suspended silt found at Topock can be rightly attributed to the steeper grades, higher velocities, and churning effects of the canyon section, and that after the river emerges from deep-walled canyons and flows on flatter grades with much less disturbance, the heavier silt

is temporarily deposited and transported as bed silt or rests on the bed of the channel until a flood carries it farther downstream.

"Judging from the manner in which silt is transported by water in motion, it is believed that some bed silt in addition to suspended silt is carried past Topock, but with the data at hand there is no means of ascertaining its relative quantity. There is also known to be permanent silt deposition between Topock and the mouth of the Gila River, but the quantity can not be computed. If these two unknown quantities were equal, they would counterbalance each other, and the total load of suspended silt at Topock would be approximately equal to the total load of suspended and bed silt at the mouth of the Gila River.

"The Gila River contributes about 6 per cent of the normal flow of the Colorado River, and the results of silt measurements show that it carries about double the percentage of silt in the main river at Yuma. Accordingly, there would be about 12 per cent less silt in the Colorado immediately above its junction with the Gila than at Yuma. Reducing the normal suspended silt load of 183,759,000 tons at Yuma by this amount gives 161,708,000 tons as the normal load of suspended silt exclusive of that contributed by the Gila River.

"Furthermore, since the quantity of suspended silt in the river during the period under consideration was below normal, it is necessary to increase the quantity of silt found at Topock during the period August 1, 1917, to July 31, 1918, from 205,763,000 tons a year to 253,628,000 tons a year, to bring it to normal.

"Comparing this load with that at Yuma exclusive of the Gila would indicate that 36 per cent of the silt load at Topock either passed Yuma as bed silt or was temporarily deposited in the river channel or flood plains above Yuma.

"The estimate just set out eliminates from consideration the silt carried by Gila River for the reason that the Gila's silt will not contribute to the sedimentation of any reservoir built above Topock, which is the matter of principal concern in the present discussion.

"No practical method was found for measuring the total amount of bed silt moving in the river channel, but minimum and maximum cross sections at Yuma gauging station indicated a scour of about 1600 acre-feet per mile during the flood of 1916. Further indications that large quantities of bed silt are shifting is shown by the rise and fall of the river bed at Yuma. The All-American Canal Board estimated that there were 12,000 acre-feet of bed silt in a total silt load of 102,000 acre-feet at Yuma or about 12 per cent bed silt. This was based on movement of bed silt in Imperial Valley main canal. Silt measurements at Topock from August, 1917, to June, 1918, inclusive, show that 37 per cent of the suspended silt was coarser than a No. 100 sieve, and because of the decreased relative quantity of this grade of suspended silt found at Yuma it is believed that more than one-half passes the latter point as bed silt.

"A consideration of all the available data on this subject leads to the general conclusion that of the total normal load of silt passing Yuma 80 per cent is suspended silt and 20 per cent bed silt.

"In estimating the weight of silt deposited in a reservoir located near the lower end of the canyon section of the river, 85 pounds of dry silt per cubic foot of sediment would seem to be a fair average, on the assumption that it is mixed. On this basis there would be an average of 137,000 acre-feet of wet sediment deposited annually.

"Some of the estimates made by others of the amount of silt transported by the Colorado River are shown.

Some Previous Estimates of Amount of Silt Transported Annually by the Colorado River.

Reference	Location	Period	Dry weight of silt per cu. foot	Annual silt load	Remarks
			Pounds	Acre-ft.	
Dole and LaRue, Water Supply Paper 395, U. S. Geological Survey.	Yuma	1895-1914	93	80,000	Compact deposits of suspended silt in reservoir.
Mead, Schlecht, and Grunsky Report of All-American Canal Board.	Yuma	1909-1910	100	97,330	Suspended silt.
Mead, Schlecht, and Grunsky Report.	-----	Average	100	102,000	Compact deposits of suspended silt in reservoir.
Weymouth. Unpublished Report U. S. Bureau of Reclamation.	Yuma	1909-1922	86	105,000	Suspended silt.
Bureau of Reclamation (1922) Sen. Doc. No. 142.	Yuma	Average	85	113,000	Suspended silt.
Bureau of Reclamation (1922) Sen. Doc. No. 142.	Boulder Canyon	Average	-----	88,000	Suspended silt.

"Attention is drawn to the fact that the estimate made in this report is 137,000 acre-feet, whereas the previous estimates made by others range from 80,000 to 113,000 acre-feet annually. In this connection it is to be understood that the present estimate includes both suspended and bed silt, whereas, with one known exception, the earlier estimates do not include bed silt. They are based on the suspended silt records at Yuma, which have been converted from a weight to a volume basis by using dry weights of silt ranging from 85 to 100 pounds per cubic foot. These weights are too high for suspended silt, although they may be correct for a mixture of bed and suspended silt as deposited in a reservoir.

"The following estimate of the total silt load in the river above its junction with the Gila River is based on the silt measurements at Yuma and is made as a check. 62.5 pounds would be a fair average weight of a cubic foot of suspended silt (not including bed silt) after being thoroughly dried. On this basis the normal suspended silt load of 161,708,000 tons at Yuma, exclusive of that from the Gila River, would be equal to 119,000 acre-feet. Assuming that this represents 80 per cent of the total load and that the additional bed silt has a dry weight of 100 pounds per cubic foot, there would be a bed load of 19,000 acre-feet, which when added to the suspended load, gives a total silt load of 138,000 acre-feet in the river at Yuma exclusive of the Gila.

"After giving the matter careful thought, the authors consider that 137,000 acre-feet is a fair estimate of the average amount of silt which would be deposited annually in a reservoir located near the lower end of the canyon section of the river. On this basis, in 100 years the silt would occupy a space in the reservoir equivalent to 13,700,000 acre-feet. However, the construction of additional reservoirs, together with a more regulated flow and the increased use of water in the upper basin, will prolong the life of such a reservoir.

"The quantity of silt transported through the canyon section is believed to be about 37 per cent larger than previous estimates have indicated. Should this larger estimate be found to be approximately accurate, it would be a waste of money to attempt to store silt, prevent floods, and provide water for both power and irrigation by the impounding of a relatively small quantity of water. The building of a dam on the Colorado River near Topock to store some 10,000,000 acre-feet of water has been advocated, but if the quantity of silt annually deposited in this proposed

reservoir is 137,000 acre-feet, it would not be long until its effectiveness for flood control and water storage purposes would be seriously impaired.

"If it be true that the Colorado River transports so large a normal load of silt to the lower basin, the necessity for providing an artificial lake of the largest practical dimensions, in which the water may be desilted and the silt stored, becomes of first importance. The proposed Boulder or Black Canyon Dam if built to a height of 550 feet above mean low water in the river, would store approximately 26,000,000 acre-feet of water. In view of the larger quantity of silt to be stored, earnest consideration should be given to raising rather than lowering the height of this proposed structure, for the principal reason that water can be stored in the upper levels of such a reservoir at a cost not exceeding 75 cents per acre-foot of storage. (Note: The latest plans (1930) call for 30,500,000 acre-feet of storage. J. L. B.)

"The subject of removal of silt from proposed reservoirs on the Colorado River was not investigated, but it deserves consideration. In order to determine proper means for preserving the required capacity of the San Carlos Reservoir (to be created by Coolidge Dam) on the Gila River, a United States Army board made an extensive study of various methods of desilting. The conclusion reached was that "the most promising method, indeed the only practicable method is dredging," but it was estimated that dredging would cost 5 cents per cubic yard or about \$80 per acre-foot. Such a cost would be prohibitive on the Colorado River where there are many reservoir sites in which additional storage capacity could be furnished at a much lower cost.

Chemical Analyses

"At various times during the past third of a century analyses have been made of the chemical ingredients of the water in the Colorado River and its tributaries and in typical irrigation canals of Imperial Valley. The results show considerable variation, apparently due mainly to the stage of the stream flow when the samples were taken and the watersheds from which the water was derived. W. H. Ross, of the University of Arizona, found in 1900 that the main river during the October and November floods occurring in the southern part of the Colorado River Basin contained nearly four times more chemicals than those borne by the May and June floods from the upper basin.

"Several chemical analyses have been made of the suspended silt in the waters of Colorado River. Collingwood, (Ariz. Agr. Expt. Sta. Tech. Bul. 8, 1892), took daily samples of the river water at Yuma for the seven-month period from August, 1891, to February, 1892. The average results are given in the following table:

Average Chemical Analysis of Colorado River Silt at Yuma, August 1891, to February, 1892.

<i>Constituent</i>	<i>Per cent</i>
Sand-silica, combination of water and organic matter-----	71.19
Oxide of iron-----	3.32
Alumina (Al ₂ O ₃)-----	10.01
Lime (CaO)-----	7.15
Magnesia (MgO)-----	2.39
Soda soluble in water-----	4.18
Soda soluble in acid-----	1.22
Potash soluble in water-----	.16
Potash soluble in acid-----	1.05
Phosphoric anhydride (P ₂ O ₅)-----	.17
Nitrogen (N)-----	.08

INDIAN LANDS

Development of the Indian lands from the Colorado River system has been a source of much discussion.

Assumptions have been made by Arizona that all lands in an Indian reservation capable of being irrigated automatically have a water right which must be satisfied from any allocation made to that State, provided of course that these lands are within the State of Arizona. What might appear to be a rather fine drawn distinction, but one which has nevertheless been the object of serious consideration, and much controversy, is based on the fact that there are two kinds of title affecting right to use water from the Colorado River; one is the title to use of water which falls within the 7,500,000 acre-feet allocated to the Lower Basin under the Colorado River Compact. The other is the right to use of water actually physically present in the Lower Basin system over and above the 7,500,000 acre-feet of allocated use.

In discussing the rights of Indian lands this distinction should be borne in mind. The Arizona contention is that full allowance must be made to that State for water use on the full acreage of the irrigable lands in these Indian reservations and that a sufficient water use allowance must be made for this purpose to the State of Arizona out of the 7,500,000 acre-feet of allocated use in the Lower Basin.

Under Act of Congress April 24, 1904, Chapter 1402, 33 Stat. 189, the following provisions are made for irrigation of Indian lands:

"That in carrying out any irrigation enterprise which may be undertaken under the provisions of the Reclamation Act of June 17, 1902, and which may make possible and provide for, in connection with the reclamation of other lands, the reclamation of all or any portion of the irrigable lands of the Yuma and Colorado River Indian Reservations, California and Arizona, the Secretary of the Interior is hereby authorized to divert the waters of the Colorado River and to reclaim, utilize and dispose of any lands in said reservations which may be irrigable by such works in like manner, as though the same were a part of the public domain;

"Provided, that there shall be reserved and allotted to each of the Indians belonging on the said reservations five acres (amended March 3, 1911, to read 10 acres in place of five acres) of the irrigable lands. The remainder of the lands irrigable in said reservations shall be disposed of to settlers under the provisions of the Reclamation Act;

"Provided further, that there shall be added to the charges required to be paid under the said act by settlers upon the unallotted Indian lands such sums per acre as in the opinion of the Secretary of the Interior shall fairly represent the value of the unallotted lands in said reservations before reclamation, said sums to be paid in annual installments in the same manner as the charges under the Reclamation Act. Such additional sums when paid shall be used to pay into the Reclamation Fund the charges for the reclamation of said allotted lands, and the remainder thereof shall be placed to the credit of said Indians and shall be expended from time to time under the direction of the Secretary of the Interior for their benefit."

In the case of the Parker Project the following statement is made in Senate Document 142, '67th Congress, 2d Session, page 53:

"All the lands in the proposed Parker project lie within the United States Indian reservation. Fifteen thousand acres is the maximum that will be needed for allotment to the Indians; the balance may be thrown open to settlement.

"Area—	Acres
Gross -----	121,000
Irrigable—	<u> </u>
Gravity -----	104,000
Pumping, lift approximately 135 feet -----	6,000
Total irrigable -----	<u> </u> 110,000"

The above statement made by the Reclamation Department after investigation of the project gives a considerably smaller acreage than that indicated in the letter from the Indian Service given below and the assumption would be that the Reclamation Department's estimate was based on a rather careful estimate of the situation, while that of the Indian Service was a gross estimate made evidently for safety's sake, giving a large enough figure to cover every possibility.

Under the present allocation of 10 acres to each Indian, a large proportion of the reservation lands on any reservation will naturally be thrown open to entry by whites and these lands will become just as much of a State asset as lands from any other part of the public domain within the State and should be considered on exactly the same basis as any other area within the State, the probability being that they will be developed along with other public lands in the order of their practicability. When it comes to absolute title to water the Government, knowing that there will be a vast amount of water actually flowing down the Colorado from the Upper Basin and physically present in the Lower Basin which will be subject to use over and above the amount technically allocated to the Lower Basin by the compact, and that this water, according to all obtainable reports, will never be used in the Upper Basin, naturally will be subject to use on Lower Basin lands.

California has felt that under the proposals made to Arizona and under the conditions which California has already accepted under the Boulder Canyon Project Act, that every acre of Indian land in Arizona capable of being irrigated will have ample water available for such use. California has also felt that to give this Indian land a sort of super-title and thus deprive California lands of title water necessary in order to properly finance projects would be unfair, believing that under the allocation made to Arizona by any of the California proposals, there would be ample firm water allocated to that State to satisfy all reasonable demands for such use. California has further felt that to make a blanket allocation of water to Arizona of a maximum amount of water based on gross acreage containing much land which probably never would or could be irrigated and to take such appropriation from firm title water would be unfair and would not only prohibit necessary development on the river but by preventing such development would permit of an excessive amount of water running down the river across the boundary line into Mexico and thus assist in building up in Mexico an excessive demand for water which would work to the detriment of all of the lands in the United States. In other words, were a block of water to be set aside for a use to which it would probably never be put, such allocation, while prohibiting the use of the water on United States lands would not prevent its use in Mexico and consequently would work to great detriment to the agricultural interests of this country.

The Colorado River Compact states, Article VII, "Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes."

In 1923 Secretary Hoover in reply to a question from Congressman Hayden gave an explanation of the meaning of this particular clause, as follows: (Congressional Record, Jan. 30, 1923, p. 2713.)

"Question. What was the necessity for Article VII relating to the obligations of the United States to Indian tribes?"

"This article was perhaps unnecessary. It is merely a declaration that the States, in entering into the agreement disclaim any intention of affecting the performance of any obligations owing by the United States to Indians. It is presumed that the States have no power to disturb these relations, and it was thought wise to declare that no such result was intended."

As an estimate of the total amount of Indian lands in Arizona the following letter from the Indian Service is given. (House Hearings: H. R. 5773, Part 1, January 9, 1928, p. 140.)

"United States Department of the Interior,
Indian Irrigation Service, Supervising Engineer,
Los Angeles, Calif., April 10, 1926.

Mr. Frank P. Trott,
State Water Commissioner,
Phoenix, Ariz.

Dear Sir: I have been instructed by the Commissioner of Indian Affairs to forward to you a list of all the water filings made by the United States Indian Service in the State Engineer's office and the total water requirements for the Indians of the several reservations within this district in Arizona.

After our conversation in January, it is my understanding that what you desire in general is a statement of the requirements of the Indians for your information in connection with the granting of applications for water on the various streams of the State, and with this in view I have prepared a list of the reservations affected, showing the water rights reserved for the Indians based upon their needs to provide irrigation for their lands in accordance with the findings by the Supreme Court of the United States in the case of *Winters vs. United States* reported in 207 United States page 564. Such water filings as have been made were for the information of the State officials so that they would be in position to know the requirements of the Federal Government on behalf of its Indian wards.

No reference is made to those reservations where pumping or other means of tapping the underground water supply within the reservation must be resorted to to develop water.

The only filing of which we have record was made May 16 1923, for 35 second-feet from the drainage canal of Maricopa County drainage district No. 5 at a point where it enters the Salt River. The field is, therefore, limited to the following reservations:

(1) Camp McDowell, (2) Cocopah, (3) Colorado River, (4) Fort Apache, (5) Fort Mohave, (6) Gila Bend, (7) Gila River (Pima), (8) Salt River, (9) San Carlos.

These will be taken up in order.

No. 1 Camp McDowell. The area of this reservation is 24,971 acres. No definite project has been surveyed, but the irrigable area is estimated at 2,000 acres, for which water from the Verde River would be required for irrigation purposes.

It should be noted that under the Kent Decree these Indians are entitled to 390 M. I. continuous flow from the Verde River based upon prior usage. This should not be taken, however, to limit the amount required by future development for the entire irrigable area.

No. 2. Cocopah Reservation. The area of this reservation is approximately 400 acres, all of which is irrigable, and for which water is required for irrigation purposes.

No. 3. Colorado River Reservation. The area of this reservation is 242,710 acres, of which approximately 222,090 acres are in Arizona, and approximately

115,000 acres of bottom land in Arizona can be irrigated, in addition to which there are approximately 8,000 acres of mesa land which can be irrigated, making a total irrigable area in Arizona of 123,000 acres on the Colorado River Reservation for which water is required from the Colorado River.

Surveys have been made and plans prepared preliminary to construction of a project which will, no doubt, be done some time in the future along with the development of the Colorado River. At the present time we are irrigating about 6000 acres annually by means of pumps taking water from the Colorado River.

No. 4. Fort Apache Reservation. This reservation comprises 1,681,920 acres, most of which is mountainous land suitable for grazing only. However, it is estimated that there are approximately 5000 acres of land which can be farmed profitably if the rainfall is supplemented by irrigation. Approximately 3000 acres are being farmed at the present time and another 2000 acres can be placed in cultivation. Water is required for the irrigation of 5000 acres on this reservation.

No. 5. Fort Mohave Reservation. The area of Fort Mohave Reservation is 34,762, of which 24,855 acres are in Arizona. Nearly all of this is bottomland, most of the remainder being mesa land of good quality, which can be cultivated. Water is, therefore, required from the Colorado River for approximately 24,000 acres on this reservation.

No. 6. Gila Bend Reservation. This reservation includes 10,231 acres, 4340 of which it is feasible to cultivate, and water is required from the Gila River for this amount of land.

No. 7. Gila River (Pima) Reservation. The area of this reservation is 371,422 acres, of which in the neighborhood of 120,000 acres can be cultivated. Construction is under way at the present time which contemplates the irrigation of 50,000 acres of this land under the gravity system from the Gila River, and it is estimated that as far as conditions warrant additional area up to the limit of 120,000 acres will be brought under cultivation through the development and conservation of gravity water and by pumping in connection with this project as a part thereof taking water from the Gila River.

An additional area of approximately 70,000 acres of white land in the Florence-Casa Grande Valley will ultimately receive irrigation from this source, including conservation and pumping. In all, for this project, both white and Indian, approximately 190,000 acres must receive its water from the Gila River through original diversions, return flow, and underground sources, approximately 100,000 of which is estimated to be from direct diversion, and of this 50,000 acres of direct diversion is claimed for the Indians.

No. 8. Salt River Indian Reservation. This reservation contains 46,720 acres, of which approximately 35,000 acres are irrigable and for which sufficient water will be required from the Salt and Verde Rivers. Approximately 3000 acres of this land are now being irrigated with water to which the Indians have a prior right under the Kent decree in the amount of 1034 M. I. which is being delivered through the Arizona and Utah Canals. Plans are under way through which it is hoped to secure water for the balance of the irrigable area.

No. 9. San Carlos Reservation. The area of this reservation is 1,834,240, of which only a small portion is irrigable, the balance being very mountainous and broken and beyond the reach of water. Prior to 1914 the Indians were cultivating a considerable acreage, approximately 3000 along the Gila and San Carlos Rivers, with water diverted from these streams. With the destruction of their canals and ditches, by floods, the pumping plants were installed under which they are now irrigating approximately 1000 acres in addition to which approximately as much more land is being irrigated along the San Carlos River by gravity diversion from that stream. The total irrigable area on this reservation is approximately 2500 acres, of which approximately 1500 will require water from the Gila River, and 1000 acres from the San Carlos.

I trust the above information will be satisfactory, and if any further explanation is desired, I would be very glad to give you the information to the best of my ability.

Very truly yours,

(Signed) HERBERT V. CLOTTIS,
Supervising Engineer."

The Reclamation Department in Senate Document 142, pages 51 to 80 list the following Indian lands in the various projects. No listing of

lands on the Gila River being given and only such lands as would be irrigable from the main stream of the Colorado.

	<i>Gross acreage</i>	<i>Net irrigable</i>
Mohave -----	22,500	12,500
Chemehuevis Valley-----	2,900	2,300
Parker (Colo. River Indian Reservation)-----	121,000	110,000
Yuma -----		9,000
Coachella Valley -----		11,400

The above tabulation gives reservation areas and not areas that would be assigned to Indians under the 10-acre provision.

Considerable information respecting Indian lands in the two States is also given in Senate Document 142 (Fall-Davis Report) in connection with the tabulation of lands in the various possible irrigation districts in the Lower Basin.

Indian Lands in California.

The following tabulation gives the approximate acreage of Indian lands susceptible of irrigation from the Colorado River lying within the State of California. The information is taken from Senate Document 142, the figures in parenthesis being the page in each case where the information is found.

Mohave Valley-----	2,500 acres	(51)
Chemehuevis Valley-----	2,900 acres	(52)
Yuma -----	9,000 acres	(63)
Coachella Valley-----	11,400 acres	(13)
	<hr style="width: 10%; margin: 0 auto;"/>	
Total -----	25,800 acres	

MEXICAN SITUATION

The Mexican situation might be briefly summed up as follows:

There are no treaty obligations between the two nations respecting use of water for irrigation.

A fair interstate water allocation must be worked out to prevent water usable on United States lands running down the river into Mexico in excessive amounts.

A fair proportion of water should, of course, go to Mexican lands but American acreage should not be starved for water in order to permit an excessive amount to flow across the border.

The water supply for United States agricultural acreage must be removed from Mexican control and the Mexican acreage placed on an independent basis. American lands should have an American water supply, Mexican lands a Mexican water supply, the two should be independent.

By the construction of the All-American Canal United States lands will have the control of their water in their own hands and the Mexican lands will have their independent water under Mexican control.

The use of the Colorado River water in Mexico has been a matter of grave concern to the states of the Colorado River Basin. There is a gross area of some million and a half acres on the delta of the Colorado River in Mexico just south of the international boundary line. Mexican engineers report that some 1,000,000 of this area is land capable of being irrigated from the Colorado River. There is no treaty with the Republic of Mexico establishing the right to use water for irrigation.

When water was brought into the Imperial Valley the canal carrying the water from the Colorado River followed the stream bed of one of the old branches of the Colorado River in Mexico. This old river bed was known as the Alamo River and ran from the Colorado River near the point where the boundary line intersects the river curving down through Mexico in a long flat loop and entered the United States some 40 miles west in a direct line from the Colorado River.

In order to provide for this method of diverting water to the Imperial Valley it was necessary to form a Mexican corporation owning and operating the portion of the main canal lying within Mexican territory. This Mexican corporation in obtaining the concession to operate from the Mexican government entered into a contract, May 17, 1904, by which the Mexican Company (The Sociedad de Riego y Terrenos de la Baja California, S. A.) was authorized to build a canal and convey water in an amount of 284 cubic meters per second, provided that lands in Mexico should be allowed to take water in an amount not to exceed one-half of the volume of water passing through such canals. The full text of this agreement is given on page 319.

This was not a treaty but simply a contract between a Mexican corporation and the Mexican government. This Mexican corporation, which was organized for the purpose of constructing this part of the canal for bringing water into the Imperial Valley is owned and controlled by the Imperial Irrigation District. This arrangement was necessary under Mexican law.

By the construction of a new canal on the United States side of the boundary line, connecting the Colorado River with the Imperial Irrigation system (All-American Canal), there would be no necessity for maintaining this Mexican corporation and water for the supply of the present Mexican system could be obtained through a new diversion from the river below the boundary line, connecting with this present Mexican canal, or under proper agreement, through a connection with the proposed All-American Canal near the intersection of the international boundary line and the Colorado River. This latter arrangement would bring water into Mexico in about the same manner as is now practiced. By such an arrangement the Mexican lands would have their own canal system and the American lands would have their separate system.

The main canal, all of the levee protection works, and the maintenance of the main canal system in Mexico are maintained and operated in fact by the Imperial Irrigation District, the Mexican corporation being in existence simply to satisfy the Mexican law.

This unsatisfactory arrangement places the burden of the maintenance of all the protective works and the main canal system in Mexico on the shoulders of the American farmers in the Imperial Irrigation District, the Mexican land owner simply paying for water if and when used. In order to get the water onto the United States lands the diversion is made from the Colorado River at a point approximately one mile north of the international boundary line on the United States side. The water is then carried down parallel with the river and across the international boundary line for about $3\frac{1}{2}$ miles and from that point flows along what was practically the old bed of the Alamo River. Thus the water is diverted on the American side, carried across the international boundary line, and then through some 60 miles of main canal in Mexico before it reenters the United States.

All of the water used for irrigation in Mexico originates in the United States and reaches Mexico either through the main channel of the Colorado River, by seepage across the boundary line or through the Imperial Canal, there being an insignificant amount of water actually coming from the small amount of watershed on the Mexican side.

In 1929 there were some 165,000 acres of land actually being irrigated in Mexico from the canal system (see records Imperial Irrigation District). A small amount of land was being irrigated either by pumping or diversion direct from the Colorado River in Mexico.

There appears to be no legal obligation on the part of the United States to provide water for the irrigation of Mexican lands. There may be a moral obligation to see that there is a sufficient flow of water reaching Mexico to permit of irrigating land actually under irrigation today. Most of the land under irrigation or susceptible of irrigation is controlled by American interests or syndicates, not allied with, and largely antagonistic to, the agricultural interests in the Imperial Valley on the United States side of the boundary line. Seemingly in an effort to build up a maximum demand for water, it is reported that vast areas of this Mexican land will be placed under irrigation one year and the following year allowed to go dry and the water diverted upon another area. Seemingly this is done in order to build up a claim that all of the land that has ever had water at any time may be

claimed to be under irrigation. The figure of 165,000 acres given above was the actual area under irrigation in the year 1929.

In an effort to establish international rights on the Colorado River various conferences have been held between representatives of the two governments. These conferences first started in connection with the Rio Grande and the scope of the conferences was later extended to include Colorado River, and at a still later date to include the Tia Juana. Senator Hayden (Arizona) in a speech in the Senate May 22, 1928 (Cong. Rec. 70th Cong. 1st Sess. p. 9806) sums up the progress made to that time. Part of Senator Hayden's statement is as follows:

"International Rivers Treaty With Mexico.

By authority of the act of May 13, 1924 (43 Stat. 118) the President appointed Maj. Gen. Lansing H. Beach, United States Army, retired; Mr. W. E. Anderson, of Texas, a civil engineer; and Dr. Elwood Mead, of California, Director of the United States Reclamation Service, as commissioners to negotiate a treaty or convention with the United States of Mexico for an equitable apportionment of the water of the Rio Grande River. The jurisdiction of this commission was extended by the last Congress to include the Colorado River, so that a division of the waters of both streams between the two nations might be accomplished in the same treaty. The Mexican Government last September appointed Gustavo P. Serrano, Federico Ramos, and Javier Sanchez Mejorada commissioners to meet with those appointed by our Government, and negotiations are in progress.

I am not personally acquainted with any of the Mexican commissioners, but friends of mine who know them tell me that they are all gentlemen of culture who are fully qualified by wide experience adequately to speak for the Republic which they have the honor to represent in these important international negotiations.

Negotiations for a treaty or convention with Mexico were under way in 1910, just at the close of the Diaz regime in that country. The negotiations were interrupted by the Madero revolution.

Mr. Louis C. Hill, then a division engineer of the United States Reclamation Service, was appointed to act on behalf of the American Government. Mr. Fernando Beltran y Puga was the Mexican commissioner.

I have here a letter written to the Secretary of State by Mr. Hill, in which he describes the progress that had been made in these negotiations up to the time when they were interrupted by the revolution in Mexico. The letter is dated Los Angeles, Cal., March 26, 1923, and is addressed to Hon. Charles E. Hughes, Secretary of State, Washington, D. C. I read the letter as follows:

Los Angeles, Cal., March 26, 1923.

HON. CHARLES E. HUGHES,

Secretary of State, Washington, D. C.

My dear Mr. Secretary: Having read in a recent Congressional Record Secretary Fall's and your letters on the Colorado River compact, it may be of interest to your department to know (what was informally agreed upon as fair to both countries by the Mexican Commissioner for the Division of the Waters of the Colorado and myself, then American commissioner.

The revolution in Mexico prevented any formal recommendation by the commissioners to their respective Governments. The tentative agreement was about as follows:

(1) Mexico and the United States to abrogate such parts of the treaty of Guadalupe Hidalgo as conflicted.

(2) The two Nations to divide the low-water flow of the Colorado equally between them. (Mexico's share of this would be less than 1500 second-feet and hence less than will irrigate the lands in Mexico now irrigated by Colorado River.)

(3) The United States to build reservoirs if it so desires to impound all the remaining water of Colorado River for the purposes, among others, of irrigating all the land which can be irrigated by Colorado River waters either by gravity or by pumping.

(4) That Mexico be permitted by paying her pro rata part of the cost of the reservoirs and their operation to have the use of such remaining water as can not be utilized in the United States.)

This was considered by the Mexican representative as a most fair and friendly proposal.

It gave to Mexico nothing the United States could use but at the same time shared with Mexico the storage facilities on the upper river, facilities which do not exist in Mexico)

Very respectfully,

L. C. HILL."

(It appears from the above statement by Mr. L. C. Hill that it was mutually agreed that the only water to be considered for Mexico in settling international demands was clearly based upon the low water flow of the river) These negotiations continued under successive acts of Congress. The personnel of the commissioners changing from time to time. No agreement has been reached.

At a conference of Governors held in Denver August, 1927, the following memorial concerning international relations respecting Colorado River was adopted (H. Com. Hear. H. R. 5773, part 2, p. 202, Jan., 1928) :

To the Hon. Calvin Coolidge,
President of the United States of America, and
The Hon. Frank B. Kellogg,
Secretary of State.

Whereas the prosperity and growth of the Colorado River states, namely, Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, are dependent upon present and increasing use of the waters of the Colorado River for domestic, agricultural, industrial, and other beneficial purposes, and the need of many regions of these states for additional water from that source already is extremely acute and will become increasingly so; and

Whereas said river is an international stream between the United States of America and the United States of Mexico with all of the water supplying the same coming from the United States of America, and the United States of Mexico is rapidly extending the irrigated area supplied from said river within her own boundaries, and great storage projects within the United States of America are in existence and in contemplation; and

Whereas said United States of Mexico, although having no strictly legal right to a continuance of the river flow for beneficial purposes, nevertheless may hereafter make some claim thereto; and

Whereas under acts of Congress of May 13, 1924, and March 3, 1927, a commission of three has been appointed by the President to cooperate with representatives of the United States of Mexico in a study regarding the equitable use of the waters of the Colorado River and other international waters for the purpose of securing information on which to have a treaty relative to international uses:

Now, therefore, and to the end that no unfortunate misunderstanding may arise between the United States of America and the United States of Mexico, and that no false encouragement may be given to present or future developments along the Colorado River in the United States of Mexico, we, the governors of all seven of the Colorado River States, with our interstate river commissioners and advisors in conference assembled in the city of Denver on this 26th day of August, 1927, do hereby in great earnestness and concern make common petition that a note be dispatched to the Government of the United States of Mexico calling attention of that Government to the fact that neither it nor its citizens or alien investors have any legal right as against the United States of America or its citizens to a continuance of the flow of the Colorado River for beneficial purposes and that the United States of Mexico can expect no such continuance except to the extent that, as a matter of comity, the two governments may declare hereafter by treaty and that especially under no circumstances can the United States of Mexico hope to use water made available through storage works constructed or to be constructed within the United States of America, or hope to found any right upon any use thereof. We believe, too, so great are the water necessities of our states, that any adjustment made with the United States of Mexico concerning the Colorado River should be based upon that river alone. We further earnestly suggest that a special commission be created by acts of Congress for the Colorado River alone, a majority of the commission to be appointed from citizens of the Colorado River states, or that by act of congress

the present commission already referred to be enlarged to contain two additional members to come from the Colorado River states.

It is only by such precautionary measures, promptly taken that our seven states with their millions of people can be given a basis of economic certainty, adequate protection, and a feeling of security pending the negotiation of an early treaty between the two governments.

And your memorialists will forever pray.

GEORGE W. P. HUNT, Governor of Arizona.

C. C. YOUNG, Governor of California.

WILLIAM H. ADAMS, Governor of Colorado.

F. B. BALZAR, Governor of Nevada.

RICHARD C. DILLON, Governor of New Mexico.

GEORGE H. DERN, Governor of Utah.

FRANK C. EMERSON, Governor of Wyoming.

