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Irrigation of
Twelve Million Acres
in the
Valley of California

Col. Robert Bradford Marshall

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IN the presentation of these plans no thought is entertained of moving water from one drainage basin to another unless and until sufficient water has been developed to meet the full irrigation requirements of the first drainage basin.

No water user will be given less than he is now entitled to nor asked to pay for the cost of construction except in proportion to the amount of additional benefit he receives.

What is primarily desired is an immediate complete survey by the State of all possible reservoir sites, a determination of the maximum amount of water development practicable, then the necessary legislation to put it into effect.

The situation demands the combined thoughts and efforts of the entire State.

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COL. R. B. MARSHALL

Who He Is and What He Has Done

COL. ROBERT BRADFORD MARSHALL has been connected with the United States Geological Survey since December 1st, 1889. He started as a field assistant in Colorado, becoming assistant topographer a few months later and topographer in 1890.

In 1891 he came to California, surveying continuously here from that year until 1902 when he was given administrative charge of all work in California and Reclamation Service detail surveys at Yuma, Arizona.

In 1903 he was given administrative charge of all topographic work in California and in 1904 these duties were extended to California and Oregon.

In 1905 he was given the title of Geographer with administrative charge of all work in California, Oregon and Nevada. In 1907 he was appointed Geographer in Charge of Pacific Division embracing the States of California, Oregon, Washington, Idaho, Utah, Arizona and Nevada.

In 1908 he was appointed Chief Geographer, in charge of the Topographic Branch with administrative charge of the entire United States which position he held until the Fall of 1919.

He has driven with mule teams and buck-board all over the State of California long years before either the high-ways or the automobiles were thought of. For eleven years straight he was personally out on the front line, helping gather the data that today places him in a position to speak with authority.

Men who have worked and traveled with him through the mountains and the valleys of California say:

"We who know 'Bob' Marshall know that he knows California, every inch of it, better than any of us!"

Back in those early days Col. Marshall wondered why they didn't irrigate in Northern California as they were doing in Colorado, where he had surveyed the year before. And he then as a young man dreamed that dream of EMPIRE BUILDING that every man of vision at one time or another has dreamed when he views California's millions of acres parched and burning in the Summer and her millions of acre feet of water pouring into the Pacific in the winter.

Col. Marshall climbed to the very top of his profession. No year passed that did not see him progress. At the age of forty-one he was Chief Geographer directing the work of over a thousand men. But back in his mind **always** there remained the ambition to some day be able to submit to the people of California definite, positive knowledge that the complete irrigation of the twelve million or more acres of land lying within the Sacramento and the San Joaquin Valleys was practicable from an engineering stand-point.

Thus for years he has directed the expenditures of the United States Government in its Geological Surveys of the State of California with the view of getting for the people this precise data that was needed before the problem could be viewed from a State-wide stand-point. He has watched the measurement of the streams that he might know the amount of water available. And each elevation, whether determined in the north or south or the east or the west has all been gradually put together with one well defined purpose in view.

Men who have known Col. Marshall and worked with him say that he was never known yet to suggest putting a plan of construction into effect until he knew it to be practicable. He wants his facts before he makes recommendations. It is this in-born conservatism that enabled the man to work for twenty-five years to perfect a plan before making it public. During his last year at Washington he devoted almost his entire time and that of many of the government employees to gathering together in graphic form the results of these years of surveying over all parts of the State.

Maps of the entire State were made showing in detail the course of the proposed canals and the locations of the reservoir sites and much other important data made ready.

In the Fall of 1919 Col. Marshall announced to the press that he had this material ready. Nearly every newspaper in the State commented favorably upon the subject or reviewed it from a news stand-point. But very few people took the trouble to go into the matter seriously and study his report and maps in detail.

Col. Marshall is not a man of large wealth. He has not the funds to inaugurate an extensive publicity campaign even if it was his nature to do so. He has a large ranch near Patterson, Calif., that he has been wanting to give personal attention for some years, so he went down to the ranch, put on overalls and went to work. He asks no financial reward from the State for the result of his years of labor, and he knows that in time facts will demand recognition. He feels that he has the facts as Nature herself has written them.

