Clemson University
3 1604 013 657 814

Digitized by the Internet Archive
in 2013

http://archive.org/details/reclamationera2324unit

need 75, 5

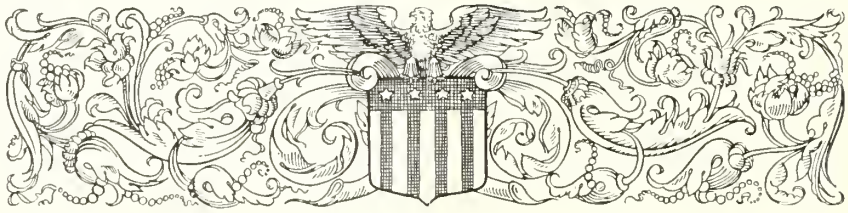
Glenwood College Library

THE RECLAMATION ERA

VOL. 23, NO. 1 JANUARY, 1932

Photo. by J. E. Stimson

MAIN CANAL, KLAMATH PROJECT, OREGON-CALIFORNIA



RECLAMATION

I believe the work of the Reclamation Service to be founded deep in democracy and the needs of the common people. It is also founded in the intense desire of great leaders, who loved men as brothers, to give the lowliest, poorest, and humblest the opportunities, at least, to reach after the enjoyments of comfort, prosperity, and happy living for themselves and their families.

In the territory comprised by Utah, Arizona, Idaho, Washington, and Oregon, a miniature commonwealth has been carved out of desert lands formerly covered only with sagebrush and cactus. These same plains now represent untold taxable value, all of which contribute to the support of schools, churches, and excellent highways. In turn, these new centers of activity and American society create a market for eastern manufacturers, which, in the endless chain of economic science, supply employment for thousands of urban men and women. The channels of trade are enriched by approximately $120,000,000 each year, which represents the amount of money expended for manufactured articles by the people who reside on irrigation projects.

HON. C. BEN ROSS,
Governor of Idaho.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 1 JANUARY, 1932

Interesting High Lights on the Federal Reclamation Projects

IN the recent potato show held at Riverton, Wyo., the Riverton project took three first, one second, and one third prizes in competition with the best potato growers in the county. Part of the exhibit was later taken to the Colorado seed potato show at Denver by Don R. Sabin, crop specialist of the University of Wyoming.

ON the Milk River project five sales of project farms were recently completed, four in the Malta division and one in the Glasgow division. Three of these units were subdivisions of larger holdings, as there is a decided tendency toward the smaller acreages. Several additional sales to dry-land farmers are being negotiated and the demand still exceeds the number of suitable farms available. Considerable interest in the so-called "Malta Plan" of land sales to dry-land farmers on easy terms of payment is evident on the Glasgow division, and it is probable that there will be some land movement there before spring.

CONTRACTS with the State highway department for the surfacing of the new highway from the Carlsbad project to Carlsbad Caverns have been let at a price approximately $60,000.

THE sugar factory at Burley, Idaho, Minidoka project, ceased operations after a campaign of about 6 weeks, during which it handled 38,305 tons of beets, of which 12,000 tons were grown on the Gravity Division, and 15,000 on the Pumping Division, the balance having been shipped from the Twin Falls projects. The average yield on the Minidoka project was 9 to 10 tons per acre. Because of the high sugar content, averaging 17.62 per cent, the farmers received a bonus of 50 cents per ton, making the total price $6.50 per ton for the crop. About 90,000 bags of sugar were manufactured.

BEET tops are providing good pasture for stock on the Belle Fourche project, and in many cases this roughage is being hauled into the feed lots for rations. The sugar factory at Belle Fourche was unable to supply the demand for beet pulp, indicating that this by-product is being more extensively fed than ever before.

PROSPECTS for a good lettuce market on the Yuma project are very encouraging as a result of extensive damage to lettuce in other sections. Indications are that top prices will be paid for the crop, which promises to be of good quality and yield.

THE onion crop on the Uncompahgre project has made good yields this season despite the shortage of water. The prevailing price now ranges around $2.25 per hundredweight, which will mean a gross return of around $450 per acre to the growers who did not sell from the field and who stored the crop raised.

THE installation of teletype equipment at the local United States Weather Bureau and similar equipment, together with radio equipment, at the new Department of Commerce Airways Broadcasting Station recently erected on the Yuma Mesa near Fly Field, the local airport, has been completed and the Airways broadcasting station placed in service. The local Weather Bureau force was increased and the station placed on a 24-hour operation basis in order that meteorological data might be furnished the broadcasting station hourly.

ON the Carlsbad project the paving of two strips along the new highway within the city limits of Carlsbad has been completed and the highway opened for traffic.

ON the completion of the beet-slicing season the Black Hills Sugar Plant at Belle Fourche, S. Dak., reported a continuous run of 54 days. A total of 76,500 tons of beets were supplied to the factory, of which two-thirds came from the Belle Fourche project. About $425,000 was paid to growers of the crop and employment was given to 140 men during the operation of the plant.

THIS season's yield of citrus fruit, composed mostly of grapefruit, on the Yuma auxiliary project is expected to exceed that of last year by about 50 per cent. Picking of this crop will probably continue until April.

ABOUT 75,000 pounds of turkeys for the Thanksgiving trade were marketed from the Orland project by the California Turkey Growers' Association, a cooperative organized at Orland two years ago.

DURING several recent months a great number of cattle and sheep have been shipped or driven to the Klamath project, and it is estimated that 40,000 head of beef cattle, 7,000 of which are feeders, 70,000 lambs, and 225,000 head of ewes, are being fed on project farms and Tule Lake lease lands.

THE harvesting of this season's pecan crop on the Yuma project has been completed with excellent yields reported.

THE acreage of beets harvested and the amount of sugar manufactured on the Milk River project at the close of the season exceeded that of any previous year. The industry is now well established on the project and its success is practically assured.

Requests for a Moratorium and the Effect of Such Action on Federal Reclamation

Statement Submitted by the Commissioner of Reclamation at a Senate Conference Held December 10, 1931

THE following statement and accompanying draft of a temporary relief measure were unanimously approved in principle at a meeting of western Senators and Representatives in Secretary Wilbur's office on December 12, 1931:

For the past six months the Bureau of Reclamation has been deeply concerned over the agitation for a moratorium on reclamation payments. On September 15 a circular letter was sent to the superintendent of each project. Copies of this letter are submitted.

The agitation culminated in a meeting of representatives of 20 Government projects at Boise, Idaho, on October 27, when demands for a 3-year moratorium on "construction and other payments (excepting current operation and maintenance charges) and that said deferred charges be extended without interest thereon to the end of the repayment period" was adopted. The information gathered as a result of the circular letter of September 15 and submitted by the projects since the October meeting is voluminous and has been analyzed and carefully studied. The result is a conviction that the relief asked for is not necessary. There should no doubt be legislation which will provide aid for the needy individual water user, and this can be given without demoralizing reclamation finances and discrediting the reclamation policy.

A BLANKET MORATORIUM UNWISE

The following facts in support of these conclusions are submitted:

Of the 888,000 acres represented at the Boise meeting, water users on some 200,000 acres make no payments to the Government, since construction charges are paid from the profits of power plants erected on the projects by the Government. On nearly 200,000 other acres an average of one-half the construction charges are paid from the profits of power plants also built by the Government. Out of a total irrigable area on the Federal reclamation projects of 1,993,390 acres, the annual construction payments on 598,314 acres are not based on the cost of the works, but are 5 per cent of the average crop income. If the crop prices are low this is reflected in payments and at the present rate some of these debts will not be paid in 40 years, but will extend over 70 years.

Other objections to the moratorium are—

1. It will demoralize reclamation finances. The construction income has already been greatly reduced by wiping off $27,000,000 of the capital debt in 1926 and ending all payments on this sum. The annual income has been reduced by the extension of payments under the original contracts to a longer period until now for 1931 the total construction income of the fund is about $6,500,000, if all the payments owing the Government are made. As a matter of fact they never are all made

If this moratorium is granted, it will mean a reduction in the yearly income of about $3,000,000, leaving available something over $3,000,000, but from this there have to be taken in 1932 and 1933 payments due the Government on borrowed money. These payments will be $1,000,000 in 1932 and $2,000,000 in 1933. Hence for 1933 our construction income would shrink to $1,000,000 a year. A 3-year moratorium therefore would mean the stopping of work on Cle Elum reservoir before it is finished and on the Owyhee and Vale projects before they are finished. It would prevent entering on any new work, some of which is sorely needed to furnish additional water to communities. Every State in the arid West is urging the Bureau of Reclamation to consider the construction of storage works to provide additional water for developed communities. The suspension of construction involved in the proposed moratorium would result in the breaking of construction contracts, the throwing out of employment of thousands of laborers, and the wrecking of the reclamation organization. It would utterly discredit the reclamation policy and might lead to legislation for its abolition.