Hon. Phil D. Swing (later congressman) at the time of the hearings on the first All-American Canal Bill (House Irrigation Committee Hearings, July 12, 1919, page 110) gave a summing up of international law affecting the states as follows:

"International Law Lays No Obligation Upon the United States to Furnish Mexico with Water

"The right of American citizens within the jurisdiction of the United States to appropriate and use American waters in accordance with the laws of the United States for the reclamation and improvement of American lands seems to follow as a necessary corollary from the sovereignty of our nation over its own territory.

"Chief Justice Marshall, in *Schooner vs. McFadden* (7 Cranch, page 136), said:

"The jurisdiction of the nation within its own territory is necessarily exclusive and absolute. It is susceptible of no limitation not imposed by itself. Any restriction upon it, deriving validity from an external source, would imply a diminution of its sovereignty to the extent of the restriction, and an investment of that sovereignty to the same extent in that power, which could impose such restriction.

"All exceptions, therefore, to the full and complete power of a nation within its own territories must be traced up to the consent of the nation itself. They can flow from no other legitimate source."

"Attorney General Judson Harmon, in an exhaustive and conclusive opinion (21 Official Opinions, 274), holds there is no obligation imposed upon the United States, by international law, to restrain its citizens from making a beneficial use of American waters so long as said waters are within the United States. He held:

"The rules, principles, and precedents of international law impose no duty or obligation upon the United States of denying to its inhabitants the use of the water of that part of the Rio Grande lying entirely within the United States, although such use results in reducing the volume of water in the river below the point where it ceases to be entirely within the United States.

"The fact that there is not enough water in the Rio Grande for the use of inhabitants of both countries for irrigation purposes does not give Mexico the right to subject the United States to the burden of arresting its development and denying to its inhabitants the use of a provision which nature has supplied, entirely within its own territory. The recognition of such a right is entirely inconsistent with the sovereignty of the United States over its national domain."

"This view of international law has never been doubted or criticized by any American authority, and even the Mexicans recognize the force of it, and invoke this same doctrine of exclusive territorial sovereignty in their own behalf. As we have seen, Engineer Garza quotes with approval the opinion of Emilio Valazco:

"The Republic (of Mexico), however, can not prevent the waters from being taken in American territory, but has a perfect right to prevent the waters taken in American territory from being carried across the Mexican territory, etc."

"Indeed, it would be a curious application of the principle of international law or the comity of nations or the doctrine of natural rights to deprive our own citizens of the means of life that it might be bestowed upon the citizens of another country. No authority has been found that holds that the proprietary country may not make use of the stream within its own territory that was necessary to maintain the comfort or life of its inhabitants. If this be not true, then the lower country would have control of the lives and property of the upper country. The

fundamental principle of international law is absolute sovereignty of every nation against all others. If then our treaties with Mexico put us under no obligation to furnish it with water, which is gathered wholly on our own soil, for its use either for navigation or agriculture, certainly no law of nations or law of right calls upon us for such a sacrifice. Humanity, common sense, self-preservation, all cry out against it."

The opinion of Attorney General Judson Harmon mentioned above is given on page 315-319.

The Arizona legislature by act approved March 16, 1925, memorialized Congress requesting that an act be passed declaring that it is the policy and purpose of the United States that all water stored or impounded within the United States be reserved for the exclusive benefit of the United States.

Congressman Hayden in order to carry out the purpose of the Arizona memorial proposed an amendment to the Boulder Canyon Project bill. This amendment was referred by Chairman Addison T. Smith of the House Committee to the Secretary of State for his opinion. The proposed amendment and the correspondence being brief and self-explanatory as given herewith (Hearings H. R. 9826, part 2, pp. 259-261, 1926):

The amendment—

"Sec. ----. It is hereby declared to be the policy and purpose of the government of the United States of America to reserve for use within the boundaries of the United States of America all waters of the Colorado River which may be stored or impounded therein to the end that the government of the United States of Mexico, the citizens of that republic, and the owners of Mexican lands may have direct and timely notice and warning that the use by them of any of such waters as may temporarily flow into Mexico shall establish no right, legal or moral, to the continued use of such waters."

The correspondence—

May 1, 1926.

"HON. FRANK B. KELLOGG,

Secretary of State, Washington, D. C.

My dear Mr. Secretary:

This committee has been considering for some time the inclosed bill (H. R. 9826) to provide for the protection and development of the lower Colorado River Basin, to which Mr. Hayden, of Arizona, proposes to offer an amendment when the consideration of the bill reaches the proper stage. Copy of the proposed amendment is inclosed.

The committee is somewhat in doubt of the advisability of accepting this amendment, and, if agreeable, we would be very pleased if a representative of the State Department would attend the meeting of our committee at room 331, House Office Building, Wednesday morning, the 5th, at 10.30 o'clock, for the purpose of advising the committee.

Sincerely yours,

ADDISON T. SMITH, Chairman."

Department of State, Washington, May 4, 1926.

My dear Mr. Smith:

I have received your letter of May 1, 1926, with which you inclosed a copy of H. R. 9826, "To provide for the protection and development of the lower Colorado River Basin," and a copy of an amendment to the bill which Mr. Hayden, of Arizona, proposes to offer. You state that the Committee on Irrigation and Reclamation is in doubt as to the advisability of accepting this amendment, and you request that, if agreeable, a representative of this department attend a meeting of the committee, May 5, for the purpose of advising the committee.

As explained to you by telephone this afternoon, I determined, after consultation with the Secretary of the Interior, to inform you of my view that the acceptance of any such amendment would be to the detriment of our international relations.

Under the circumstances, I beg to be excused from delegating a representative of this department to attend the meeting of your committee tomorrow morning.

I am, my dear Mr. Smith,

Very sincerely yours,

FRANK B. KELLOGG.

The Hon. Addison T. Smith

Chairman Committee on Irrigation and Reclamation,
House of Representatives."

One of the questions often asked in connection with the use of water in Mexico has been: What effect would a treaty between the United States and the Mexican Government have upon water allocation or division between States made prior to such international treaty, or in other words if the States entered into a contract or agreement between themselves dividing up the water of the Colorado River, and this agreement was approved by Congress, would a subsequent treaty between United States and Mexico affect the water division previously made between the States? In the Hearings before the House Irrigation Committee on H. R. 5773, part 3, page 342, January, 1928, the question was asked Mr. Ward Bannister of Denver as to what the status would be if the seven states of the Colorado River Basin got together and made a treaty (compact) which was approved by the Federal Government, and therefore became effective, and the Federal Government at a subsequent time came in and made any kind of a treaty that would affect the rights that were covered by the treaty between the States. Mr. Bannister's reply in part was: "I am inclined to believe that a treaty could not affect existing water rights, but the effect of this compact (Santa Fe Compact) between the States is not to create in the States any property in water; it effects a division, and all the States have, as you say, is sovereignty over the water and not property in them, and therefore I should think that the Federal Government under its treaty-making power could make a treaty, because it has a right, even as against States, to make treaties, so long as it does not take away the property of its States or nationals in doing so, and I do not believe, in the case you put, there is any property being affected."

Mr. Bannister also pointed out that the Colorado River Compact provides that if a treaty be made between the United States and Mexico the burden shall be borne fifty-fifty between the upper and lower basins.

(It has been the fear expressed all through the Colorado River conferences between the States that there might be a possibility sometime in the future of an excessive amount of water being allocated to Mexico by treaty and that the allocation of this water would hamper and probably prevent proper development of agricultural areas on the United States side of the boundary line. It was this fear that was expressed in the Governor's memorial adopted at the Denver conference and the same thought was carried out in the Arizona resolution) It is the same fear which has influenced California in her stand in connection with interstate negotiations. California's feeling being that if an improper allocation of water was made between the States, one State would be prohibited from properly developing, and an excessive amount of water, more than could be used, allocated to another State and this excess of water which other States could not use and which California would be prevented from using by compact would flow downstream and be appropriated in Mexico. While there might be no international agreement

at the time the water was put to use, actual appropriation and use in Mexico might entail a moral obligation that would be recognized either by international treaty or before some international tribunal. In other words, improper allocation of water between States would operate to discourage development on the American side and encourage development on the Mexican side of the international boundary line.

The following is condensed from a translation of a report made by Mexican engineers, the translation of which appears under the heading "Mexican Lands" in volume 3. of the unpublished Weymouth report of 1924. This report of course gives the Mexican viewpoint and is inserted here for that purpose. The condensed report follows:

"MEXICAN LANDS

Translation from *La Revista Agrícola*

Mexico City, April, 1922

Mexican Lands Irrigable by the Colorado River

By Ignacio Hayo Lopez, Engineer

The press of the capital is now giving its attention to Lower California and to the proposals of the United States to acquire this portion of our national territory. It is, therefore, opportune to publish the following data giving an idea of the present state of the lands irrigated by the Colorado River.

Mexican lands which can be irrigated by the Colorado River are in the region of Mexicali and in the northwestern part of the district of Altar in the State of Sonora.

Mexicali Region:

The irrigable zone is bounded on the north by the international line between monuments Nos. 207 and 224; on the east by the bed of the Colorado River (which is the international line) continuing southward between the old bed on that river which is also the boundary between Sonora and Lower California to include a little beyond the river mouth; on the south by the Pintos Hills; and on the west by the foot of the Mayor and Cucapas Hills to Centinela Hill (signal mountain), and involving a small area between Mayor and Pintos Hills, which extends to Macuta or Salada Lagoon.

Sonora Region:

This region includes the lands bounded on the north by the international line between monuments Nos. 203 and 205; on the east by irregular lines running over the sandy plain to the Purto Isabel trail; on the south by the Gulf of California and the mouth of the Colorado River; on the west, following the old course of the Colorado River which is the line with Lower California.

To clarify the foregoing there is attached Map No. 1 (not given here) on which has been entered the best data available with a view to giving an idea of the topographic configuration. On this map there appear two tracings of the bed of the Colorado River. One of them, shown in heavy lines, shows the course followed by the river as mapped in 1904. The other is the course last followed by the river in 1907. In 1908 it had definitely turned its course by way of the Abejas River and the Volcanes Lagoon, going thence by way of the Nevudo and Hardy Rivers.

Quality of the Lands

The lands have been divided into various classes according to their agricultural qualifications as can be seen by table herewith.

Lot No. 1:

Bounded on the north by the international line and Andrade sand hills; on the east and southeast by the Saize levee and the border Volcano; on the southwest and west by the sandy hills of the Cucapas and signal mountain. These lands have their greatest elevation 35 meters above sea level in the extreme northeast. From there they descend gradually towards the west to Mexicali at sea level, and then continue their descending toward the Imperial Valley, where there is a point 80 meters below sea level. This lot is entirely protected against flooding from the river and has been in great part open to cultivation with the exception of some

small sand hills and some small depressions scattered irregularly over it. It has a complete system of irrigation by gravity, but has some lands which can be irrigated only by a slight elevation of the water.

Lots Nos. 2, 3 and 4:

These are mountainous lands with much mesquite, and free to a certain point from inundations from flooding. They are susceptible to cultivation and are of excellent quality. By returning the waters of the Colorado River to the old channel these lands can be easily irrigated.

Lots Nos. 5, 6 and 7:

These are the lands on the Sonora side which are considered cultivable. A large part of them are in the sand hills along that side of the river, and a small part of them at the foot of the hills to the south. In the various irrigation projects all of these lands have been considered as cultivable; but it will always be necessary to elevate the water in order to irrigate them.

Lots Nos. 8, 9 and 10:

These lands have been subject to flood. They are good for cultivation, and could be put in good condition by confining the delta.

Lots Nos. 11 and 12:

These lands are subject to flood, but by reason of the fact that the flood waters are salinitrous they require adequate treatment in order to be made productive. They should be considered as among the lands which could be benefited by the waters of the Colorado River.

Finally Lot No. 13 is of condition similar to the foregoing. Effort is already being made to render part of this productive by building levees to prevent inundation and by the use of water from the Hardy River for irrigation, it being taken at a point called Mayor.

Mention must also be made of the lands marked with the numbers 14, 15, 17, 18 and 19. These are sandy and even stony, and can not in any event be considered as cultivable. Profitable use of the lands marked No. 16, in the Volcanes Basin, is also remote.

All of the lands which have been referred to as cultivable are, agriculturally speaking, of good quality with a deep covering of tillable soil, and almost entirely of alluvial formation. In great part they have an adobe base, that is, a clayey formation, well drained and broken up.

It is well to note here the classification of these lands made some time ago by Messrs. Garnett and Holmes. They are as follows:

Sandy mud: In the northeast of the valley, as far as Volcanes.

Mud: Still water, or water running over level places; Hardy, Paredones and Nuevo (New) rivers.

Clayey mud: Level land.

Sand and gravel: Sandy plain to the east of the Cucapas.

Sand and dunes: Of Aeolic origin; the dunes of Andrade and of Sonora.

Owners of the Lands

The titles of the present owners or proprietors of these lands are based on the divers concessions granted by the Secretary of Fomento to companies which have undertaken to colonize this territory. These are:

Grants in favor of Senor Guillermo Andrade, of 950,000 acres in Lower California and 126,000 acres in Sonora, lands on the banks of the Colorado River. This document was issued August 7, 1888. Under its terms Andrade was required to colonize part of these lands, according to contract of March 22, 1897.

Grant issued June 2, 1886 in favor of the Mexican International Company, of Hartford, Connecticut, assignee of the grant of Luis Huller of 747,000 acres in Lower California, known as "Section V." This concession embraced all of the lands of this capital territory from the international boundary to latitude 28, excepting the Andrade concession. The concession to the International Company was transferred to the Mexican Land and Colonization Company, also known as the "English Company." The concession of the company was declared lapsed by the decision of April 12, 1917, thereby being replevined and now considered as national land.

The various properties are outlined on Plan No. 3, and are described as follows:

Lower California

Lots Nos. I, III and VI. With areas of 1320, 580 and 9200 acres, respectively, a total of 11,100 acres, which come from the lapsed English Company and are now national lands. Those which are rented bring an annual rent of \$6.25 per acre.

Lot No. II, with an area of 9700 acres, was acquired from the same lapsed company by the present owners, the Signal Mountain Company.

Lot No. IV, with an area of 1840 acres, comes from the same lapsed English Company, and forms the Sonora Colony, whose lands are divided in lots of 24 acres and under. These lots are now occupied by poor people who, though they have possession in the character of renters, do not pay rent, on account of bad economic conditions of recent times.

Lot No. V, of 2500 acres, also contains replevined lands, which were divided in lots of 10 acres and distributed among poor people under rental arrangements, but rents are not being paid. These lands comprise the Zaragoza Colony.

Lot No. VII contains various parcels of private ownership of from 96 to 480 acres, and with one of over 3100 acres. The titles to these lands are based on the first alienation made by Andrade, to a company of which he formed part, called the Irrigation and Land Society of Lower California. The successor of this company is now called the "Land and Water Company of Lower California."

Lot No. VIII, with an area of 84,000 acres, is owned by the foregoing company. A third of this land has been cut up into small lots of different sizes and sold, and is occupied by small farmers. The Land and Water Company of Lower California controls and administers the whole irrigation system.

Lot No. IX. These are sandy lands, of 66,500 acres. It is not known that they have been sold, and it appears that they still belong to the Andrade heirs.

Lot No. X. The largest of those considered, is of 684,000 acres. It forms the greater part of the lands granted to Guillermo Andrade, and is now owned by the Colorado River Land Company. This company is commonly known in that region as the C. M.

Lot No. XI comprises two properties. The large rectangle of 15,500 acres belongs to the Imperial Development Company, and the small one to the northwest, of 970 acres, belongs to the Imperial Valley Land Company. Both properties were acquired by the Colorado River Land Company, from which they were purchased. The lands of the first company are commonly known there as the "Cudahy Ranch," or "Hechicera."

Lot No. XII, of about 132,000 acres, known as the "Cucapas Lands," is now owned by the Colorado River Land Company, which acquired it from the lapsed "Land and Colonization Company."

Lot No. XIII. This forms part of the replevined lands (now national) and was a concession to "Chinn, Grivel and Company," with a view to improving them and fitting them for cultivation. As has been stated, they are protected from floods, and water from the Hardy River is used in irrigating them.

Lot No. XIII has always been composed of national lands. It is known by the name of "Second Section." These lands were alienated in 1913, but the matter was reconsidered and the sale was nullified, the lands returning to the national dominion.

Sonora

Lot No. XIV, of 96,000 acres. These are part of the lands granted to Andrade in Sonora. Mr. Auerlio Sandoval has right to a third part of these lands by cession from the Andrade heirs. Near Monument No. 204 on the international boundary is found the military colony of San Luis.

Lot No. XV also forms a part of the Andrade concession and comprises 30,000 acres, in the Puerto de Santa Isabel.

Lot No. XVI is land which was alienated. That in the north, on the Mesa, went to Manuel Martinex del Rio, who transferred the concession to the Mexican Land and Colonization Company, now lapsed. That in the south was granted to Mr. Sandoval. I understand that all of these lands have been replevined and are now national property.

Individual Classification

The attached table shows the quantity of lands according to the classifications which have been considered, and also shows their ownership.

The total of cultivated lands refers to lands open to cultivation, of which in 1920, the year of greatest development, 185,000 acres were worked and made to produce.

In 1918, Mexicali produced 12,000 metric tons of cotton; 12,250 metric tons of cotton seed; 22,680 metric tons of alfalfa and 5452 hectoliters of barley. Good results have been obtained in experimental cultivation of rice, garbanzas, and sugar-cane.

The lands indicated as cultivable are those which are considered as productive, but which require greater expenditure of labor and money than the "cultivated," especially in the matter of irrigation.

The project of putting the river back in its old channel is still on foot. If this is done it will facilitate the irrigation of much of the cultivable land, and also render productive almost all of the lands subject to flood.

We will turn a moment from the description we have been following and make a comparison of the interests represented in the Lower California region. They are: The National Lands (I, III, IV, V and VI); the Colorado River Land Company (II, X and XII)—considering here the Signal Mountain Company as being closely connected with the Colorado River Company.

	<i>Cultivated, per cent</i>	<i>Cultivable, per cent</i>	<i>Subject to flood, per cent</i>
National lands.....	5	1	6
Colorado River Land Co.....	75	80	90
Other owners.....	20	29	4

As will be seen the Colorado River Land Company is the one most affected by anything relating to its lands. It should also be noted that with the exception of a part of the national lands, and an occasional lot owned by Mexicans, all of the lands which we have been considering are in the possession of American citizens or companies.

Summing up, taking the first three columns of the table, we have: In lower California, 728,000 acres; and Sonora 245,000 acres, a total of 973,000 acres of lands which should take advantage of the waters of the Colorado River, and 256,000 acres which can also be made productive agriculturally, giving a total of 1,229,000 acres. Professor W. Nelson, Chief of the Biological Survey, Washington, estimates at 1,500,000 acres, the land in Lower California which could be irrigated.

Area of Mexican land irrigable by the waters of the Colorado River, classified by ownership and quality of these lands, in acres.

(Revised from Department of Commerce Translation)
Area of Mexican Land Irrigable by the Waters of the Colorado River, Classified by Ownership and Quality of the Lands, in Acres.
 (La Revista Agrícola.) April, 1922, page 671.

Tract number	Irrigable		Non-irrigable	Alkaline	Totals
	Class I	Class II			
		Irrigable Subject to flood			
LOWER CALIFORNIA					
I National lands	1,235		125		1,360
II Signal Mountain Company	9,390		610		10,000
III National lands		590			590
IV Sonora Colony	1,160	730	100		1,890
V Zaragoza Colony	1,600	860	70		2,560
VI National lands	9,140	250			9,460
VII Privately owned	5,760	4,620	540		10,920
VIII Land and Water Company of Lower California	27,220	29,600	4,350		32,800
IX Andrade Grant			68,500		68,500
X Colorado River Land Company	159,180	156,140	67,670	35,320	708,100
XI Imperial Dev. and Imp. Valley Land Co.	7,110	7,420	1,610		17,000
XII Colorado River Land Company	860	17,660	117,350		135,850
XIII National lands				153,170	171,700
	222,655	217,870	278,185	188,490	1,215,730
SONORA					
XIV Andrade and Sandoval	540	62,450	19,140		98,800
XV Andrade		4,200	7,410	8,390	29,640
XVI National		141,530	17,040	64,840	223,410
	540	208,180	25,810	73,730	351,850
Totals	223,195	426,050	303,995	262,220	1,567,580

The areas in the above table are gross. The net irrigable area after the usual deductions for small local areas not susceptible of profitable development, rights of way, stream channels, etc., is estimated at 80 per cent of the 1,264,000 acres quoted as being fit for reclamation, or in round numbers 1,000,000 acres. Roughly 200,000 acres lie adjacent to the gulf and to the river below the re-entry of flood channels traversing the delta. The development of these lands will probably be very slow owing to the complex problems of irrigation supply, drainage and salt elimination involved. Two hundred thousand acres of lands around the head of the gulf would likely also be served by pumping as the lands lie little if any above the water supply expected to be used. Return flow from upper delta lands, water wasted at Laguna and unused Gila River waters are likely to provide a sufficient flow for these lands, leaving 800,000 acres dependent on original diversions from Colorado River and largely if not wholly to be diverted at Laguna.

Of the 800,000 acres the areas requiring pumping are the eastern slopes of the Cucupus mountains, mesa lands lying east of the old channel of Colorado River in Sonora, which might be covered by an extension of the canal serving the Yuma Mesa on the Yuma project, isolated mesas or rises in the delta region and lands lying above the proposed All-American Canal, or such substitute therefor as may be adopted.

Summary

Gross irrigable area in Mexico.....	1,264,000 acres
Net irrigable area, 80 per cent.....	1,000,000 acres
Irrigable from local supplies near Gulf.....	200,000 acres
Dependent on Upper Colorado River.....	800,000 acres
Areas requiring pumping—	
Cucupus Mountain Slopes, Area XII and X.....	20,000 acres
Sonora Lands	120,000 acres
From All-American Canal.....	8,000 acres
Isolated mesas, etc.	12,000 acres
Gulf lands.....	200,000 acres
	360,000 acres
Area irrigable by gravity systems.....	640,000 acres

With respect to the time when these lands will be reclaimed it is estimated that flood control and increased irrigation supply would result in the immediate increase of the irrigated area from 190,000 acres now irrigated to an area equal to all of "Irrigable, Class I" and one-half of "Irrigable, Class II" and "Irrigable, subject to flood" areas shown in the previous table. The balance of the lands with the exception of those requiring protection from the gulf are expected to be developed in the near future and the gulf lands in the far future.

Acres—80 Per Cent of Gross Area

	<i>Irrigated in 1922</i>	<i>Additional development Immediate future Class A</i>	<i>Near future Class B</i>	<i>Far future Class C</i>	<i>Ultimate</i>
Dependent on Colorado River.....	190,000	300,000	310,000		800,000
Not dependent on Colorado River.....				200,000	200,000
Total.....	190,000	300,000	310,000	200,000	1,000,000

In the Hearings before the House Committee January, 1928, on H. R. 5773, page 277, the following tabulation of lands irrigated in Mexico is given:

"The land irrigated in Mexico from the Imperial Irrigation system since 1921 is as follows:

<i>Year</i>	<i>Acres</i>
1921.....	120,000
1922.....	150,000
1923.....	180,000
1924.....	185,000
1925.....	200,000
1926.....	217,000"

The report of the Imperial Irrigation District gives the following figures:

<i>Year</i>	<i>Acres</i>
1927 Total acreage irrigated-----	156,000

Information obtained from Imperial Irrigation District's office gives the acreage in Mexico irrigated in 1929 as 165,039 acres. Estimating from the amount of water used in 1928 and 1929 and taking proportionate acreages and figures would indicate that in 1928 about 191,000 acres of land was under irrigation.

The following information in connection with Mexican lands and use of water is taken from a report compiled by Mr. Frank Adams and contained in the Report of the American Section of the International Water Commission, United States and Mexico, submitted April 21, 1930, and published as House Document 359, 71st Congress, 2d session, pages 161, 162, 163, 164 and 165.

"It was found impossible to obtain a clear idea of the irrigable and the irrigated lands south of the international boundary without first securing information regarding at least the larger and more important land ownerships.

"The larger part of the irrigable land in the delta south of the international boundary is owned by the Colorado River Land Company, S. A., their total present holdings approximating 800,000 acres. The original holding of which this 800,000 acres was a part contained 832,337 acres and, according to Mr. H. H. Clark, general manager of the Colorado River Land Company, was purchased outright from the Mexican government in 1898 by the California-Mexican Land and Cattle Company, predecessor of the present company. Three parcels of this land have been sold up to 1927, containing in all 32,000 acres. Of this, 8000 acres is owned by the Shintani Company, 7000 acres by W. C. Allen (Globe Mills Company), 16,000 acres by the Imperial Development Company (Cudahy Ranch), and approximately 1000 acres by the Mexican government. A beginning was made in 1927-28 in subdivision and sale of some of the 800,000 acres remaining to the Colorado River Land Company, but the amount disposed of at this writing has been only about 100 acres. Of this 800,000 acres, approximately 132,000 acres is classed by the company as mountain and desert, leaving about 668,000 acres in the delta proper.

"Next to Colorado River Land Company, the largest holding of lands south of the international boundary is that of the Compania de Terrenos y Aguas de la Baja California, S. A., a subsidiary of the Southern Pacific Company. This property is part of an approximately 100,000-acre tract purchased in the early days from G. Andrade by the California Development Company, through its subsidiary, the "old" Mexican company, but largely retained by the Southern Pacific Company, through repurchase at auction, at the time of the financial reorganization of the system. This tract lies between the international boundary and the Hunt survey or C. D. line and approximately from Colorado River on the east to north and south line about 4 miles west of Calexico and Mexicali, not including the Andrade estate lands, which are largely mesa. A considerable portion of this area has been sold, the portion still remaining in the hands of the Southern Pacific Company (Compania de Terrenos y Aguas de la Baja California, S. A.), approximately 28,500 acres. About 12,600 acres of the original Andrade tract (99,848 acres) has been sold by the Southern Pacific Company to the Mexican government for colonization purposes, the area thus disposed of comprising the western portion of the original tract, beginning approximately opposite monument No. 216 on the international boundary.

"The statements in the preceding paragraph account for most of the area between the international boundary and the Hunt or C. D. line with the exception of the following: The Packard tract, near Mexicali, owned by the Mount Signal Land and Cattle Company; the mesa and other undeveloped areas north of the Southern Pacific Company holdings east of monument 217, and belonging to the Andrade estate; the 'Andrade lands' between an old and the present channel of the Alamo southerly from monuments 210 to 212, as to which ownership is contested but which are at present in control of the Daugherty estate, of San Francisco; and the lands sold by the Southern Pacific Company, other than that sold to the Mexican government. A general tabulation of all of the above lands follows in Table No. 1.

“Table No. 1—Summary of land ownership in the Colorado River Delta in Lower California.

(In round numbers.)

	<i>Gross areas</i> (Acres)
“Colorado River Land Co., S. A. (including approximately 132,000 acres of mountain and desert areas)-----	800,000
Southern Pacific Co. (Compania de Terrenos y Aguas de la Baja California, S. A.)-----	28,500
Mexican Government (including El Progreso colonies, lands released to the Mexican Government by Colorado River Land Co., S. A., and lands purchased from Southern Pacific Co. and W. C. Allen)-----	35,500
Globe Mills Co. (W. C. Allen and Allen, Goh and O’Hashi)-----	12,000
Imperial Development Co. (Cudahy Ranch)-----	16,000
Shintani Ranch-----	8,900
Cia Agricola Civil del Valle Imperial (Daugherty estate)-----	10,000
Lands sold by Southern Pacific Co. (other than to Mexican Government and to Allen, Goh and O’Hashi) :	
Algodones Plantation Co. (W. H. Harris & Son)-----	2,995
Alamorada Ranch Co. (Weed and Laing)-----	4,262
Cuervos Development Co. (H. de Nancy & Co.)-----	1,657
Cia Agricola Cuervos (P. E. Williams)-----	2,666
Miscellaneous (including roads and canals and some doubtful areas)-----	17,634
	29,000
Andrade estate (including mesa lands)-----	50,000
Mount Signal Land & Cattle Co.-----	10,000
Total-----	999,000

Irrigable Lands Along Colorado River in Mexico

“No accurate estimate of the irrigable area in Mexico would be possible without extensive and expensive detailed studies in the field. Numerous estimates have been made, some being as high as 800,000 acres, exclusive of the Sonora Mesa, which alone contains probably in excess of 100,000 acres which it would be physically possible to reach, very largely by gravity, through diversion at Laguna Dam. No field consideration has been given to Sonora Mesa, nor in fact to any of the lands in Mexico east of Colorado River. An attempt has, however, been made to obtain an approximate check on the irrigable area below the international boundary as far south as the present irrigation development has extended, and to make the best estimate possible of the irrigable area still below that.

“Two courses have been followed in approximating the irrigable areas south of the international boundary:

“(1) For the developed section of the area—that is, as far south as the Bee and Pescadero Channels and the Rodriguez Levee, but not including undeveloped Southern Pacific and Andrade estate tracts between the international boundary and the C. D. line—use has been made of the 1927 crop report records of Imperial Irrigation District. In these records the irrigable areas are those indicated as irrigable in the water applications on file in the Mexicali office of Imperial Irrigation District; that is, in the office of Compania de Terrenos y Aguas de la Baja California, S. A. In some cases the areas are stated in the applications as gross, in others as net. The tabulation of these areas is presented as compiled by the subsidiary “compania” of the district, arranged by canals from which they are irrigated. A second tabulation is presented with the areas rearranged by principal ownerships or leases, and with some corrections made by the owners or lessees.

“(2) The lands in the entire delta south of the international boundary have been platted on the map inserted and the irrigable lands indicated to the extent shown by the lease plats on file with the Colorado River Land Company, or in accordance with information obtained from owners or lessees or operating officials of Compania de Terrenos y Aguas de la Baja California, S. A., or of Colorado River Land Company and Delta Canal Company. The results of this method, obtained by planimetry, can be considered only approximate, although care has been taken to show the various classifications as accurately as the information available permitted. For the undeveloped and unprotected portions of the delta south of the Bee and Pescadero Channels and Rodriguez Levee the boundaries of the irrigable lands are as indicated by the officials of the Colorado River Land

Company and Delta Canal Company, with some corrections as suggested by Engineer G. Gonzales, chief of the first zone of waters, department of agriculture and development, with residence in Mexicali, Lower California.

"Table No. 2—Summary of irrigable lands in the developed sections along Colorado River in Lower California as taken from 1927 crop report of Compania de Terrenos y Aguas de la Baja California, S. A. (subsidiary of Imperial district).
(Data arranged by principal canals.)

	<i>Acres</i>
Alamo (including Carrilo Bend and east side main)-----	319,324
Solfatara-----	15,031
East High Line-----	877
Mesa-----	641
South Alamo-----	172
Ash-----	353
Alamitos-----	560
Central main-----	957
West side main-----	17,315
Wistaria-----	4,304
Encina-----	1,952
Wormwood-----	3,079
Cerro Prieto-----	50,368
Total-----	415,000

"Table No. 3—Summary of irrigable lands in the developed sections along Colorado River in Lower California as taken from 1927 crop report of Compania de Terrenos y Aguas de la Baja California, S. A. (subsidiary of Imperial Irrigation District), in part revised by owners or lessees.

(Data arranged by principal ownerships or lessees.)