That the reader may better appreciate the man and his work, some of the more important Special Assignments with which he has been identified are listed below:

THE FOLLOWING IS A PART OF COL. MARSHALL'S PERSONNEL RECORD IN THE GOVERNMENT SERVICE

- 1903 Established and had charge of office of Geological Survey in U. S. Post Office Building, Sacramento, California; (had charge of establishing and the inauguration of cooperation (topographic surveys) with State of California).
- 1904 June 14, appointed a member of the Yosemite National Park Commission, created by Secretary of the Interior for the purpose of changing the boundary of the park as authorized by Congress in a provision of the Sundry Civil Bill of April 28, 1904. Report of commission submitted August 31, 1904, duties terminated.
- 1906 April 18, appointed by Relief Committee of Sacramento, California, for San Francisco earthquake and fire sufferers to take charge of \$100,000 cash fund with which to purchase supplies and take same to San Francisco by river steamboat. Delivered supplies and crew for distributing them to Captain Wm. W. Harts, now Brigadier General, Corps of Engineers, at Presidio wharf in San Francisco, April 20, at 9 A. M. Had all Geological Survey property in California, of which he had charge, sent to Sacramento, then \$1600 worth of camp equipment was delivered to Governor Pardee of California for use by Committee; then telegraphed Director Walcott, Geological Survey at Washington, D. C., what had been done. Action taken was approved.
- 1907 Chairman of committee on reorganization of Topographic Branch, Spring of 1907.
- 1908 March 18, appointed a member of Personnel Committee; on December 12, 1910, made acting chairman of committee, and on December 2, 1911, made chairman of reorganized Personnel Committee; assignment retained to December 10, 1915, when appointed Superintendent of National Parks.
- 1909 October, visited Hawaiian Islands and inaugurated topographic surveys in cooperation with Territorial Government. Appointed Chief Geographer of Territory of Hawaii, October, 1909.
- 1910 October 14, appointed a member of the Sub-Committee on Surveying, Map Making and graphic Reproduction of the Departmental Committee on Efficiency and Economy; December 30, designated temporary acting chairman of sub-committee (vice A. P. Davis, chairman, then absent from the country), and on Jan. 5, 1911, elected by sub-committee as acting chairman during the absence of Mr. Davis, who did not again serve. April 29, 1911, report of sub-committee submitted by acting chairman, and duties of members suspended.
- December 13, appointed Chairman of Committee on One-Millionth-Scale Map; assignment retained to Dec. 10, 1915, when appointed Superintendent of National Parks.