2. A moratorium giving relief to all water users on a project regardless of the ability of individuals to make their payments would be no more sensible or defensible than a moratorium to all the borrowers from a Federal land bank because a part of the borrowers can not meet their obligations. A large percentage of the water users on each of these projects are able to pay. A considerable number of water users have paid. If a moratorium is granted, we should in honesty refund to them the money already paid in. One of the evils of former relief measures is that we have kept the money paid in and relieved those who have resisted payment. This has left a legacy of bitterness and a determination in the future not to pay until controversies over payment have been definitely decided.

At present the anticipation of a moratorium is demoralizing reclamation finances. On some projects the operation and maintenance charges are being met, county and State taxes are being paid, but the construction payments are being withheld, and they are being withheld not by needy cultivators alone but by bankers and large nonresident estate owners. There is a large nonresident ownership on these projects; and many mortgage debts are so large as to be equivalent to ownership. The tenant cultivators will have to pay their rentals if these water charges are remitted, and the benefit in such case will go not to the struggling cultivator but to the landlord, who should meet these payments just as he does his other obligations. If any other basis is adopted the collection of money due under these contracts in the future will be so difficult as to be practically impossible.

SUGGESTED RELIEF ONLY TEMPORARY

3. Both the moratorium recommended by the Boise conference and the credit to settlers recommended by the bureau are only palliatives. They do not cure a situation that ought to be dealt with. This is the mortgage and other debts of water users. On a majority of the projects asking for relief, the water payments due the Government are only a small fraction of the fixed charges of the farms, and foregoing water payments by the Government does not give to farmers the relief they must have to survive.

Recently the bureau has had a committee studying conditions on projects where the settlers are in economic and financial distress. On one of these a Federal land bank has mortgages on 62 per cent of the land and the loans range from $80 to $90 an acre. The payments on this mortgage debt, taxes, and the Government water charges amount in all to $21 an acre, of which the Government construction charge is $4.69 an acre. The loans are for more than the land is worth. To forego water charges simply means that it enables the settler to pay the interest on his debt to the bank and makes absolutely meaningless the first mortgage, which the law requires the

Government to have. If we reduce our payment to $1 a year, which is asked, it will not help the settler or give him a secure tenure. It only insures the bank interest on a bad loan. We proposed to the bank that we would reduce payments if the bank would reduce its mortgage to what the farms are really worth. This has been refused.

That is not an isolated instance. On a dozen projects which have been investigated in recent months, mortgage debts and high taxes are the chief factors in the settlers' delinquency. The Reclamation Bureau can not become a relief agency for debts which are a hangover from a period of inflated prices without being destroyed.

It is recommended, therefore, that the Secretary be authorized to appoint one or more authorities who will make a thorough economic study of each of these financially embarrassed projects and make a report of the results of those investigations, with whatever recommendations seem proper, at the next session of Congress.

4. Granting the moratorium requested would result—and justifiably so—in bitter criticism by distressed farmers outside the projects, who would have ground for the belief that the water users on Federal reclamation projects are in the position of wards of the Government who are to be protected from the vicissitudes encountered by farmers elsewhere. It would tend to convert men who now stand on their own feet into leaners and make the main business of reclamation the providing of props to hold them upright. Many of the projects asking for this relief have been in operation for years, farms are fully improved and equipped and settlers are established. They are at an economic advantage over water users under private enterprises built with borrowed money on which interest has to be paid. The subsidy on these Federal projects in 1931 due to interest-free money, counting interest at 6 per cent, is $9,000,000. Agricultural statistics show crop returns on these projects average considerably larger than on private projects, while the per acre value of crops grown on the Federal projects is two and one-half times the per acre value of crops for the country as a whole.

5. A moratorium would be especially unfair to drought-stricken farmers who borrowed money from the Department of Agriculture at 5 per cent and are repaying the loans in a satisfactory manner and in many cases before the due date.

OTHER WESTERN ORGANIZATIONS OPPOSE A MORATORIUM

6. It would be contrary to the sentiment of the western organizations such as the Oregon Reclamation Congress and the Western Governors Conference, each of which adopted a resolution condemning a proposed blanket moratorium as "unjustified, uneconomic, and detrimental to the best interests of the people of the West." The conviction of many western editors and writers of letters to the bureau is expressed in the following paragraph from an editorial:

> A general moratorium to water users could only be excused on the ground that the Government had inveigled them into assuming burdens too great to be borne; that irrigation is a failure, and that those who are farming irrigated lands are in a worse position than those in the nonirrigated sections. Such is not the case, of course, but if the inferences to be drawn from such an appeal go unchallenged it will place in the hands of enemies of irrigation the very weapon for which they have been looking.

ONLY THOSE UNABLE TO GET 1932 WATER SHOULD HAVE RELIEF

7. A moratorium is entirely unnecessary to enable a majority of the projects joining in this movement to get water in 1932. There are individual settlers who are so far behind that they must either pay their charges or the district or association must pay for them, but taken as a whole, irrigators on the following projects can get water in 1932 if they provide money for operation and maintenance: Salt River, Yuma, Orland, Uncompahgre, Boise, Minidoka, Huntley, Milk River, Lower Yellowstone, Sun River, North Platte, Newlands, Carlsbad, Belle Fourche, Strawberry Valley, Salt Lake Basin, Yakima, Shoshone, and Riverton. No additional legislation is needed to permit the delivery of water in the case of the majority of the water users on these projects.

8. While the moratorium should not be approved, there are many cases where the worthy cultivator of his own farm is unable to meet the charges necessary to enable him to receive water in 1932. He has our deepest sympathy and should have a chance to go on. This can be given and still leave reclamation a self-sustaining business enterprise. It can be done by extending credit from the reclamation fund, with a possible reduction in the money available for construction of $1,000,000, without any gifts and only a small loss to the fund.

9. A draft of a bill to provide credit for all who are entitled to it is submitted for your consideration.

Section 1 of the proposed act provides for an extension of not to exceed five years on delinquent charges where the Government is still dealing directly with the water user, but contemplates that the local association will underwrite the deferred charge.

Section 2 cares for the situation, where the repayment of Government charges is already an obligation of a district or association, by granting the district or association a deferment on its debt to the United States in the same amount as the total deferments extended by these agencies to the individual. In these cases it is impossible because of contractual relationships for the Government to deal directly with the water users.

Section 3 provides for an investigation of and report on the financial difficulties of settlers in meeting their numerous charges incident to irrigation farming, part of which are unduly burdensome because of inflated valuations assumed in past purchases and mortgages.

> A BILL For the temporary relief of water users on irrigation projects constructed and operated under the reclamation law
>
> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That where a water-right applicant or entryman under an irrigation project constructed or being constructed under the act of June 17, 1902 (Thirty-second Statutes at Large page 388), and acts amendatory thereof or supplementary thereto, is ineligible to receive water during the 1932 irrigation season on account of failure to make payment of any construction charge and penalties accrued to December 1, 1931, owing the United States, the Secretary of the Interior is hereby authorized in his discretion, upon application duly made therefor by said water-right applicant or entryman, to extend the time for payment of any such charge or charges in such manner that payment shall be required to be made on or before December 1, 1936, subject, however, to the condition that before any such extension shall be granted the payment of the charges so extended, with interest thereon as hereinafter provided, shall be assumed by a water users' association or irrigation district organized under state laws by means of such contract or other arrangement for payment as may be found satisfactory by the Secretary of the Interior. Before any such extension of time shall be granted the applicant therefor shall first show to the satisfaction of said association or district, and of the Secretary of the Interior, by a detailed verified statement of his assets and liabilities, inability to make payment at the time the application is made. The applicant must also show as a condition to receiving an extension that the land against which the charge has accrued is under cultivation and that said landowner or entryman resides upon or in the vicinity of said land. Each charge and accumulated penalties so extended shall draw interest payable annually at the rate of one-half of one per cent per month from December 1, 1931, until paid, to the United States in lieu of any penalty that may now be provided by law.