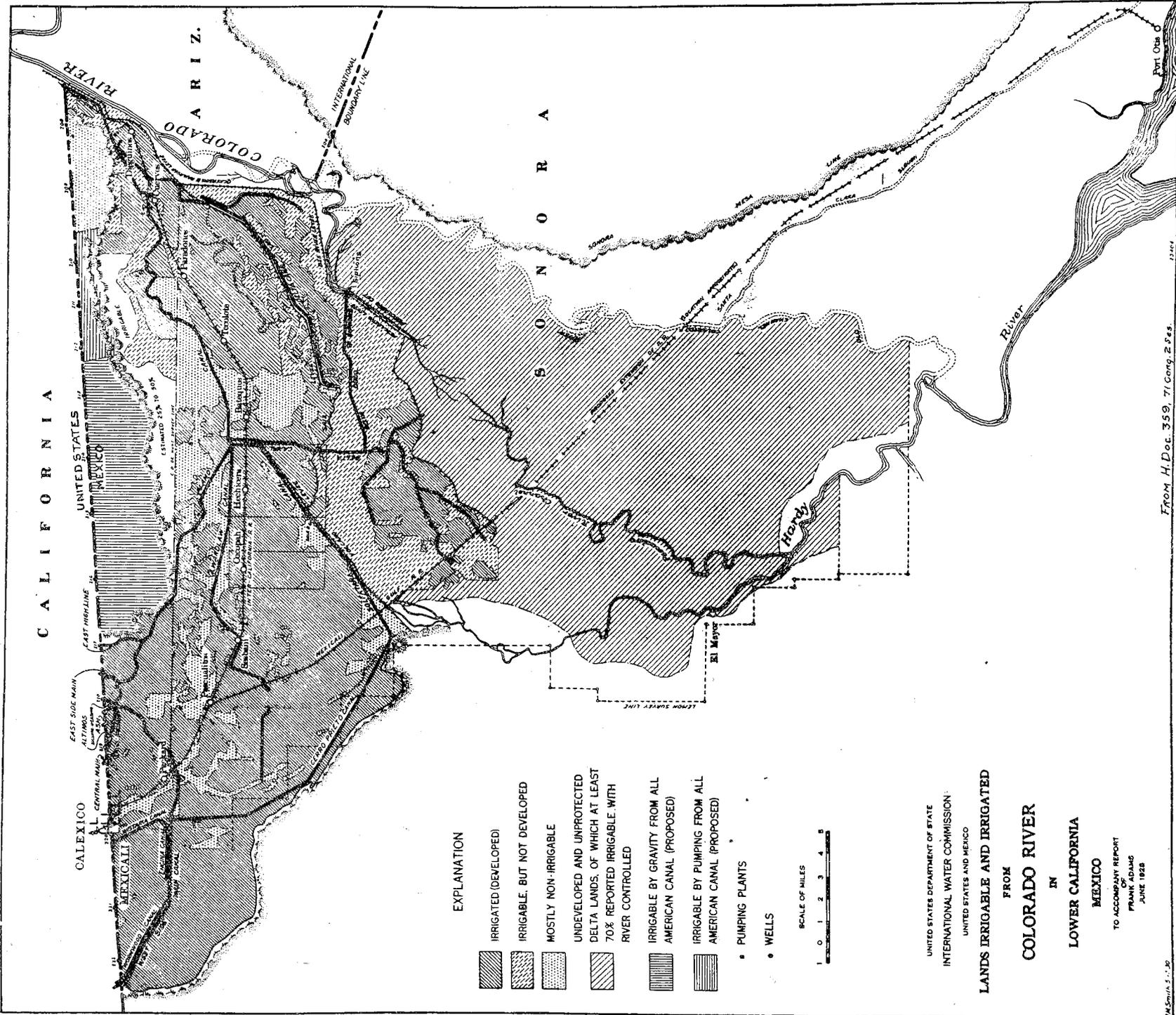
	<i>Acres</i>
Colorado River Land Company-----	173,643
Delta Canal Company (lessee of Colorado River Land Company)-----	80,000
Mexican Government, including El Progreso colonies-----	34,056
Imperial Development Company (Cudahy ranch)-----	10,315
Globe Mills Company-----	8,998
Southern Pacific Company (including small area belonging to the Colorado River Land Company)-----	6,861
Mount Signal Land and Cattle Company-----	6,381
Small independent areas-----	22,663
Total-----	342,917

"Table No. 4—Summary of irrigable area along Colorado River in Lower California as planimeter from accompanying map (Plate XXII). North of Bee and Pescadero channels and Rodriguez levee, exclusive of mesa lands:

	<i>Acres</i>
Developed to 1928-----	280,000
Undeveloped-----	70,000
Mesa lands directly south of international boundary (approximately 90 per cent of total)-----	30,000
Unprotected and undeveloped areas south of Bee and Pescadero channels and Rodriguez levees (estimated at 70 per cent of gross area 315,000)-----	220,000
Total-----	600,000

Reconciliation of Discrepancies in Above Summaries

"It will be noted that the total irrigable area given in Table No. 2 is some 72,000 acres in excess of the total in Table No. 3; also that the sum of the developed and undeveloped areas given in Table No. 4 falls between the other two. It will be remembered that the source of the information in Table No. 2 is the applications for water filed with Compania de Terrenos y Aguas de la Baja California, S. A., and that in some cases the areas are stated as gross and in others net. If the gross areas were reduced to net areas, the total obviously would be smaller and tend to approach the figure given in the second summary. As a matter of fact, the corrections used in preparation of the latter were reductions of this nature, so that the second summary should be more nearly correct than the first. Furthermore, the



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From H. D. 359, 71 Cong. 2 Ses.

total of the planimetered developed and undeveloped areas as platted, 350,000 acres, is in substantial agreement with the second total. On the basis of Tables Nos. 3 and 4, therefore, 350,000 acres might be assumed as an approximately correct figure. On the other hand, the Colorado River Land Company estimates the total irrigable area, developed and undeveloped, south of the international boundary and north of the channels of the Bee and the Pescadero, at 450,000 acres, and Imperial Irrigation District states that they have had applications for water for over 400,000 acres.

"It is to be regretted that the available data do not permit of a more complete reconciliation of the figures given. However, for the purposes of this report, it is believed that 400,000 acres is a safe outside figure to use for the irrigable area south of the international boundary and north of the Bee and Pescadero channels and Rodriguez Levee, and that figure will be accepted in the final summary of this report. This is about 80 per cent of the total planimetered area of 500,000 acres within the exterior boundaries of the portion of the delta under consideration above. The 400,000 acres should be assumed, however, as the gross irrigable area, including land occupied by roads, canals, levees, local waste spaces, etc., normally considered to be about 15 per cent of the gross.

"Coming now to Table No. 4, which covers the entire delta in Lower California, it should be made clear that the figures for the area south of the Bee and Pescadero channels and Rodriguez Levee are also necessarily approximations, although as nearly correct as the method used in arriving at them permitted. The total figure, 600,000 acres, is in agreement with independent estimates by the Colorado River Land Company. It should be noted here, however, that the planimetered area south of the Bee and Pescadero channels and Rodriguez Levee makes no deduction for the channel of Colorado River and will only hold true if and when the river is returned to its old channel along the Sonora Mesa. Present new development assumes that the river will flow, as now, in the general neighborhood of the Pescadero Channel. With the river flowing in the Pescadero Channel area, the irrigable land probably will not exceed 150,000 to 175,000 acres."

The United States representation on an international water commission was originally authorized by the act entitled "Public No. 118, 69th Congress, 1st Session, approved May 13, 1924." This original act had to do simply with the equitable use of the waters of the Rio Grande below Fort Quitman, Texas. On March 3, 1927, Congress passed Public Resolution No. 62, 69th Congress, as follows:

"*Resolved*, By the Senate and House of Representatives of the United States of America in Congress assembled, That the act of May 13, 1924, entitled 'An act providing for a study regarding the equitable use of the waters of the Rio Grande below Fort Quitman, Texas, in cooperation with the United States of Mexico' is hereby amended to read as follows:

"That the President is hereby authorized to designate three special commissioners to cooperate with representatives of the government of Mexico in a study regarding the equitable use of the waters of the lower Rio Grande and of the Lower Colorado rivers, for the purpose of securing information on which to base a treaty with the government of Mexico relative to the use of the waters of these rivers. One of the commissioners so appointed shall be an engineer experienced in such work. Upon completion of such study the results shall be reported to Congress. The commission may also, with the concurrence of Mexico, make a study of the Tia Juana River, with the view of having a treaty governing the use of its water.

"Sec. 2. There is hereby authorized to be appropriated out of any moneys in the treasury not otherwise appropriated such amounts not to exceed \$50,000 as may be necessary for carrying out the provisions hereof." (Reference: Report of the American Section of the International Water Commission, House Document 359, page 2.)

(On June 15, 1927, the Secretary of State directed that under its enlarged powers the title of the commission should be the "International Water Commission, United States and Mexico."—JLB.)

"In August, 1927, the American embassy at Mexico City informed the State Department that Mexico had appointed the following commissioners to represent that country:

"Gustavo P. Serrano, an engineer and the Mexican member of the International Boundary Commission, United States and Mexico.

"Javier Sanchez Mejorada, an engineer and a member of the National Irrigation Commission of Mexico, which is a branch of the Department of Agriculture and Improvement in that country.

"Federico Ramos, general adviser of the Department of Foreign Relations.

"Mr. Ramos did not attend any of the meetings of the commission, but was represented by Mr. Armando Santacruz, Jr., an engineer of experience in regard to the boundary streams. Miss M. A. Schnurr, assistant to Dr. Mead, Commissioner of Reclamation in the Department of the Interior, was designated secretary of the American section and Mr. Fernandez MacGregor was designated by the Mexican section as its secretary."

A full report of the commission's actions and investigations is given in the document above referred to. On pages 22 and 23 of the report is a very able summing up of the situation as follows:

Mexican Natural Storage

"In one respect Mexico is in a better position than the United States with regard to water from the Colorado. It has in the extensive deltaic plain south of the border an underground storage due to the fact that the permeable silt soil over which the river flows absorbs water like a sponge and, which acts as a natural regulator of the widely fluctuating discharge of the stream. Due to this percolation, the water plane is only a few feet below the surface, enabling water to be pumped from this underground storage at slight expense. Extensive tests with pumps of large capacity do not exhaust or materially lower the supply. This supply will be renewed when the next high water comes down the river and will be held for use without the necessity of law or costly storage regulation. This is probably the reason why Mexico desires to acquire hydroelectric power from American works. Irrigators in the United States, on the lower Colorado, have no such natural regulation. On the contrary, the wide fluctuation in discharges in different months of the year makes the construction of large and costly storages an essential part of the utilization of this river in irrigation or for other industrial uses.

Suggested Action

"It is already apparent that the needs in the United States for Colorado River waters are destined to be much greater than has been realized in the past, and probably greater than can be fully estimated or appreciated at present. Stability in development and peaceful relations on both sides of the boundary, require further efforts to reach an agreement as to policies, and as to the limits which will govern the recognition of rights to water across the boundary.

"In the absence of any agreement as to principle governing the division of water across the international boundary, it is believed that the position which the United States holds with regard to such division, and the recognition of rights in either country to water across the boundary, should be officially stated and notice given to Mexico through the appropriate channel. The interests of both countries will be served by an early agreement as to the extent to which existing uses of water on both the Rio Grande and Colorado on both sides of the international boundary are to be recognized, but in the absence of such agreement it is believed that the United States should give notice to Mexico that no rights to water in the Colorado based on future development and extension of existing uses, will be recognized until an agreement covering all three streams has been reached."

The following is an extract from the same report, beginning on page 234, "Memorandum on Treaty Rights of the United States and Mexico in Colorado River," by Karl F. Keeler, Associate Engineer, dated January 21, 1930. Translations only of the documents referred are here given, although the original report contains both the English and Spanish text.

The Agreements

"The international agreements between the two countries which touch upon this matter are commonly known as—

"(A) The treaty of Guadalupe Hidalgo, signed and proclaimed in 1848, particularly Articles V, VI, and VII thereof.

"(B) The Gadsden Purchase Treaty, signed in 1853 and proclaimed in 1854, particularly Articles I and IV thereof.

"(C) The boundary convention, signed in 1884 and proclaimed in 1886, particularly the last paragraph of Article V thereof.

"The pertinent portions of the various articles mentioned above are as follows:

“(A) Articles V, VI and VII of the Treaty of Guadalupe Hidalgo.

(Signed at Guadalupe Hidalgo, February 2, 1848; proclaimed July 4, 1848.)

Article V

“The boundary line between the two Republics shall commence in the Gulf of Mexico, three leagues from land, opposite the mouth of the Rio Grande, otherwise called Rio Bravo del Norte, or opposite the mouth of its deepest branch, if it should have more than one branch emptying directly into the sea; from thence, up the middle of that river, following the deepest channel, where it has more than one to the point where it strikes the southern boundary of New Mexico; thence, westwardly along the whole southern boundary of New Mexico (which runs north of the town called Paso) to its western termination; thence, northward, along the western line of New Mexico, until it intersects the first branch of the river Gila; (or if it should not intersect any branch of that river, then, to the point on the said line nearest to such branch, and thence in a direct line to the same); thence down the middle of the said branch and of the said river, until it empties into the Rio Colorado; thence, across the Rio Colorado, following the division line between Upper and Lower California, to the Pacific Ocean.

(The remainder of this article is omitted because it is not important here.)

Article VI

“The vessels and citizens of the United States shall, in all time, have a free and uninterrupted passage by the Gulf of California, and by the river Colorado below its confluence with the Gila, to and from their possessions situated north of the boundary line defined in the preceding article; it being understood that this passage is to be by navigating the Gulf of California and the river Colorado, and not by land, without the express consent of the Mexican Government.

“If, by the examinations which may be made, it should be ascertained to be practicable and advantageous to construct a road, canal or railway, which should, in whole or in part, run upon the river Gila, or upon its right or its left bank, within the space of one marine league from either margin of the river, the governments of both Republics will form an agreement regarding its construction, in order that it may serve equally for the use and advantage of both countries.

Article VII

“The river Gila, and part of the Rio Bravo del Norte lying below the southern boundary of New Mexico, being, agreeable to the fifth article, divided in the middle between the two Republics, the navigation of the Gila and of the Bravo below said boundary shall be free and common to the vessels and citizens of both countries; and neither shall, without the consent of the other, construct any work that may impede or interrupt, in whole or in part, the exercise of this right; not even for the purpose of favoring new methods of navigation. Nor shall any tax or contribution, under any denomination or title, be levied upon vessels or persons navigating the same, or upon merchandise or effects transported thereon, except in the case of landing upon one of their shores. If, for the purpose of making the said rivers navigable, or for maintaining them in such state, it should be necessary or advantageous to establish any tax or contribution, this shall not be done without the consent of both governments.

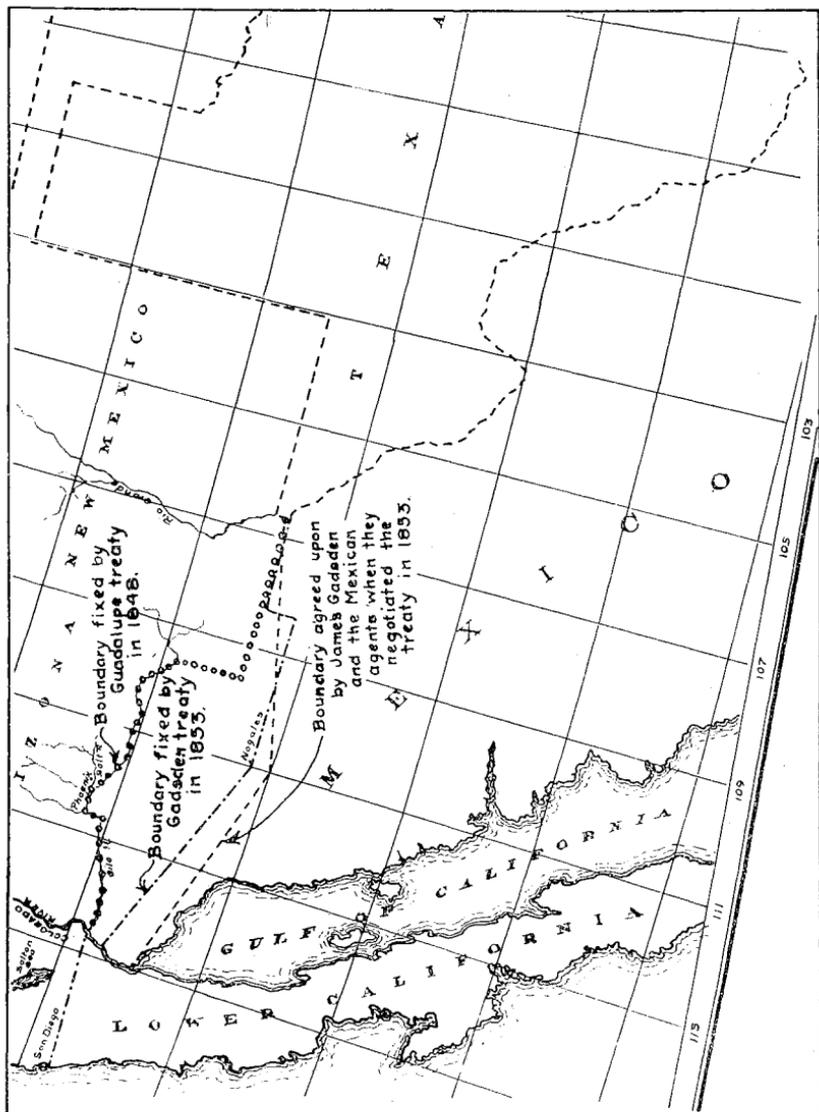
“The stipulations contained in the present article shall not impair the territorial rights of either Republic, within its established limits.

“(B) Articles I and IV of the Gadsden Purchase Treaty.

(Dated at the City of Mexico, December 30, 1853; proclaimed June 30, 1854.)

Article I

“The Mexican Republic agrees to designate the following as her true limits with the United States for the future. Retaining the same dividing line between the two California's as already defined and established according to the 5th Article of the Treaty of Guadalupe Hidalgo, the limits between the two republics shall be as follows: Beginning in the Gulf of Mexico, three leagues from land, opposite the mouth of the Rio Grande as provided in the fifth article of the treaty of Guadalupe Hidalgo, thence as defined in the said article, up the middle of that river to the point where the parallel of 31° 47' north latitude crosses the same, thence due west one hundred miles, thence south to the parallel of 31° 20' north latitude, thence along the said parallel of 31° 20' to the 111th meridian of longitude west of Greenwich, thence in a straight line to a point on the Colorado River twenty English miles below the junction of the Gila and Colorado rivers, thence up the middle of the said river Colorado until it intersects the present line between the United States and Mexico.



VARIOUS BOUNDARY LINES, 1849 TO 1853, UNITED STATES AND MEXICO. (From House Doc. 359, 7 Cong., 27 Sec.)

PLATE XXIII

(An unimportant part of this article is omitted here.)

"The dividing line thus established shall in all time be faithfully respected by the two governments without any variation therein, unless of the express and free consent of the two, given in conformity to the principles of the Law of Nations, and in accordance with the constitution of each country respectively.

"In consequence, the stipulation in the 5th Article of the Treaty of Guadalupe upon the boundary line therein described is no longer of any force, wherein it may conflict with that here established, the said line being considered annulled and abolished wherever it may not coincide with the present, and in the same manner remaining in full force where in accordance with the same.

Article IV

"The provisions of the 6th and 7th Articles of the Treaty of Guadalupe Hidalgo having been rendered nugatory for the most part by the cession of territory granted in the First article of this treaty, the said articles are hereby abrogated and annulled and the provisions as herein expressed substituted therefor. The vessels and citizens of the United States shall in all time have free and uninterrupted passage through the Gulf of California to and from their possessions situated north of the boundary line of the two countries. It being understood that this passage is to be by navigating the Gulf of California and the river Colorado, and not by land, without the express consent of the Mexican government and precisely the same provisions, stipulations and restrictions in all respects are hereby agreed upon and adopted and shall be scrupulously observed and enforced by the two contracting governments in reference to the Rio Colorado, so far and for such distance as the middle of that river is made their common boundary line by the First article of this treaty.

"The several provisions, stipulations and restrictions contained in the 7th article of the treaty of Guadalupe Hidalgo, shall remain in force only so far as regards the Rio Bravo del Norte below the initial of the said boundary provided in the First article of this treaty. That is to say below the intersection of the 31° 47' 30" parallel of latitude with the boundary line established by the late treaty dividing said river from its mouth upwards according to the 5th article of the treaty of Guadalupe.

"(C) Article V of the Boundary Convention.

(Concluded at Washington, November 12, 1884; proclaimed September 14, 1886.)

Article V

"Rights of property in respect of lands which may have become separated through the creation of new channels as defined in Article II, hereof, shall not be affected thereby, but such lands shall continue to be under the jurisdiction of the country to which they previously belonged.

"In no case, however, shall this retained jurisdictional right affect or control the right of navigation common to the two countries under the stipulations of Article VII of the aforesaid Treaty of Guadalupe Hidalgo; and such common right shall continue without prejudice throughout the actually navigable main channels of the said rivers, from the mouth of the Rio Grande to the point where the Rio Colorado ceases to be the international boundary, even though any part of the channel of said rivers, through the changes herein provided against, may be comprised within the territory of one of the two nations."

Historical Background

"By Art. 5, 1848, a portion of our boundary was established as being along the Gila River to its junction with the Colorado; thence across the Colorado and westward to the Pacific Ocean. (See map.) When James Gadsden and the Mexican agents negotiated the treaty of 1853 they finally agreed to the line shown on the map on the preceding page. This line was to descend the Colorado from the junction of the Gila to a point two marine leagues (about six miles) north of the northernmost part of the Gulf of California, and was then to go southeastward straight to the intersection of 30° north latitude and 111° west longitude, etc. Our present boundary line in this region is that fixed by Art. 1, 1853, as it was finally revised by the United States Senate. In the region of the Colorado, this boundary is very different from the line agreed to by Gadsden and the Mexican agents. The present boundary is also shown on the map on the preceding page.

"Full understanding of the above facts concerning the actual and proposed boundaries is very helpful in arriving at the meaning of the treaty of 1853 and the convention of 1884. A lack of understanding of these facts is responsible, in a large part, for the many different interpretations, for these international agreements which I have referred to."

"What are the Rights of the Two Countries in the Colorado Under Articles 5, 6, and 7 of the Treaty of Guadalupe (1848).

"Art. 5, 1848, merely erected the boundary line which separated the two countries from 1848 until 1854. This boundary line did not follow the Colorado River, but crossed it at the junction of the Gila. This boundary was changed by the Gadsden treaty (1853); hence no more notice need be given to this article.

"Arts. 6 and 7, 1848, contained provisions regarding the Gulf of California, the Rio Grande, Colorado, and Gila rivers. I have shown, however, in my memorandum to you of November 7, 1929, re navigability of the Colorado River, that the United States had no obligation under Arts. 6 and 7, 1848, to maintain or assist in maintaining the navigability of the Colorado. I have also shown in my memorandum to you of January 3, 1930, re Art. 5, 1884, that the stipulations of Art. 7, 1848, were not applicable to the Colorado. As shown (memorandum of fifth conference not given here, J.L.B.) it was the intention of those who negotiated the treaty of 1853 that the provisions of the treaty of * * * 1848 were to continue in force where not done away with or rendered negatory by the stipulations of the treaty * * *" of 1853. In accordance with this expressed intention of the negotiators, Art 4, 1853, completely " * * * abrogated and annulled * * * " Arts. 6 and 7, 1848; so we need notice these articles no more at this point, for, no matter what rights the United States or Mexico may have had under these articles (Arts. 6 and 8, 1848) or what obligations they may have assumed under them, all such rights and obligations, as to the Colorado, were completely swept away by the first sentence of Art. 4, 1853.

Conclusions

"Inasmuch as the 1848 boundary merely crossed the Colorado and did not follow it, and because Arts. 6 and 7, 1848, were completely abrogated and annulled, as to the Colorado, by Art. 4, 1853, it is seen that the United States or Mexico have no subsisting treaty rights in the Colorado River or its waters as a result of Arts. 5, 6, and 7 of the treaty of Guadalupe.

"What are the Rights of the Two Countries in the Colorado Under Articles 1 and 4 of the Gadsden Treaty (1853).

"Art 1, 1853, merely erected the new boundary line and "annulled and abolished" the old wherever the new conflicted with the old line. As already noted, the new boundary line as agreed to by the negotiators, descended the Colorado from the junction of the Gila to within about six miles of the gulf (over 80 miles along the river) while the line fixed by the final treaty descended the river only 20 miles.

"By Art. 1, 1853, Mexico acquired no new rights in the Colorado. She did however, surrender to the United States her right of sovereignty over a portion of the river channel.

"We now come to the examination of Art. 4, 1853, which holds the key to the proper understanding of treaty rights in the Colorado. We will therefore examine it closely.

"Below, Art. 4, 1853, is reproduced; divided into parts V, W, X, Y, and Z, convenient for analysis and reference.

Article IV

"(V) The provisions of the 6th and 7th Articles of the Treaty of Guadalupe Hidalgo having been rendered nugatory for the most part by the cession of territory granted in the First article of this treaty, the said articles are hereby abrogated and annulled and the provisions as herein expressed substituted therefor. (W) The vessels and citizens of the United States shall in all time have free and uninterrupted passage through the Gulf of California to and from their possessions situated north of the boundary line of the two countries. (X) It being understood that this passage is to be by navigating the Gulf of California and the river Colorado, and not by land, without the express consent of the Mexican government, (Y) and precisely the same provisions, stipulations and restrictions in all respects are hereby agreed upon and adopted and shall be scrupulously observed and enforced by the Two Contracting Governments in reference to the Rio Colorado, so far and for such distance as the middle of that river is made their common boundary line by the First article of this treaty.

"(Z) The several provisions, stipulations and restrictions contained in the 7th article of the Treaty of Guadalupe Hidalgo, shall remain in force only so far as regards the Rio Bravo del Norte below the initial of the said boundary provided in the First article of this Treaty. That is to say, below the intersection of the 31° 47' 30" parallel of latitude with the boundary line established by the late treaty dividing said river from its mouth upwards according to the 5th article of the Treaty of Guadalupe.

"W and X together refer to the Colorado river below where it forms the boundary line. Y refers to that part of the Colorado which forms the boundary line. Z refers only to the Rio Grande.

Part V

"A reading of the first sentence, which I have designated as part V, shows its meaning to be perfectly plain. It completely sweeps away and annuls the old articles 6 and 7, 1848: giving the reason for so doing and designating what is substituted therefor.

"By comparison and analogy of language and subject matter, it is plain that parts W, X, and Y are substituted for old article 6, 1848, and part Z for old article 7, 1848. Some of the provisions of old article 6, 1848, were well adapted to the changed boundary. Such provisions were used again, almost verbatim, in parts W and X of article 4, 1853. The Gila River being no longer the boundary, part Z of this article, by definite and specific words, readopts, but limits and restricts, the provisions of old article 7, 1848, to the Rio Grande (called also Rio Bravo del Norte) below El Paso, Texas.

"So we see that the meaning of part V is perfectly plain and in no need of interpretation by the rules of law. In speaking of the interpretation of treaties Vattel says (Law of Nations, Book II, sec. 263):

"It is not allowable to interpret what has no need of interpretation."

Part W

"Part W of article 4, 1853, says:

"The vessels and citizens of the United States shall in all time have free and uninterrupted passage through the Gulf of California to and from their possessions situated north of the boundary line of the two countries."

"When this is read with the other parts of the article, part W is likewise plain and unambiguous. It is a grant from Mexico to the vessels of the United States and to the citizens of the United States. By specifically naming 'the vessels and citizens of the United States' and at the same time failing to name anyone else, everyone except those named are excluded from this grant of 'free and uninterrupted passage.'

"The United States did not here agree that it would maintain the navigability of the river south of its territory nor that Mexico might navigate without cost or interruption the waters mentioned here. If Mexico has any right to navigate the Gulf of California or the lower part of the Colorado such right is not derived from the above-quoted sentences of the treaty. Mexico naturally has such right by virtue of its sovereignty.

"Of course the United States may renounce its right under this grant; for as Vattel says (Book II, sec. 32), when speaking of treaty rights of nations, 'Every one (nation) is at liberty to renounce his right.'

"It is important here to notice what waters this grant of 'free and uninterrupted passage' applies to. Part W says that such passage shall be 'through the Gulf of California to and from their possessions situated north of the boundary line * * *'

"As agreed in Mexico City, by the negotiators, this boundary line was to descend the Colorado to within about 6 miles of the gulf and then turn southeastward. It is therefore evident that this grant of 'free and uninterrupted passage' was limited, by the negotiators, to the gulf and the lower 6 miles of river channel; for to extend it more than this would have been to extend it beyond what was necessary to fulfill the aforementioned grant. To such an extension Mexico could, and likely would, have objected. As finally changed by the United States Senate and agreed to by Mexico this boundary line was to descend the Colorado only 20 miles. But this change in boundary line merely changed the right of passage, mentioned above, so that it would include all of that part of the river below the place where the new boundary line leaves the river and turns southeastward. But when part W is read in connection with parts X and Y it is clear that part Y extends this grant of free passage to that 20 miles of the Colorado River which forms the boundary.

Part X

"Part X modifies the aforementioned grant. It provides two stipulations or restrictions thereto:

"(a) It restricts the aforementioned grant of 'free and uninterrupted passage' to passage by 'navigating the Gulf of California and the river Colorado.'

"(b) It stipulates that the 'passage' shall not be 'by land without the express consent of the Mexican government.'

"These provisions were very important indeed, for without them the 'Yankees' could have, and likely would have, claimed unrestricted 'passage' over land and water, so long as they were passing 'through the Gulf of California to or from their possessions situated north of the boundary line.' For the word 'passage' does not designate travel by water only. It designates travel by any means whatever including air travel. It is certain that trouble would have soon arisen over the interpretation of this article of the treaty if it were not for these 'provisions, stipulations, and restrictions.'

"The punctuation of the Spanish text makes parts W and X one sentence. Undoubtedly part X forms a portion of the statement of the grant of 'free and uninterrupted passage' mentioned in part W. So it is seen that this grant consists of several (more than (a) and (b) above) provisions, stipulations, and restrictions.

Part Y

"Part Y says:

'* * * and precisely the same provisions, stipulations, and restrictions in all respects are hereby agreed upon and adopted and shall be scrupulously observed and enforced by the two contracting Governments in reference to the Rio Colorado, so far and for such distance as the middle of that river is made their common boundary line by the first article of this treaty.'

"Part Y clearly extends the grant of free and uninterrupted passage to a definite and limited portion of the Colorado River; the boundary portion. According to the English text, parts X and Y form a single sentence; they certainly are closely connected; for when it says the 'same provisions, stipulations, and restrictions,' it clearly means those which were just stated, that is, those of parts X and W. That is to say part Y extends the provisions, etc., of parts W and X to the boundary portion of the Colorado. Yes, and part Y does more; for it says that the provisions, etc., of parts W and X * * * shall be scrupulously observed and enforced by the two contracting Governments * * * These words place an obligation upon the United States to 'observe and enforce' the terms and stipulations of the grant of free passage. Notice, however, that this joint obligation does not apply to the gulf and lower end of the Colorado but only applies to the boundary portion of the river. Mexico certainly did not want American warships or troops in the Gulf of California or in Mexican territory along the lower end of the Colorado under the guise of enforcing the terms of this grant of free passage. But she did want the United States obligated to restrain the construction or use of a railroad or any other form of land passage, to the Gulf, through Mexican territory, along the boundary portion of the river.

"The news of the capture of La Paz, the capital of Lower California, by William Walker and his men from San Francisco and their declaration of the free and sovereign republic of Lower California, on November 3, 1853, as well as Walker's establishment of his headquarters at Ensenada on November 10, and the quick opening, under the flag of the new republic, in San Francisco, of a recruiting office—was all fresh in the mind of the Mexican Minister of Foreign Affairs, Senor Bonilla, when he prepared the draft of the treaty (from December 25 to 30, 1853). With these historical facts in mind it is seen to be but natural and logical that this obligation is placed upon the United States by part Y, and that the article No. 8, concerning filibusters, should have been desired as a part of the original treaty agreement as signed by Gadsden on December 30, 1853.

Part Z

"Part Z is the part that was substituted for old article 7, 1848. But part Z is seen to be greatly limited as compared to old article 7, 1848. Old article 7, 1848, applied to 'the river Gila, and that part of the Rio Bravo del Norte lying below the southern boundary of New Mexico * * * ' whereas part Z, with definite and unambiguous language says that old article 7, 1848 * * * shall remain in force

only so far as regards the Rio Bravo del Norte below * * * (El Paso, Tex.) It is seen that part Z does not refer or apply to the Colorado River.

Conclusion

"Article 1, 1853, merely erected the new boundary line and abolished the old, thereby reducing Mexico's territorial rights over a portion of Colorado River and enlarging those of the United States.

"Article 4, 1853, abrogated all the old rights and obligations that existed under articles 6 and 7, 1848. It also granted to the vessels and citizens of the United States, in perpetuity, certain restricted rights of passage through Mexico and obligated the United States to enforce these restrictions along that part of the Colorado River which formed the new boundary. It also readopted some of the provisions of old article 7, 1848, but caused them to apply only to the Rio Grande below El Paso, Texas.

"It is therefore seen that articles 1 and 4 of the treaty of 1853 increased the rights of the United States and its citizens in the Colorado River and decreased the rights of Mexico therein.

Summary of Interpretations by the Writer

"The writer's interpretations as to what are the treaty rights of the two Governments in the Colorado River and its waters may be briefly summarized as follows:

"(a) Any treaty rights which the United States and Mexico may have in the Colorado River are to be found in articles 5, 6, and 7, 1848, articles 1 and 4, 1853, and article 5, 1884.

"(b) When read together and interpreted according to the accepted rules of law these international agreements reveal:

"1. No restriction upon the complete territorial sovereignty of the United States over the river or its waters within the boundary lines established by the treaty of 1853.

"2. A grant in perpetuity by Mexico to the vessels and to the citizens of the United States of a right of passage through Mexico, restricted to passage by navigating the Gulf and Colorado River.