- 1911 July 19, designated delegate to Tenth International Congress of Geography to be held at Rome, Italy; October 15-22, 1911, and on August 25, 1911, designated by Secretary of State as head of the American delegation to that Congress; Congress postponed until Spring of 1912. (Finally postponed indefinitely).
- September, member of conference in Yellowstone National Park, Wyo., to consider national parks; gave paper on general administration of national parks, their needs, etc.
- 1912 Selected by Hon. W. L. Fisher, Secretary of the Interior, to report on advisability of creating a national park in vicinity of Estes Park, Colorado, 1912. Made report January 9, 1913. Based upon this report the Rocky Mt. National Park was created in 1915.
- October, member of conference in Yosemite Park, California, to consider national parks. Gave address on general conditions regarding advisability of admitting automobiles to park.
- 1914 Member of Inter-Departmental Committee on Senator Newland's River Regulation Bill, committee making report January 10, 1914, and March 30, 1914.
- 1915 January 29, appointed by President Woodrow Wilson member of U. S. Geographic Board, a representative of the Interior Department on the Board (1918 appointed by the board a member of the executive committee).
December 10, appointed Superintendent of National Parks. Resigned Dec. 31, 1916. (During incumbency of Superintendent of National Parks retained office of Chief Geographer).
- 1917 February 16, commissioned Major in Engineer Officers' Reserve Corps, U. S. A. June 18, ordered into active service by Special Order No. 140, War Department. Received order on and started to comply with same June 22, reporting by letter to the Director, U. S. Geological Survey, Washington, D. C., for duty in connection with military mapping then being done for the War Department.
- June 22, Survey Order—Military Surveys.
"Major R. B. Marshall, as Chief Geographer in charge of the Topographic Branch, is instructed to continue general supervision of the topographic surveys now being made for the War Department. His station will be at Washington, D. C."
- 1918 August 1 Special Order No. 179, Extract 178.
"The appointment of Major Robert B. Marshall, Engineer Reserve Corps, to the grade of Lieut. Colonel, Engineers, National Army, with rank from July 25, 1918, is announced. By order of Secretary of War, Peyton C. March, General Chief of Staff. Official: H. P. McCain, the Adjutant General."
- October 15, 1918.
- Honorably discharged as Lieut. Col., Engineers, March 31, 1919, and reappointed Chief Geographer in the U. S. Geological Survey, April 1, 1919.
- Member of:
- American Society of Civil Engineers, May 4, 1904.
 - Sierra Club of California, 1906.
 - Geological Society of Washington, D. C., February 12, 1908.
 - Cosmos Club of Washington, D. C., May 11, 1908.
 - Washington, Society of Engineers, December 12, 1908.
 - National Geographic Society, 1909.
 - Canadian Camp Club, Spring of 1911.
 - Association of American Geographers, 1913.
 - Luther Burbank Society, 1913.
 - Honorary member, Colorado Mountain Club, 1913.
 - Advisory Committee of Colorado Geographic Society, 1914.

California's Greatest Opportunity

Reclaiming An Empire--The Valley of California

Making Homes for 3,000,000 People

Increasing the Present Value More Than \$6,000,000,000

By COL. R. B. MARSHALL

INTRODUCTION

I desire to set before you some facts regarding the development of the resources of California that to me seem to need immediate attention. The Power and the wealth of California lie in its agricultural lands. These lands are the foundation on which everything else must stand, and California possesses a richer stock of this fundamental resource than any other State or similar area in the United States, if not in the world, and yet a large part of the resource lies dormant. We know it lies there unused, yet we calmly look on and do nothing to bring it into use. California's potential wealth in land reaches into billions of dollars; 12,000,000 acres lie all around us bristling with invitations to help ourselves, yet there they remain practically untouched.

The people of California, indifferent to the bountiful gifts that Nature has given them, sit idly by waiting for rain, indefinitely postponing irrigation, and allowing every year millions and millions of dollars in water to pour unused into the sea, when there are hungry thousands in this and in other countries pleading for food and when San Francisco and the Bay Cities, the metropolitan district of California, are begging for water.

Is it indifference or unreasonable procrastination that makes the people of California neglect this wealth, or do they not know what they have or how to use it? At any rate there, in the Valley of California—in the Sacramento and San Joaquin valleys combined—in one immense tract, lies the largest, richest, and most fertile body of indifferently used or unused land in the United States—perhaps in the world—an empire the value of whose products, when once it is reclaimed and producing fair returns, will exceed that of all the present products of California, increase the taxable value of the land by billions, and treble its population. In its climate, its fertility, and its fitness for healthful human use the land in the Valley of California can not be surpassed anywhere on the globe, and yet to-day probably not 20 per cent of that land is fully improved, so that it is producing scarcely more than one-fifth of what it can produce if the people would only use that which Nature has given them; and the remaining 80 per cent is used indifferently—millions of acres are not used at all. California needs more population, and the present population needs more water, and both may be had by means of one of the most clearly defined engineering projects ever proposed and at a cost commensurately so low that rapid and permanent settlement would surely follow.