Sec. 2. The Secretary of the Interior is authorized, in his discretion, to grant to any association or district having a contract with the United States of payment of construction charges an extension of time in the payment of any construction and/or deferred operation and maintenance charges due and payable or to become due and payable to the United States of a sum equivalent to the total amounts of assessments or charges for repayment of United States construction and/or deferred operation and maintenance charges due to such association or irrigation district the payment of which has been extended for landowners or entrymen of lands who because of delinquency in the payment of such assessments or charges and who under Federal or State laws applicable, and/or under contracts in force, would be ineligible to receive water during the 1932 irrigation season in the absence of such extension: *Provided*, That before any such extension shall be granted by the United States to the association or district necessary arrangements shall be made by said association or district to extend the time for payment by said landowners or entrymen of the assessments or charges so in arrears, to the end that the ineligibility of said landowners or entrymen to receive water during the 1932 irrigation season shall be removed. Such extensions shall be made by said associations or districts only upon a showing satisfactory to the association or district and to the Secretary of inability on the part of each delinquent to make payments so to be extended, that the land against which the charge has accrued is under cultivation, and that the applicant resides upon or in the vicinity of the land. Charges so extended to any association or district shall be required to be paid to the United States on or before December 1, 1936. Each charge so extended shall draw interest payable annually at the rate of one-half of 1 per centum per month from December 1, 1931, until paid, in lieu of any penalty or interest that may now be provided by law.

Sec. 3. The Secretary is authorized and directed to make an investigation of payments which irrigators must make on account of mortgages, taxes, interest, assessments, and other charges which the landowner must make to receive water and/or retain ownership of land and water including comparative data on typical non-Government projects, together with the bearing thereof on the repayment of construction charges to Government and to report thereon to Congress when it shall convene in December, 1932.

Sec. 4. The Secretary of the Interior is authorized to make any necessary rules or regulations or to take any other action necessary to carry out the purposes of this act.

Morocco Builds Irrigation Project

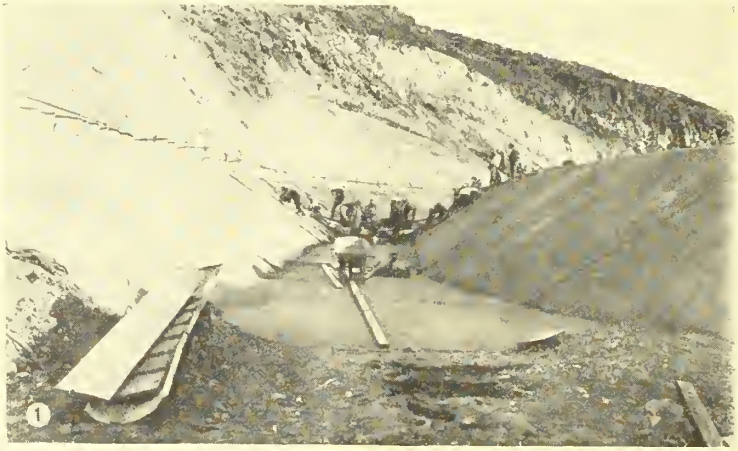
The public works department of the protectorate government is developing on the River Beht (Oued Beht) one of the most extensive hydroelectric and irrigation projects yet undertaken in the French Protectorate of Morocco.

The dam is situated on the Oued Beht about 50 miles due east of Rabat, Morocco. It is being constructed at the entrance of the gorge of El Kansera. By closing this gorge to the desired height, the Oued Beht will be impounded in what was formerly a natural lake.

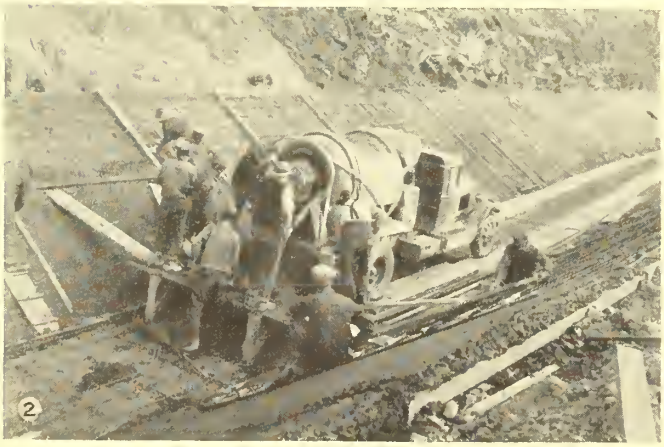
The dam itself is 656 feet long, its greatest height rising 126 feet above the bed of the river. It has a thickness of 20 feet at the top and 118 feet at the base. Over 153,000 cubic yards of concrete will be used in its construction. The construction of this dam was begun in 1926 and will be completed according to plans in 1933. The initial undertaking consisted in the diversion of the river through a tunnel in order to facilitate laying the foundation of the dam in what was found to be very difficult terrain. The dam when completed will impound about 221,000 acre-feet of water. It will be used in development of power which is estimated at 15,000 horsepower and for the irrigation of approximately 75,000 acres of land.

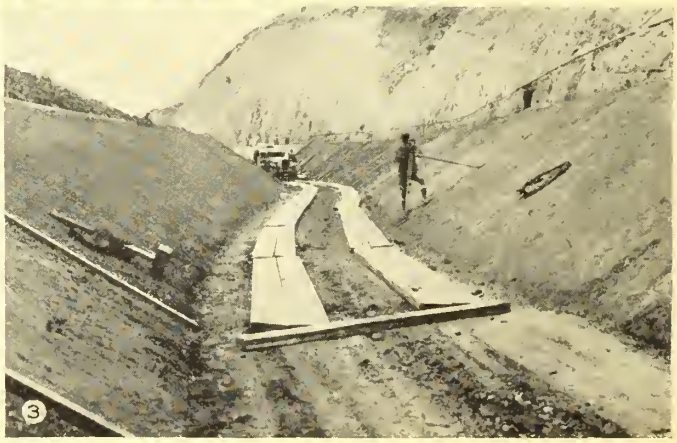
VALE PROJECT
OREGON

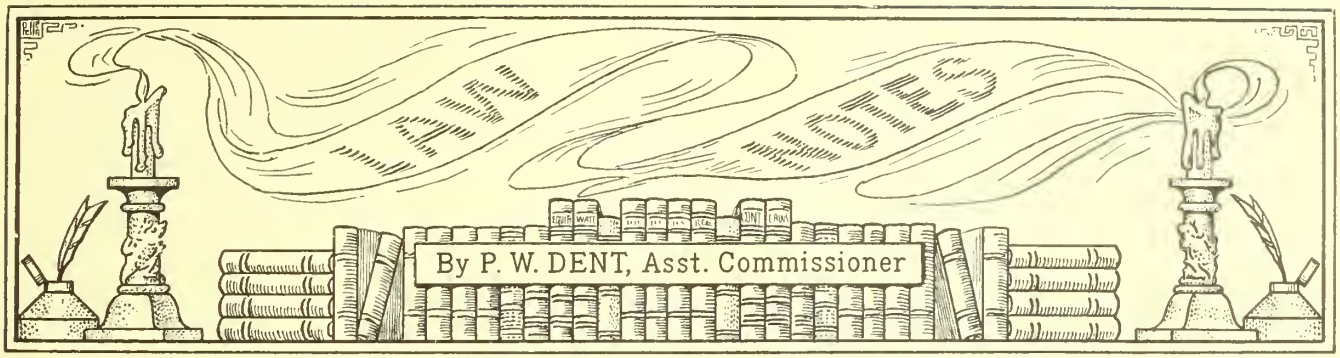
CONSTRUCTION
MAIN CANAL



1. CONCRETE LINING
2. PORTABLE CONCRETE MIXER ON TRUCK PLACING CONCRETE
3. COMPACTED EMBANKMENT READY FOR PLACING REINFORCING STEEL AND CONCRETE LINING







Summary of 1931 Irrigation Legislation in South Dakota, Wyoming, Nebraska, and Montana

SOUTH DAKOTA

IN 1931 the South Dakota Legislature enacted two acts of interest to the Bureau of Reclamation, reference to which is made by their chapter numbers as they appear in the Session Laws of South Dakota, 1931.

Chapter 171 provides that the failure of the owners, mortgagees, or lienors of land described in individual water-right contracts with the United States to answer the petition of the irrigation district directors praying for a confirmation of a contract between the United States and an irrigation district, in which said land has been included, shall cause the district contract, if inconsistent with the individual water-right contract, to be amendatory thereof.

Chapter 172 permits an irrigation district in a contract with the United States to provide for a different deficiency assessment than that authorized by the irrigation district law in all other cases.