"3. An obligation upon the United States to enforce against its cogramtee—the citizens of the United States—the restrictions of the aforementioned grant, but only to enforce them along the boundary portion of the Colorado River.

"4. The aforementioned grant is further limited, along the boundary portion of the river, to the actually navigable main channels of the river, but such channels may be navigated even though they lie wholly within Mexican territory.

"5. No acknowledgment, grant, or stipulation of any right in Mexico, of, in, or to any part of the Colorado or its waters, except such as are incident to its territorial sovereignty over a portion of the same.

"6. No provision for Mexico to navigate the boundary portion of the Colorado River.

"Herein no expression has been made as to Government policy regarding treaty rights in the Colorado River; such being wholly outside the province of this memorandum. Many factors will combine to determine such a policy; and since the law is the servant of politics and must not be suffered to become its master, legal treaty rights will serve to orient the view of such other factors.

Respectfully,

KARL F. KEELER,
Associate Engineer."

Use of Water from International Streams

Opinion of Attorney General Harmon
The Attorney General to the Secretary of State
Department of Justice

Washington, D. C., December 12, 1895.

Sir:—

I have the honor to acknowledge the receipt of your letter of the 5th ultimo in which you refer to the concurrent resolution of Congress passed April 29, 1890, providing for negotiations with the Government of Mexico with a view to the remedy of certain difficulties mentioned in the preamble of such resolution, which arise from the taking of water for irrigation from the Rio Grande above the point where it

ceases to be entirely within the United States and becomes the boundary between the United States and Mexico. I have also the copy which you inclose of the note of the Mexican minister to yourself, dated October 21, 1895, in which he states at length the position taken by his Government.

You say:

"The negotiations with which the President, acting through the Department of State, is charged by the foregoing resolution can not be intelligently conducted unless the legal rights and obligations of the two Governments concerned and the responsibility of either, if any, for the disastrous state of things depicted in the Mexican minister's letter are first ascertained."

I have the honor, therefore, to call your attention to the legal propositions asserted in Mr. Romero's letter and to inquire whether, in your judgment, those propositions correctly state the law applicable to the case. In other words—

(1) Are the provisions of article 7 of the treaty of February 2, 1848, known as the treaty of Guadalupe Hidalgo, still in force so far as the River Rio Grande is concerned, either because never annulled or because recognized and reaffirmed by article 5 of the convention between the United States and Mexico of November 12, 1884?

(2) By the principles of international law, independent of any special treaty or convention, may Mexico rightfully claim that the obstructions and diversions of the waters of the Rio Grande in the Mexican minister's note referred to are violations of its rights which should not continue for the future and on account of which, so far as the past is concerned, Mexico should be awarded adequate indemnity?

I reply as follows:

(1) Article 7 of the treaty of Guadalupe Hidalgo, while it was declared to have been rendered nugatory for the most part by the first clause of article 4 of the treaty concluded December 30, 1853, and proclaimed June 30, 1854, was, by the second clause thereof, reaffirmed as to the Rio Grande (now, Rio Bravo del Norte) below the point where, by the lines as fixed by the latter treaty that river became the boundary between the two counties. Said article 7 is recognized as still in force by article 5 of the convention concluded November 12, 1884, and proclaimed September 14, 1886.

So far, therefore, as it affects the subject now in hand, said article 7, in my opinion, is still in force. I am unable, however, to agree with the minister in the interpretation which he gives it.

His statement is that the city of El Paso del Norte has existed for more than 300 years, during almost all of which time its people have enjoyed the use of the water of the Rio Grande for the irrigation of their lands. As that city and the districts within its jurisdiction did not need more than 20 cubic meters of water per second, which was an almost infinitesimal portion of the volume of water, even in times of severest drought, they had sufficient water for their crops until about ten years ago, when a great many trenches were dug in Colorado, especially in the St. Louis Valley and in New Mexico, through which the upper Rio Grande and its affluents flow, so greatly diminishing the water in the river at El Paso that except when rains happen to be abundant there is scarcity of water from the middle of June until March. In 1894 the river was entirely dry by June 15, so that no crops could be raised, and even fruit trees began to wither. The result has been to reduce the price of land and cause great hardships to the people, whose numbers in Paso del Norte, Zaragoza, Tres Jacalles, Guadalupe, and San Ignacio diminished from 20,000 in 1875 to one-half that number in 1894.

The minister further states that from a report of the assistant quartermaster general, addressed to the general in chief of the United States Army, dated September 5, 1850, it appears that Captain Lowe (meaning Love), United States Army, ascended the river in a vessel to a point several kilometers above Paso del Norte, showing that it was then navigable to that place. The minister has been misinformed. The original report, which is before me now, shows that Captain Love was instructed to carry "to the highest attainable point in the Rio Grande" his small keel boat, which "drew, with her crew, provisions, arms, etc., on board, 18 inches of water." He found this point at some "impossible falls" which he names "Brookes Falls." Carrying around them "the skiff which had accompanied his boat," he rowed 47 miles farther to other falls, which he named "Babbitts Falls." Beyond this point he "found it impossible to proceed with the skiff, either by land or water," and it was "about 150 miles by land below El Paso."

The minister contends that the irrigation ditches in Colorado and New Mexico, which result in diminishing the flow of water at El Paso, come within the treaty prohibitions of "any work that may impede or interrupt, in whole or in part, the

exercise of this right" (of navigation), because, as he says, "nothing could impede it more absolutely than works which wholly turn aside the waters of these rivers." But article VII is limited in terms to "the part of the Rio Bravo del Norte lying below the southern boundary of New Mexico." Article IV of the treaty of 1853 continues the provisions of said article VII in force "only so far as regards the Rio Bravo del Norte below the initial of said boundary provided in the first article of this treaty." It is that part alone which is made free and common to the navigation of both countries and to which the various prohibitions apply. It is plain that neither party could have had, in framing these restrictions, any such intention as that now suggested. The fact, if such it were, that the parties did not think of the possibility of such acts as those now complained of would not operate to restrain language sufficiently broad to include them; but the terms used in the treaty are not fairly capable of such a construction. They naturally apply only to the part of the river with which the parties were dealing and to such works alone as either party might construct on its own side if not restrained. Though equally divided, in theory, between the two nations where it is their boundary, the river is, in fact, a unit for purposes of navigation, and therefore the treaty required the consent of both for the construction of "any work that may impede or interrupt" navigation, even though it should be "for the purpose of favoring new methods of navigation." (Art. VII.) Up to the head of navigation no such work could have been constructed save by one of the two Governments, or by its authority. The prohibition was, therefore, appropriately made applicable to them alone and not to the citizens of either, "neither shall, without consent of the other, construct, etc." Above the head of navigation, where the river would be wholly within the United States, different rules would apply and private rights exist which the Government could not control or take away save by exercise of the power of eminent domain, so that clear and explicit language would be required to impose upon the United States such obligation as would result from the construction of the treaty now suggested.

Moreover, the only right the treaty professed to create or protect with respect to the Rio Grande was that of navigation. The claim now made is for injuries to agriculture alone at places far above the head of navigation. Captain Love, in the report referred to, said, "The mouth of Devils River, which is about 100 miles below the mouth of the Puerco (Pecos) and 617 above Ringgold Barracks, is the head of steamboat navigation," and that "with some difficulty" navigation by keel boats was possible "to a point 56 miles above the 'Grande Indian Crossing' or about 283 miles above the mouth of Devils River." So far as appears, the large and numerous tributaries below El Paso supply a sufficient volume of water for the needs of navigation.

In fact, the part of the treaty now under consideration merely expresses substantially the same rights and duties which international law would imply from the fixing of the middle of the river as the boundary, viz, free navigation of the entire stream below the point where it becomes common to both nations, without any levy or exaction or the construction of any work which might impede navigation, without the consent of both.

In my opinion, therefore, the claim now made by Mexico finds no support in the treaty. On the contrary, the treaty affords an effective answer to the claim by the well-known rule that the expression of certain rights and obligations in an agreement implies the exclusion of all others with relation to the same subject.

It is not necessary, in order to bring this principle into play, that it shall appear that either party, or both, actually thought of the particular matter whose exclusion is asserted, although that fact, when it appears, may serve to emphasize the inference. I am not advised whether the subject of the use of the water of the Rio Grande for irrigation was mentioned during the negotiations or not, but it is stated that such use had long been made by the Mexicans, and it was known that agriculture could not be carried on in that region without it. It was known, too, certainly to Mexico, that this necessity existed also throughout the entire region watered by the upper Rio Grande and its tributaries, for, as a province of Spain and then as an independent nation, Mexico had included both New Mexico and Colorado, and from the independence of Texas in 1836 down to the treaty of 1848 Mexico's eastern boundary was the Rio Grande to its source. By this treaty Mexico ceded to the United States the territory west of the Rio Grande and north of the southern boundary of New Mexico, just as she had abandoned to Texas all the territory east of that river, without any reservations, restrictions, or stipulations concerning the river except those above mentioned.

Settlements had long existed in the region of Santa Fe, and the probability of the ultimate settlement of the entire territory along the Rio Grande must have been

apparent to both parties. Yet the treaty made no attempt to create or reserve to Mexico or her citizens any rights or to impose on the United States or their citizens any restraints with respect to the use of water for irrigation, although rights of property in the territory were secured to all Mexicans, whether established there or not. (Art. 8.)

The treaty of 1848 was a treaty of peace, and a different rule for the construction of such treaties is laid down by some writers. (Vattel, *Law of Nations*, Chitty's ed., p. 433.) If it be suggested that the circumstances under which this treaty was made bring its terms, as against the United States, within the operation of such rule, it is a sufficient answer that, even if the existence of the rule be acknowledged, it simply subjects provisions in favor of the United States to strict construction. Like all rules of construction, it has no application except in cases of doubtful meaning of language used and can not be made the means of introducing new terms. Moreover, the United States paid \$15,000,000 for the territory acquired by the treaty (Art. 12), and by the treaty of 1853, which was not a treaty of peace, Mexico ceded further territory in consideration of \$10,000,000 (Art. 3), repeating without enlarging the stipulations of the former treaty as to rights on the Rio Grande.

(2) I have given my opinion of the construction and effect of the treaty, because it is responsive to your general request, though not to your specific questions. That opinion, perhaps, in strictness makes it unnecessary for me to consider your second question, but as that question is not put alternatively or conditionally, I proceed.

An extended search affords no precedent or authority which has a direct bearing.

There have been disputes about the rights of navigation of international river, but they have been settled by treaty. (For a list of such treaties see Heffter, *Droit Int.*, Appendix VIII.) The subject is fully discussed by Hall (*Int. Law*, Sec. 39), who denies that the people on the upper part of a navigable river have a natural right to pass over it through foreign territory to its mouth. Now, if such right be conceded, no aid is afforded for the present inquiry, because use for navigation, being common, would not curtail use by the proprietary country, while in the case now presented, there not being enough water for irrigation in both countries, the question is which shall yield to the other.

It is stated by some authors that an obligation rests upon every country to receive streams which naturally flow into it from other countries, and they refer to this as a natural international servitude. (Heffter *Droit Int.*, Sec. 43; 1 Phillimore, *Int. Law*, p. 303.) Others deny the existence of all international servitudes apart from agreement in some form. (Letters of Grotius quoted 2 Hert., p. 106; Klüber, *Droit des Gens Moderne*, Sec. 139; Bluntschli, *Droit Int. Cod.*; Woolsey's *Int. Law*, Sec. 58; 1 Calvo, *Droit Int.*, Sec. 556.)

Such a servitude, however, if its existence be conceded, would not cover the present case or afford any real analogy to it. The servient country may not obstruct the stream so as to cause the water to back up and overflow the territories of the other. The dominant country may not divert the course of the stream so as to throw it upon the territory of the other at a different place. (See authorities *supra*.) In either of such cases there would be a direct invasion and injury by one of the nations of the territory of the other. But when the use of water by the inhabitants of the upper country results in reducing the volume which enters the other, it is a diminuation of the servitude. The injury now complained of is a remote and indirect consequence of acts which operate as a deprivation by prior enjoyment. So it is evident that what is really contended for is a servitude which makes the lower country dominant and subjects the upper country to the burden of arresting its development and denying to its inhabitants the use of a provision which nature has supplied entirely within its own territory.

Such a consequence of the doctrine of international servitude is not within the language used by any writer with whose works I am familiar, and could not have been within the range of his thought without finding expression.

Both the common and the civil law undertake to regulate the use of the water of navigable streams by the different persons entitled to it. Neither has fixed any absolute rule, but leaves each case to be decided upon its own circumstances. But I need not enter upon a discussion of the rules and principles of either system in this regard, because both are municipal and, especially as they relate to real property, can have no operation beyond national boundaries. (Creasy, *Int. Law*, p. 164.) So they can only settle rights of citizens of the same country *inter sese*. The question must therefore be determined by considerations different from those which would apply between individual citizens of either country. Even if such a question could arise as a private one between citizens of one country and those of another,

it is not so presented here. The mere assertion of the claim by Mexico would make it a national one, even if it were of a private nature. (Gray vs. United States, 1 C. Cls. R., 391-392.) But the use of water complained of and the resulting injuries are general throughout extended regions, so that effects upon individual rights can not be traced to individual causes, and the claim is by one nation against the other in fact as well as form.

The fundamental principle of international law is the absolute sovereignty of every nation as against all others within its own territory. Of the nature and scope of sovereignty with respect to judicial jurisdiction, which is one of its elements, Chief Justice Marshall said (Schooner Exchange vs. McFaddon, 7 Cranch, p. 136) :

"The jurisdiction of the nation within its own territory is necessarily exclusive and absolute. It is susceptible of no limitation not imposed by itself. Any restriction upon it, deriving validity from an external source, would imply a diminution of its sovereignty to the extent of the restriction, and an investment of that sovereignty to the same extent in that power which could impose such restriction.

"All exceptions, therefore, to the full and complete power of a nation within its own territories must be traced up to the consent of the nation itself. They can flow from no other legitimate source."

It would be entirely useless to multiply authorities. So strongly is the principle of general and absolute sovereignty maintained that it has even been asserted by high authority that admitted international servitudes cease when they conflict with the necessities of the servient state. (Bluntschli, p. 212; see criticism by Creasy, p. 258.) Whether this be true or not, its assertion serves to emphasize the truth that self-preservation is one of the first laws of nations. No believer in the doctrine of natural servitudes has ever suggested one which would interfere with the enjoyment by a nation within its own territory of whatever was necessary to the development of its resources or the comfort of its people.

The immediate as well as the possible consequences of the right asserted by Mexico show that its recognition is entirely inconsistent with the sovereignty of the United States over its national domain. Apart from the sum demanded by way of indemnity for the past, the claim involves not only the arrest of further settlement and development or large regions of the country, but the abandonment, in great measure at least, of what has already been accomplished.

It is well known that the clearing and settlement of a wooded country affects the flow of streams, making it not only generally less, but also subjecting it to more sudden fluctuations between greater extremes, thereby exposing inhabitants on their banks to increase of the double danger of drought and flood. The principle now asserted might lead to consequences in other cases, which need only be suggested.

It will be remembered that a large part of the territory in question was public domain of Mexico and was ceded as such to the United States, so that their proprietary as well as their sovereign rights are involved.

It is not suggested that the injuries complained of are or have been in any measure due to wantonness or wastefulness in the use of water or to any design or intention to injure. The water is simply insufficient to supply the needs of the great stretch of arid country through which the river, never large in the dry season, flows, giving much and receiving little.

The case presented is a novel one. Whether the circumstances make it possible or proper to take any action from considerations of comity is a question which does not pertain to this department; but that question should be decided as one of policy only, because, in my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States.

Very respectfully,

JUDSON HARMON,
Attorney General.

Canal Contract with Mexico

Contract entered into between the Citizen General D. Manuel Gonzales Cosio, secretary of state and of development, in representation of the executive government, and Lic. Ignacio Sepulveda, as representative of the Sociedad de Irrigacion y Terrenos de la Baja California, S. A., to carry the waters of the Colorado River through Mexican territory and for the use of said waters.

Article 1. The Sociedad de Irrigacion y Terrenos de las Baja California, S. A., is authorized to carry through the canal which it has built in Mexican territory, and through other canals that it may build, if convenient, water to an amount of two hundred and eight-four cubic meters per second from the waters taken from the Colorado River and territory of the United States by the California Development

Company and which waters this company has ceded to the Sociedad de Irrigacion y Terrenos de la Baja California, S. A. It is also authorized to carry to the lands of the United States the water with the exception of that mentioned in the following article:

Art. 2. From the water mentioned in the foregoing article, enough shall be used to irrigate the lands susceptible of irrigation in Lower California, with the water carried through the canal or canals, without in any case the amount of water used exceeding one-half of the volume of water passing through said canals.

Art. 3. Within the term of six months, counted from the publication of the present contract, the company shall deliver to the office of the secretary of development, in duplicate, properly arranged in decimal, metrical scale, the maps and profiles of the canal already built and of the other hydraulic works connected therewith, with a descriptive report.

Art. 4. The company is also authorized to connect in Mexican territory the aforesaid canal or canals with the Colorado River, so that it may be able, without injuring the rights of a third party nor the navigation, as long as the river is destined for navigation, to take from said river as much as two hundred and eighty-four cubic meters of water per second. Those waters shall be used in the irrigation of lands in Mexico and the United States in a proportion established in articles first and second.

Art. 5. The Executive Government may authorize the company, while the needs of the country do not require the use of the total amount of the waters appropriated, to use them where it may find it convenient.

Art. 6. The company, grantee, is under the obligation to deliver to the office of the secretary of development, within the term fixed in the following article, the design of the hydraulic works referred to in article fourth, with a descriptive report and the necessary maps and profiles for greater clearness of the details of the works.

Art. 7. The surveys of the land to locate the hydraulic works shall be begun by the company, grantee, within the term of six months from the date of the promulgation of the present contract, and within the term of twelve months, counted from the same date, it will deliver to the secretary of development the respective maps of said works in duplicate, and properly arranged in a decimal, metrical scale, with the approval of the inspector to be appointed, and requesting the approval of the secretary of development. The duplicate of the maps shall be returned to the company, grantee, with the annotation of having been approved or not, and the other copy shall remain in the archives of the office of the secretary.

Art. 8. Within the term of twenty-four months, counted from the date of the promulgation of this contract, the company, grantee, shall begin the construction of the works, which shall be ended at the latest within seven years, counted from the same date.

Art. 9. The company, grantee, may build, over the canals it may construct, the bridges it may think necessary for private traffic, presenting previously to the secretary of development for his approval, the maps, and the company shall be obliged also to build, at its own expense, the bridges which may be required for the local or general traffic. Whenever its canals shall traverse any road or highway of public use, presenting the respective maps, and requesting the previous approval of same, either from the Secretary of Interior and the government of the territory of Lower California, or from the secretary of communications and public works as the case may be.

Art. 10. The company, grantee, is subject, in all that refers to the present contract, to the inspection of the engineer to be appointed by the secretary of development, and obliged to contribute to the expense of said inspection with the sum of three hundred dollars every month, which amount shall be delivered in advance to the general secretary of the federation from the date of the promulgation of the contract.

In case that the company, grantee, shall not fulfill the provisions of the present article, it agrees with the right given the revenue collectors to seize and sell its property to pay the debts due to the treasury.

Art. 11. The company shall have the right of way of twenty meters in all the length of its canals on each side of said canals, besides the width of the said canals.

Art. 12. The lands belonging to the Nation and which the company, grantee, may occupy in all the extension as set forth in the foregoing articles, and the lands which it may need for dams, reservoirs, or basins, storehouses, deposits, and other buildings shall be taken freely by the company in accordance with the provisions of paragraph III, article 3, of the law of the sixth of June, 1894.

Art. 13. The company, grantee, may take in accordance with the laws of condemnation by reason of public utility, the private lands, needed for the establishment of its aqueducts and their appurtenances, depots, stations, and other accessories, in accordance with fraction IV of article 3 of the law of June 6, 1894, as per the following rules:

(1) If there shall be no agreement between the company, grantee, and the owners of the land, there will be appointed an expert appraiser by each one of the parties, and both appraisers shall deliver to said parties their respective valuations within the term of eight days from the date of their appointment. If the valuations are not in accord, the case shall be submitted to the district judge of the territory of Lower California, and he shall appoint a third expert, who shall render his decision within the preematory term of eight days from the date of his appointment of the amount which in justice should be given to indemnify the owner of the lands to be occupied. The district judge, taking into consideration the opinion of the experts, and the proofs presented by the parties, while the experts formulate their decisions, shall fix the amount of indemnity within three days. The decree of the judge shall be final, unless it shall appear to be biased.

(2) If the owner of the land to be occupied for public use for the construction of the aqueducts, depots, appurtenances, and accessories, should not appoint his expert appraiser within the term of eight days after so notifying by the district judge, at the request of the company, grantee, said judge shall officially appoint an appraiser to represent the interests of the owner.

(3) In all cases in which it be necessary to apply to the district judge, said official, if the company, grantee, would ask it, or if it would be impossible for it to specify the amount of land to be occupied, shall begin the case, and the judge, after having previously had an audience with the government engineer, or in the absence of this one, with the expert appointed by the same judge, shall name a sum to be deposited while the case is tried, authorizing the company, grantee, meanwhile, to occupy the lands in question, with the understanding that if the final valuation of the experts should be more or less than the amount deposited by the company, grantee, the company to pay the balance or to receive the difference.

(4) If the owner of the lands in question should be unknown, or the ownership in dispute by reason of litigation or any other motive, the district judge shall fix, as the total of his indemnity the amount rendered by the expert appointed by said judge in representation of the rightful owners of the land in question. The amount ultimately fixed shall be deposited in accordance with the legal provisions to be delivered to whom it belongs.

(5) The experts, in making their valuations, must take into account the amount of taxes paid by the land to be condemned and the damaged and benefits to accrue by same to the owner.

(6) If, to carry out the surveys, it should be necessary to destroy or cut down, in all or in part, trees, cactus, or other obstacles, the company, grantee, shall have the right to do it, being under the obligation to pay an indemnity as soon as that be fixed.

Art. 14. The company, grantee, is authorized to build the telegraph and telephone lines as it may think necessary along the works, for the exclusive use of its enterprise, with the previous approval of the secretary of communications and public works, and also to exploit those already built in the exclusive use of its works; the Government having the right to place freely and without any payments, one or two telegraph wires on the posts of the line of the company, grantee, the company being subject to the laws and rulings now in force, or that in the future may be enacted, for the construction and exploitation of telegraph and telephone lines.

Art. 15. The company, grantee, may import, free of customhouse duties for once only all the engines, scientific instruments, and necessary apparatus for the outlines construction and exploitation of the works.

The company, grantee, shall present to the secretary of development statements in detail of the articles which in accordance with this concession, it shall have to import when needed, provided it be done within the stipulated terms, in the present contract for the installation and construction, specifying in said statements the number, quantity, and quality of the articles, observing for said importation the rules enacted and which in the future may be enacted by the Treasury Department, and also the limitations to be fixed by the secretary of development.

Art. 16. The articles needed shall be imported by the company, grantee, for the exclusive use of its works and its exploitations, but if it should sell or apply to

any other uses any or some of said articles, the secretary of treasury shall enact the payment of the respective duties, besides the penalties fixed by law in cases of smuggling.

Art. 17. During ten years from the promulgation of this contract, the capital invested by the company, grantee, in the survey, construction and maintenance of the works referred to in this contract, shall be exempt from all Federal taxes, with the exception of those to be paid in stamps, which taxes shall be paid in accordance with the said law.

Art. 18. The company, grantee, is at liberty to enter into contracts and agreements with individuals and private and public corporations for the use of the water granted to it, being subject in the prices to be charged to the tariff which with due opportunity shall be presented to the secretary of development for his examination and approval, the company, grantee, having the right, nevertheless, to use said waters in the irrigation of the lands belonging to it.

Art. 19. The company, grantee, shall lose the right to use the water granted to it in this contract in article fourth in case it does not use it for a period of ten consecutive years, the government being at liberty to grant it to any other persons, who, if they should accept the works made by the company, grantee, shall have to pay to this company the amounts fixed by the appraisers appointed by both parties.

Art. 20. The company, grantee, may transfer all or part of the concessions in the present contract with the previous permit of the secretary; also may mortgage it to individuals or private corporations; it being absolutely necessary in the first case that individuals or associations accept respectively all and each one of the obligations imposed to the company, grantee, by the present contract.

Art. 21. The company, grantee, shall have the right to issue common shares, preferred shares, bonds and obligations, and dispose of them.

Art. 22. At no time nor by any reason can the company, grantee, sell or mortgage the concessions made in the present contract to any government or foreign state, nor admit it in partnership, it being null and of no value nor effect whatever, any stipulation made to that end.

Art. 23. The company, grantee, shall have in this capital a representative fully authorized to treat with the government in all that refers to the present contract.

Art. 24. The company, grantee, shall guarantee the obligations contracted in this contract, making a deposit in the National Bank of Mexico of (10,000) ten thousand dollars in bonds of the consolidated public debt within eight days from the promulgation of the contract, and said deposit shall be returned to it when the hydraulic works referred to in this contract shall be finished.

Art. 25. This contract shall have no force if the deposit is not made within the term fixed in the foregoing article, and shall become extinct by the following reasons:

(1) For not beginning the works for the surveying and construction of the works and by not finishing the same in the term fixed in articles seventh and eighth.

(2) For not making use of the waters in the term of ten consecutive years.

(3) By the transfer of this contract to an individual or corporation without the previous permit of the secretary of development.

(4) By the transfer or mortgage of this contract and the concessions herein contained to a government or foreign state.

Art. 26. If the cancellation of this contract shall take place by the reasons set forth in paragraph one and two of the foregoing article, the company, grantee, shall lose the deposit made and the concessions and especial grants hereby made to it in this contract in article fourth and in those related to it, it being enforced only in what refers to article first.

In the case set forth in paragraph third, the company, grantee, shall lose the deposit and the concessions and especial grants made to it in this contract.

If the cancellations should take place by the reasons expressed in paragraph four the company shall incur the loss of all its rights, estates, and properties of any kind related with this contract.

In all cases, and before the declaration of cancellation is made, the secretary of development will grant to the company, grantee, a reasonable term to make its defense.

Art. 27. The obligations agreed to by the company, grantee, in regard to the terms fixed in this contract shall be suspended in all cases of unexpected accident, or by force of the elements duly justified and which may stop directly and abso-

lutely the fulfillment of such obligations. The suspension shall last only for the term that the causes exist, the company, grantee, being under the duty to give to the general government the statements and proofs of the unexpected accident within the term of three months from the time it took place, and by the sole reason of not presenting the proofs within the said term, it will be impossible for the company, grantee, to allege at any time the circumstance of unexpected accident or the force of the elements.

The company, grantee, shall also present to the Federal Government the statements and proofs that the works have been continued as soon as the cause has ceased to exit. The presentation of said statements to be made within two months following the other three above mentioned. The company, grantee, shall only be excused for the term during which the impediment existed, or at most two months more.

Art. 28. The government shall give to the company, grantee, the material and moral help within its possibilities, when the company so requests it, to overcome the difficulties that may arise in carrying out the present contract.

Art. 29. The company, grantee, shall be subject to the laws and rulings now in force and which in the future may be enacted for the supervision, use, and benefit of the water.

Art. 30. The company, grantee, and its company, assigns, shall always be considered as Mexican corporations, though all or any of its stock holders should be foreigners, and the corporations shall be subject to the jurisdiction of the courts of the Republic in all the affairs emanating and to be decided within the territory of the Republic.

They would never be able to allege in all the affairs in relation to the present contract the rights of foreigners under any circumstances, and they shall only have the rights and the way to establish the same as the laws of the Republic grant them to the Mexicans, and consequently in any of the said affairs the diplomatic foreign agents shall not have any interference.

Art. 31. This contract shall be subject to the approval of both houses.

Art. 32. The stamps on this contract shall be paid by the company, grantee.

Made in duplicate in the City of Mexico on the seventeenth day of the month of May, 1904.

MANUEL G. COSIO,
Y. SEPULVEDA.

Cia. De Terrenos y Aguas de la Baja, Cal., S. A.

Office of Secretary, ss:

This is to certify that the foregoing is a full, true and correct copy of water concession from the Mexican government, under date of May 17th, 1904.

In witness whereof I have hereunto set my hand and the seal of said district, this nineteenth day of March, 1924.

[SEAL]

J. DON FOER, Secretary.

The above translation is taken from hearings before the Committee on Irrigation and Reclamation, House of Representatives, H. R. 2903, Pt. 2, p. 250, 1924.

The following statement is taken from Report of the American Section of the International Water Commission, United States and Mexico, House Document 359, 71st Congress, 2nd Session, dated April 21, 1930, page 144.

Operation of Imperial Canal in Mexico

That portion of the main Imperial Canal system that passes through Mexico on its route from the California heading at Hanlons back into California was originally constructed under a contract, dated December 28, 1900, between the California Development Company and La Sociedad de Yrrigacion y Terrenos de la Baja California (Sociedad Anonima). This was a private contract without governmental sanction between the California company promoting Imperial Canal and the owners of some 100,000 acres of land lying mostly immediately south of the international boundary through which the water diverted in California must pass on to reach Imperial Valley. Under this contract the California Development Company was to construct the canal across the lands of La Sociedad de Yrrigacion y Terrenos de la

Baja California. It was soon found, however, that in order to conform to Mexican law a new arrangement, under which all operations in Mexico should be conducted by a Mexican rather than an American company, was necessary. This new arrangement provided in a "concession" or contract, dated May 17, 1904, between Sociedad de Riego y Torrenos de la Baja California S. A., successor to La Sociedad de Yrrigacion y Torrenos, and the Mexican Government, through the Secretary of State and Development thereof, approved June 10, 1904, by the Congress of Mexico.

* * * this contract is still in force, and, together with regulations issued from time to time by the Mexican Government, particularly with reference to rates authorized to be charged for water carried, still governs the operation of the Imperial Canal system below the international boundary. The property of the Sociedad, however, passed to the Compania de Terrenos y Aguas de la Baja California S. A., which still remains as the operating company. On June 23, 1916, this company came under control of Imperial irrigation district through purchase by the district of all its capital stock. Later, further to meet the requirements of the "concession" of 1904, the individual members of the board of directors became the owners of all of the stock of the compania, and that arrangement still continues. As new directors are from time to time elected the shares of capital stock held by their predecessors are indorsed and transferred to them.

CALIFORNIA-ARIZONA SITUATION

Some understanding of the general situation existing among the Colorado River states is needed in order to appreciate or understand the California-Arizona situation.

In 1922 commissioners of the seven Colorado River Basin states met with Honorable Herbert Hoover, then Secretary of Commerce of the United States, in conference to formulate the Colorado River Compact. It was the expectation that the available water supply of the Colorado River Basin would be allocated for use among the *individual states*. For various reasons, after a few meetings of the commission, the idea of apportioning water to the *individual states* was abandoned and the use of water was divided or allocated between two *groups* of states, the Upper Basin, and the Lower Basin groups.

The Colorado River Compact allocated an "exclusive beneficial consumptive use" of 7,500,000 acre-feet of water per annum to each of these groups from the Colorado River System, with the further statement that this apportionment of water "shall include all water necessary for the supply of any rights which may now exist" [Art. III (a)]. In the following paragraph (Art. III (b)) of the compact, the statement is made that in addition to the above apportionment "the Lower Basin is hereby given the right to increase its beneficial consumptive use of such waters by 1,000,000 acre-feet per annum." In other words each basin was given the right, or exclusive title, to the use of 7,500,000 acre-feet of water from *all* waters in the *system* and in addition the Lower Basin was given the right to increase this use by 1,000,000 acre-feet from the waters in the *system*.

The 7,500,000 acre-feet of water apportioned to each basin by paragraph III (a) of the compact is commonly referred to as "III-a" or "firm title" water. The exact status of the 1,000,000 acre-feet of additional usage ("III-b water") in the Lower Basin has been the source of considerable controversy. In the Boulder Canyon Project Act, California's use of water has been limited, and this limitation has been accepted by Act of the California Legislature (Senate Bill No. 1, Chap. 1, Jan. 10, 1929. This limitation reads as follows, (Sec. 4-(a) of Act.)

" * * * the State of California * * * shall agree * * * as an express covenant and in consideration of the passage of this act, that the aggregate annual consumptive use (diversion less returns to the river) of water of and from the Colorado River for use in the State of California, including all uses under contracts made under the provisions of this act and all water necessary for the supply of any rights which may now exist, shall not exceed 4,400,000 acre-feet of the waters apportioned to the Lower Basin States by paragraph (a) of Article III of the Colorado River Compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact."

California has accepted and agreed to the Colorado River Compact, she has also accepted and agreed to the limitation of water imposed upon her by the Boulder Canyon Project Act.