Some engineers have said that the reclamation of this Valley of California and adjacent parts of the State by one great coordinated project is impracticable, but I propose to show that the possibility of reclaiming it by engineering is its greatest asset. It is a large undertaking, but this is a day of large undertakings, and although it is a comprehensive, State-wide job its immediate practicability and success depend only upon the successive building of its various parts to form a consistent whole, each part so arranged as to yield instant returns on a proportionate fair first cost—each practically self-supporting. The project has been thought impossible of execution because of legal difficulties, but the present laws pave the way for the removal of all obstacles.

For some twenty-five years I have surveyed and topographically mapped areas in California. During most of that time I have had administrative charge of the State Co-operative Survey and in this connection have traveled all over the State, with the ever-present thought of the wonderful possibilities involved in the reclamation of its millions of unused acres. The unusual opportunities thus afforded me for observing

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the field conditions throughout the entire State, together with my familiarity with existing maps and their interpretation, now enables me to assemble in graphic and concrete form the results of twenty-five years' study; without the detailed map of the Valley of California made by the U. S. Geological Survey in cooperation with the State the study could not be made. I have traveled on the Sacramento River with some of the commissions that made reports; I have read the interesting statements of able engineers that it is not feasible to take the waters from the Sacramento Valley into the San Joaquin Valley, but notwithstanding all the authorities I say it is entirely feasible. It is not only feasible but necessary. It must be done and it will be done. I desire therefore to give you the benefit of my thirty years' training and experience in the U. S. Geological Survey, during which I have seen most of the United States and have noted its development, to tell you briefly of my observations, and to suggest a general outline for a plan that will help make the Valley of California the world's greatest garden. The plan is a large one, larger by many times than the entire program of the U. S. Reclamation Service for the 16 public-land States, but it is in keeping with the State, for small ideas have no place in California.

GENERAL STATEMENT

There are approximately 12,000,000 acres of level land in the Sacramento, San Joaquin, Santa Clara, Livermore, and Concord Valleys, and more than enough water annually passes through the Sacramento and San Joaquin rivers into the sea unused. lost forever, to put water 3 feet deep on each of these 12,000,000 acres. Who will dispute that, taken as a whole, each of the 12,000,000 acres is not worth an expenditure of at least \$50, yes even \$100, to place it under permanent water control? Who will dispute that the value of each acre thus put under permanent water control will not be increased over its present value at least \$500 per acre? This would mean an increased State valuation of \$6,000,000,000.

Los Angeles, San Francisco and the Bay Cities need water and no doubt would be glad to spend their proportionate share of the cost of State-wide development when shown that they will participate in the benefits.

The engineering plans for such a project must be comprehensive, for their execution must not only assure the complete reclamation of 12,000,000 acres of valley lands but must also effectively and forever control the river floods and insure safe and continuous river navigation throughout the year. The hydro-electric current generated along most of the streams would furnish all the power necessary for construction as well as supply more power than would be needed for use on electric railroads, in municipal lighting, for manufacturing, and for domestic use in the new homes as they were established, and the sale of this power at fair rates would be a big revenue producer as noted below under "The Cost."

Consider also that our west coast, particularly that of California, needs protection, and that there can be no better propoganda for patriotism than to place owned homes in the hands of present and prospective citizens, for it is well known and recognized the world over (as has been lately and so truly exemplified in France and elsewhere) that every man will defend to the death his tract of land, his home, his castle. Place 3,000,000 more in happy country homes in the Valley of California, and she will forever defend herself from invasion.

My solution of the whole problem is to turn the Sacramento River into the San Joaquin Valley, a feat which is now shown to be practicable as an engineering enterprise that is possible of execution within ten years and that would justify a cost, if necessary, of \$750,000,000, be safe for the investor, present no legal obstructions, and provide for the present as well as the prospective land owner the most attractive proposition ever offered in the State. Remember, however, that the plan is a big, State-wide plan and also remember that success, as California measures success, is assured only when the enterprise is planned and carried out in its entirety.

With the above assurances it at once becomes a necessity, with "Now" as the psychologic moment, NOW when we need work and big work to keep our people employed, and especially NOW when so many soldiers not only need the work but are seeking such new homes as can here be offered for a minimum of first cost and a maximum of yield, and all to be had in a climate and in an environment that defy comparison.