WYOMING

Chapter 79, Session Laws of Wyoming, 1931, authorizes the inclusion in an irrigation district of lands within the limits of towns or cities if the creation of the district results in a benefit to the town or city in any amount equal to or in excess of the amount of assessment for construction against the lands therein.

House Joint Memorial No. 3 memorializes Congress, the Department of the Interior, and the Bureau of Reclamation to apply project power-plant revenues in accordance with the act of Congress of December 5, 1924, commonly known as the fact finders' act.

MONTANA

The 1931 session of the Montana Legislature enacted two acts of special interest to the Bureau of Reclamation and one act of general interest. These acts will be referred to by their chapter numbers as found in the 1931 laws of Montana.

Chapter 24, section 1, authorizes and empowers an irrigation district to contract with the United States for a loan of money to liquidate its outstanding indebtedness and for the repair or reconstruction of its irrigation system. The board of commissioners is empowered to create by levy and collection of assessments a sinking fund to be available for the construction of necessary betterments to the irrigation system during the term of such a contract and to invest any surplus in the sinking fund in interest-bearing securities of the United States or of the States approved by the Secretary of the Interior, such securities to be deposited with the Federal reserve bank or a branch thereof.

Section 2 relates to the levy of assessments against the district lands for the United States contract fund, including deficiency assessments, as required by the terms of the contract.

Section 3 provides that the amounts to be paid to the United States under the contract shall be a lien upon the district lands and also upon the irrigation system of the district.

Section 4 authorizes the surrender of the control, operation, and maintenance of the district in the case of default in payments to the United States.

Section 5 authorizes and empowers the county treasurer to cancel the district bonds liquidated with the money furnished by the United States and to surrender the bonds to the United States.

Sections 6, 7, and 8 relate to the procedure to be followed in contracting with the United States under the act.

Chapter 89 provides for the levy of irrigation district assessments by the board of county commissioners when the levy is not made by the board of commissioners of the district.

Chapter 69 is an act of general interest. This act creates an irrigation and water-right code commission to be known as the Special Irrigation Commission of the State of Montana. The commission is authorized to investigate the irrigation and water-right laws of the State of Montana and the laws of other arid States, relative to the organization, administration, financing, supervision, and dissolution of irrigation districts, and relative to the system of water-right law now in force within the State of Montana and the systems in force in other arid States. The purpose of the commission is to formulate a uniform statutory system of general application covering irrigation districts and water rights within Montana. The commission is required to report to the Governor of Montana on or before the 1st day of November, 1932, and advise and recommend to the governor for transmission to the twenty-third legislative assembly the enactment of such legislation as the commission deems necessary to carry out the objects and purposes of the act.

NEBRASKA

Chapter 90, Laws of Nebraska, 1931, provides for a mode of appeal to the district court from the action of the board of directors of an irrigation district, acting as a board of equalization fixing the valuation of lands for irrigation purposes.

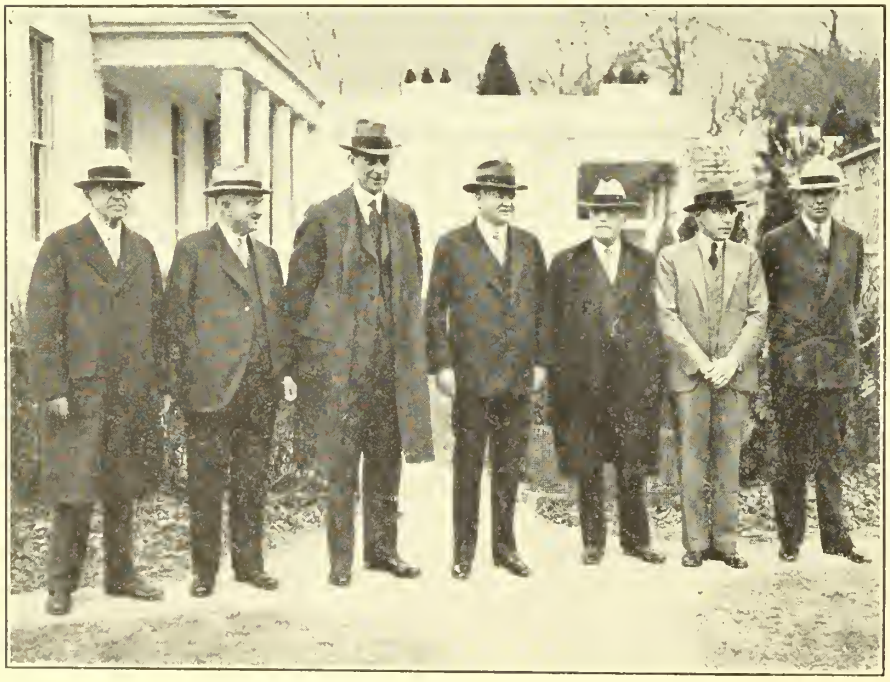
Chapter 91, Laws of Nebraska, 1931, authorizes irrigation districts to acquire, construct, extend, improve, operate, and dispose of electric light and power plants, lines, and systems; provides for the generation, transmission, distribution, purchase and/or sale by irrigation districts of electrical energy for lighting, heating, and power purposes; provides for the extension, by any irrigation district, of its electric light and power plants, transmission lines, systems, and service outside of the boundaries of such district; provides for interconnection of electric light and power plants, lines, systems, and service by and between irrigation districts and/or between irrigation districts and

one or more cities, villages, public electric light and power districts and the Government of the United States; provides means of financing, by irrigation districts, of such electric light and power plants, lines, and systems and the cost of operation, extension, and improvement thereof; authorizes irrigation districts operating any electric light and power plants, lines, or systems to fix rates and charges for electric current sold and for service and physical connection furnished, and provides that irrigation districts shall have the exclusive right to make application for the use of water for hydroelectric plants for all water in their districts used for irrigation and/or the return seepage water from all lands irrigated in said irrigation districts.—*William J. Burke, District Counsel.*

Thomas C. Yager Dies

Thomas C. Yager, of Indio, Calif., attorney for the Coachella County Water District, which is to be joined in the execution of the contract for the construction of the All-American Canal, died on December 11, 1931.

Mr. Yager spent several weeks this fall with Charles L. Childers, attorney for the Imperial Irrigation District, in the Washington office. He had many friends in the department and bureau and his loss is felt keenly.



PRESIDENT HOOVER CONFERS WITH DEPARTMENT OFFICIALS

Left to right: Edward C. Finney, Solicitor; Elwood Mead, Commissioner of Reclamation; Ray Lyman Wilbur, Secretary of the Interior; President Hoover, Joseph M. Dixon, Assistant Secretary; E. K. Burlew, Administrative Assistant to the Secretary; C. A. Dobbel, Executive Assistant

Liability of an Irrigation District for Crop Damage Because of Seepage

IN the Nebraska case of Livanis *v.* Northport Irrigation District (232 NW. 582) the plaintiff brought an action to recover damages to his beet crop, which he alleged was destroyed by seepage in 1924.

The petition states two causes of action: First, that the damage resulted because of seepage from an irrigation canal operated by the district; and second, that the damage resulted because of the negligence of the district in the construction, operation, and maintenance of the irrigation canal.

In its answer the district alleged *inter alia* that the irrigation system was constructed, operated, and maintained by the United States under the reclamation law as the Northport division of the North Platte project, and that "said irrigation works were constructed, operated, and maintained by the employees of the Department of the Interior of the United States Government, and that this defendant has no supervision over the construction of said irrigation system or over the operation and maintenance of the same; that said construction, operation, and maintenance are paid for by money appropriated by the Congress of the United States from the reclamation fund of the United States for that purpose, and that the only function of the district is to levy and collect taxes from the individual water users to reimburse said reclamation fund."

The reply of the plaintiff admitted that the canal was constructed and operated by the United States, set out a contract between the United States and the Northport Irrigation District, and alleged "that the irrigation works were constructed by the United States of America under and by virtue of said contract, and has since the construction thereof been operated under said contract."

The lower court granted the motion of the defendant district for judgment on the pleadings.

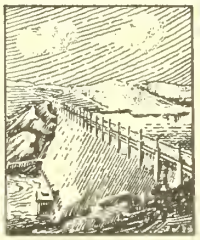
The attempt of the plaintiff by the allegations in his reply to the defendant's answer to establish a contractual liability on the part of the defendant district by virtue of its contract with the United States was disposed of by the Supreme Court by invoking the rule that a plaintiff must recover, if at all, on the cause of action stated in his petition and not on a new cause of action introduced in his reply.