Technically the Lower Basin of the Colorado includes portions of five states, Arizona, California, New Mexico, Nevada and Utah. The

interests of New Mexico and Utah are primarily with the Upper Basin, a very small portion only of these states lying within the Lower Basin. No controversial points have developed in connection with the disposal of water in the Lower Basin which really affect either New Mexico or Utah. Nevada has been conceded by common consent an amount of water, 300,000 acre-feet per annum, which that state has agreed to accept. This narrows down the controversy in the Lower Basin to Arizona and California.

Ever since the formulation of the Colorado River Compact and Arizona's refusal to accept such compact without additional understanding between the states, efforts have been made to draw up such an agreement to apportion benefits expected from the development of the Lower Colorado River among the Lower Basin states. These negotiations have really narrowed down to negotiations between Arizona and California.

It should be said in justice to Arizona that they made the first overtures for such an agreement. At the time these overtures were made California as a state appeared to be little interested and almost totally ignorant of Colorado River development. Later, steps were taken by both states to bring about an understanding and efforts have been made to settle the differences through interstate negotiations in such a way that Colorado River development could proceed logically and harmoniously.

Negotiations between the states were at first carried on through committees appointed by the legislatures or the governors of the states and later by commissions authorized by the legislature and appointed by the governors. These commissions have been known as Colorado River Commissions. All of the Colorado River basin states have either a commissioner or commission authorized to negotiate in connection with Colorado River matters. The Arizona and California commissions at present are—

Arizona—

Chas. B. Ward, Chairman,
John Mason Ross, Commissioner,
A. H. Favour, Commissioner.

California—

John L. Bacon, Chairman,
W. B. Mathews, Commissioner,
Earl C. Pound, Commissioner.

A brief record of the various committees and commissions appointed in California and the acts of the legislatures under which they were appointed follows:

California Legislative Acts Authorizing Interstate Negotiations and List of Conferences Held With Other States

The present California-Colorado River Commission was appointed under an act of the California legislature approved May 17, 1927 (Chapter 596).

"Sec. 1. There is hereby created a commission to be known as the Colorado River Commission of California, and hereinafter designated the "commission," consisting of three persons to be appointed by the governor and to serve at the

pleasure of the governor, one of whom shall be designated by the governor as chairman of the commission. The chairman of the commission shall be regarded as the executive officer. * * *

"Sec. 2. Said commission shall have the power:

"To maintain an office at some suitable place within the State, to be selected by the commission;

"To hold meetings and conferences within or without the State with representatives of other States or communities and with representatives of the United States relating to interstate agreements, compacts, water rights, and any and all things in which California or its citizens are or might become interested in or relating to the Colorado River; to take such steps as the commission may deem necessary or advisable to protect the interests of California and its citizens in the waters of or water rights in the Colorado River, and upon the recommendation of the commission or the governor, the attorney general is hereby authorized to institute and prosecute such proceedings at law or in equity or otherwise, and in the name and on behalf of the people of the State of California, as will safeguard and protect their rights and interest; to appear before and cooperate with the Congress of the United States or members or committees thereof, or any United States authority concerning any and all matters relating to the Colorado River in which California or its citizens are or might become interested; employ and appoint such secretaries, engineers, attorneys and other technical or other assistants as the commission may deem advisable and prescribe their duties and fix their compensation and do any and all things necessary to fully safeguard and advance the interests of California, in the Colorado River and the uses thereof, and carry out the purposes of this act and report their proceedings to the governor at such intervals as he may prescribe.

"Sec. 5. The commission and all officers and positions thereunder shall cease and determine on the first day of September, 1929."

The succeeding legislature in 1929 passed an act, approved May 21, 1929 (Chapter 367), extending the life of the commission to September 1, 1931.

"An act to amend section 5 of an act entitled 'An act creating the Colorado River Commission of California, prescribing its powers, fixing compensation and appropriating funds for its use,' approved May 17, 1927, and to add a new section thereto, to be numbered section 4½, making an appropriation for the use of said commission and extending the term of its existence.

"Sec. 2. Section 5 of said act is hereby amended to read as follows:

"Sec. 5. The commission and all offices and positions thereunder shall cease and determine on the first day of September, 1931."

State Legislative Acts and Conferences

- 1925. April 27. Senate Joint Resolution No. 28. Authorized appointment of a legislative committee of four consisting of two members to be appointed by the President of the Senate, and two members to be appointed by the Speaker of the Assembly, to negotiate with like committee from the States of Arizona and Nevada for the purpose of settling the respective rights of lower basin states in and to the waters of the lower basin of the Colorado River system.
- 1925. Dec. 1. Water allocation proposal submitted to Arizona by California legislature committee.
- 1925. Dec. (Some date prior to Dec. 17.) Counterproposal submitted by Arizona committee.
- 1925. Dec. 17-18. Los Angeles, Calif. Conference between California and Nevada representatives. Nevada represented at this conference by Gov. James G. Scrugham, Ed. W. Clark, Dr.

- Roy W. Martin, James Cushman, Fred Cole, Chas. P. Squires. California represented by Hon. Ralph Swing, Hon. A. C. Finney, Hon. Walter J. Little, members of California legislature committee and twenty-two others, representing various California interests. Result of these meetings was appointment of a subcommittee consisting of one member of the Nevada State Committee, one member of the California State Committee to go to Arizona and meet informally the Arizona State Committee to discuss situation in interest of better understanding.
1926. Dec. Several meetings were held between Arizona, California and Nevada representatives at Los Angeles between the dates of December 19 and 29.
1926. Dec. 29. Conference at Los Angeles between committees of Lower Basin States adjourned.
1927. Jan. 6. Assembly Joint Resolution 1. Authorizing appointment of a committee of three to negotiate with committees from the States of Arizona and Nevada for the purpose of settling the respective rights of California, Arizona and Nevada in and to the waters of the Colorado River system. Under authority of this resolution Arthur P. Davis, Oakland; James A. Anderson, Los Angeles, and Earl C. Pound, Brawley, were appointed.
1927. Jan. 22. Assembly Joint Resolution No. 9. Amending resolution No. 1, increasing committee members to five, under which authority Dr. S. S. M. Jennings, Coachella, and Col. S. H. Finley, Santa Ana, were added to the California Committee.
1927. Jan. 24. Col. Finley and Dr. Jennings joined the California Committee, which was reorganized with Earl C. Pound, chairman, and Col. S. H. Finley, secretary.
1927. Jan. 19 to 26, inclusive. Meetings of Arizona, California and Nevada committees held in Los Angeles, in effort to reach a tri-State agreement.
1927. Feb. 7 to 11, inclusive. Meetings tri-State conference held in Los Angeles.
1927. May 17. Legislature passed act creating the Colorado River Commission of the State of California. Under authority of this act Governor Young appointed John L. Bacon, of San Diego, chairman; W. B. Mathews of Los Angeles, and Earl C. Pound of Brawley, commissioners.
1927. Aug. 22. Conference of governors and commissioners of all Colorado River states at Denver, Colorado, called by Upper Basin State governors for the "purpose of devising ways and means to bring about seven-State ratification of the Santa Fe Compact." Recessed September first, reconvened September 19, adjourned October 5.
1927. Dec. 2. Conference on power, Arizona, California and Nevada, Clift Hotel, San Francisco.
1928. Jan. Conference, Washington, D. C. This conference and the one in March were rather informal, being largely discussions between the State commissions held in an effort to reach an understanding. Members of the commissions being in Washington at that time in connection with pending Boulder Dam legislation.

1928. March 8 to 26, inclusive. Conference, Washington, D. C.
1929. Feb. 14 to March 5, inclusive. Tri-State conference, representatives from Upper Basin States present and took part in conference as interested observers, at Bishop's Lodge, Santa Fe, New Mexico. March 6-8. Continuation of Santa Fe meeting at Albuquerque. Col. W. J. Donovan was present as representative of federal government and served as chairman of this and subsequent meetings at Washington, Reno and Phoenix.
1929. April 5 to 7. Informal conference between California and Arizona at Los Angeles, Mr. Louis C. Hill and Mr. R. W. Van Norden were present and aided.
1929. May 21. An act adopted amending original resolution extending California Colorado River Commission to September 1, 1931.
1929. May 28-June 16. Washington conference. Lower Basin States commissions with representatives of Upper Basin States present.
1929. August 28. Conference—Salt Lake City. Arizona, California, Nevada, Colorado, New Mexico, Utah and Wyoming. Power and granting of permits or licenses for power projects discussed.
1930. Jan. 20 to 31, inclusive. Lower Basin States commissions, conference at Reno, Nevada. Representatives from Upper Basin States attending. Meeting called at suggestion of Secretary of Interior and an adviser from each state present. Advisers—Arizona, Senator Carl Hayden; California, W. J. Carr; Nevada, Thomas Cole, and Senator Pittman.
1930. Feb. 6 to 9, inclusive. Conference at Phoenix, Arizona, being an extension of the Reno conference. This was adjourned session of Reno meeting.

In the following pages an effort is made to analyze the interstate situation as affecting California and Arizona. Many elements enter into this rather complicated situation. Political, economic, jealousy of State rights, whether real or imaginary, and in many cases lack of information regarding real facts and fear that figures available fail to indicate real conditions and last but not least different attitudes on the part of the different States regarding policies to be followed to best serve the public good. Coupled with this there has been indicated a belief on the part of some that California as a State has prospered and developed faster than some of her sister States and for that reason should be made to pay out of proportion for any development that may be necessary to safeguard and further advance the Lower Basin even though other States are offered thereby as great or greater advantages in proportion than California.

Only certain high spots can be touched on in this section. For a better understanding of the details the reader is referred particularly to the sections on the Colorado River Compact, Projects, Litigation, and Water.

Water, its control, and use, has been the dominant element, and power with the attendant income feature has been the other great factor, that has been the cause of so much contention between Arizona and California.

A large portion of the irrigation development in Arizona is on the Gila River, one of the tributaries of the Colorado River. There is one

large project near the mouth of the Gila, the Yuma project (a very small portion of which is in California), which diverts and uses water directly from the Colorado River and during the year 1929 some 150,000 acre-feet of water was used on this project, about 120,000 acre-feet (figures obtained from project manager) being used on land in Arizona, but a large portion of all the water used in Arizona is from the Gila River and its tributaries before such water reaches the main stream of the Colorado.

In accepting and ratifying the Colorado River Compact California has been placed in the position of "underwriting" the use of water in the Lower Basin. As Arizona has not accepted and is consequently not bound by the Colorado River Compact, she stands in exactly the same position regarding water rights in the Colorado River system as she did before the compact was drawn up. California on the other hand, having by her ratification of the Colorado River Compact agreed to the limitation on use of water in the Lower Basin, has seemingly cut off any grounds for action against the Upper Basin States for redress, if the use of water in the Upper Basin States plus the Arizona use should imperil California diversions, provided the Upper Basin use is within that allowed by the compact. As most of the California diversions on the Colorado River will be physically below the point where Arizona might make major diversions, California, taking water from points on the lower river will, of course, be the one to suffer in case of shortage.

When the Colorado River Compact was drawn up there was very little general understanding of the actual conditions existing upon the Colorado River, the irrigable areas in the various States were more or less problematical, surveys had not been made and the information regarding real conditions was uncertain. The general impression was that there was more water than could be used. As more information was made available considerable apprehension was felt that the water supply would be inadequate to irrigate certain areas susceptible of irrigation in the two States. This feeling of apprehension was probably exaggerated in some cases while in other cases investigations seem to indicate that it was justified.

Congress, in passing the Boulder Canyon Project Act, inserted (second paragraph of Sec. 3 (a)) a suggested form of compact between the States of Arizona, California and Nevada. At the time the amendment incorporating this suggestion was placed in the bill (Congressional Record, page 485-6, 70th Cong., 2d Sess.) Senator Johnson, during the debate, and in accepting the amendment made the following statement:

" * * * but what I want to make clear is that this amendment shall not be construed hereafter by any of the parties to it or any of the States as being the expression of the will or the demand or the request of the Congress of the United States," and Senator Pittman, the sponsor of the amendment made reply "exactly not" and stated further "it is not the request of Congress."

As stated in the debate this proposed agreement was inserted in the Act in a seeming effort to save time and to grant preapproval of Congress to a compact should the States of Arizona, California and Nevada see fit to adopt it. California in her last proposal to Arizona proposed to accept what California believed to be the apportionment laid down in this suggested agreement.

It will be noted that the wording of the proposed agreement in the Act is tied up with that of the Colorado River Compact.

Arizona in all of her proposals has insisted on one point that would deny approval of the proposed agreement, *i.e.* the Arizona stand has been that only *main stream water* of the Colorado was to be considered. While California, having accepted the Colorado River Compact and being bound by the terms of that compact, is compelled to accept the definitions therein and in considering water to be allocated between the States is bound to give consideration to the language of the pact which deals with Colorado River *system* waters. One of the elements in connection with this distinction is that the Colorado River Compact states (Art. III (a)) that "there is hereby apportioned from the Colorado River system in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist."

Under the terms of the compact Gila water must be considered in making allocations, and any rights which may *now* exist on the Gila or elsewhere must be satisfied out of any allocation made to Arizona from the waters apportioned under Article III (a) of the Colorado River Compact.

Arizona contends that use on the Gila shall not be considered, but, as has been tersely expressed, "Gila waters out."

Under the Colorado River Compact the Lower Basin is permitted a total use of "firm title" water of 8,500,000 acre-feet, made up of 7,500,000 acre-feet of apportioned water (Art. III (a)), plus an additional beneficial consumptive use 1,000,000 acre-feet (Art. III (b)) water. *All* uses of water within the Lower Basin are charged against this allocation. *All present* rights anywhere within the Lower Basin *must be satisfied* out of the 7,500,000 acre-feet of III (a) water.

Arizona proposes to disregard these provisions, reserve the Gila and other tributary uses for herself, disregard their inclusion in the system, and then proceed to divide up the total 8,500,000 acre-feet of water as though the Gila did not exist. Arizona wants firm title to the Gila water, but wants it outside and in addition to the 8,500,000 acre-feet of firm title use permitted to the Lower Basin by the compact.

In other words, assuming the use on the Gila is 1,800,000 acre-feet under the Arizona contention the "firm title" water in the Lower Basin would become 7,500,000 plus 1,000,000 plus 1,800,000 acre-feet or 10,300,000 acre-feet.

California believes that the Colorado River Compact is clear in its meaning that 8,500,000 acre-feet is the total of "firm title" water use allocated to the Lower Basin, and regardless of how this is divided among the Lower Basin states, all *firm title* water *must* come within this amount.

Arizona has claimed a much larger use on the Gila than given above, which would make the situation still more difficult. X

Arizona has seemingly asked for two things, water and revenue. Power has been included as one of the elements insisted upon by Arizona to be settled by compact, but seemingly the power has been considered as merely a means of revenue, possibly through resale. In support of this assumption, no request, as far as can be learned,

has been made by Arizona for any power. The Secretary of the Interior in making contracts for power has reserved for Arizona 18 per cent of the total, to be taken, if, and when desired.

Arizona has always insisted that any agreement on water allocation shall also be tied up with an agreement for revenue for Arizona. The two elements of water and revenue have been made interdependent in the proposals.

An effort is made under the heading "Projects" to show the amount of water that is really needed in California and Arizona.

Governor Young of California at the Denver conference, August 23, 1927, after repeating the proposals that California had previously made to Arizona, submitted a further proposal and in closing made this statement, "If Arizona is unwilling to accept any of these offers, then California is willing to submit its case to an impartial tribunal as heretofore indicated." (Stenographic report of Conference, Vol. 1, page 166.)

It has been difficult for the California representatives to determine exactly what the State of Arizona is seeking. Any proposal that Arizona has made on water has been coupled with the proviso that the acceptance of such conditions were predicated upon a satisfactory arrangement regarding power being reached and any proposal in connection with power carried the same proviso regarding a satisfactory agreement being reached upon water. It has been rather difficult to accurately define Arizona's contentions but on one point however, there appears to be no doubt.

Chairman Ward of the Arizona Commission at the last conference in Phoenix made the statement that "Arizona will not sign any compact which has to do with water alone." (Sen. Committee Hearings, 2d Deficiency Appro. Bill for 1930, p. 192.)

Governor Hunt, of Arizona, in 1928, outlined Arizona's position when appearing for Arizona before the Senate Congressional Committee in Washington. The following is taken from Hearings before the Committee on Irrigation and Reclamation, United States Senate, 70th Congress, 1st Session, on S. 728 and S. 1274, Jan. 17 to 21, 1928, p. 30 et seq:

"Senator Johnson: There are certain circumstances under which you would ratify the Colorado River compact, are there not?"

Gov. Hunt: Well, that is a broad question, and as a broad reply I would say yes.

Sen. Johnson: There are certain circumstances under which you would consent to the construction of the dam provided for by this bill, are there not?

Gov. Hunt: That is a rather broad question, and I would say yes.

Sen. Johnson: All right; that is all.

Gov. Hunt: But I will give you a detailed reply tomorrow.

Sen. Johnson: Very well.

Gov. Hunt: I thank you, Senator.

Responses of Gov. George W. P. Hunt to the questions of Senator Hiram Johnson, of California.

Question. Will Arizona ratify the Santa Fe Compact?

Answer. The Arizona-Colorado River Commission, of which I am chairman, has formally declared that it will ratify the Colorado River compact under the following conditions or subject to such other conditions in a supplemental compact as may be agreed upon:

(1) Arizona will accept the Santa Fe compact, if and when supplemented by a subsidiary compact, which will make definite and certain the protection of Arizona's interests.

(2) That before regulation of the Colorado River is undertaken, Mexico be formally notified that the United States Government reserves for use in the United States all water.

(3) That any compact dividing the water of the Colorado River and its tributaries shall not impair the rights of the States, under the respective water laws, to control the appropriation of water within their boundaries.

(4) That the waters of the streams tributary to the Colorado River below Lees Ferry and which are inadequate to develop the irrigable lands of their own valleys be reserved to the States in which they are located.

(5) That so much of the water of the Colorado River as is physically available to the lower basin States, but without prejudice to the rights of the upper basin States, shall be legally available to, and divided between Arizona, California, and Nevada as follows:

(a) To Nevada, 300,000 acre-feet per annum.

(b) The remainder, after such deductions as may be made to care for Mexican lands allotted by treaty, shall be equally divided between Arizona and California.

(6) That the right of the States to secure revenue from and to control the development of hydroelectric power, within or upon their boundaries, be recognized.

(7) That encouragement will be given, subject to the above conditions, to either public or private development of the Colorado River, at any site or sites harmonizing with a comprehensive plan for the maximum development of the river's irrigational and power resources.

(8) That Arizona is prepared to enter into a compact at this time to settle all questions enumerated herein, or Arizona will agree to forego a settlement of items 6 and 7, and make a compact dividing the water alone, providing it is specified in such compact that no power plants shall be installed in the lower-basin portion of the main Colorado River until the power question is settled by a power compact among the States.

Question: What does Arizona want in the way of power revenues?

Answer: Arizona stands for and has been advocating the principles so definitely stated in the Pittman resolution, which I filed with my remarks of January 17.

Question: Do you deny the right of the Government to build a dam at Boulder Canyon?

Answer: Arizona denies the right of the Government to build a dam at Boulder Canyon under the terms and conditions of the Swing-Johnson bill.

Question: Do you deny the right of the Government to engage in flood control?

Answer: That is a legal question. Our legal advisers inform me that the Government has no authority under the Constitution of the United States to engage in controlling floods as such, but may engage in controlling floods as an incident to improving navigation and by receiving the consent of the States to build dams and control floods under the terms of the United States reclamation act and the federal power act.

Question: Do you claim title to the bed of the river?

Answer: Arizona considers the Colorado River a navigable stream and as such claims title to its bed.

Question: Do you claim to own the river, water, bed, banks, or what?

Answer: Arizona claims the Colorado River is navigable, that it owns the bed and banks to high-water mark and controls the appropriation and use of water within its State and an equal claim with other States upon its boundaries, subject to the decisions of the United States Supreme Court, and particularly the Colorado-Wyoming decision of that court.

Question: Do you deny the right of the Government to construct a dam?

Answer: Our attorneys advise me that the Government will have authority to erect a dam without the consent of the States of Arizona and Nevada, for the improvement of the navigation on the Colorado River. We do not believe anyone would seriously urge that the Government should expend \$50,000,000 or more for that purpose. We do deny the right of the Government to erect the dam described in the Swing-Johnson bill unless it receives a permit from the States of Arizona and Nevada.

Question: Under what circumstances would you consent to a dam at Boulder?

Answer: In that connection our commission has no authority to speak. If a compact was arranged which was satisfactory to Arizona and approved by the legislatures of these seven States and Congress, the consent of the State of Arizona

for a permit to construct dams would come from a legislative act, as is required under the laws of our State.

Question: There are certain circumstances under which you will consent to a dam at Boulder?

Answer: I do not believe the Boulder Canyon site is the proper place to construct a large storage reservoir. It is an excellent site for a power dam of medium height.

Question: The bill gives an option to the Secretary of the Interior to operate a plant at Boulder. Is that one of your objections?

Answer: I responded January 17 that I did not care to see the Government go into the power business in competition with private enterprise. I want to add to that. If it denies to the States the right to derive an equitable revenue or tax for the needs of the State. I have no objection to Government development as such, although I am opposed to the extension of Federal bureaus. I believe that the Federal power act is adequate, when supplemented by State legislation, regulation, and control, to amply care for the needs of the Nation, the State, and the consumer. I think this answers the questions propounded by Senator Johnson."

The last proposal made by California to Arizona probably will show as well as a more lengthy explanation what California has done in attempting to reach a settlement. The last paragraph in the California proposal refers to power and revenue matters, and while this wording of the paragraph might leave some doubt in the mind of the casual reader, the meaning was well understood by those representing the various States at the conference. This is the last proposal submitted by either Arizona or California and this proposal on water has neither been accepted nor rejected by Arizona.

At the last conference held between the States, Arizona refused to outline or submit a proposal covering all of the matters which she said were necessary to cover in order to reach an agreement. Arizona insisted on treating on water alone, with the proviso that if a satisfactory tentative agreement was reached on water then power and revenue matters would be discussed, but refused to even outline what the demands would be along these lines, yet any water proposal was always made with the condition that such a water agreement would be considered provided a satisfactory arrangement could be made respecting power and revenue.

California's last proposal to Arizona is given herewith.

"Phoenix, Arizona,
February 8, 1930.

"California, anxious to make one more effort to bring about an agreement, makes the following proposal for the division of the waters of the lower Colorado River system:

To Nevada, 300,000 acre-feet of water.

Utah and New Mexico to have all water necessary for use on areas of those states lying within the lower basin.

Arizona to have all waters of the Gila System and her other tributaries, excepting such water as reaches the main stream, also her present uses from the main stream, within the state.

California to have water now diverted in California for agricultural and domestic use in California.

Balance of water in main stream to be divided one-half to Arizona and one-half to California.

Mexican obligations to be met one-half by Arizona and one-half by California from main stream water.

All other points to be left to determination of the Secretary of the Interior, under the Act.

California-Colorado River Commission."

The following in a brief statement of conditions:

California has ratified and is bound by the Santa Fe Compact.

Congress and six of the seven Colorado River Basin States have ratified the compact and accepted it as binding with the six-State ratification.

Arizona has not accepted or ratified the compact and is therefore not bound by these conditions.

California believes that under any water allocation, even under the California proposals, that there will not be sufficient water available to develop known feasible projects in California. Thousands of acres of land otherwise capable of irrigation must forever remain arid.

California believes that under the proposals which she has made to Arizona, Arizona can develop every known feasible project.

California has contended that under the contracts now in force for the sale of power and the storage of water at Boulder Dam, Arizona will be given a revenue in excess of any revenue that would be derived by any reasonable system of taxation that would permit the development to be made by private capital.

Arizona has contended that a revenue for that State should be provided by interstate agreement.

California has contended that an attempt to regulate the price at which power should be sold by interstate agreement would be impracticable and might be disastrous as such price is inevitably controlled by economic conditions beyond the control of interstate agreement.

Arizona has imposed conditions in all her proposals which would necessitate modification of the Colorado River Compact and the Boulder Canyon Project Act.

The Colorado River Compact was agreed upon only after long drawn out discussions, compromise and readjustment on the part of all the States. Arizona's desire to modify the compact would be based on the assumption of receiving additional benefits which would of necessity mean concessions on the part of States other than Arizona. In other words, Arizona would have to be given something by modifying the compact which the other States would be expected to give up, a condition which would meet with bitter opposition.

Arizona has contended that the Federal Government has attempted to take away some of her rights. Both the Enabling Act and the Arizona Constitution provided for and contemplated such a development as the Boulder Canyon Project and made specific provisions for such Federal development.

Arizona has maintained that development of the power on the Colorado River for the benefit of that State is one of Arizona's rights and one of her great assets, but with the construction of Boulder Dam guaranteed, as far as can be learned no effort has been made on the part of Arizona to apply for any power whatever, Arizona's evident intention having been to control the power development and then resell the power, to California or other States that could use it, at a higher price.

The Boulder Canyon Project Act provided for a very material income to the State of Arizona in the event that economic conditions would justify selling power at a high enough price to develop such an income, and under present contracts this will probably be in excess of \$550,000 per year (See section on Finance).

Power is a commodity and is worth just what it can be replaced for. Under the present contracts power is sold at a slightly higher cost than

it could be replaced for by steam generated power on the Pacific Coast, the point at which most of the power will have to be disposed of.

Arizona has evidently been actuated by the belief that on account of California's urgent need for flood protection and water, that California should be made to pay an excessively high price for power.

It was known that California must have the dam for flood protection. Water and power must be sold in order to permit the construction of the dam, and as the California market is the only one sufficiently large to absorb the power, there seems to have been an impression that California through necessity could be made to pay this high price for power in order to guarantee the development.

As matters now exist the power contracts call for payment of a higher price than the power could be duplicated for on the Pacific Coast (See section on Power). California has accepted a limitation upon water use imposed by the Colorado River Compact and the Boulder Canyon Project Act. This limitation upon California's use of water will not permit of full development of all known projects. It would be disastrous to California to agree to any further reduction in this water allocation. Power can not be made to pay a higher price under present conditions.

Secretary Wilbur in a letter to Governor Phillips of Arizona, on May 9, 1930, made the following statement:

"* * * an amount ranging between \$29,000,000 and \$66,000,000, depending on the same factors, will have been paid into the Colorado River Dam for other developments on the river, in which your State will have a share. In other words, your State, without guaranteeing a penny toward the success of this project, is handed a sum ranging from \$350,000 to upwards of \$600,000 per year and given a free option on over 100,000 horsepower. The share of the firm power given Arizona and Nevada together is 36 per cent. Compare your position, as stated above, with that of the Metropolitan Water District, which pays for an exactly equivalent amount (36 per cent) about \$118,000,000 over the period of its contract, under a firm obligation which must be fulfilled whether the power is needed or not. These privileges in favor of your State mean a corresponding assumption of burdens by the California purchasers of power; and it would have been impossible to finance this project as a power project, pure and simple, under such burdens. * * * Recollection of these facts may help your people to recall that this is a water project and not a power project. Power is being sold to build the dam; the dam is not being built to sell power."

The Colorado River Compact as originally drawn required ratification of all seven Colorado River Basin States and Congress before becoming effective, but after repeated refusal of Arizona to ratify, it was finally accepted as binding by six of the States and the Congress, leaving Arizona as the one dissenting State outside of and not bound by the compact. Development is proceeding on the Colorado River in the face of Arizona opposition, although such development will be to her very great advantage.

California has accepted this condition based upon the belief founded upon the best information obtainable, that Arizona demands for water were greater than actual use could ever develop, and that if Arizona were given a free hand unhampered except by natural limitations and commonly recognized laws of appropriation, her actual use of water would be less than the artificial reservation of water that would be imposed by any conditions she has been willing to accept.

The Boulder Canyon Project Act contained a provision that is probably the most stringent ever enacted in connection with the develop-

ment of a Government project. This provision was to the effect (Sec. 4 (b)) that before any construction work could start the Secretary of the Interior was required to have contracts that would repay, with interest every dollar that the Government was to invest. This compelled the Secretary to make such contracts as would make the project a going concern; his was the responsibility of placing on a sound financial basis a project representing an investment of over \$150,000,000. It is easy to see how such a project if hampered by interstate compact, drawn with an idea of yielding the largest possible income to one of the States, could be placed on such a footing as to destroy all hope of repayment to the Government, and impose conditions which would render unsound the entire financial structure.

Another point of contention has been the price charged for stored water. Arizona, at one time, (proposal made March 3, 1929) proposed a minimum charge of \$2.00 per acre-foot for stored water. Secretary Wilbur in a letter to Governor Phillips, of Arizona, dated May 9, 1930, made the following statement:

"Finally, one word about the price being charged to the Metropolitan Water District for storage of water. That price is 25 cents per acre-foot, plus the value of power lost if the water is taken out above the dam. From past communications from your Commission, I gather that you want the price fixed at a higher rate so that the excess revenues coming to Arizona will be increased. I doubt whether your people have a proper vision of what they are doing when they make that request. The Act provides that no charge shall be made for water furnished to Imperial and Coachella Valleys. But the Act gives your State no such protection. It is in exactly the same status as the Metropolitan Water District. It is left to the discretion of the Secretary to determine the charge against you, as also against that district. As I understand it, you are asking upward of 3,000,000 acre-feet of main stream water. Your State will some day come to the Secretary of the Interior for a contract for delivery of your water, just as the Metropolitan Water District has done. If you receive 3,000,000 acre-feet and are charged what we are charging the District for water delivered below the dam, 25 cents per acre-foot, the charge will be \$750,000 per year. If we charge you what you have asked us to charge the District, that is, from \$1 up, the charge against you will be upwards of \$3,000,000 per year. Which of those two precedents do you wish established? Which shall pay the way: power, which you do not want, or water, which you do? I think that consideration of these questions may help you in coming to the conclusion that I have given some thought to the future of your State."

We thus have this existing condition. California has need of all water allocated to her and California interests are paying the highest price for power that conditions justify.

It will be disastrous to California to attempt to reduce the amount of water she can use under present allocations, and no further revenue could be obtained from power, because the power price is as high as is justified.

Under the terms of the power contracts Arizona has reserved for her a large block of power which she may take if, and when, wanted. She is not obligated to take this power, but it is there if she wants it, thus that State is given an opportunity for industrial development due to cheap power.

Arizona today is questioning by a suit in the Supreme Court of the United States the validity of both the Colorado River Compact and the Boulder Canyon Project Act. (See section on Litigation.)

California feels that perhaps this is the wisest course to pursue as many of the disputed points that have been a matter of controversy for a number of years will thus be cleared up by the highest authority in the land.

LITIGATION

Arizona for many years threatened to start litigation unless her demands in connection with Colorado River development were complied with.

In October, 1930, Arizona filed a bill of complaint in the United States Supreme Court asking "that the Colorado River Compact and the Boulder Canyon Project Act be decreed to be unconstitutional, void and of no effect; that the defendants, and each of them, be permanently enjoined from enforcing or carrying out said Compact, or said Act, or any of the provisions thereof, and from carrying out the three pretended contracts above mentioned, or any of them, or any of their provisions, and from doing any other act or thing pursuant to or under color of said Boulder Canyon Project Act; and that the State of Arizona recover its costs, and have such other and further relief as to the court may seem just and equitable."

One of the interesting features of this complaint (Section XXIX of abstract of bill of complaint) recites that "the Colorado River is not navigable." This appears to be at direct variance with the contention that the Arizona representatives have continuously made, as witness the statement made by Governor Hunt (of Arizona) before the Senate Committee. (Hearings, Senate Irrigation Committee, S. 728 and S. 1274, page 28, January 17, 1928.)

Senator Johnson: Do you claim the water?

Gov. Hunt: We claim the bed of the stream. It is a navigable river.

Sen. Johnson: It is a navigable river, is that correct?

Gov. Hunt: That is one of the things; yes.

Sen. Johnson: Is the river navigable throughout its entire length in Colorado?

Gov. Hunt: It is navigable or has been navigable up to The Needles. It is now used in Utah as a navigable river, and we can use a portion of it in Arizona.

Sen. Johnson: You deem it a navigable stream?

Gov. Hunt: I certainly do."

The following is an abstract of the Bill of Complaint as filed by Arizona and a comment thereon written by Congressman Phil D. Swing, co-author of the Boulder Canyon Project Act:

In the
SUPREME COURT OF THE UNITED STATES

October Term, 1930

No. ----- (original)

STATE OF ARIZONA,

Complainant,

vs.

STATE OF CALIFORNIA, STATE OF NEVADA, STATE OF UTAH, STATE OF NEW MEXICO, STATE OF COLORADO, STATE OF WYOMING, AND RAY LYMAN WILBUR, Secretary of the Interior,

Defendants.