OUTLINE OF THE MAIN PROPOSITION

From a high dam to be built across the Sacramento River near Red Bluff water will be carried in large canals down each side of the Sacramento Valley and thence up each side of the San Joaquin Valley. These main canals will operate by gravity, siphons, or pumps, or through tunnels as may be necessary or expedient. On the main West Side Canal opposite San Francisco a large supply will be diverted for the use of the "San Francisco and Bay Cities unit," as briefly outlined under that heading below. The main East Side Canal will be twice dropped and twice again started at new and higher levels on the east side of the San Joaquin Valley as shown on Map A. Separate in construction and operation from the two Valley of California systems as above referred to, but necessarily cooperative in a State-wide sense, is a third system, outlined below under the heading "Los Angeles unit." This system must always be dependent upon the Kern River, which will be diverted through a long tunnel for use in southern California. To offset the diversion of the Kern River waters from the San Joaquin Valley the Klamath River will be diverted below Klamath Falls and carried into the upper Sacramento River near Shasta Springs. Above all these grand canals the tributary streams will be drawn upon through reservoirs, to be built along their courses, and further flexibility of the total flow will be provided by additional storage below the canals. All these systems are briefly explained under appropriate headings below.

ENGINEERING, CONSTRUCTION, AND LABOR

The U. S. Geological Survey, in cooperation with the State of California, has now topographically surveyed and mapped (primarily for study and use in reclaiming the Valley of California) the entire Sacramento Valley and the San Joaquin Valley as far south as Merced; it has also, cooperatively, gaged streams, made profiles, and surveyed the larger reservoir sites along the principal streams in the State. Prior to this cooperative survey the U. S. Geological Survey had mapped practically all the area draining into the Valley of California and the San Francisco and Bay Cities section, as well as southern California. **Thus we have all the field data necessary to begin this work and could start construction tomorrow.** A study of these complete maps now available will convince the layman, the farmer, the land owner, and, I hope, any progressive engineer that the proposed plan of reclamation presents no serious obstacle, for it is only a Big Job.

The undertaking would give employment to thousands of men, including soldiers, would make homes for them, and would be a strong factor in keeping labor so constantly employed as to leave little time or tolerance for the agitator. It would also give employment to thousands of home seekers, who, either having chosen their land or needing the opportunity to inspect it, would be awaiting the delivery of the water.

The outlines of the various units as described below or as graphically shown on the exhibits call for some big engineering, is true, but these are days of ever-increasing needs for bigger engineering and likewise for successfully accomplished results; and if California should now construct some engineering works larger than any ever heretofore constructed it will only be because the world before never had the need that California has to-day. So with the ever-advancing progress in labor-saving machinery and a job big enough to develop it to the fullest, confidence is doubly assured, for the largest of the engineering features proposed are so well within the factors of safety or possible construction that we need only consider the cost.

RIVER CONTROL AND NAVIGATION

Although the control of the Sacramento River for navigation is vested in the War Department, and Congress has appropriated money for its improvement, the State has already expended nearly an equal amount for the single purpose of maintaining it as a navigable stream. But the withdrawal of water for irrigation already almost preempts the supply necessary for summer navigation, and the further the land development proceeds the greater the need will become for more water upon which to transport the rapidly growing commerce of the valley.

I do not know how many millions of dollars have been spent in trying to control the flood waters of the Sacramento and San Joaquin rivers, and I doubt if anyone knows how much damage to property these river floods have caused. I do know, however, that as long as the present piecemeal attempts to control the river floods

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by the foolish levee policy continue, the damage to property, the waste of millions of dollars' worth of water, and the failure to profit by the vast quantity of products that could be obtained from the lands now unused will also continue. From the tower of the Post Office in Sacramento I have looked westward over an open sea about 12 miles across, filling the Yolo Basin nearly to Davisville, at a time when Sacramento was on a depressed peninsula protected by levees—a condition dangerous to both health and property. The levees have been a source of trouble no less than the hydraulic mining debris in making low water in the Sacramento River at Sacramento today higher than high water in 1850. I also know that it is not possible to maintain secure river navigation in the Sacramento and San Joaquin valleys under this present picayune attempt to control the flood waters by levees and dredges.