In affirming the judgment of the trial court, the Supreme Court said: "* * * it appears that the plaintiff alleges a cause of action based upon the assumption that the defendant herein constructed and operated the irrigation works; while in his reply the plaintiff admits that said canal was constructed and operated by the United States under the reclamation law. * * * The pleadings established the fact that the damage alleged occurred during the time the defendant was not operating or maintaining said works, but was only acting as fiscal agent of the United States with reference to the irrigation project."

In the instant case, the petition, contradicted by the admission in the reply, and not being aided by the new allegations therein, required the judgment of the trial court.—*William J. Burke, District Counsel.*

TWO carloads of fat lambs, the last of the season, have been shipped from the Minidoka project by the Cassia County Sheep Marketing Association. This organization sold over $29,800 worth of lambs during the season, and $12,100 worth of wool, or a total of practically $42,000. Lamb prices dropped from $7.92 per hundredweight on May 19 to $3.65 on September 30, thus proving the value of early fattening.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Canal Construction by Bureau of Reclamation

THE Bureau of Reclamation during the past 25 years has constructed 13,594 miles of canals ranging in capcity from 10 to 2,500 cubic feet per second. These water carriers to thirsty lands on the Federal irrigation projects if placed end to end would extend more than four times across the country from New York to San Francisco. On one project the North Platte in Nebraska-Wyoming, there are 1,619 miles of canals; on the Yakima project, Washington, 1,120 miles; Salt River project, Arizona, 1,100 miles; and on the Boise project, Idaho 1,057 miles. The largest canal constructed by the bureau is the Main South Canal on the Boise project, with a capacity of 2,500 cubic feet per second, while the 127-mile Fort Laramie Canal on the North Platte project, Wyoming-Nebraska, is the longest. Both of these canals will be exceeded by the All-American, which will carry 15,000 cubic feet per second, and the Coachella Branch, 130 miles in length, both of which are authorized for construction by the Boulder Canyon project act.

Of the 13,594 miles of canals completed to date, it has been found necessary to line 495 miles, or 3.7 per cent, with concrete to prevent water losses by seepage in sections where porous soils were encountered. Most of the concrete lining is to be found on four projects: The Orland in California has 92 miles, Umatilla in Oregon 108 miles, Strawberry Valley in Utah 64 miles, and Okanogan in Washington 45 miles. Recent operations on the, Kittitas division of the Yakima project Washington, brought out some new and improved methods of lining canals with concrete.

On the project canals there have been built 165,427 structures, of which 62,795 are constructed of concrete and 102,632 of wood. They include 12,194 bridges with a total length of 296,013 feet, or 56 miles. On several of the projects the topography along the located lines of the main canals has been such that flumes of considerable length have been necessary, one on the C Canal of the Klamath project in Oregon being 4,316 feet long. To date, the bureau has built 5,540 flumes with a total length of 878,640 feet, or 166 miles.

VALE MAIN CANAL

To irrigate the 31,000 acres of the Vale project in eastern Oregon will require a main canal 75 miles in length, extending from the Harper diversion dam near Namorf, Oreg., on the north side of the Malheur River, to Willow Creek, near Jamieson, Oreg. This canal is now under construction. The first 3 miles of the canal route are in a narrow canyon and three 10.5-foot diameter tunnels with a total length of 8,843 feet were required in this section. Another important structure on the canal is an 8-foot diameter siphon, 7,100 feet long, across Bully Creek. A 34-inch steel siphon, 2,250 feet in length, will take out of the canal to water 1,132 acres of land in the Little Valley division, which are the only irrigable lands south of the Malheur River. The Main Canal is designed to carry 1 cubic foot of water per second for each 50 acres of land to be irrigated, having an initial capacity of 600 cubic feet per second. However, sufficient freeboard is provided to allow a greater delivery during periods of peak demand. Certain sections of the canal are lined with 3 inches of reinforced concrete lining. Work on canal construction was started in 1927, and over half of the 75-mile canal is now completed. The December, 1931, ERA contains an article on earth-lining operations.

MILNER-GOODING CANAL

The Milner-Gooding Canal extends from the Milner Dam, on the Snake River, located about 25 miles east of Twin Falls, Idaho, a distance of 70 miles northwesterly, to the vicinity of Gooding, Idaho. This canal will carry water by gravity to 45,000 acres of land under the Big Wood Canal Co. project, now receiving an insufficient water supply from Big Wood and Little Wood Rivers, and also to 40,000 acres without water, lying north of the Twin Falls North Side project. Work on the canal is nearing completion, and water was available at Little Wood River in the spring of 1931. The total fall is 200 feet, which is 80 feet more than is required by the canal, a 70-foot fall being made between mile points 44 and 45.2 to shorten the line as much as possible. There are no tunnels or siphons on the whole line, the only important structures being the main headgate structure, the crossings of the two rivers and three railroad crossings. The first 1½ miles of canal were largely in solid rock, with depths varying from 12 to 40 feet, and required concrete lining. The main heading consists of two steel radial gates 17 by 14 feet, set between concrete abutments with a middle pier. Between the two rivers is a rough lava field of bare rock which necessitated making a series of cuts, and here concrete flumes were built on the natural rock surface or on rock fills. These flumes are 6½ feet high by 13 to 14 feet wide inside, with 6-inch concrete walls. Rock cut portions are gunited. The length of this type of construction is 2.6 miles, which includes the Big Wood River crossing. The structure at this crossing is a concrete flume 170 feet in length, and is similar in section to the flume across the adjoining lava field. At the Little Wood River a change in the channel is made and the canal is carried under the river by a siphon. The river is now used as a main lateral for the South Gooding tract. Wasteways are provided at both rivers and also to the Wilson Lake reservoir of the North Side Twin Falls Co. There are diversions at stations 101 and 183 to the North Side Twin Falls canal system, and this company is paying for canal enlargement and also for the diversion structures. The 70-foot fall in the canal starting at mile 44 is not adapted to power development. Water is to be delivered mainly at two points—into the Little Wood River and into the North Gooding Canal 9 miles northeast of Shoshone.

YAKIMA-KITTITAS CANALS

The main canal of the Kittitas division of the Yakima project, Washington, was completed in May, 1929, and the first water was turned into the canal for priming purposes on October 11, 1929. On no other project of this bureau has there been

more difficult construction than that involved in the Kittitas distribution system. About 50 per cent of the Main Canal is lined with concrete. In the October, 1930, number of the ERA is a very complete description of the construction of this canal lining. In places, because of very steep slopes, it was necessary to build combination sections of canal lining and bench flume, with canal section inside and vertical retaining wall outside. Water is diverted at the Easton Dam on the Yakima River, just above the town of Easton, into this canal for the irrigation of 72,000 acres, the initial capacity being 1,320 cubic feet per second. The canal parallels the river on the south side for about 26 miles. Most of the water is then carried across the river by the North Branch Canal and around the north and east sides of the Kittitas Valley a distance of 36 miles to the Wippel pumping plant. Crossing of the river is accomplished through a concrete-lined pressure tunnel, 9 feet 3 inches in diameter; 3,215 feet long, horizontally and 3,596 feet over-all length, and carrying 925 second-feet of water under a maximum head of 533 feet. The South Branch Canal diverts from the Main Canal 1 mile above the river crossing and extends 14 miles down the south side of the valley. It has a capacity of 250 second-feet at the headworks. About 1¼ miles of this canal are lined with 3-inch reinforced concrete slabs.

On the Kittitas canals, because of rough topography, it was necessary to construct 22 inverted siphons varying in head from 14 to 240 feet, from 3 feet to 12 feet 6 inches in diameter, and from 148 to 3,326 feet in horizontal length. For the higher heads, riveted steel pipe was used instead of concrete. Other than the Yakima River crossing, 10 tunnels were built, having a total length of 13,753 feet.