Abstract of Bill of Complaint

This is an original action by the Supreme Court of the State of Arizona against the other six named states, and the Secretary of the Interior, for a decree declaring the Colorado River Compact and the Boulder Canyon Project Act to be unconstitutional and void, and enjoining the defendants from enforcing or carrying out

said Compact or said Act, and from carrying out the contracts made by the Secretary of the Interior with The Metropolitan Water District of southern California, the city of Los Angeles, and Southern California Edison Company, Ltd., and from doing any act or thing under or pursuant to the Boulder Canyon Project Act.

The following is a brief resume, paragraph by paragraph in narrative form, of the averments in the bill of complaint:

I. The complainant and all of the defendants, except the individual defendant, are states of the Union. Ray Lyman Wilbur is the Secretary of the Interior, and a citizen of the State of California.

II. The Colorado River rises in Colorado and flows in Colorado, Utah, Arizona and Mexico and on the boundary between Arizona and Nevada, and between Arizona and California, and between Arizona and Mexico, for certain stated distances. The total length of the river, exclusive of tributaries, being given as 1293 miles, of which 688 miles are in Arizona or on the boundary thereof. The location of Lee Ferry, Black Canyon and Laguna Dam is given.

III. The principal tributaries of the Colorado River are the Gunnison River, which rises in Colorado and flows in Colorado for a distance of 160 miles, and there enters the Colorado River; the Green River, which rises in Wyoming and flows in Wyoming for a distance of 246 miles, thence in Utah for a distance of 56 miles, thence in Colorado for a distance of 35 miles, thence in Utah for a distance of 272 miles, and there enters the Colorado River; the San Juan River, which rises in Colorado and flows in Colorado for a distance of 61 miles, thence in New Mexico for a distance of 110 miles, thence in Utah for a distance of 130 miles, and there enters the Colorado River; the Little Colorado River, which rises in Arizona and flows in Arizona for a distance of 268 miles, and there enters the Colorado River; the Virgin River, which rises in Utah and flows in Utah for a distance of 83 miles, thence in Arizona for a distance of 30 miles, thence in Nevada for a distance of 60 miles, and there enters the Colorado River; the Williams River, which rises in Arizona and flows in Arizona for a distance of 132 miles, and there enters the Colorado River; and the Gila River, which rises in New Mexico and flows in New Mexico for a distance of 115 miles, thence in Arizona for a distance of 406 miles and there enters the Colorado River. The Gila River enters the Colorado River 10 miles below Laguna Dam, 286 miles below Black Canyon and 641 miles below Lee Ferry. The Williams River enters the Colorado River between Laguna Dam and Black Canyon. The Virgin River and the Little Colorado River enter the Colorado River between Black Canyon and Lee Ferry. All the other tributaries above mentioned enter the Colorado River above Lee Ferry. Said tributaries have a total combined length of 2164 miles, of which 836 miles are in Arizona. No tributaries enter the Colorado River from California, nor does California contribute any appreciable quantity of water to said river.

IV. The drainage basin of the Colorado River in the United States has a total area of 240,000 square miles, of which 103,000 square miles, or approximately 43 per cent, are in Arizona; 4000 square miles are in California, 12,000 square miles in Nevada, 40,000 square miles in Utah, 23,000 square miles in New Mexico, 39,000 square miles in Colorado, and 19,000 square miles in Wyoming. Approximately 90 per cent of the total area of Arizona is in said basin.

V. The Colorado River, from the point where it enters Arizona to the point where it enters Mexico, has a fall of 3230 feet, of which 2200 feet are in Arizona, 650 feet on the boundary between Arizona and Nevada, 350 feet on the boundary between Arizona and California, and 30 feet on the boundary between Arizona and Mexico. That part of the river which flows in Arizona and on the boundary between Arizona and Nevada flows between canyon walls varying from a few hundred feet to more than 5000 feet in height, and is, therefore, practically inaccessible. This part of the river contains numerous rapids, cataracts and other natural obstructions, because of which, and because of the great fall and rapid flow of the river, navigation thereof in Arizona and on the boundary between Arizona and Nevada has always been and is now utterly impossible.

VI. That part of the river which flows on the boundary between Arizona and California, and between Arizona and Mexico, flows between comparatively low banks, is easily accessible and is comparatively free from rapids and cataracts, but is obstructed by numerous sandbars and is further obstructed by great quantities of silt, and by the construction of Laguna Dam resulting in the diversion of great quantities of water from the river. Because of these conditions the Colorado River has never been, and is not now, a navigable river.

VII. The total average flow of the Colorado River and its tributaries in the United States is 18,000,000 acre-feet of water annually, of which 9,000,000 acre-feet

were appropriated and put to beneficial use in the United States prior to June 25, 1929 (the date of declaration of the six-state ratification of the Colorado River Compact). Said appropriated water has ever since been, and is now, being used and consumed. Of said appropriated water, 2,500,000 acre-feet are diverted annually from the Colorado River above Lee Ferry and from tributaries entering the river above Lee Ferry, and are used and consumed in Utah, New Mexico, Colorado and Wyoming; and 6,500,000 acre-feet are diverted annually from said river below Lee Ferry and from tributaries entering the river below Lee Ferry, and are used and consumed in Arizona, California, Nevada and New Mexico. Of the appropriated water so diverted below Lee Ferry, 3,500,000 acre-feet are annually diverted, used and consumed in Arizona, of which 2,900,000 acre-feet are diverted from the Gila River and its tributaries.

Of the total flow of the Colorado River and its tributaries in the United States 9,000,000 acre-feet were, on June 25, 1929, ever since have been, and are now, wholly unappropriated. All of said unappropriated water flows in Arizona, and on the boundary thereof. All of it is needed and can be put to beneficial use in Arizona, and all of it is subject to appropriation under the laws of Arizona. Of said unappropriated water, 8,000,000 acre-feet are flowing in the main stream of the Colorado River, and 1,000,000 acre-feet in tributaries entering said river between Lee Ferry and Laguna Dam. All of the water of the Gila River and its tributaries was appropriated and put to beneficial use in Arizona and New Mexico prior to June 25, 1929. The word "appropriated" is defined in accordance with Arizona law.

VIII. All land in the drainage basin of the Colorado River is arid in character, and irrigation is necessary. The varying average annual rainfall in those parts of the basin susceptible of irrigation is stated, namely: in Arizona and California, less than 5 inches; in Nevada, 6 inches; in Wyoming, 7 inches; in Utah and New Mexico, 8 inches; in Colorado, 10 inches. The average quantity of water per acre required annually for irrigation is: In Arizona and California, 4.5 acre-feet; in Nevada, 3 acre-feet; in Utah, New Mexico, Colorado and Wyoming, 1.5 acre-feet.

IX. The increase in population and wealth of Arizona is given. This has resulted from the constantly increasing use of irrigation and the consequent development of agricultural land. There are 2,000,000 acres of land in Arizona not now irrigated, but susceptible of irrigation from the unappropriated water of the Colorado River and its tributaries, and which can not be irrigated by any other means or from any other source; more than 200,000 acres of said land are owned and held by the State of Arizona. The irrigation of this land will require all of the unappropriated water of the Colorado River and its tributaries, aggregating 9,000,000 acre-feet annually.

X. In that part of the Colorado River which flows in Arizona, and on the boundary between Arizona and Nevada, there are numerous sites suitable for dams and reservoirs required for diversion of water for irrigation and power development, one of such sites being at Black Canyon. The business, and all property used in connection therewith, of generating and selling such power would be subject to taxation by Arizona. For these reasons the water of the Colorado River and the dam sites and reservoir sites constitute the greatest natural resource of the State of Arizona.

XI. Irrigation projects are now in existence involving more than 1,000,000 acres of the 2,000,000 acres of unirrigated but irrigable land in Arizona. More than 100,000 acres in said irrigation projects are owned by the State. None of the land in said projects is now irrigated, but all of it is susceptible of irrigation, and definite plans for the same have been made. Such irrigation will require 4,500,000 acre-feet annually of the unappropriated water in the main stream of the Colorado River, and permits for the appropriation of said water have been granted by the State Water Commission of the State of Arizona. This will necessitate use of the dam sites and reservoir sites above mentioned. There are also in existence certain power projects for which plans have been approved by the State Engineer of the State of Arizona. But for the passage of the Boulder Canyon Project Act the work on these irrigation and power projects would have been commenced, and if said Act be held unconstitutional said work will be commenced immediately and prosecuted to completion, resulting in taxable property yielding substantial revenues to the State of Arizona.

XII. The State of Arizona, since its admission to the Union on February 14, 1912, has had, and now has, sovereign control of all water within its boundaries, including the water of the Colorado River and its tributaries. The Arizona Constitution provides that the doctrine of riparian rights shall not obtain. The statutes

of the state, copy of which is appended to the bill of complaint, regulate and control the appropriation of water and the acquisition of rights thereby. These statutes provide that all water in streams or other natural channels belong to the public and is subject to appropriation, and that the appropriator, prior in time, shall have the prior right. Such appropriator must apply to the State Water Commissioner for a permit, which may be denied if the application or proposed use of the water is a menace to the safety or against the interests and welfare of the public. All dams are under the jurisdiction of the State Engineer and must be approved by him. By virtue of these statutes all of the unappropriated water of the Colorado River and its tributaries, aggregating 9,000,000 acre-feet annually, was, on June 25, 1929, and ever since has been, and is now, subject to appropriation in Arizona and can not be lawfully appropriated, stored, diverted, used or disposed of, except as provided in said statutes.

XIII. The Colorado River Compact, copy of which is annexed to the bill of complaint, was drafted by commissioners representing the States of Arizona, California, Nevada, Utah, New Mexico, Colorado, and Wyoming. Said Compact provides that, as used therein, the term "Colorado River System" means that portion of the Colorado River and its tributaries within the United States; that the term "Colorado River Basin" means all of the drainage area of said Colorado River System and all other territory within the United States to which the water of said system shall be beneficially applied; that the term "Upper Basin" means those parts of Arizona, Utah, New Mexico, Colorado, and Wyoming within and from which water naturally drains into said Colorado River System above Lee Ferry, and also all parts of said states located without said drainage area which are now, or shall hereafter be, beneficially served by water diverted from said System above Lee Ferry; that the term "Lower Basin" means those parts of Arizona, California, Nevada, Utah and New Mexico within and from which water naturally drains into said Colorado River System below Lee Ferry, and also all parts of said states located without said drainage area which are now, or shall hereafter be, beneficially served by water diverted from said System below Lee Ferry; that there is apportioned from said Colorado River System, in perpetuity, to said Upper Basin and to said Lower Basin, respectively, the exclusive, beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist; that if the United States shall recognize any right in Mexico to the use of any water of said System, such water shall be supplied from water unapportioned by said Compact; that further equitable apportionment of the water of said System unapportioned by said Compact may be made at any time after October 1, 1963; that, inasmuch as the Colorado River has ceased to be navigable for commerce, and the reservation of its water for navigation would seriously limit the development of its basin, the use of its water for purposes of navigation shall be subservient to the use of such water for domestic, agricultural and power purposes; and that said Compact shall become binding and obligatory when it shall have been approved by the legislatures of all the signatory states (Arizona, California, Nevada, Utah, New Mexico, Colorado and Wyoming) and by the Congress of the United States.

XIV. Said Colorado River Compact is inequitable, unjust and unfair to the State of Arizona, for the following reasons:

(1) Said compact attempts to apportion to the Upper Basin more, and to the Lower Basin less, than an equitable share of the water of the Colorado River System. The compact attempts to apportion to the Lower Basin only 1,000,000 acre-feet of unappropriated water, whereas it attempts to apportion to the Upper Basin 5,000,000 acre-feet of unappropriated water. The compact attempts to deprive Arizona, its citizens, inhabitants and property owners, of their right to appropriate said 5,000,000 acre-feet of unappropriated water apportioned to the Upper Basin.

(2) The compact leaves unapportioned 3,000,000 acre-feet annually of the water of the Colorado River System, and attempts to withdraw this water from appropriation, to the injury of the State of Arizona, its citizens, inhabitants and property owners.

(3) The compact defines the term "Colorado River System" so as to include therein the Gila River and its tributaries, having a flow of 3,000,000 acre-feet annually, all of which was appropriated and put to beneficial use prior to June 25, 1929. The State of New Mexico has but a slight interest, and the States of California, Nevada, Utah, Colorado and Wyoming have no interest whatever, in said

water. Thus the compact, by providing that the water apportioned shall include all water necessary to supply existing rights, reduces by 3,000,000 acre-feet annually the quantity of water now subject to appropriation in Arizona.

(4) The compact defines the terms "Colorado River Basin," "Upper Basin," and "Lower Basin," so as to include therein not only the actual drainage basin of the Colorado River, but also all parts of the seven states outside of the drainage basin which are now, or which shall hereafter be, beneficially served by water diverted from the said Colorado River System. The right, thus attempted to be established, to use said water outside of the actual drainage basin of the Colorado River, is denied by Arizona, and, if recognized, would not benefit, but would injure, said state, because no part of Arizona, outside of the actual drainage basin, is, or can be, beneficially served by water diverted from the Colorado River System.

Arizona has never ratified the compact, which therefore, is inoperative, void and of no effect.

XV. The Boulder Canyon Project Act was passed by Congress and approved by the President, on December 21, 1928, a copy of said Act being annexed to the bill of complaint, section 1 thereof provides that, for the purpose of controlling floods, improving navigation, regulating the flow of the Colorado River, and providing for the storage and delivery of the water thereof for reclamation of public lands and other beneficial uses, and for the generation of electric power as a means of making the Project a self-supporting and financially solvent undertaking, the Secretary of the Interior, subject to the terms of the Colorado River Compact, is authorized to construct, operate and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon adequate to create a storage reservoir of capacity not less than 20,000,000 acre-feet of water, and to construct, equip, operate and maintain at, or near, said dam, a complete plant and incidental structures for the development of electric power from the water discharged from said reservoir. Said dam and reservoir, if constructed, will be partly in Arizona, and partly in Nevada, and will store all of the 8,000,000 acre-feet of unappropriated water now flowing in the Colorado River, and subject to appropriation in Arizona. The Boulder Canyon Project Act contemplates that the Secretary of the Interior will disregard the laws of Arizona in carrying out its provisions.

XVI. Said Act provides for an All-American Canal, at a cost of \$40,000,000, for diverting and conveying to Imperial and Coachella Valleys, in California, the water to be stored in said reservoir, including the aforesaid 8,000,000 acre-feet of unappropriated water, for which no charge is to be exacted by the Secretary of the Interior. There is no provision for similar facilities for Arizona, nor for gratuitous furnishing of water to said State.

XVII. The provision in said Act for appropriations by Congress, not exceeding \$165,000,000, is noted.

XVIII. The Boulder Canyon Project Act became effective upon California's agreement, by act of its Legislature, approved March 4, 1929, that the aggregate annual consumptive use of water of and from the Colorado River for use in California, shall not exceed 4,400,000 acre-feet of the water apportioned to the Lower Basin by the Colorado River Compact, plus not more than one-half of any excess or surplus water unapportioned by said Compact; and upon declaration of six-state ratification of said Compact, declared by the President of the United States, on June 25, 1929, to have occurred.

XIX. The Boulder Canyon Project Act provides for an agreement between Arizona, California and Nevada, apportioning the 7,500,000 acre-feet of Lower Basin water—to Nevada, 300,000 acre-feet; to Arizona, 2,800,000 acre-feet. This latter amount is less than the quantity of water already appropriated in Arizona, and such allocation would deprive Arizona, its citizens, inhabitants and property owners, of their right to appropriate any of the unappropriated water of the Colorado River system, aggregating 9,000,000 acre-feet annually. No such agreement has been entered into between Arizona, California and Nevada.

XX. Said act provides that, before any appropriation is made, the Secretary of the Interior shall make provision for certain revenues by contract.

XXI. Said act authorizes the said Secretary, under general regulations prescribed by him, to contract for the storage of water in the reservoir and for the delivery thereof for irrigation, domestic use and generation of electric power, upon charges that will provide the necessary revenues. The contracts respecting water for irrigation and domestic use shall be for permanent service, and no person shall have, or be entitled to the use of, the water stored in the reservoir, except by contract with the Secretary. The 8,000,000 acre-feet of unappropriated water now flowing

in the Colorado River and subject to appropriation in Arizona, and would thus be withdrawn from such appropriation, and the Secretary might refuse to contract to deliver any of such water to Arizona, or, if any were so delivered, he would be required to make charge therefor, although water is to be delivered to Imperial and Coachella Valleys in California, without charge. The Secretary may contract for the delivery of water for use outside of the drainage basin of the Colorado River.

XXII. The Act provides that after repayment to the United States of all money advanced, with interest, charges shall be on such basis as may hereafter be prescribed by Congress, and that the revenues derived therefrom shall be kept in a separate fund to be expended in the Colorado River Basin, and that general and uniform regulations shall be prescribed by the Secretary for awarding of contract for electric power.

XXIII. Said Act provides that title to the dam, reservoir, power plant and incidental works shall forever remain in the United States, and does not provide for any taxation by the State of Arizona of said dam, power plant and other works or of the operation thereof, but contemplates that the same shall be exempt from all taxation, thereby permitting the Secretary to utilize the water and other natural resources of the State of Arizona, and to prevent the use thereof by other persons, to the loss of the State of Arizona in the matter of tax revenues.

XXIV. The Act provides that the United States, its permittees, licensees and contractees, and all users and appropriators of water stored, diverted, carried or distributed by said reservoir, canals and other works, shall be controlled by the Colorado River Compact. The contracts made by the Secretary so provide.

XXV. The Act provides for six-state ratification of the Colorado River Compact, which has occurred. The effect of the Act would be to subject the State of Arizona to the Compact, although said State has not ratified the same.

XXVI. Said Act provides that the rights of the United States in or to the water of the Colorado River and its tributaries, and the rights of those claiming under the United States, shall be subject to and controlled by the Colorado River Compact; that all patents, grants, contracts, concessions, leases, permits, licenses, rights of way or other privileges from the United States or under its authority, necessary or convenient for the use of said water, or for the generation of electric power by means thereof, or for the transmission of such power, shall be upon the express condition and covenant that the rights of the recipients or holders thereof shall be subject to and controlled by said Compact, and that said conditions and covenants shall be deemed to run with the land, and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Nevada, Utah, New Mexico, Colorado and Wyoming, and the users of water therein or thereunder. All lands in Arizona are owned and held, either by the United States or by those claiming under the United States, and all rights to the use of water for irrigation in Arizona are appurtenant to land, and have no existence separate and apart from the land to which they are appurtenant. The water of the Colorado River and its tributaries can not be used for irrigation in Arizona except by those holding land under patents, grants, contracts, concessions, leases, permits or licenses from the United States or under its authority, and in order to irrigate Arizona land it is frequently necessary to utilize rights of way over public land of the United States. Thus, under the Boulder Canyon Project Act, all users of water for irrigation in Arizona would be subjected to the Colorado River Compact, although said State has never ratified the same.

XXVII. Said Act provides that any commission or commissioner authorized under the laws of any state ratifying the Colorado River Compact, shall have the right to act in an advisory capacity to the Secretary of the Interior. Such commissions and commissioners of the six states ratifying the Compact are so acting.

XXVIII. The Boulder Canyon Project Act is unconstitutional and void, for the following reasons:

(1) Said Act attempts to deprive Arizona of its sovereign control of water and other natural resources of the State, and to vest such jurisdiction and control in the United States and to abrogate the laws of the State respecting appropriation and use of water and other natural resources.

(2) Said Act attempts to subject the State of Arizona to the Colorado River Compact and to enforce the Compact and make it effective in Arizona, notwithstanding said State has never ratified said Compact. Thereby said Act attempts to deprive said State, its citizens, inhabitants and property owners, of their right to appropriate the 5,000,000 acre-feet of unappropriated water which said Compact attempts to apportion to the Upper Basin, and of their right to appropriate the

3,000,000 acre-feet of unappropriated water which said Compact leaves unappropriated, and attempts to withdraw from appropriation.

(3) Said Act attempts to authorize the Secretary of the Interior to store in the reservoir the 8,000,000 acre-feet of unappropriated water now flowing in the Colorado River and subject to appropriation in Arizona; to withhold said water from appropriation; to withhold said water from use in Arizona, or, if any such use be permitted, to require payment of charges therefor; and to sell and dispose of said water for use in other states, even outside of the drainage basin of the river; all in violation of the laws of Arizona. Thereby said Act attempts to deprive the State of Arizona, its citizens, inhabitants and property owners, of their right to appropriate said 8,000,000 acre-feet of unappropriated water, and of their right to use any of said water in Arizona, except by contract with the Secretary, and upon payment of such charges as he may prescribe.

(4) Said Act attempts to discriminate against Arizona and in favor of California, by providing for construction of the All-American Canal, and for the delivery of water stored in the reservoir, for use in Imperial and Coachella Valleys in California, without charge, there being no similar provision in regard to water to be used in Arizona.

(5) Said Act attempts to authorize the Secretary to engage in the business of storing and selling water, the business of generating and selling electric power, and the business of leasing water and equipment for the generation of such power; to utilize therefor the water and other natural resources of Arizona, to the deprivation of the right of that State to tax such businesses and the property used in connection therewith.

The power to do all or any of the things so attempted by said Act has not been granted to Congress by the Constitution of the United States.

XXIX. The recital in the Boulder Canyon Project Act that the purpose thereof is the improvement of navigation and the reclamation of public land is a mere subterfuge and false pretense. This is evident from the following facts:

The Colorado River is not navigable, and the said Act provides that the United States shall observe the Colorado River Compact, which in turn provides that the use of water of the Colorado River, for purposes of navigation, shall be subservient to the use of such water for domestic, agricultural and power purposes. Even if the river were navigable, the diversion, sale and delivery of water, as authorized in the Act, would not improve, but would destroy, its navigability. Seventy-five per cent of all land possible of reclamation by the works, or by the storage and delivery of water, provided for in said Act, is privately owned. A dam and reservoir having one-fifth the capacity and requiring one-fifth of the expenditure authorized in the Act, would accomplish the reclamation of public land.

XXX. Defendant Ray Lyman Wilbur, Secretary of the Interior, has proceeded, and is now proceeding, under said Act, and has threatened, and now threatens to enforce the provisions thereof. He has taken possession of that part of the Colorado River flowing in Arizona, and on the boundary thereof, and of all of the water in said river, including the 8,000,000 acre-feet of unappropriated water flowing therein, and of all of the dam sites and reservoir sites, and is excluding the State of Arizona, its citizens, inhabitants and property owners, therefrom, and is preventing their appropriation of any of said 8,000,000 acre-feet of unappropriated water, all of which is now subject to appropriation in Arizona.

XXXI. Said Defendant Wilbur has made surveys, plans and specifications for, and has commenced, the construction of the dam, reservoir, power plant and other works provided for in said Act, and has made and prescribed general regulations respecting contracts for the storage of water in said reservoir and for the delivery thereof for irrigation and domestic use. A copy of said regulations is annexed to the bill of complaint.

XXXII. Said Defendant Wilbur has made a pretended contract with the Metropolitan Water District of Southern California for the storage of water in the reservoir and for the sale of such water to the District for consumptive use of said District outside of the drainage basin of the Colorado River. A copy of said pretended contract is annexed to the bill of complaint. The water so contracted for, together with the 6,500,000 acre-feet of water heretofore appropriated and now being used in the Lower Basin, will exceed the full amount of 7,500,000 acre-feet of water apportioned by the Colorado River Compact to the Lower Basin. There would remain in the Colorado River System 7,950,000 acre-feet of unappropriated water per year, but none of it would be available for appropriation in the Lower Basin, by reason of the Colorado River Compact. Thus the effect of carrying out the

provisions of the Boulder Canyon Project Act and of said pretended contract, would be to deprive the State of Arizona, its citizens, inhabitants and property owners, of their right to appropriate any of the unappropriated water of said Colorado River System, aggregating 9,000,000 acre-feet annually, all of which is now subject to appropriation in Arizona.

XXXIII. Said Defendant Wilbur has prescribed general regulations for the lease of electric power to be generated at the dam, a copy of said regulations being annexed to the bill of complaint. Said defendant also has made a pretended contract with the city of Los Angeles and Southern California Edison Company, Ltd., for lease of power privileges at the dam, and has made a pretended contract with the Metropolitan Water District of Southern California for the sale of electric power to be generated at the dam. These three pretended contracts are made upon the express condition that all rights thereunder shall be subject to, and controlled by, the Colorado River Compact. Unless enjoined, said defendant will carry out the provisions of said pretended contracts, which are void.

XXXIV. Said Defendant Wilbur has not complied, and will not comply, with the laws of Arizona, and has not applied, and will not apply, to the State Water Commissioner, or to the State Engineer, of the State of Arizona, for the permits required under the Arizona laws.

XXXV. The defendant States of California, Nevada, Utah, New Mexico, Colorado and Wyoming, are causing their commissions and commissioners to act, and they are acting, in an advisory capacity to said Defendant Wilbur, in carrying out the provisions of the Boulder Canyon Project Act, and said States are claiming an interest in the three pretended contracts made by said Defendant Wilbur. Said defendant States are claiming that the Colorado River Compact became effective when approved by Congress and by the defendant States and that the State of Arizona, its citizens, inhabitants and property owners, are subject to, and controlled by, said Compact. Said defendant States have aided and abetted, and are aiding and abetting, and, unless enjoined, will continue to aid and abet, said Defendant Wilbur, in carrying out the provisions of the Act.

XXXVI. If the defendants shall enforce and carry out the provisions of the Boulder Canyon Project Act and of the said pretended contracts, the State of Arizona, its citizens, inhabitants and property owners, will be prevented from appropriating any of the unappropriated water of the Colorado River and its tributaries, aggregating 9,000,000 acre-feet annually, all of which is now subject to appropriation in Arizona, and from using any of said unappropriated water, except in accordance with, and subject to, the Colorado River Compact, and from using any of the 8,000,000 acre-feet thereof now flowing in the main stream of the river, except by contract with the Secretary, and upon payment of such charges as he may prescribe; it will be impossible to appropriate water for the irrigation of the whole or any part of the 2,000,000 acres of unirrigated but irrigable land above mentioned, and it will be impossible to finance the irrigation projects mentioned above, or any other irrigation project in Arizona; all of said land will remain forever unirrigated, unused and incapable of use; it will be impossible for the power projects mentioned above to carry out their plans; the great increase in population, wealth, prosperity and taxable resources of the State of Arizona, which would have resulted from the irrigation of said land and from the use of said power sites, will be prevented and made impossible; and the State of Arizona will thereby suffer great and irreparable injury, for which it has, and can have, no adequate remedy at law.

The complainant, State of Arizona, prays that the Colorado River Compact and the Boulder Canyon Project Act be decreed to be unconstitutional, void and of no effect; that the defendants, and each of them, be permanently enjoined from enforcing or carrying out said Compact, or said Act, or any of the provisions thereof, and from carrying out the three pretended contracts above mentioned, or any of them, or any of their provisions, and from doing any other act or thing pursuant to or under color of said Boulder Canyon Project Act; and that the State of Arizona recover its costs, and have such other and further relief as to the court may seem just and equitable.

The bill of complaint is signed by K. Berry Peterson, Attorney General of the State of Arizona, Solicitor for Complainant, and by Dean G. Acheson and Clifton Mathews, of Counsel.

THE ARIZONA LAW SUIT
LAST EFFORT TO BLOCK BOULDER DAM PROJECT

By REPRESENTATIVE PHIL. D. SWING
Co-author with Senator Johnson of the "Boulder Dam Act"

More than eight years after I introduced the first bill to authorize the construction of the Boulder Dam, Arizona has filed her suit in the United States Supreme Court to enjoin the construction. During those intervening eight years she placed every known political and legislative obstacle in the way of the progress of the Swing-Johnson Bill. Her leaders were able and resourceful and with the strong support of the power corporations and Mexican landowners were able to hamper and delay but not defeat the legislation. Now she has played her last card—a suit to declare the Act of Congress unconstitutional. I will briefly recite the principal allegations of the complaint.

The complaint filed by the State of Arizona is directed against the States of California, Nevada, New Mexico, Utah, Colorado, Wyoming and Secretary of the Interior Ray Lyman Wilbur.

The complaint begins by describing the general physical characteristics of the Colorado River and its principal tributaries giving the distances each flows in each of the seven basin states, the area of the drainage basin in each state, asserting that 43 per cent of the whole is in the State of Arizona; the fall of the river in the canyon section and the existence of sand bars in the lower section, because of which, the complaint declares, the "river has never been, and is not now, a navigable river."

The complaint states the average run-of of the river is 18,000,000 acre-feet per annum of which 9,000,000 acre-feet has been appropriated and put to use in the United States, 2,500,000 of which is used in the upper basin and 6,500,000 in the lower basin. Arizona declares 3,500,000 acre-feet is being used in that State. The complaint further alleges that the remaining 9,000,000 acre-feet of unappropriated water is all "needed and can be put to beneficial use in Arizona" on 2,000,000 acres of arid land which is "at present uncultivated and practically uninhabited" but which is "capable of supporting a population of more than 500,000" when irrigated and "will add greatly to the wealth and taxable resources of the State of Arizona."

The complaint alleges the existence of numerous sites on the river in Arizona and between Arizona and Nevada suitable for constructing dams behind which could be stored "all of the water of the Colorado River" and in connection with which could be constructed and operated power plants from which "great quantities of electric power could be generated and sold in Arizona and elsewhere," which dams and power plants (if, and when, constructed) would be taxable and "yield substantial revenues to the State of Arizona," for which reasons, the water of the river and the dam sites are declared to constitute "the greatest natural resource of the State of Arizona."

The complaint further says that irrigation projects already formed, plan to irrigate 1,000,000 acres of land in Arizona which will require 4,500,000 acre-feet of additional water out of the Colorado River for use of which permits have already been granted by the Arizona Water Commissioner. The state also alleges that it is the owner of 100,000 acres of this land. (It is interesting to note that it does not allege that any of these 100,000 acres are riparian to the Colorado River for

the reason that Arizona's constitution repudiates the common-law doctrine of riparian water rights.) These plans necessitate the use of the dam sites in Arizona and between Arizona and Nevada. Also there have been formed power projects for the use of said dam sites for generating power, plans for which have been approved by the State Engineer of Arizona. The Supreme Court is assured that if the Boulder Canyon Project Act "shall be held unconstitutional said work will be immediately commenced and prosecuted to completion" which business would be taxable and "yield substantial revenues to the State of Arizona." (It should be noted that the complaint does not say that the Federal Government, either through the War Department or the Federal Power Commission, has ever approved any plans for the construction of the contemplated dams and power plants in the Colorado.)

The complaint asserts that Arizona, as a sovereign State, possesses jurisdiction (it does not say exclusive jurisdiction) and control of all water within its boundaries including the water of the Colorado River, and refers to the laws of the State which requires "any person intending to appropriate water shall apply to the Water Commissioner for a permit" and also that it shall be unlawful to construct a dam except upon the approval of the State Engineer; recites that the Federal Government has not complied with these laws and recites the drafting of the Colorado River Compact; the approval by six of the States and by the United States Government, waiving, as between themselves, the requirement for Arizona's approval; states Arizona did not approve it because (1) it apportions to the upper basin more and to the lower basin less than an equitable share of the water of the Colorado River; (2) it attempts to withhold from appropriation until October, 1963, as unapportioned water 3,000,000 acre-feet with a view to supplying Mexican demands therefrom; (3) it includes in the Colorado River system the Gila River whose entire flow of 3,000,000 acre-feet annually has already been appropriated for use in Arizona; hence if Arizona accepted the compact her claim for additional water from the Colorado River would be reduced proportionately on account of this 3,000,000 acre-feet of Gila water which the State has already put to use; (4) the compact includes in the definition of "Colorado River Basin" lands outside the actual drainage basin and attempts to establish a right in those lands to use Colorado River water. (This refers in particular to the lands around Denver on the east side of the Rocky Mountains proposing to draw water from the Colorado through the Moffat Tunnel and the Metropolitan Water District of southern California proposing to secure domestic water from the Colorado by means of a 265-mile aqueduct.) Declares for the said reasons the compact is void.

The complaint then recites the enactment of the Swing-Johnson Bill authorizing the Secretary of the Interior to construct the project including a reservoir in the Black Canyon of not less than 20,000,000 acre-feet capacity which would store all the unappropriated water in the river; also the All-American Canal connecting Laguna Dam on the river with the Imperial and Coachella Valleys and that no charge should be made for the water delivered to said valleys. Says the "act does not provide any similar facilities for the benefit of water users in Arizona." Recites the authorization of an appropriation of not exceeding \$165,000,000, the estimated cost of the project.