By means of the storage provided by the reclamation scheme we would not only provide forever for the upper river navigation, but we would make the "Benicia deep-sea harbor" and also the "Suisun Bay harbor" for river boats, straighten the river channel and levee it, and then partly divert the river into Suisun Bay for silt deposit and obtain further filling by suction dredge from Suisun harbor into Suisun Bay, thus at once reclaiming both the Suisun marsh and Suisun Bay, for after the Grand Canal is in full operation there will be practically no silt brought to Suisun harbor. In this connection we should also construct the sorely needed Port Costa railroad drawbridge and the much needed Army Point highway bridge (lock and draw).

THE COST

We used to think in thousands of dollars, then in millions, but now we can think and are thinking in billions. Thirty years ago the cost of the Panama Canal would have frightened the entire United States. Now we have it, and no doubt it is worth to us and the world many times more than the \$500,000,000 it cost. Twenty years ago a bond issue in California for \$18,000,000 for good roads would have staggered the people and been voted down, 20 to 1. Now we see the absolute necessity for State highways and will continue to build them at any cost up to a hundred million or more. Therefore, why haggle at an expense of even \$1,000,000,000 when we know that the reclaimed land will within 20 years produce, with the use of the water provided, many times more than the cost.

The amount estimated as possibly necessary for the reclamation work will, it is proposed, be raised through a State-authorized bond issue. The interest on these bonds will be more than met by the revenue produced by the sale of the hydro-electric current to be generated as construction proceeds and sold as fast as available, and a surplus will be created for maintenance, depreciation, etc., leaving the users of water to pay by the purchase of water from the State the cost of construction over a period of say fifty years.

Therefore, this scheme of reclaiming the Valley of California does not call for the expenditure of one penny from the State or National treasury. All the general public will be called on to do is to give their endorsement to the bonds, which will be secured by the land, thus placing on the market bonds as good and as safe as Government bonds. The water users, whether land-owners or municipalities, will pay the entire cost of the construction. Everything done under the plan would be an affair of community interest; all rates for water, electric railroad rates, navigation routes and rates would be controlled by a board of directors to be elected by the water users' association. Under this plan the bonds would be much sought after by the land-owning water users, and this would inspire them to expedite the creation of the district and the completion of the work.

VALLEY OF CALIFORNIA UNIT

(Map A)

We would start the general plan by constructing in the Sierra Mountains reservoirs and building a high dam across the upper Sacramento River in Iron Canyon, near Red Bluff, and also building a low dam against the ridge west of Iron Canyon, the tops of the dams reaching an elevation above sea level of at least 420 feet, and from this initial point the main development would begin by way of two grand canals, one down each side of the Sacramento Valley.

All along and below these grand canals, in places where there are ample reservoir sites, flood water would be stored in foothill reservoirs, to be released for irrigation early in spring and in low-water periods in August, September, and October. All reservoir sites on any of the streams before they reach the grand canals encircling the Valley of California would also be utilized. For additional flow in exchange for the Kern River, which is to be diverted to southern California, we would divert the Klamath River at an elevation of 4,000 feet after it leaves the lower marsh lands in the vicinity of Klamath Falls and approximately 16 miles above its narrow canyon (below which it goes into the ocean unused), take it through tunnels and by canal 40 miles over Shasta Pass near Upton at an elevation of 3792 feet and drop it 1250 feet into the Sacramento River near Shasta Springs developing 375,000 horse power and adding over 2,000,000 acre-feet to the water supply of the Valley of California.