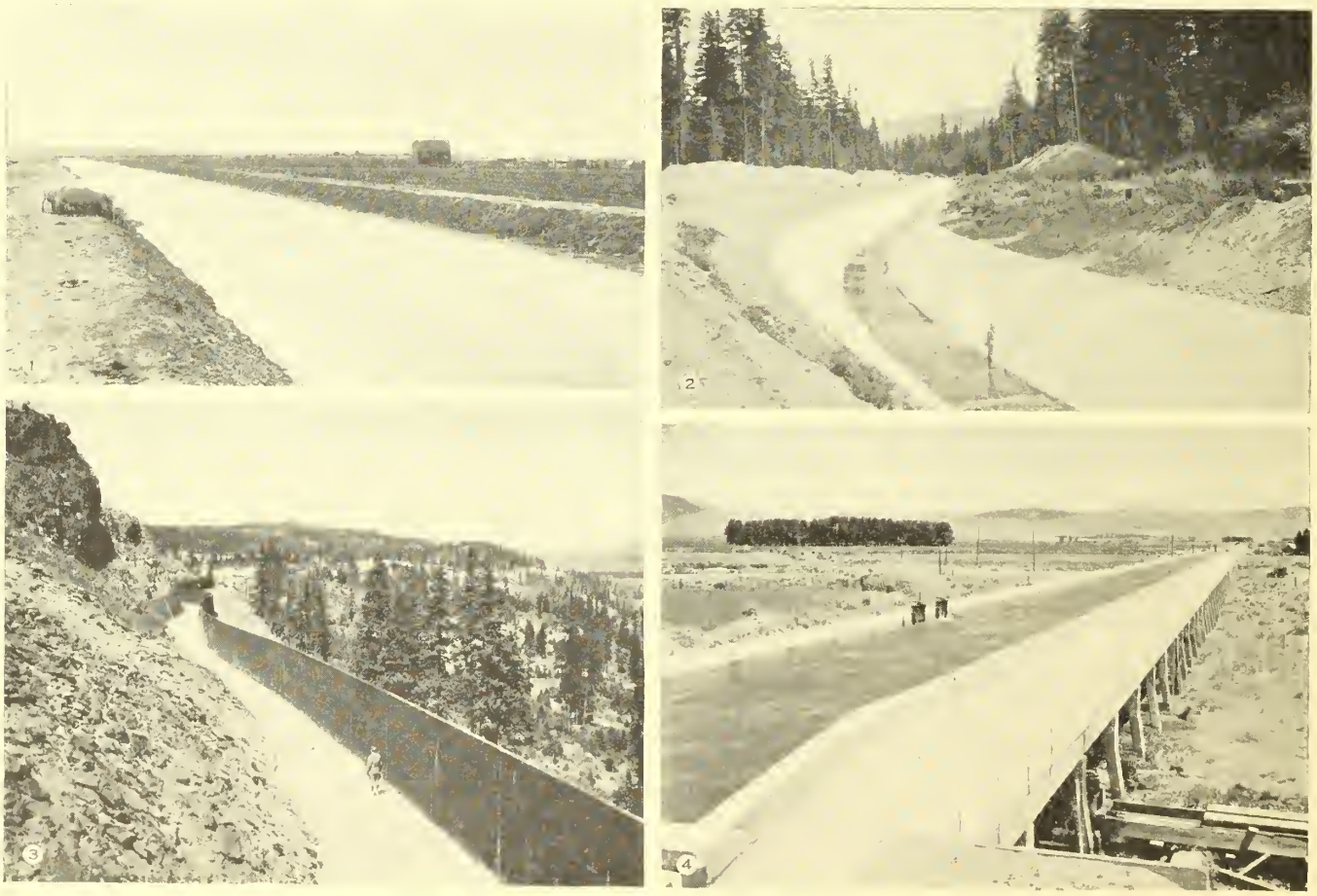
At the point of diversion the Main Canal has a capacity of 1,320 second-feet, requiring a bottom width of 30 feet and a water depth of 11.4 feet in unlined earth section. Just below the diversion dam the canal is carried in tunnels of 12 feet 3 inches diameter under the Northern Pacific and Chicago, Milwaukee, St. Paul & Pacific Railroad tracks.

FORT LARAMIE CANAL

The Fort Laramie Canal on the North Platte project, Nebraska-Wyoming, is the longest canal ever built by the Bureau of Reclamation. It extends a distance of 127 miles, from the Whalen diversion dam in Wyoming, near the State boundary to a point 5 miles southeast of Gering, Nebr., and is the main supply canal for 106,000 acres of irrigable lands. The canal was started in 1915 and completed in November, 1923, and its construction required the excavation of 11,362,617 cubic yards of material. Of this amount, 7,621,570 cubic yards were excavated by contract at a field cost of 17 cents per cubic yard, and 3,741,047 cubic yards were excavated by Government forces at a field cost of 9.9 cents per cubic yard, which meant a saving to the Government of $265,000. At the heading, the canal has a bottom width of 45 feet and carries 1,425 cubic feet of water per second. The principal structures are the Laramie River siphon and three tunnels with a total length of 11,300 feet.

INTERSTATE CANAL

This canal is 95 miles long and serves 129,000 acres on the North Platte project, on the north side of the North Platte River. In the 45-mile section from Whalen Dam to the State boundary line the canal is designed for a capacity of 1,400 second-feet at the headworks and 1,200



RECLAMATION PROJECT CANALS

1, Main Canal, Huntley project, Montana; 2, Kittitas Main Canal, Yakima project, Washington, lined with concrete; 3, combination section of canal lining and bench flume, Kittitas Main Canal, Yakima project; 4, concrete flume on "C" Canal, Klamath project, Oregon.

second-feet at the end of the division. The bottom width at the headworks is 34 feet and its depth is 13 feet throughout, with a 10-foot depth of water. Work was started on the Interstate Canal in 1905 and completed in 1915, utilizing both contract and Government force account methods. The cost of the canal was about $2,346,000.

BOISE MAIN SOUTH AND MORA CANALS

The largest canal on any of the Federal irrigation projects is the Main South Canal of the Boise project, Idaho, which has an initial capacity of 2,500 cubic feet per second. It heads at the diversion dam on the Boise River about 8 miles above the city of Boise and extends southwesterly a distance of 26 miles to Indian Creek. The waters are there discharged into the creek and carried through the channel for 9 miles and then diverted into a new canal 8 miles in length, discharging into the Deer Flat Reservoir. Part of the construction was done by contract and part by Government forces from 1906 to 1908. Originally the canal had a carrying capacity of 1,500 cubic feet per second, but from 1909 to 1912 the canal was enlarged to carry 2,500 cubic feet per second, and certain sections were lined with 4 inches of concrete. In the unlined portions the canal has a bottom width of 70 feet and a water depth of 8 feet, with 4 feet freeboard. This canal is the main distributary for 108,000 acres of the Arrowrock division. Construction of the Main South Side Canal has cost $2,064,000.

A second important canal of the Boise project distribution system is the Mora Canal, 56 miles in length, with an initial capacity of 915 cubic feet of water per second. It is properly a branch of the Main South Side Canal and extends westerly from a point near the Main Canal-Indian Creek junction to carry water to lands south and west of Deer Flat Reservoir.

OWYHEE MAIN CANALS

Diversion for 100,000 acres of the Owyhee project, Oregon-Idaho, to be irrigated by gravity, will be accomplished through Tunnel No. 1, 16 feet 7 inches in diameter, 3½ miles long, 1,840 second-feet capacity, from the reservoir on the Owyhee River to Tunnel Canyon, taking out of the reservoir at a point 85 feet below the crest of the Owyhee Dam. This dam is now under construction and will be completed in 1932. Tunnel work is in progress, but the first contract for canal construction has just been awarded. From Tunnel Canyon a second tunnel, known as Tunnel No. 5, 9 feet 3 inches in diameter, 4.15 miles long, and of 650 second-feet capacity, extends in a southeasterly direction to the Sucker Creek division, south of Adrian, Oreg., and west of the Snake River. From the tunnel outlet a main canal, 60 miles in length, will be built to serve lands in the Sucker Creek division.

Extending northward from the outlet of Tunnel No. 1, water for the Mitchell, Butte, and Dead Ox Flat divisions will be carried in the North Canal, which will require large siphons across the Owyhee and Malheur Rivers. The maximum capacity of this main canal will be 1,190 cubic feet per second. The Mitchell Butte section will be about 60 miles long and the Dead Ox Flat section about 35 miles. Of the total project cost of $18,000,000, approximately one-half will be spent on main canals.

ALL-AMERICAN CANAL

The Boulder Canyon project act approved December 21, 1928, authorized the Bureau of Reclamation to construct the All-American Canal for the purpose of supplying irrigation water to the Imperial and Coachella Valleys of southern California through a canal located entirely in the United States. (The present Imperial Main Canal is partly in Mexico.) Surveys for the proposed canal have been made and construction will begin as soon as a contract is negotiated with the irrigation district and Congress makes funds available by appropriation.