The complaint then narrates the steps taken to put the Boulder Dam Act into force and effect, to wit: Ratification of Colorado River Compact by six states waiving the requirement that Arizona should approve it; agreement by California Legislature that California shall be restricted in its firm water rights from the Colorado River to 4,400,000 acre-feet per year plus not more than one-half of any excess or surplus water unapportioned by said compact; the Proclamation of the President that all conditions precedent had been complied with.

The complaint recites the optional compact suggested in the Boulder Dam Act for Arizona, California, and Nevada to divide the waters allotted to the low basin and says they never entered into that, or any other, agreement.

Says the act requires the Secretary, as a condition precedent to an appropriation, to make contracts for the sale of water and power which will, in his judgment, reimburse the Government all expenditures within 50 years from completion of the works. Recites these were pretended to be complied with and that Congress made the first appropriation of \$10,660,000 to commence work.

Says the act prohibits any person from using the water stored in the reservoir except by contract with the Secretary and since all the water in the river can be stored in the reservoir, Arizona is thereby prohibited from appropriating any of said water except by contract with the Secretary and if he were so minded he could withhold all water from Arizona; also the act does not restrict the Secretary to the drainage basin in disposing of the said stored waters.

The complaint further alleges that the act provides for the Government "building a power plant and leasing the same for operation but said act does not provide for the levy or collection by the State of Arizona of any taxes on said dam, power plant and incidental works" resulting in depriving that State "of its right to levy and collect taxes on such businesses and on the property used in connection therewith."

Since the act provides that "all users and appropriators of water stored, diverted, carried or distributed by said reservoir, canals, and other works therein authorized shall observe and be subject to and controlled by the Colorado River Compact," and also since the act provides that "all patents, grants, contracts, concessions, leases, permits, licenses, rights of way, or other privileges from the United States, necessary or convenient for the use of waters of the Colorado River or its tributaries" shall be subject to and controlled by the Colorado River Compact; therefore, the State of Arizona and all users of water for irrigation in that State would be subjected to the Colorado River Compact notwithstanding Arizona had never approved the Compact.

It is, therefore, contended that the Boulder Dam Act is unconstitutional because (1) it attempts to deprive Arizona of its sovereign jurisdiction and control of the water, dam and reservoir sites situated in that State and vests control thereof in the United States without the necessity of its complying with the laws of Arizona; (2) it subjects Arizona to the Compact and makes it effective in that State without its approval thereof; (3) it authorizes the Secretary to build the Boulder Dam and store in it the 8,000,000 acre-feet per annum of unappropriated water, withhold the same from use in Arizona except by contract and authorizes him to sell it for use in other states even outside the drainage basin, thereby depriving Arizona and its citizens "of their right to

appropriate said 8,000,000 acre-feet of unappropriated water"; (4) that said act aids and facilitates the use of the stored water in California and does not extend equal privileges and facilities to water users in Arizona; (5) authorizes the Secretary of the Interior to engage in the business of storing and selling water and generating electric power by the utilization of the natural resources of Arizona without providing appropriate compensation such as taxes to that state.

Alleges that since the act approves the Compact and the Compact declares that the use of the waters of the river for navigation "shall be subservient to the use of such water for domestic, agricultural, and power purposes," it follows that the recital in the act that one of the purposes thereof is "improvement of navigation is a mere subterfuge." Declares that the reclamation of public lands is not a purpose since 75 per cent of all lands that can be benefited are privately owned.

Alleges that Secretary Wilbur is now proceeding to carry out the provisions of said act and has seized all that part of the Colorado River which flows in Arizona and on its boundary and all of the water flowing in said river and all of the dam and reservoir sites on the river in said State "and now has said river, said water and said sites in his possession" and is now "excluding the State of Arizona, its citizens, inhabitants and property owners from all access thereto."

Alleges that the Secretary has made plans for and has commenced the construction of a dam, reservoir and power plant, the dam to be 727 feet high, the reservoir to have a storage capacity of 29,500,000 acre-feet, the power plant a generating capacity of 1,200,000 horsepower.

Says the Secretary has made a contract with the Metropolitan Water District representing 11 Pacific Coast cities for the delivery to it of 1,050,000 acre-feet of stored water annually for use in said cities outside the Colorado River drainage basin. This it is claimed would deprive citizens of Arizona of their right to appropriate any of the unappropriated water of the Colorado River System although the complaint admits "there would still remain in said Colorado River System 7,950,000 acre-feet of unappropriated water per year."

Recites the making of three contracts for power with the City of Los Angeles, Southern California Edison Company and the Metropolitan Water District, alleges that these contracts are void since all are made "upon the express condition that all rights thereunder shall be subject to and controlled by the Colorado River Compact."

It is claimed that the defendant States are interested in the three power contracts since the act provides that after the government is paid, the project revenues are to be kept in a special fund and expended within the Colorado River Basin; also that the defendant states are interested in claiming the Colorado River Compact effective.

It is further contended that if said act and contracts are carried out, Arizona and its citizens will be prevented from appropriating any of the 9,000,000 acre-feet annually of the unappropriated water of the Colorado except in accordance with the Colorado River Compact and under contracts with the Secretary of the Interior with the result that it will be impossible to finance irrigation projects; to construct dams and canals; to reclaim the 2,000,000 acres of unirrigated but irrigable lands in Arizona; that it will be impossible to carry out the power projects heretofore mentioned; the growth of the State in population and

wealth will be prevented and the "state will thereby suffer great and irreparable injury."

The complaint closes with the usual prayer for an injunction to prevent the defendants carrying out the said compact, the said act or the said contracts and also asks that the act and compact be declared unconstitutional.

Defendants May Move to Dismiss or Answer

The defendants have two courses they may pursue. At the time set by the Court for their showing, January 5, 1931, they may file a motion to dismiss or they may file an answer. The motion to dismiss would raise only questions of law. The answer would raise questions of fact and law. The filing of the motion to dismiss, if ruled against by the Court, would not prevent a subsequent filing of an answer.

Grounds For Dismissal

From a careful study of Arizona's pleading I am of the opinion that it does not state facts sufficient to constitute a course of action and therefore is subject to dismissal. As against this view it should be noted that the Court has already tentatively passed upon this very question when it granted leave to Arizona to file its complaint. The Court, however, at that time did not have the benefit of opposite Counsel and was doubtless influenced by Arizona's point blank allegations that the river was not, and never has been, navigable. The Supreme Court will take judicial notice of history and facts set forth in official documents. It is believed that the fact that navigation was conducted successfully for years on the Colorado River, from its mouth up the stream as far as Calville, Nevada, which is above the site of the Boulder Dam can be so well authenticated by standard works of historians and by numerous official records and documents of the government that the Supreme Court will not hesitate to ignore the contrary allegations in the complaint. Nor can it be said that the government is estopped to claim navigability because it has approved the Colorado River Compact which contains the recital: "Inasmuch as the Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of its basin, the use of its waters for purposes of navigation shall be subservient to the users of such waters for domestic, agricultural and power purposes." Navigation does not have to be the dominate use to be recognized nor does improvement of navigation have to be the sole or even the primary purpose of a project to justify federal jurisdiction. It is enough that it is one of the purposes and that some navigation will follow. Congress has, in express language, directly declared, in the very beginning of the Boulder Canyon Project Act, that it was enacted "for the purpose of controlling the floods, improving navigation, and regulating the flow of the Colorado River." And again in Section 6 it is declared "that the dam and reservoir provided for in Section 1 hereof shall be used: First, for river regulation, improvement of navigation and flood control." There is no reason to expect that the Court will allow the indirect inference that may be drawn from the language used in the Colorado River Compact to offset this unequivocal language found in the act itself.

It is interesting to note that in the case of the United States vs. The State of Utah, original No. 14 now pending before the Supreme Court and involving the question of navigability of the Colorado River above the Boulder Dam site, the special master, Charles Waren, in his report filed October, 1930, after exhaustive hearings, recommended the finding that the Colorado River was a navigable river from mile 176 above Lees Ferry south to the Utah-Arizona boundary line, reciting much evidence which seems to accept as undisputed that the Colorado in its lower reaches was a navigable stream.

The Supreme Court has never, so far as I know, held contrary to a declaration of Congress when Congress has said a stream was navigable. If the Colorado is held, in a legal sense, to be a navigable river, then Congress has the constitutional power to authorize a project for its improvement and the Courts will not consider the merits of the plans adopted by Congress for so doing.

There are a number of constitutional grounds in addition to navigation on which the federal government is justified in constructing the Boulder Dam. Reclamation is one of these, and the inclusion of the All-American Canal as a part of the project clearly shows the intention of Congress to put some of the stored water to use reclaiming some of the public lands in the Imperial Valley. The authorization in Section 11 of a survey of the Parker-Gila Valley with a view to creating a new reclamation project in Arizona is another declaration of the intent of Congress to apply more of the stored water to irrigating its public lands.

Flood control, as a protection to interstate commerce, is another constitutional ground. Numerous transcontinental highways and railroads cross the lower Colorado River and its alluvial valley and important commerce over them is subject to interruption annually but for flood protection works. If Congress has seen fit to adopt the flood control reservoir to solve this problem it is just as legal as to build levees.

Congress is authorized to do what ever is necessary to carry out treaty obligations. The Colorado River Compact is a treaty between the six states and the federal government. This project is in part execution of that treaty. We have treaties with Mexico—another is in process of being negotiated pursuant to an Act of Congress. Some water from the Colorado will have to be delivered to Mexico under the new treaty. All of the low flow of the river is now put to use in the United States. The federal government can get water for Mexico only by storing some of the storm water in a reservoir like the one at Boulder.

Finally there are the provisions to be found in the Enabling Act admitting Arizona to the Union which reserved to the United States all lands in the State valuable for development of water power and gave the Secretary of the Interior five years in which to make the selections and providing lieu lands for Arizona in place of those so withdrawn. The Secretary subsequently made a withdrawal which included the Boulder Dam site and Arizona recognized the validity of this withdrawal. Furthermore in complete execution of the terms of the Enabling Act, Arizona later applied for and received the lieu lands which makes an executed contract from which Arizona could not afterwards withdraw. Therefore, Arizona is in no position to complain of the government building a dam and power plant on land withdrawn for that very purpose, with the active consent of the state. This point is

vouched for by such good Arizona attorneys at James S. Casey and John Mason Ross, present State Colorado River Commissioner, in an able brief written in 1926 (see Appendix E, The Boulder Canyon Project, Report California-Colorado River Commission).

Whether all of these points can be raised on a motion to dismiss will depend on how far the Court will go in taking judicial notice of facts set out in official government documents. I believe all of the points mentioned could be successfully raised by answer.

An additional point on the motion to dismiss would be that the suit was prematurely brought, that by the very allegations of her complaint Arizona shows she has not been injured yet and as a matter of fact may never be injured. She admits that there is 9,000,000 acre-feet annually unappropriated water in the river. She alleges only one contract made by the Secretary to deliver 1,050,000 acre-feet of this to the Metropolitan Water District leaving 7,950,000 acre-feet flowing in the river. At another place she contends that there are irrigation projects already formed comprising more than 1,000,000 acres which will require 4,500,000 acre-feet of water but that still leaves 3,450,000 acre-feet of unappropriated water flowing in the river on her own statement of fact. It would seem that Arizona had failed to show by her complaint where any of her proprietary, political, or governmental rights had been invaded down to the present time.

Finally the point might be made that the United States was a necessary and indispensable party defendant. It is the United States *i. e.*, Congress plus the executive that is carrying forward this great project, not merely Secretary Wilbur. The complaint challenges the power and authority of the entire federal government under the constitution to do this thing, not merely the authority of the Secretary of the Interior. Therefore, the United States itself must be made a party defendant. But this can not be done without its consent and that would take an Act of Congress and it is doubtful that could be secured.

Answers to Arizona's Attacks on Boulder Dam Act

Arizona undertakes to make five points against the Boulder Dam Act but they are not sound.

First, her reference to the invasion by the federal government of her sovereign rights in and to water, dam and reservoir sites situated within her State overlooks the doctrine of dual sovereignty and fails to recognize that the federal government too has sovereign rights in and to the same water, dam and reservoir sites for any and all constitutional purposes.

Secondly, when Arizona complains of being coerced by having the Colorado River Compact made effective in her State notwithstanding she has not ratified it she complains merely of a coercion of physical and economic factors and not legal coercion. True the United States owns much public land in Arizona; true it will control the water stored in the dam it builds at Boulder. In agreements for rights of way over public lands and for release of water from the Boulder Dam it will insist that the contracts contain a provision recognizing the validity of the Compact. But that is the only moral position the government can take. It is a party to the Compact—it has approved it—it therefore should insist that all its agencies, and all its contractees, licensees, grantees and lessees shall also observe it. The sovereign State

of Arizona is not impressed with the Compact against its will. Only the public lands of the United States situated in Arizona, and only the contractees, licensees, grantees, and lessees of the United States are impressed with the Compact and that through their voluntary agreement to observe it.

Third, when Arizona complains of the government building a dam on the Colorado River and controlling the water to be stored in it and releasing it only on contract, it complains of what a private corporation might do on any river in any state and of what the government has done on many of its reclamation projects. The only allegation that has a shadow of a legal basis is that referring to the delivery of water for use outside the drainage basin and before that complaint could be good Arizona would have to show that some holder of a present vested water right was being injured thereby. That she has not done nor can she make such a showing.

Fourth, the complaint that the distribution of the benefits of the project will be more favorable to California than to Arizona is true but is not a legal objection. Nevada could make the same complaint as to the relative advantages accruing to Nevada as compared to Arizona. If no project could be started by the federal government unless each State was to receive an equal benefit there would be no federal projects.

Fifth, the complaint of the absence of any provision in the bill for Arizona to tax the works overlooks the principal established at the very beginning of our government in the famous case of *McCullough vs. Maryland* wherein Chief Justice John Marshall held that the States had no right to tax the property of the federal government because "the power to tax was the power to destroy."

Answer to Arizona's Attack on the Colorado River Compact

Much of Arizona's complaint has been drawn with a view to showing that the division of water set out in the Colorado River Compact is unfair and unequitable to Arizona in an effort to bring her case within the language used by the Supreme Court in *Kansas vs. Colorado* (206 United States 46), where the Court said that States upon an interstate stream have an equitable interest therein.

However, in the first place the Colorado River Compact does not undertake to make any allotment to Arizona and therefore it can not be said to do any injustice to Arizona. It allots only to the lower basin as a group. What water Arizona would ultimately receive a right to, even if she came under the compact, would depend on what kind of a compact she might be able to negotiate with California and Nevada or, in the absence of that, on the diligence and alacrity with which she was able to put the water to a beneficial use within her State.

But Arizona has not ratified the Compact, therefore, she is not bound by it; therefore she can not complain of its terms. Her legal rights today are exactly what they were before the Compact was negotiated. Arizona had a perfect right to stay out of the friendly family of basin States. She has a right to go it alone. But having chosen that route she can not complain that she is not at one and the same time getting the political, financial and economical benefits that would flow from cooperation with the other basin States and the federal government in the development of the Colorado River.

Trial Would Take Years But Would Not Delay Dam Construction

It is to be hoped that the dispute can be disposed of on the motion to dismiss. To have to proceed to answer and trial would probably consume 10 or 15 years. A special master would have to be appointed and long hearings held in each and every one of the seven basin States. Every filing, every appropriation, and every water right on the river is involved under the allegations of the complaint. Hundreds of thousands of pages of evidence would have to be taken to prove just when each water user in each State began using Colorado River water and how much he used in each and every year. The scope of the engineering plans for every public and private irrigation project in the whole 244,000 square miles of the basin would have to be looked into to determine the extent of the water rights claimed. Not only would it be necessary to consider the vested water rights but also the inchoate rights and since the relative equities between States might be involved all possible future developments as well would have to be noted.

Furthermore, the special master would be obliged to hear evidence on all theories since he would not know in advance on what theory the Supreme Court might desire to consider the case, whether on the doctrine of "equitable division" as laid down in *Kansas vs. Colorado* or on priority of use regardless of State lines as announced in *Wyoming vs. Colorado* (259 United States 419).

Certainly the case promises to make a record for the number of years consumed if it is to be sent to trial on the allegations that are to be found in the complaint and the additional allegations that probably will be put into the various answers of the defendants. The government, the upper basin states, and the State of California will likely desire to file separate answers on separate theories of the case, while the City of Los Angeles, the Metropolitan Water District, the Southern California Edison Company will seek as intervenors to defend their contracts. The city of Denver and the Moffat Tunnel Improvement District, diverting water from the Colorado River drainage basin, will desire to intervene to protect their rights. All in all, it promises to be a battle royal if the fight is permitted to go the full route.

The encouraging thing is, there is to be no interruption in the work on the project. Arizona asked for no preliminary injunction, and if she had it would in all probability have been denied. Therefore, the government's slogan promises to be like that pronounced by Roosevelt who said, "Let's build the Panama Canal and talk about it afterwards."

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LIST OF CONGRESSIONAL REPORTS ON THE COLORADO RIVER
 In Reference Files, Washington Office, Bureau of Reclamation, June 30, 1929

Compiled by W. I. Swanton, Engineer, Washington Office
 (From "New Reclamation Era," August, 1929)

Date	Report	Pages	Number	Congress and session
1903— Dec. 18..... Dec. 18.....	Colorado River, Arizona and California, Chief of Engineers, War Department. Freight on river..... Colorado River, Nevada, Chief of Engineers, War Department. El Dorado-Rioville.....	6 5	H. Doc. 204..... H. Doc. 237.....	58th, 2d 58th, 2d
1904— Mar. 21..... April 2..... April 21..... April 28.....	Irrigation by means of the Colorado River; Heber and Smythe. House Irrigation Committee..... Water from Colorado River for irrigation; Heber and Smythe. Tables of discharge of Colorado River..... Division of Colorado for Yuma and the Colorado Indian reservations (33 Stat. 189)..... Investigation use of waters of Colorado for irrigation by the Secretary of the Interior (33 Stat. 591).....	86 65 1 1	House hearings..... Senate hearings..... Indian appropriation..... Pub. Res. 32.....	58th, 2d 58th, 2d 58th, 2d 58th, 2d
1905— Jan. 9.....	Use of waters of lower Colorado for irrigation; C. D. Walcott.....	8	H. Doc. 204.....	58th, 3d
1907— Jan. 12..... Jan. 18.....	Imperial Valley or Salton Sink region, illustrations. Message of President on flood..... Salton Sea, Imperial Valley and lower Colorado River. House Committee on Public Lands.....	40 50	S. Doc. 212..... Hearings.....	59th, 2d 59th, 2d
1908— Feb. 11..... Feb. 26..... Feb.-April.....	Irrigation in Imperial Valley; map and drawings; C. E. Taft, irrigation engineer..... Memorial to John Wesley Powell. Report S. 4469..... Southern Pacific Railroad Imperial Valley claim; House Committee on Claims; Cory, Grusky, etc.....	56 2 70	S. Doc. 246..... S. Rept. 293..... Hearings.....	60th, 1st 60th, 1st 60th, 1st
1910— June 8.....	Grand and Green Rivers; surveys by engineers, War Department.....	29	H. Doc. 963.....	61st, 2d
1911— Feb. 23..... Dec. 22.....	Dam across Colorado River, Yuma County, Arizona (near Head Gate Rock)..... Ockerson report on Imperial Valley levee construction; maps; pp. 129-191.....	2 63	S. Rept. 1233..... H. Doc. 504.....	61st, 3d 62d, 2d
1914— Dec. 18-19.....	Imperial Valley, flood protection. Hearings urgent deficiency bill 1915, pp. 118-137. Kettner et al.....	141	Hearings.....	63d, 3d
1915— Jan. 7.....	Protection lands and property in Imperial Valley; map of delta; Marshall.....	16	H. Doc. 1476.....	63d, 3d

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Date	Report	Pages	Number	Congress and session
1916—				
Jan. 5	Flood control; H. M. Chittenden, U. S. Army. I. The Colorado Problem, pp. 59-65.	67	H. Doc. 2	64th, 1st
Jan. 13	Imperial Valley, construction protection works (report of General Marshall in manuscript)	2	S. Doc. 232	64th, 1st
Jan. 13	Plan for protection of Imperial Valley, Marshall's report, illustrations and maps.	21	H. Doc. 356	64th, 1st
July 29	Colorado River Indian irrigation project. Report on H. R. 6901 by Secretary.	2	H. Rept. 1062	64th, 1st
1917—				
June 1	Colorado River and relation to Imperial Valley, C. E. Grusky, June 30, 1907.	39	S. Doc. 103	65th, 1st
1919—				
Feb. 3	Colorado River in Arizona. House Flood Control Committee; Marshall, Cory, etc.	28	Hearings	65th, 3d
Feb. 27	Flood control, Colorado River, California and Arizona. Data complete.	1	H. Rept. 1149	65th, 3d
July 9-Mar.	All-American Canal for Imperial and Coachella Valleys, three parts.	619	Hearings	66th, 1st
July 16	Colorado River survey, Imperial Valley. Hearings House Flood Control Committee.	24	Hearings	66th, 1st
July 22	All-American Canal report, maps; by Messrs. Mead, Schlecht, Grunsky, and Preston.	98	Report.	66th, 1st
1920—				
Mar. 5	Examination of Imperial Valley and other lands in California. Report on H. R. 12537.	4	H. Rept. 717	66th, 2d
April 1	Imperial Valley, California. Report on H. R. 12537 by secretary.	2	S. Rept. 497	66th, 2d
May 18	Imperial Valley investigations, Kinkaid Act (41 Stat. 600).	2	Pub. No. 208	66th, 2d
May 19	Irrigation of Imperial Valley; appropriation for investigation, \$20,000.	2	S. Doc. 276	66th, 2d
1921—				
Jan. 1	Problems of Imperial Valley and vicinity; preliminary report; maps	91	Committee print	66th, 3d
Jan. 4	Compacts between States; Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming. House Judiciary Committee.	32	Hearings	67th, 1st
June 17	Division and apportionment waters of Colorado. Report on H. R. 6877.	2	H. Rept. 191	67th, 1st
June 27	Disposition waters of Colorado. Report on S. 1853.	1	S. Rept. 180	67th, 1st
Aug. 19	Colorado River compact permitted by act (42 Stat. 171)	2	Pub. No. 56	67th, 1st
1922—				
Feb. 8	Parker, Fort Mohave, and Cibola irrigation projects, Arizona; maps, appendix A to hearings, H. R. 11449.	149	Hearings	67th, 2d
Feb. 23	Problems of Imperial Valley and vicinity. Fall-Davis report, illustrations and maps.	326	S. Doc. 142	67th, 2d
Feb. 28	Development of the Imperial Valley illustrations. House committee print of nearly all S. Doc. 142.	233	Committee print	67th, 2d
June 15-Feb. 21	Protection and development, lower Colorado River Basin. House Committee on Irrigation; five parts.	273	Hearings	67th, 2d

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Date	Report	Pages	Number	Congress and sessions
1923—				
Jan. 23	Southern Pacific Company. Report of S. Committee on Claims; break in Colorado.	21	S. Rept. 1066	67th, 4th
Feb. 28	Promotion industry, Colorado River Basin. Report from President and Bureau of the Budget.	3	S. Doc. 331	67th, 4th
Mar. 2	Colorado River compact. Report of Colorado River Commission, Herbert Hoover, chairman.	12	H. Doc. 605	67th, 4th
April-Aug.	Protection and development of lower Colorado River Basin; Information House Committee on Irrigation; Diamond Creek, H. R. 2403, including Federal Power.	212	Hearings.	68th, 1st
1924—				
Feb. 9-May 17	Protection and development of lower Colorado River Basin, Swing Bill, H. R. 2403; eight parts, with index.	1980	Hearings.	68th, 1st
April-June	Protection and development of lower Colorado River Basin; information by citizens of Arizona and others. H. R. 2903.	152	Information.	68th, 1st
May 14	La Plata River compact. Report on S. 1656.	1	S. Rept. 554	68th, 1st
May 26	Southern Pacific Railroad claims; account of Colorado River flood (43 Stat. 171).	1	Pub. 141	68th, 1st
Dec. 17-Jan. 23	Colorado River Basin; Senate Committee on Irrigation on S. 727; two parts.	320	Hearings.	68th, 2d
1925—				
Jan. 6	La Plata River compact. Report on S. 1656.	7	H. Rept. 1076	68th, 2d
Oct. 26-Dec. 22	Water Supply Paper No. 556, E. C. La Rue, Colorado River. Numerous maps and drawings. Colorado River Basin, Senate hearings, S. Res. 320; 6 parts.	176 931	H. Doc. 540 Hearings.	68th, 2d 69th, 1st
1926—				
Feb. 5-May 17	Colorado River Basin. House Irrigation Committee hearings on H. R. 6251 and H. R. 9826; two parts.	312	Hearings.	69th, 1st
April 19	Boulder Canyon reclamation project, two parts. Report on S. 3331.	116	S. Rept. 654	69th, 1st
May 17	Glen Canyon, Bridge Canyon, and Arizona High Line Canal. Fred T. Colfer (illustrations).	19	S. Doc. 113	69th, 1st
Dec. 22-Jan. 28	Boulder Canyon reclamation project. Report on H. R. 9826; five parts.	125	H. Rept. 1657	69th, 2d
1927—				
Jan. 17	Estimates for irrigating lands under Colorado River compact. Report on S. J. Res. 131.	2	S. Rept. 1258	69th, 2d
Jan. 20-22	Rules Committee (House). Hearings on Boulder Dam, H. R. 9826, in three parts.	121	Hearings.	69th, 2d
Feb. 2	Lower Rio Grande and lower Colorado Rivers. Report of Secretary of State.	2	H. Doc. 676	69th, 2d
Feb. 3	Lower Rio Grande and lower Colorado Rivers. Report of Secretary of State.	2	H. Rept. 1951	69th, 2d
Feb. 9	Lower Rio Grande and lower Colorado Rivers. Report of Secretary of State.	2	S. Rept. 1455	69th, 2d
Feb. 23	Protection and development, lower Colorado River.	1	H. Rept. 2212	69th, 2d
Mar. 1	Federal Power Commission licenses affecting Colorado River. Report on S. J. Res. 4.	2	H. Rept. 2285	69th, 2d
Mar. 3	Investigation Rio Grande and lower Colorado River. H. J. Res. 345 (44 Stat. 403)	1	Pub. Res. 62	69th, 2d
Mar. 4	Federal Power Commission licenses affecting Colorado River (44 Stat. 1456).	1	Pub. Res. 71	69th, 2d

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Date	Report	Pages	Number	Congress and session
1928—				
Jan. 7	Regulating the Colorado River; Mr. Davenport. House Irrigation Committee on H. R. 5770.	52	Hearings	70th, 1st
Jan. 6-14	Protection and development of lower Colorado River Basin. House Irrigation Committee on H. R. 5773; four parts, index and appendix.	864	Hearings	70th, 1st
Jan. 17-21	Colorado River Basin; Senate Irrigation Committee on S. 1274, including special advisors' report.	517	Hearings	70th, 1st
Jan.	Development, lower Colorado River; Special Advisors Emerson, Durand, Schrugham and Garfield. (Reprint Senate hearings)	71	Report	70th, 1st
Mar. 15-24	Boulder Canyon project. Report on H. R. 5773; three parts.	134	H. Rept. 918.	70th, 1st
Mar. 20-April 9	Boulder Canyon project. Report on S. 728; two parts.	76	S. Rept. 692.	70th, 1st
April 2	Investigation of waters of Gila River, New Mexico and Arizona. H. R. 10786	2	H. Rept. 1101.	70th, 1st
April 24-May 2	House Rules Committee, Boulder Dam; two parts	88	Hearings	70th, 1st
May 3	Investigation of waters of Gila River, New Mexico and Arizona. H. R. 10786	2	S. Rept. 1179	70th, 1st
May 15	Rules report on Colorado River bill on H. R. 5773	1	H. Rept. 1666.	70th, 1st
May 18	Compact, New Mexico and Colorado, Gila and San Francisco Rivers. H. R. 6498.	2	H. Rept. 1739.	70th, 1st
May 18	Compact, New Mexico and Arizona, Gila and San Francisco Rivers. H. R. 6499.	2	H. Rept. 1740.	70th, 1st
May 18	Interstate compact, Colorado, New Mexico, San Juan, Las Animas, etc.	1	H. Rept. 1747.	70th, 1st
May 18	Interstate compact, Colorado, Utah	1	H. Rept. 1751.	70th, 1st
May 28	Equitable use waters, lower Colorado and Rio Grande, Department of State	9	S. Doc. 163	70th, 1st
May 29	Board of Engineers to report on Boulder Dam. S. J. Res. 164 (45 Stat. 1011)	1	Pub. Res. 65	70th, 1st
May 30	Sibert Report on Boulder Dam project, Colorado River.	15	H. Doc. 446.	70th, 2d
Dec. 3	Colorado River development, Colo. W. Melone	225	S. Doc. 186.	70th, 2d
Dec. 10	Boulder Canyon project act. H. R. 5773 (45 Stat. 1057)	11	Pub. No. 642	70th, 2d
Dec. 21				
1929—				
Jan. 17	Apportionment waters, Gila and San Francisco Rivers.	2	S. Rept. 1498	70th, 2d
Jan. 17	Reapportionment, Rio Grande, San Juan and Las Animas Rivers.	2	S. Rept. 1497	70th, 2d
Feb. 11	Compacts, Colorado, Wyoming, New Mexico and Utah, respecting division of water.	2	S. Rept. 1724.	70th, 2d
Feb. 19	Restricting Federal Power Commission licenses affecting the Colorado River.	3	H. Rept. 2621.	70th, 2d
Feb. 25	Apportionment of waters of Gila and San Francisco Rivers. H. R. 6499.	2	H. Rept. 2784.	70th, 2d
Mar. 1	Restricting Federal Power Commission granting licenses on Colorado River.	1	Pub. Res. 98.	70th, 2d
Mar. 2	Compacts, Colorado and New Mexico, regarding Rio Grande and San Juan Rivers, etc.	1	Pub. No. 946	70th, 2d
Mar. 2	Compact, New Mexico and Arizona, respecting Gila and San Francisco Rivers.	1	Pub. No. 963	70th, 2d
June 25	Presidential proclamation. Boulder Canyon Dam project act effective.	1	N. C. 1882.	70th, 2d

**CHRONOLOGICAL BIBLIOGRAPHY OF ARTICLES IN ENGINEERING
NEWS (LATER ENGINEERING NEWS-RECORD).**

(Most of the following compilation was furnished by the Bureau of Reclamation. Additions have been made to bring matter down to date.)

- Vol. 48—July–December, 1902. Colorado River.
 Aug. 7, p. 89. Colorado Desert is the hottest place; 138° in shade.
 Sept. 18, p. 208. Silt in Salt River, Ariz. (Brief table of silt in Southwest.)
 Nov. 20, p. 413. Dam failed near Red Cliff, Colo., on Nov. 6, on Eagle River, owned by D. & R. G. R.R. (Short.)
 Dec. 18, p. 514-15. Pumping plant for water works at Prescott, Ariz. Illus. by W. W. Follett.
- Vol. 49—January–June, 1903.
 Apr. 9, p. 328. Pebble-covered plains in desert regions. W. P. Blake.
 Apr. 30, p. 395-6. Cost of diamond drilling in Colorado River Valley and at St. Mary's Lake. A. P. Davis.
 May 28, p. 478. Effect of forests on flood heights. J. B. Lippincott. (Hydrography of Queens Creek at Whitlow's Ranch, Ariz.)
 June 4, p. 489. Scheme for utilizing the Colorado, by A. P. Davis, from Los Angeles Times of May 22.
 Feb. 19, Lit. Supp., p. 6. Romance of the Colorado River, by F. S. Dellenbaugh. (Long review of book.)
- Vol. 50—July–December, 1903.
 July 2, p. 1. Gunnison irrigation tunnel to be begun in a month. (Short.)
 July 2, p. 1. Measurement of flow of the Colorado River planned in connection with Kansas-Colorado case. (Short.)
- Vol. 51—January–June, 1904.
 Jan. 7, p. 24. Cement plant built by Government at dam site. (Short.)
 Feb. 25, p. 177-8. Government cement-making plant, at Roosevelt. (Long editorial.)
 Mar. 10, p. 223. Bids for furnishing cement at Hondo dam rejected. (Short.)
 Mar. 10, p. 248. Rate of evaporation at Yuma, Ariz., by J. B. Lippincott. (Over 80 inches.)
 Mar. 17, p. 259-61. Government cement-making plant at Hondo dam, Ariz. (Long letter by W. G. Hartranft.)
 Apr. 21, p. 379-80. Daily and monthly discharge of streams with sandy and changeable bed, by E. C. Murphy. (Yuma, Ariz., on the Colorado.)
- Vol. 52—July–December, 1904.
 Sept. 8, p. 215-17. Proposed Gunnison and South Canal, Colorado. (Illustrated.) (Long staff article.)
- Vol. 53—January–June, 1905.
 Feb. 9, pp. 146-7. Laguna Dam, Yuma Irrigation Project, California. (Illus.) (Includes views of Egyptian weirs.)
 Apr. 6, p. 357-58. Failure of a bridge pier (due to Gila flood) on the Phoenix and Eastern R. R. (Illus.) C. K. Conrad.
 Apr. 27, p. 450-51. Repair and subsequent partial destruction of Arizona Canal crib dam near Phoenix, Ariz., by H. F. Robinson.
 June 8, p. 606. Gunnison Tunnel cave-in, May 30. (Short.)
 June 15, p. 610. Progress on Salt River and Yuma and Uncompahgre projects. (Short statement.)