East Side: Leaving Iron Canyon at about 350 feet above sea the East Side Grand Canal would flow southeastward along the grade (approximately 6 inches to the mile) necessary to handle the large volume of water needed, picking up the waters from each tributary river or stream as it was reached and continuing along the edge of the foothills far east of Marysville, Sacramento and Stockton, to a point near the crossing of the San Joaquin River, where the first section of the canal would end. In order to obtain a higher gradient for the irrigation of the rest of the San Joaquin Valley a second section of the East Side Grand Canal would start from a diversion dam on the Stanislaus River at an elevation of about 400 feet and be carried high above and east of Fresno to a point in the valley above Tulare Lake and there dropped. A third section would start from an elevation of about 1,000 feet on the San Joaquin River and flow southward past Bakersfield, around the south end of the San Joaquin Valley, and down the west side past Coalinga to a point near Dos Palos.

West Side: Leaving Iron Canyon at an elevation of at least 400 feet above the sea the West Side Grand Canal would flow southward along the west side foothills through Creston Pass and deliver water at Benicia at an elevation of about 300 feet, where an inverted siphon would carry it across Benicia harbor, to a point from which the West Side Grand Canal would be carried through Martinez tunnel, into and around the Concord Valley, and into and up the west side of the San Joaquin Valley to its end near Dos Palos.

For the construction of the Benicia siphon and the Martinez tunnel the Southampton power plant (Map B) will be installed, power from which may be used elsewhere when needed.

SAN FRANCISCO AND BAY CITIES UNIT

(Map B)

If any further ample water supply is to be had for San Francisco and the Bay Cities it must be taken from the Sacramento River, and it is therefore planned to tap the West Side Grand Canal at two points—first at the south end of the Martinez tunnel and again near Walnut Creek, where the canal crosses over the Ramon Valley. At the latter place water will be pumped 200 feet to an elevation of about 490 feet in Amador Pass, from which there is a double diversion—(1) eastward into the Livermore Valley, the canal passing both Livermore and Pleasanton and, after flooding the large Sunol reservoir, at an elevation of about 300 feet going down Niles Canyon to near Niles; and (2) westward through San Ramon tunnel to the proposed Haywards power plant.

San Francisco proper would then be served direct by means of a pipe line carried across the bay on the Dumbarton dam and the railroad and wagon bridge between Niles and Redwood; and the supply at Niles would be further augmented by a partial or total diversion southeastward from the Haywards power plant. The Dumbarton dam would also offer the means of reclaiming the large south arm of San Francisco Bay and marsh. The Santa Clara Valley would be supplied by diversion southward from Niles and around the entire valley and northwestward to a point near Palo Alto.

Oakland, Berkeley, Alameda, and Richmond would obtain their water either from the Martinez tunnel and a string of tunnels, canals, and reservoirs flowing into the Richmond reservoir at an elevation of about 300 feet or from the Haywards power

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plant and thence through Lake Chabot. This double source of supply for the Oakland section obviously suggests the utilization of water stored in Lake Chabot as a possible further auxiliary supply for San Francisco, thus making absolutely sure the future supply for all the Bay Cities.

The three power plants at Southampton (drop 300 feet), Grayson Creek in Concord Valley (drop 200 feet), and Haywards (drop 265 feet), making a total drop of 765 feet, will develop more power than will be necessary to lift all the water needed for San Francisco and the Bay Cities and provide a permanent supply for the irrigation of the Livermore and Santa Clara Valley lands.

The properties of the Spring Valley Water Company and the other water companies now supplying the metropolitan district must be taken over by San Francisco and the Bay Cities and used in their entirety, and there should be no haggling over the purchase price. The water companies should not be allowed to embarrass the cities, and the cities must be entirely fair to the water companies. Let's handle the proposition in the big California way, considering the value to all concerned and the good of the State. Let's be perfectly frank in the matter and do not deceive anyone. For once at least let's eliminate politics.