In size the All-American Canal will be six times as large as the Main South Canal on the Boise project, Idaho, now the largest on any of the Federal irrigation projects. The initial capacity will be 15,000 second-feet, bottom width 130 feet, water depth 22 feet, water surface width 200 feet. From the diversion dam to be built on the Colorado River above Yuma, Ariz., to its connection with the present distribution system of the Imperial Irrigation District the canal will be 80 miles long. Forty-one miles from the diversion a branch canal to the Coachella Valley will take out. This branch will be 130 miles in length and have an initial capacity of 2,000 second-feet. It is planned to line 47 miles of the canal with concrete.

At the siphon drop on the Yuma (Federal) irrigation project 2,000 of the 15,000 second-feet will be diverted for the requirements of that project. Six miles farther along the canal, at Pilot Knob, 3,000 second-feet will be dropped back into the Colorado River for power development. The remaining 10,000 second-feet will be taken to the Imperial and Coachella Valleys for irrigation.

The All-American Canal system will provide water for about 1,000,000 acres in the two valleys and adjacent mesa lands. Between 60,000,000 and 65,000,000 cubic yards of earth and rock must be excavated, this amount being one-fifth of the total excavation yardage by the bureau in 25 years of construction activities. The estimated cost of the project, including canals, diversion dam, and desilting works, is about $34,000,000, of which about $28,000,000 is for the main and branch canals.

The accompanying table shows data on some of the more important canals constructed by the Bureau of Reclamation.

PRINCIPAL CANALS CONSTRUCTED BY BUREAU OF RECLAMATION

Name	Project	State	Maximum capacity	Length	Maximum section	
					Bottom width	Water depth
			Second-feet	*Miles*	*Feet*	*Feet*
Vale Main [3]	Vale	Oregon	662	75.0	22.0	7.6
Milner-Gooding	Minidoka	Idaho	2,405	70.0	50.0	12.6
Kittitas Main	Yakima	Washington	1,320	26.0	30.0	11.4
Fort Laramie	North Platte	Wyoming-Nebraska	1,425	127.0	45.0	12.0
Interstate	do	do	1,400	95.0	34.0	13.0
Main South	Boise	Idaho	2,500	26.0	70.0	8.0
North [3]	Owyhee	Oregon	1,190	60.0	24.0	10.9
All-American [1]	Boulder Canyon	California	15,000	[2] 80.0	130.0	22.0
Main	Grand Valley	Colorado	1,425	62.0	38.0	10.5
North Side	Minidoka	Idaho	1,500	13.0	50.0	7.5
Truckee	Newlands	Nevada	1,200	30.0	23.0	13.0
"A" Canal	Klamath	Oregon	1,400	9.0	44.0	11.0
Sunnyside Main [4]	Yakima	Washington	1,200	60.0	44.0	8.0
Garland	Shoshone	Wyoming	1,000	18.0	20.0	9.7
North Side	Belle Fourche	South Dakota	700	45.0	28.0	7.0
Inlet	do	do	1,600	6.5	38.6	10.0
Main	Huntley	Montana	500	32.0	14.5	7.0
South	Uncompahgre	Colorado	1,300	11.5	30.0	10.0

[1] Authorized for construction.
[2] Branch to Coachella Valley 130 miles.
[3] Under construction.
[4] Canal purchased and enlarged.

ALFALFA hay continues in fair demand on the Belle Fourche project at $10 to $11 in the stack.

Notes for Contractors

Boulder Canyon project.—Contracts for electrical apparatus for the Government residences in Boulder City, under specifications No. 542–D, have been awarded as follows: Boulder City Co., of Boulder City, Nev., 30 General Electric refrigerators at a total price of $4,896; Westinghouse Electric & Manufacturing Co., of Denver, Colo., 15 Westinghouse electric ranges, 36 Westinghouse electric water heaters, and 8 Westinghouse water coolers, at a total price of $4,771.75; Edison General Electric Appliance Co. (Inc.), of Chicago, Ill., 27 General Electric Hot Point combination fuel and electric ranges and 4 General Electric Hot Point electric water heaters at a total price of $4,045.50.

Contract for the construction of a Government garage at Boulder City, under specifications No. 544–D, was awarded to White & Alter, of Elko, Nev., at a total price of $5,150.

Bids, under specifications No. 545–D, were opened at Las Vegas, Nev., on December 4, 1931, for the construction of seventeen 3-room and twelve 4-room residences of timber frame construction at Boulder City. The low bidder was Carl F. Bengston & Son, of Las Vegas, Nev., the total amount of the bid being $11,905.

I. M. Bay and H. D. Morrill, of Junction, Utah, have been awarded a contract under specifications No. 543–D for building nine 5-room cottages in Boulder City.

Specifications No. 555–D has been issued covering the construction of four 5-room residences at Boulder City, bids to be opened on December 30, 1931. This will conclude all residence construction contemplated by the Government at the present time.

Plans and specifications have been prepared for an 8-room schoolhouse at Boulder City.

Grand Valley project.—Designs and specifications have been prepared for the construction of the Grand Valley power plant. The hydraulic and electrical equipment for the plant was purchased under specifications No. 528.

Owyhee project.—Bids were opened on December 4, 1931, for a combined freight and passenger elevator for the Owyhee Dam. Six bids were received, the low bidder being the Montgomery Elevator Co., of Moline, Ill.

Yakima project—Cle Elum Dam.—Bids, under specifications No. 548–D, for plate steel tunnel lining for the outlet tunnel at the Cle Elum Dam were opened on November 25, 1931, and contract awarded to the low bidder, the McClintic-Marshall Co., of Bethlehem, Pa., for $6,812.50. Bids under specifications No. 549–D, for two 132-inch diameter butterfly valves and their operating mechanisms were opened on November 25, 1931, and contract awarded to the Hardie-Tynes Manufacturing Co., of Birmingham, Ala., for $13,850.

Yakima project, Kittitas division.—Specifications have been prepared covering the construction of the Wippel pumping plant. The work includes the construction of a concrete inlet for the steel penstocks, concrete piers and anchors for the steel penstocks and discharge pipe, concrete outlet structure for the discharge pipe, the pumping plant building, installation of the pumping equipment, the construction of a short length of lateral at the end of the discharge pipe and the construction of a metal flume approximately 1,100 feet in length. The pumping equipment was purchased under specifications No. 524. The steel penstocks and discharge pipes will be purchased and installed under a separate contract.

Bids, under specifications No. 546–D, for the purchase of plate steel lining for the Yakima River pressure tunnel were opened on November 13, 1931, and contract awarded to the Babcock & Wilcox Co., of Barberton, Ohio, at a total price of $60,660.

Yakima project, Kennewick division.—Bids were opened at Yakima, Wash., on December 30 (Specifications No. 547–D) for alterations of the Prosser diversion dam, earthwork, and structures for the Prosser power canal, including headworks and concrete canal lining, and the Prosser power plant, including forebay structure and penstock.

ENGINEER'S CAMP, CLE ELUM DAM, YAKIMA PROJECT, WASHINGTON

Big Dam on Verde River to be Monument to Bailhache

The untiring faith and enterprise of a former San Francisco engineer in striving to bring 85,000 acres of Arizona land north of Phoenix under irrigation have been signally recognized in Arizona following his death.

Directors of the $23,000,000 Verde River Irrigation & Power Co. have voted to name the major dam of the project after John Goodin Bailhache, chief engineer of the project, who died November 9 at Phoenix of injuries suffered in an automobile accident.

Some day when the big dam of which he dreamed, the dam that was to give verdant life to thousands of desert acres in that oasis country of Arizona, is a reality—and the directors are determined the project shall go through—it will bear Bailhache's name. Farmers on rich citrus land who never saw the engineer will wonder about the name, and perhaps they will be told the story of Bailhache's battle.—*Western Irrigation.*

Articles on Irrigation and Related Subjects

Banks, F. A.:
Thief Valley Dam in Oregon, bids and drawings of dam. Eng. News-Record, Oct. 15, 1931, v. 107, p. 634.

Betts, Clifford A.:
Placing concrete in Owyhee Dam at rate of 50,000 cubic yards per month (illus.). Engineering and Contracting, Nov., 1931, v. 70, p. 305.

Billings, Chet.:
Construction facts about the aqueduct. Western Highways Builder, Oct., 1931, v. 13, p. 33.

Brisbane, Arthur:
"To-day" column, Hoover Dam and Colorado River. Washington Herald, Dec. 4, 1931, v. 10, No. 9, pp. 1 and 3.

Engineering News-Record:
Building Boulder City. Eng. News-Record, Nov. 26, 1931, v. 107, pp. 846–9.
First six months' progress at Hoover Dam (illus.). Eng. News-Record, Dec. 10, 1931, v. 107, pp. 923–6.