June 22, p. 661-2. Completion of San Pedro, Los Angeles and Salt Lake Railway. (Illus.)

June 29, p. 680. Cave-in of the Gunnison tunnel near Montrose, Colo. (With sketch.)

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July 20, p. 70. Brief description of Salt River and Yuma projects.

July 27, p. 96. Floods in the southwest, 1904-5 (mention of Colorado River and Imperial Valley).

Aug. 24, p. 208. United States Government cement plant at Roosevelt Dam, Arizona. Illus.

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Jan. 18, p. 49. Survey boundaries of Yava-Supai Indian Reservation, Ariz. Illus. by J. S. Girand.

Feb. 22, p. 216-18. Break of the Colorado River in the Imperial Valley and Salton Sink (with maps). Illus. Ref. to Out West Mag.

Mar. 8, p. 278. High dam on Colorado proposed. (Short.)

Mar. 8, p. 278. Yuma irrigation project, Ariz. (Short.)

Mar. 15, p. 300. Salton Sink problem. Letter Edwin Duryea.

Apr. 12, p. 406. Survey of the Salton Sink. (Short.)

May 3, p. 501. Aerial cable bridge, Colorado River. (Short.)

May 10, p. 512. Rate of filling Salton Sink. (With map.)

June 28, p. 721. Flood situation, Salton Sea. Editorial.

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Aug. 2, p. 126. Progress on Gunnison Tunnel. (Short.)

Aug. 30, p. 239. Colorado still flowing into Salton Sea.

Sept. 27, p. 341. Salton Sea still rising. (Short.)

Sept. 27, p. 341. Roosevelt Dam officially begun, Sept. 20.

Sept. 27, p. 341. Moffat road tunnel contemplated. (Short.)

Nov. 1, p. 465. Colorado River returned to original channel.

Dec. 13, p. 628. Sixty thousand second feet flood at Roosevelt Dam.

Dec. 13, p. 629. Colorado River broke from its banks again.

Dec. 27, p. 671-4. Closing break of Colorado River into Salton Sink, illus. by H. T. Cory.

Dec. 27, p. 675. Concrete and steel headgates, Imperial Canal. Illus. James D. Schuyler.

Dec. 27, p. 675-6. President Roosevelt and E. H. Harriman on closing Colorado River break.

Dec. 27, p. 687. Editorial on Colorado River closure and again breaking through to Salton Sink.

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Jan. 3, p. 15. Editorial, latest break of Colorado River.

Jan. 17, p. 69. Editorial on message of President Roosevelt regarding expense closing Colorado River.

Jan. 17, p. 77-8. Roosevelt's message to Congress on Colorado River.

Jan. 24, p. 115. Two million dollar appropriation planned for Colorado River.

Jan. 31, p. 141. Progress in closing break, Colorado River.

Feb. 7, p. 169. Laguna Dam to be completed by government. (Short.)

Feb. 7, p. 169. Progress in closing break, Colorado River. (Short.)

Feb. 14, p. 189. Break in Colorado River nearly closed.

Feb. 21, p. 210-11. Closing break in Colorado River. Illus. (Long.)

Feb. 21, p. 216-17. Editorial on closing break in Colorado.

Mar. 21, p. 327. Annexation of Lower Colorado. (Editorial.)

May 9, p. 518. Strawberry Valley project begun. (Short.)

May 16, p. 545-7. Construction of levee below Colorado River break. Illus. C. W. Ozias.

May 16, p. 550-56. "Wonders of the Colorado Desert." (Long.) Review of book by Geo. Wharton James.

May 30, p. 589-91. Large electrical operative gates for Roosevelt Dam, Illus. F. W. Hanna.

- May 30, p. 605. Gunnison Tunnel lacks 10,000 ft. of completion. (Short article.)
- Vol. 58—July-December, 1907.
- July 11, p. 25-26. Gravel spreader used on Colorado River levees construction. Illus. H. T. Cory.
- July 11, p. 26-27. Closing the Colorado River crevasse. (Long staff article.)
- Aug. 1, p. 131. Break in Colorado River permanently closed July 22. (Short.)
- Nov. 21, p. 543-6. The Rex-Red Cliff double track construction on the D. & R. G. R. R. (Illus.) views near Belden and Red Cliff, Colo.
- Dec. 26, p. 705. Evaporation measurements at Salton Basin to be made. (Short.)
- Vol. 59—January-June, 1908.
- Jan. 16, p. 75. Gunnison Tunnel holed to 20,488 ft. (Short.)
- Jan. 23, p. 99. Circuit Court decision on flooding Salton Sea.
- Feb. 6, p. 154. Roosevelt Dam built to height above floods.
- Feb. 20, p. 184-6. Traveling mold for making reinforced concrete pipe, Salt River. (Illus.). F. Teichman.
- Feb. 27, p. 213-6. Construction Laguna Dam. Illus. E. D. Vincent.
- Feb. 27, p. 216-9. Electrically operated sluice gates and drop timber regulator gates, Laguna Dam. Illus. F. W. Hanna.
- Feb. 27, p. 225-6. Editorial on Laguna Dam and silt problem.
- Apr. 2, p. 363. Cement production at Roosevelt Dam. (Short.)
- Apr. 2, p. 382. Railroad to Laguna Dam. (Short.)
- Apr. 9, p. 400. Credit for design Laguna gates. Letter. F. W. Hanna.
- Apr. 16, p. 410-11. Lower Colorado River during and after freshet of 1907, by C. E. Grunsky. (Maps.)
- Apr. 23, p. 468. Progress on Salt River, Uncompahgre and Yuma project, with costs.
- May 14, p. 538. Yuma irrigation project progress. (Short.)
- Vol. 60—July-December, 1908.
- July 2, p. 6. Colorado River conditions briefly described by W. W. Follett, at meeting A. S. C. E.
- July 30, p. 136. Colorado River waters to be investigated by United States and Mexico.
- Aug. 6, p. 160. Scouring of Santa Cruz River at Tucson, Ariz. Illus. G. E. P. Smith.
- Aug. 13, p. 163-6. Evaporation from Salton Sea. Illus. By C. E. Grunsky. (Long article with tables.)
- Aug. 27, p. 211-32. New type switchboard, Salt River. Illus.
- Sept. 10, p. 265-8. Roosevelt Dam progress, Salt River project. Illus. C. W. Smith. (Long article with cost.)
- Sept. 10, p. 281. Editorial on progress, Roosevelt Dam.
- Sept. 24, p. 344-5. Changes in bed and discharge, Colorado River at Yuma. Illus. E. C. Murphy.
- Oct. 1, p. 366. Granite Reef Diversion Dam, Salt River Project, Arizona. Illus. By J. D. Stannard.
- Oct. 15, p. 424. Roosevelt Dam construction progress. (Short.)
- Nov. 19, p. 560. Cement mill production at Roosevelt Dam. (Short article with costs.)
- Nov. 19, p. 570. Gunnison tunnel record driving, by J. B. Lippincott, giving table of records of other tunnels.
- Nov. 19, p. 571. Colorado River break of 1905. A short history of the cause. From Proc. Am. Soc. C. E. W. W. Follett.
- Vol. 61—January-June, 1909.
- Jan. 7, p. 1-6. Granite Reef Dam, gate mechanism. Illus. F. Teichman. (Long article.)
- Jan. 21, p. 87. Closure of Laguna Dam made Dec. 21, 1908. (Short.)
- Jan. 21, p. 87. Roosevelt Dam construction progress. (Short.)
- Mar. 18, p. 301. Laguna Dam practically completed. (Short.)
- Mar. 18, p. 306. Roosevelt Dam construction progress. (Short.)

May 6, p. 508. Death of A. H. Demrick in Salt River tunnel. (Short.)
 May 20, p. 540. Grand Valley topographic survey. Short article with costs.

June 10, p. 615-19. Turning the Colorado River and completing the Laguna Dam. Illus. E. D. Vincent. Long interesting article.

Vol. 62—July-December, 1909.

July 8, p. 59. Gunnison Tunnel holed through July 6. (Short.)

July 22, p. 107. Gunnison Tunnel headings met accurately. (Short item with data.)

Sept. 30, p. 353. Failure of Bluewater (Zuni) Dam, N. M. G. G. Anderson.

Sept. 30, p. 365. Gunnison Tunnel opened by President Taft, September 23. (Short.)

Oct. 7, p. 387. Letter of A. P. Davis on Zuni Dam failure.

Oct. 14, p. 411. Editorial on water supply situation in Imperial Valley and Laguna Dam.

Oct. 14, p. 420. I. W. McConnell, builder of Gunnison Tunnel, resigns. (Short.)

Oct. 21, p. 444. Golden Bell used at opening, Gunnison Tunnel. (Illus.)

Nov. 4, p. 500. Roosevelt Dam within 15 per cent of completion. (Short.)

Dec. 2, p. 597-600. Partial failure through undermining of Zuni Dam, N. M. Illus. (Long article.)

Vol. 63—January-June, 1910.

Mar. 10, p. 297. Colorado River silting, Imperial Valley Heading. (Short.)

Apr. 21, p. 474. Power development on the Salt River Project. (Short statement.)

June 16, p. 694-5. Evaporation records in Salton Sea (Long article with tables and data.) Weather bureau.

June 23, p. 713. Laguna Dam electrical equipment being installed. (Short.)

June 23, p. 739. Roosevelt cement plant to be auctioned off.

Vol. 64—July-December, 1910.

July 7, p. 28. Appropriation \$1,000,000 for Colorado River protective works by Congress. (Short.)

July 14, p. 59-60. Salt River W. U. Association will contract to build irrigation works. (Short.)

July 28, p. 112. J. A. Ockerson appointed by President to have charge of construction, Colorado River protective works. (Short.)

Oct. 6, p. 376. Death Valley water sign posts. (Short.)

Dec. 15, p. 670. Chester W. Smith, engineer on Roosevelt Dam, resigns.

Dec. 29, p. 703-6. Disposal of surplus water and power, Los Angeles aqueduct. (Illus.) By B. A. Heinly.

Dec. 29, p. 708. Dams, barrages and weirs on porous foundation. (Illus.) W. B. Bligh. (Granite Reef Dam.)

Dec. 29, p. 723-4. Editorial disposal surplus water and power, Los Angeles aqueduct. (Long.)

Vol. 65—January-June, 1911.

Jan. 26, p. 99. Colorado River break. (Large map—Mexico.)

Feb. 23, p. 243. Roosevelt Dam to be dedicated Mar. 18. (Short.)

Apr. 13, p. 444-5. Weirs on porous foundations. (Illus.) W. G. Bligh. Includes Indian weirs and Laguna Dam.

Vol. 66—July-December, 1911.

July 6, p. 4-9. Electric power for irrigation. Salt River project. (Illus.) O. H. Ensign and J. M. Gaylord (Roosevelt plant).

Oct. 26, p. 514. Utilization for irrigation of surplus water, Los Angeles aqueduct. J. B. Lippincott.

Nov. 23, p. 639. Yuma main canal begun. (Short.)

Dec. 7, p. 667-671. How United States has spent \$1,000,000 in ineffectual attempt to control lower Colorado. (Illus.) H. T. Cory.

Dec. 7, p. 671-3. Reply to Cory's article on repair and break in 1911. (Illus.) J. A. Ockerson.

Dec. 7, p. 687. Editorial on control of lower Colorado River, and what methods to employ.

- Dec. 14, p. 695-9. Colorado River silt problem and dredge "Imperial" and irrigation in Imperial Valley. (Illus.) F. C. Finkle.
- Dec. 14, p. 713. Editorial on dredge for Imperial Valley Canal.
- Vol. 67—January-June, 1912.
- Jan. 4, p. 20-21. Safe velocity of water on concrete. (Illus.) A. P. Davis. (Views of Uncompahgre and Strawberry Valley projects.)
- Jan. 4, p. 32. Alluvial soils of Colorado and Mississippi deltas. Letter of J. L. Campbell.
- Jan. 11, p. 74. Borrow pits for levee building. W. L. Marshall.
- Feb. 1, p. 214-15. Control of lower Colorado by levees. Dabney.
- Feb. 1, p. 215-16. Borrow pits for levees. Letters by several.
- Feb. 15, p. 308-10. Borrow pit practice. F. L. Sellew.
- Mar. 7, p. 429. Benefits of irrigation, Salt River. (Short.)
- Mar. 7, p. 450-53. Land-side vs. River-side borrow pits. W. L. Marshall.
- Apr. 11, p. 695-6. More about location borrow pits. F. L. Sellew.
- Apr. 25, p. 794-5. J. A. Ockerson bibliography, with portrait.
- May 16, p. 945. Yuma tunnel under Colorado holed through.
- Vol. 68—July-December, 1912.
- July 4, p. 29. Closing crevasses in levees. (Short letter by C. E. Mallard), Supt. Ariz. Eastern R. R.
- Aug. 29, p. 377-85. Colorado River siphon, Yuma, Ariz. (Illus.) F. L. Sellew. (Long article.)
- Aug. 29, p. 417. Road irrigation for dust prevention in Imperial Valley. (Short.)
- Vol. 69—January-June, 1913.
- Jan. 9, p. 66-70. Selling water by current meter measurement. (In Imperial Valley.) (Illus.) J. C. Allison.
- Jan. 9, p. 79. Editorial on selling water by current meters.
- Mar. 13, p. 506-10. Surplus waters of Los Angeles aqueduct. (With maps.) Burt A. Heiny.
- May 29, p. 1128-30. Engineers stage journey through Arizona and New Mexico in 1880, with map, by C. L. Annan.
- Vol. 70—July-December, 1913.
- July 3, p. 16-18. Flood destruction on the San Pedro Railway. (Map and Illus.) H. G. Tyrrell.
- July 3, p. 32. Editorial on Los Angeles aqueduct and debt problem.
- Aug. 21, p. 348-55. Cost irrigation projects in Colorado. J. E. Field.
- Nov. 20, p. 1021. Repairs to Imperial Valley irrigation system.
- Vol. 71—January-June, 1914.
- Jan. 1, pp. 6-12. Survey in the Sonora Desert. (Illus.) (Mexico.) Otto Lemberger. (Long interesting article.)
- Jan. 15, pp. 120-24. Federal vs. private irrigation. D. C. Henny. (Table of costs of irrigation, Grand Valley.)
- Jan. 15, p. 149. Moffat tunnel through Continental Divide.
- Apr. 23, p. 935. Floods threaten Imperial Valley. (Short.)
- Apr. 30, p. 986-7. Los Angeles power bond election. B. A. Heiny.
- Apr. 30, p. 993. Floods on lower Colorado. (Short.)
- May 14, p. 1102. Los Angeles bond election carried. (Short.)
- June 4, p. 1274-5. Failure of Hatchtown Dam Reservoir, Utah. Guy Sterling.
- Vol. 72—July-December, 1914.
- Sept. 3, p. 495-6. Irrigation operations of Imperial Water Company No. 1 for the year 1913.
- Oct. 22, p. 824-25. Suggested plan for the development of lower Colorado River. (Map and chart.) Walter D. Smith.
- Vol. 73—January-June, 1915.
- Feb. 11, p. 285. Guarding against Colorado River floods.
- Feb. 18, p. 344-6. Plan for municipal irrigation, Los Angeles.
- Feb. 18, p. 357. Colorado River control. (Acquire Mexican lands.)
- Mar. 11, p. 509. Imperial Irrigation District organization and bound issue.
- Mar. 11, 510. W. L. Marshall to supervise Imperial Valley protection.
- Mar. 18, p. 513-14. Dredging "sudd" on the River Nile. (Illus.) (Example for Colorado River.)
- Apr. 1, p. 651. Utilizing surplus waters, Los Angeles aqueduct.

- Apr. 15, p. 748-9. Control of Colorado River. (Volcano Lake levee.)
 Apr. 22, p. 794. Lyman Dam a failure on Little Colorado.
 Apr. 29, p. 823. Mud and silt in western rivers. (Short.)
 June 17, p. 1195. Flow of Colorado River sufficient to irrigate entire Colorado Delta. (Short.)
- Vol. 74—July-December, 1915.
 July 1, p. 46. Earthquake in Imperial Valley. (Short.)
 July 29, p. 234. Imperial Valley earthquake tests engineering works. (Illus.)
 Aug. 5, p. 275. Earthquake results in confidence in Imperial Valley. (Short editorial.)
 Oct. 28, p. 841. Hottest region in United States—Death Valley.
 Nov. 25, p. 1053-4. Irrigation by Los Angeles aqueduct water.
- Vol. 75—January-June, 1916.
 Jan. 27, p. 170-1. Solving Imperial Valley irrigation problem. (Long article.) Suggested annexation.
 Jan. 27, p. 197. Rain and flood conditions, Imperial Valley.
 Feb. 3, p. 246. Colorado River flood at Yuma.
 Feb. 24, p. 390. Imperial Irrigation Canal system sold. (Short.)
 Apr. 7, p. 272-3. Long-span steel arch bridge across Colorado at Topoc. (Illus.) (Correction, p. 817.)
 April 27, p. 792-3. Eight-plate girder spans over Gila River washed out by flood. (Illus.)
 Apr. 27, p. 808. Backfilling washout, Grand Canal, Salt River.
 May 4, p. 832-3. Caliche roads; a new type of construction in Arizona. (Illus.)
 May 4, p. 853. Protecting survey monuments, Phoenix. (Illus.) J. B. Girand.
 May 11, p. 873-4. Bridge washouts in the desert, Gila flood.
 May 11, p. 912. Woodstave pipe table. (Includes Yuma project.)
 May 18, p. 931. Storm water drainage sinks at Phoenix. (Illus.)
 May 25, p. 974-5. Diversion dam failure, Salt River. (Illus.)
 May 25, p. 997-8. Location survey methods, Grand Valley canal.
 June 1, p. 1040-3. Erection "Old Trails" Bridge over Colorado.
 June 22, p. 1170-1. Building a new type dam in Colorado River. J. C. Allison.
- Vol. 76—July-December, 1916.
 Aug. 3, p. 200. Water evaporation studies by Weather Bureau. (Illus.) B. C. Kadell and C. Abbe, Jr., (Roosevelt.)
 Aug. 3, p. 233. Cerro Prieto irrigation canal. (Imperial Valley.)
 Aug. 17, p. 297. Earth road maintenance, Imperial Valley. (Short account of soils.) C. N. Perry.
 Aug. 17, p. 306. Surveying dam sites in the Grand Canyon. (Illus.) Views of Diamond Creek dam site. (Correction p. 371, Aug. 24, 1916.)
 Aug. 17, p. 333. Work on the Imperial Valley canals. (Short.)
 Sept. 7, p. 435. Melted snow supplies water to arid district. Coconino Co., Ariz. (With map.)
 Sept. 28, p. 622. Temporary rock fill dam on the Colorado River.
- Vol. 77—January-March, 1917.
 Jan. 11, p. 60. Government railroad in Yuma Valley. (Short.)
 Jan. 18, p. 124. New Imperial Canal intake gate.
 Jan. 18, p. 126. Charles R. Rockwood retired as chief engineer.
 Feb. 1, p. 213. Colorado River intake to cost \$268,000. (Short.)
 Feb. 8, p. 253. Colorado River intake contract \$232,000. (Short.)
 Mar. 29, p. 504. Rainfall data, Yuma and other points. Map. James P. Wells.
 Mar. 29, p. 524. Mechanical ditching a failure, Imperial Valley. (Illus.)
- Vol. 75—Engineering Record—January-March, 1917.
 Jan. 13, p. 64-6. Oiled road through Mohave Desert, \$950 per mile.
 Jan. 20, p. 124. Imperial Irrigation Works may be put under Federal Control. Report by Elwood Mead. (Short.)
 Jan. 27, p. 162. Imperial Irrigation District considers \$2,500,000 bond issue. (Short.)
 Feb. 24, p. 326. Salt River irrigation work is declared completed.
 Mar. 10, p. 407. Dam the Colorado River in Grand Canyon.

- Mar. 17, p. 432. Intake gate designed to "skim" Colorado River water, Rockwood gates, Imperial Valley.
- Mar. 24, p. 470. Story of Imperial Valley told in moving pictures. (Winning of Barbara Worth.)
- Vol. 78—March-June, 1917, *Engineering News-Record*.
- Apr. 26, p. 227. All-American Canal to Imperial Valley not feasible? Report by Dr. Mead and others.
- May 3, p. 267. Cost of dredging ditches in Imperial Valley.
- June 14, p. 571. Danger for Colorado River levees predicted.
- Vol. 79—July-December, 1917.
- July 5, p. 1. Mammoth Reservoir, Utah. (Editorial.)
- July 5, p. 42. Mammoth Dam, Utah, failure. (Comment, p. 49.)
- July 12, p. 52-56. Mammoth Dam failure. (Illus.) H. S. Kleinschmitt.
- July 19, p. 141. Imperial Valley levee breaks, damage slight.
- Aug. 2, p. 235. Laguna Dam to irrigate 200,000 acres more. (Short.)
- Aug. 16, p. 325. Harriman and the Colorado River break. (Review of book, Salton Sea, by Geo. Kennan.)
- Sept. 6, p. 475. All-American Canal surveys. (Short.)
- Nov. 22, p. 990. Imperial Valley levees raising urged. (Short.)
- Nov. 29, p. 1010. All-American Canal to Imperial Valley. (Short.)
- Dec. 6, p. 1081. Volcano Lake levee to be raised. (Short.)
- Dec. 20, p. 1176. Imperial Valley canal to connect with Laguna Dam.
- Dec. 27, p. 1220. Salt River project turned over to water users. (Short news item.)
- Vol. 80—January-June, 1918.
- Jan. 24, p. 188. Imperial-Laguna Dam Canal, estimate of cost.
- Mar. 7, p. 482. San Diego and Arizona Railroad construction rushed.
- May 9, p. 928. Imperial Valley- Laguna Dam contract drawn.
- May 23, p. 1016. Major Powell monument dedicated by Secretary Lane.
- Vol. 81—July-December, 1918.
- July 25, pp. 196-7. All-American Canal for Imperial Valley.
- Aug. 1, p. 237-8. Water company wins Imperial Valley seepage case.
- Aug. 1, p. 244. Irrigation statistics, Imperial Valley, 1913-1917.
- Aug. 8, p. 253. Imperial Valley seepage case. (Editorial.)
- Aug. 22, p. 364-5. Rock cribs blanket for Colorado River in California. (Illus.) (At Needles.)
- Aug. 22, pp. 365-6. Will complete San Diego and Arizona Railroad to Pacific Coast. (With map.)
- Aug. 29, p. 424. Floods damage Arizona Canal. (Short.)
- Aug. 29, p. 424. Progress on connection with Laguna Dam.
- Oct. 10, p. 686. Imperial Valley flood danger studied.
- Oct. 10, p. 690. Imperial-All-American Canal Association organized.
- Oct. 17, pp. 733-4. All-American Canal plan has setback.
- Oct. 24, p. 768. Imperial Valley-All-American Canal progress.
- Nov. 14, p. 915. Laguna Dam connection contract signed.
- Nov. 21, p. 953. Proposed Arizona water code. (Short.)
- Vol. 82—January-June, 1919.
- Jan. 16, p. 167. C. N. Perry, acting chief engineer, Imperial Irrigation District.
- Feb. 13, pp. 315-6. Commission to study the Colorado and save Imperial Valley. (Editorial.)
- Feb. 20, pp. 401-2. Flood control survey on Colorado proposed.
- Mar. 6, p. 453. Controlling Colorado River floods. (Editorial.)
- Mar. 6, pp. 456-61. Colorado River flood control by storage. (Illus.) E. C. LaRue. (Maps and charts.)
- Apr. 3, p. 664. San Diego and Arizona Railroad heavy construction.
- Apr. 10, p. 739. Colorado River flood control by storage.
- May 22, pp. 1027-8. Arizona has new water code. G. E. P. Smith.
- June 26, p. 1283. Imperial Valley active on All-American Canal. Delegation to come to Washington.
- Vol. 83—July-December, 1919.
- July, 3, p. 44. Palo Verde Valley levee improved. (Short.)
- Oct. 2, p. 681. Imperial Valley votes on irrigation bond issue.
- Dec. 11-18, p. 1023. Water storage and water code of Arizona. Brief notice of bulletin by G. E. P. Smith.
- Dec. 11-18, p. 1083. San Diego and Arizona Railroad open.

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- Mar. 18, p. 502. All-American Canal report, brief notice.
 May 6, p. 933. League of Southwest considers Colorado River.
 June 17, p. 1023. Colorado River flood danger safely passed.

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- July 1, p. 27. Phoenix water supply from Verde River.
 July 15, p. 144. Imperial Irrigation District gate and gage. (Illus.)
 Invention of F. N. Cronholm.
 Aug. 5, p. 241. Imperial Valley an irrigation triumph. (Editorial.)
 Aug. 12, p. 336. R. W. Burchard surveys Boulder Canyon.
 Aug. 19, p. 380. San Diego hearings on Colorado River.
 Sept. 2, p. 465. Palo Verde Valley drainage and levees.
 Sept. 2, p. 477. Colorado River regulation. A. P. Davis' address.
 Sept. 23, p. 626. All-American Canal survey begun. (Cost \$60,000.)
 Oct. 7, p. 721. Imperial Valley problem solution, by J. C. Allison.
 Notice of address on Volcano Lake.
 Oct. 14, p. 771. J. C. Allison on new Colorado River plan. (Short.)
 Dec. 30, p. 1301. Imperial Valley preliminary report. Dewey and
 Boulder reservoirs. (Short.)

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- Jan. 13, p. 93. Lees Ferry power application received.
 Jan. 27, p. 157–206. Interstate water. R. I. Meeker. (Transmountain
 diversions.)
 Feb. 24, p. 334–5. Imperial Valley New River bridge fails. (Illus.)
 May 5, p. 735–59. Interstate water conflicts. Discussion. A. S. C. E.
 Grunsky, Weymouth, Field, Henny, Lippincott.
 May 19, p. 862. Colorado River problems being studied actively.
 July 23, p. 1093. Colorado floods again threaten Imperial Valley.
 July 23, p. 1096. Colorado River compact proposed in Congress.
 July 23, p. 1096. Colorado River power project, Diamond Creek surveys.

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- July 14, p. 81. Grand River name changed to Colorado by Congress.
 July 21, p. 94–5. State compacts for settlement interstate waters.
 A. L. Fellows.
 Sept. 29, p. 537–8. Epes Randolph and Colorado River. (Letter.)
 Oct. 13, p. 617. Reclamation Service reports Boulder Dam.
 Nov. 10, p. 791. Colorado River hearing planned at San Diego.
 Dec. 15, p. 968. Wyoming-Colorado case to be reargued in court.
 Dec. 15, p. 1001. Colorado River power discussed at Riverside, Calif.
 Dec. 29, p. 1076. Herbert Hoover appointed chairman, Colorado River
 Commission.

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- Jan. 5, p. 37. J. B. Lippincott gives address on Colorado River.
 Feb. 2, p. 184. Colorado River Dam plan proposed. A. P. Davis.
 Feb. 2, p. 209. Colorado River conference at Washington. (Short.)
 Feb. 9, p. 255–6. Colorado River conference. Hoover, Davis and Merrill.
 Mar. 2, p. 375–6. R. B. Stanton. Obituary and account of trips, Colo-
 rado River.
 Mar. 9, p. 422. A. P. Davis on flood problems, power and irrigation.
 Mar. 23, p. 506. Hoover favors construction of Boulder Canyon Dam.
 Mar. 23, p. 507. C. R. Rockwood, father of Imperial Valley. Obituary.
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 Nov. 21, p. 820. "Down the World's Most Dangerous River" book review of Clyde Eddy's book.
 Nov. 21, p. 824. "Suspended Matter on Colorado" U. S. G. S. C. S. Howard, note on W. S. paper No. 636-B.
 Nov. 28, p. 867-8. Colorado River power, Wilbur plan, and saving by installation.

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- Jan. 2, p. 39. Tri-state conference to reconvene. (Short.)
 Jan. 2, p. 40. Colorado-Kansas hearings on Arkansas River resumed. (Short.)
 Jan. 9, p. 53. Colorado River Aqueduct Board. Editorial. (Short.)
 Jan. 9, p. 56. Kaibab Trail bridge across Grand Canyon. Illus. Frank A. Kittridge.
 Jan. 9, p. 59. Metropolitan Aqueduct Board recommends against gravity route and requests further data.
 Jan. 9, p. 85. Secy. of Interior calls conference lower basin governors. Brief note.
 Jan. 16, p. 114. Conservation of water urged as California cities face shortage.
 Jan. 16, p. 124. Pasadena to buy So. Cal. Edison Plant, \$783,000. (Short.)
 Jan. 23, p. 132. Forty years of research into water resources. F. H. Newell. Illus. article.

- Jan. 23, p. 167. California members water resources commission appointed.
- Feb. 6, p. 211. Survey of engineering progress 1929-30. Editorial. Mention Colorado River project as outstanding. (Short.)
- Feb. 6, p. 213. Boulder Dam Act effective. Editorial. Short summation of price to be charged and action to be taken by Secretary.
- Feb. 6, p. 240. The Colorado River—Economic development of its basin. Dr. Elwood Mead. Illus. article.
- Feb. 6, p. 247. Controlling the Colorado. Raymond F. Walter, Eng. Plans and Construction, cuts and drawings—shows method of constructing Boulder Dam.
- Feb. 20, p. 307. Untimely wrangling—short editorial on California intrastate situation.
- Feb. 20, p. 321. Federal and state agencies dealing with water resources. W. S. Conant, analysis of functions tabulated.
- Feb. 20, p. 343. Colorado River, Washington situation reviewed—unsettled water allocations and salt conditions mentioned. (Short.)
- Feb. 27, p. 377. Coolidge Dam cracks found not serious. (Short.)
- Feb. 27, p. 381. Brief notice on progress Boulder Dam surveys and plans.
- Mar. 27, p. 508. "When Water Dictates." Editorial comment on California problem.
- Mar. 27, p. 540. Los Angeles hearing before R. R. Comm. relative to condemning water rights. (Short.)
- Mar. 27, p. 541. Boulder Dam progress and comment on ban lifted on Colorado River power development. (Short.)
- April 17, p. 669. Boulder Dam contracts being negotiated for sale of power to municipalities and Colorado River Board meet. (Short note.)
- Apr. 24, p. 701. Boulder Dam increased height of 25 ft. advised by board. (Short.)
- May 1, p. 723. Colorado River Aqueduct (L. A.). Brief review of two papers by F. E. Weymouth and E. A. Bayley at Sacramento meeting A. S. C. E.
- May 1, p. 737. Contracts signed for Boulder Dam Power April 26. Brief statement of allocation and comment on Arizona probable attitude.
- May 8, p. 781. Initial appropriation of \$10,660,000 for Boulder Dam approved by Budget Bureau—gives items and power contract data.
- May 15, p. 821. Arizona organizes to fight Boulder Dam. Short leading article, gives names of delegation sent to Washington.
- May 15, p. 826. New Power Commission set up on independent basis advocated by Secys. Wilbur and Hyde. (Short Washington notice.)
- May 22, p. 866. Colorado water for Los Angeles. Article gives present status. L. A. Aqueduct.
- May 22, p. 833. Obstructing a great work. Article criticizing Arizona stand on Colorado.
- May 22, p. 833. Washington item regarding appropriation committee hearings on Boulder Dam.
- June 5, p. 945. Item regarding change in Boulder Dam power contracts. (Short.)
- June 12, p. 989. Reorganization bill, Federal Power Commission, passed House June 9, Senate having passed similar bill.
- June 12, p. 984. Boulder Dam contract approved by U. S. Attorney General June 9—short review of opinion.
- June 19, p. 1028. Arizona protests, a letter to editor signed by various men protesting against article "Obstructing a Great Work."
- June 26, p. 1066. Why Boulder Dam height was increased—better utilization of stream and more economical development.
- June 26, p. 1069. Injunction to block Boulder Dam sought by Fred T. Coulter of Arizona, June 24. (Short.)
- June 26, p. 1069. President signs new Federal Power Commission Bill.
- June 26, p. 1072. Filibuster on bill making appropriation for Boulder Dam threatened by Arizona. (Short.)

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