LOS ANGELES UNIT

(Map C)

At a cost of \$25,000,000 Los Angeles has recently constructed a splendid 225-mile aqueduct from the Owens River valley, but this supply will not meet the phenomenal growth of Los Angeles for more than 50 years, even for the city and county alone, whereas there are now elsewhere in southern California fast-growing towns that need relief and much acreage that needs water to put it under fullest development. The only ample supply of water is the Kern River, which at a cost of \$50,000,000 would provide all the water southern California can reasonably get and perhaps would need for 150 years. Does southern California want approximately four times more water than is now carried in the present Los Angeles aqueduct? **If southern California does not join the large scheme at the beginning and Kern River water is once used in the Grand Canal system—a use which will affect the entire plan of construction—then southern California can not get the Kern River water in the future.**

The electric power now taken from the Kern River near Kernville to southern California would be continued until additional power could be furnished from plants on the South Fork and other rivers farther north. Thus the supply of both water and power to southern California can be increased to an ample amount without harming the San Joaquin Valley in the least, and the San Joaquin valley users of the Kern River water near Bakersfield cannot object if they are given an ample permanent supply of water from the Grand Canal.

We would construct a 300-foot dam across the Kern River near Kernville, below the junction with the South Fork, which would impound a lake approximately 40 square miles in area with a surface elevation of about 2,700 feet. This immense body of water would be taken by the long "Kern River tunnel" to the Mojave Desert, above Mojave, crossing about 700 feet under the present Los Angeles aqueduct near Cinco. The proposed new aqueduct would be carried eastward and southward to a point near Clearwater (reached by the Portal Ridge tunnel), where after a drop of about 300 feet it would intersect the present Los Angeles aqueduct at an approximate elevation of 2100 feet, at a total distance of 90 miles from the Kernville reservoir. But as the Los Angeles aqueduct is not large enough to carry the Kern River water below Clearwater the proposed lower aqueduct would be therefore continued alongside it.

For additional storage and power needed we would construct 200-foot dams and make four reservoirs (the Ramshaw, Monache, Kennedy and Rockhouse) on the South Fork of the Kern River and from two of these and the South Fork would develop electric power from a total drop of 4,000 feet.

RECOMMENDATIONS

I therefore recommend to the people of California:

- (1) That the United States Senators and Representatives in Congress from California be requested to use their best efforts to secure national legislation to allow railroad and highway bridges to be built across the Strait of Carquinez and to turn over the control of the navigable portions of Sacramento and San Joaquin rivers to California, because of the national importance (a) of reclaiming 12,000,000 acres of land the products from which would pay large income taxes into the Federal Treasury and (b) of making homes for soldiers and citizens without cost to the National Government.
- (2) That the Legislature of California immediately authorize the appointment of a commission of five comprising a broad-minded "Big business" man, as chairman, a civil engineer, a hydraulic engineer, an electrical engineer, and a contracting engineer, to report to the Legislature (through the Governor) within three months as to the general practicability of the proposed plan of State-wide reclamation and make the necessary appropriation for the expenses of their investigations.
- (3) That upon favorable report of the above-named commission to the Legislature the Legislature at once enact the necessary legislation to put these plans into effect.

Finally:

This Valley of California scheme differs somewhat from other plans for caring for the unemployed, especially from other ideas to make homes for the soldiers. This work will be so extensive that it will furnish employment to more of our soldiers of the world war than will ever apply for or need work, and after they have worked as long as they care to, they will no doubt, in large numbers, acquire some of the reclaimed lands and remain to enjoy the large returns that surely await the fortunate owners of farms in the Valley of California. The plan herewith presented is based upon common sense as well as science. Further, this plan does not call for a single dollar from the State or National treasury. There is no question about its being successful from every possible point of view, for in the Valley of California we have the best lands and climate, the most fertile and lasting soils, the largest returns from the soils, the best water in ample quantity—in fact, every possible condition to make country life ideal. We have no stumps to remove, no swamps to drain, no mosquitos to exterminate, no frost to destroy the crops, no industrial conditions to adjust—simply one large ideal opportunity to enthuse the most skeptical—and the entire scheme can be finished and in full operation with assured success in ten years.

ROBERT BRADFORD MARSHALL.

March 16, 1919.