Holmes, J. D.:
Contract let for first unit of Middle Rio Grande's irrigation system—Cochiti diversion works (illus.). Excavating Engineer, Oct., 1931, v. 25, No. 10, pp. 487–489.

Kelch, Norman W.:
A city of brick (views of Boulder City under construction). The Architect and Engineer, Nov., 1931, v. 107, No. 2, pp. 67–70.

McClellan, L. N.:
Electricity is man-of-all work on Hoover Dam project. Southwest Builder and Contractor, Oct. 16, 1931, v. 78, No. 16, p. 39.

Mead, Elwood:
Water problems arising among States explained (paper before Western Association State Engineers). U. S. Daily, Oct. 30, 1931, v. 6, No. 204.
Pumping system at Boulder City is now complete. U. S. Daily, Nov. 10, 1931, v. 6, p. 2 (p. 2054).
Hoover Dam project presents unusual engineering problems to Builders (illus.). Iowa Engineer, Nov., 1931, v. 32, No. 2, pp. 33, 34, and 48.
Man-made oases in American deserts (illus.). Scientific American, Dec., 1931, pp. 380–383.
Biography with portrait. Purdue Engineer, Nov., 1930, v. 26, p. 55.
Federal policy in regard to storage reservoirs is explained. Southwest Builder and Contractor, Dec. 4, 1931, v. 78, pp. 37 and 41.

Oddie, Tasker L.:
Proposed Boulder Canyon legislation (regarding schools, taxation, and safety). Letters of Secretary of Interior, Comptroller General and Gov. F. B. Balzar. Congressional Record, Dec. 10, 1931, v. 75, No. 4, pp. 351–354.

Ransome, F. L.:
At the Hoover Dam site (letter). Civil Engineering, Dec., 1931, v. 1, pp. 1397–8.

Ross, C. Ben (Governor of Idaho):
Expansion of soil cultivation by reclaiming arid land. U. S. Daily, Nov. 21, 1931, v. 6, No. 233, p. 8 (p. 2156).

Savage, John L.:
Engineering career of A. J. Wiley (1862–1931). Eng. News-Record, Nov. 12, 1931, v. 107, p. 788.

Shuart, Harry E.:
Warm-water game fishing at Elephant Butte, America's largest artificial body of water (illus.). New Mexico, October, 1931, v. 9, No. 10, pp. 24–26 and 32.

Sibert, Gen. Wm. L., chairman:
Board recommends steel plate lining in Hoover Dam tunnel. Eng. News-Record, Nov. 12, 1931, v. 107, p. 785.
Steel lining pressure tunnels, Hoover Dam. Eng. News-Record, Nov. 26, 1931, v. 107, p. 838 (brief editorial, p. 831).

Skerrett, R. G.:
America's wonder river—the Colorado (illus.). Compressed Air Magazine, December, 1931, v. 36, No. 12, pp. 3664–3669.

Soule, George:
Planning for agriculture. Presented by Senator Edward P. Costigan (from New Republic), Cong. Record, Dec. 10, 1931, v. 75, No. 4, pp. 355–357.

Wattis, W. H. (obituary):
W. H. Wattis, Hoover Dam builder, is dead (portrait). The Constructor, October, 1931, v. 13, p. 45.

Western States development:
Development statistics for Western States (census of population, area irrigated, etc.). Eng. News-Record, Oct. 29, 1931, v. 107, p. 694.

Wilbur, Ray Lyman:
Form of irrigation contract (All-American Canal) approved. U. S. Daily, Nov. 5, 1931, v. 6, pp. 3 and 9 (pp. 2019 and 2025).

Wiley, A. J. (obituary):
A. J. Wiley, consultant on Hoover Dam, dies (obituary and portrait). Eng. News-Record, Oct. 15, 1931, v. 107, p. 629.

Owyhee Dam

Concreting at the Owyhee Dam on the Owyhee project in eastern Oregon was discontinued on November 23 on account of cold weather, the General Construction Co., contractors, deciding to take advantage of being seven months ahead of schedule and save the expense of heating and protecting concrete. A small crew of men will remain on the work for several weeks to complete several odd jobs. During November, 24,000 cubic yards of concrete were placed in the dam, which to date is 91 per cent completed, with 73 per cent of elapsed time.

Death of W. B. Mathews

W. B. Mathews, special counsel for the Metropolitan Water District of California, died suddenly on December 9 in Los Angeles. Mr Mathews was a distinguished lawyer, a member from California of the Colorado River Commission, and was instrumental in the negotiation of the contracts for the sale of power developed at Hoover Dam. His death is felt keenly by Doctor Mead, Commissioner of Reclamation, and his many other friends in the bureau and department.

R. J. Coffey, district counsel of the bureau at Los Angeles, attended the funeral as the personal representative of the bureau.

DISTRICT No. 1, Lower Yellowstone project, has paid the full amount of the second half of the 1930 construction and operation and maintenance charges due on June 30, 1931, and has also made an advance payment of $9,000 on the first half of the 1931 operation and maintenance due December 31, 1931. District No. 2 owes $1,657.88 on the first half of the construction payment for 1930, which became due on April 1, 1931. Advance payments of $8,277.77 have been made above the estimated cost of operation and maintenance for the year 1931.

IMPROVEMENT in practically all farm products on the Rio Grande project is noted in the latest report from the project. Cottonseed price had advanced generally from $10 to $14 per ton, and first-grade alfalfa advanced to as high as $10.60 per ton baled, which is the equivalent of $9 per ton in the stack. The sweetpotato crop was unusually large, and the prevailing price was about 75 cents per hundredweight.

Boulder Canyon Project Notes

Outside stucco is being placed on the administration and dormitory buildings and finish floors are being poured in the administration building. Plastering is being completed in the post-office wing of the municipal building and installation of jail steel is being finished in the basement. The percentage of completion of this contract is approximately 71 per cent, divided among the three buildings as follows: Administration, 67 per cent; dormitory, 79 per cent; municipal, 69 per cent.

A recent investigation in regard to the number of Six Companies' employees that could be housed in Boulder City reveals the fact that upon the completion of the buildings now under construction the company will be able to house approximately 2,000 employees in that city. Present indications are that more than this number will apply for residence there, and it is now the plan to continue the building program so that accommodations can be secured for all workers that wish to live in Boulder City.

A celebration was held on December 3, commemorating the opening of the Mojave County road from Kingman, Ariz., to Hoover Dam site. Approximately 1,200 persons attended the barbecue and meeting, which was held on the Arizona side near the entrance to Black Canyon at the ferry crossing which connects the Arizona and Nevada sections of the highway. The principal speakers for the occasion were C. P. Squires, Las Vegas newspaper publisher, and Walker R. Young, construction engineer. The new highway will cut off approximately 70 miles from the distance between Kingman and Las Vegas over the old route, making the distance between these two cities now only 110 miles.

On December 9, the Six Companies (Inc.), had completed the following excavation in the four 50-foot-diameter diversion tunnels: 14,575 feet of 12 by 12 foot top headings and 3,004 feet of a 41 by 56 foot section. The combined length of the tunnels is 15,935 feet, or 3.02 miles.

Twenty-three leases for concessions have been executed and five plants or buildings constructed or under construction for permittees in Boulder City. Plans have been approved for the moving-picture theater that is to be erected on the corner of Arizona Street and Cardenas Plaza. The building will include within its walls a modern theater of 852 seats, a series of stores facing Arizona Street and Cardenas Plaza, and a group of office rooms on the second floor above the stores.

Grading of the Black Canyon highway from the intersection with the Boulder City highway to the bench at the top of the inclined railway has been completed and work is in progress on the construction of retaining walls.

Thanksgiving Day in Boulder City

By W. R. Nelson, Assistant Engineer

Boulder City celebrated its first Thanksgiving with all the enthusiasm and in a manner consistent with its place as the base camp from which the highest dam in the world is being built.

On Thanksgiving Eve a dance was given in the Six Companies' mess hall by the volunteer firemen, at which was present a crowd of merrymakers variously estimated at 1,500 to 2,000. Dancing was almost impossible on account of the crowd that packed the 62 by 135 foot dining room, but everyone was there for a good time and had it. With all the merrymaking, there was no drinking or evidence of disorder. The Federal Rangers were successfully on the job to stop the flow of liquor into the reservation.

On Thanksgiving Day turkey dinners were the principal topic of conversation between bites at the many homes in Boulder City, at the Government camp, and at the big Six Companies' mess hall. Many Government employees from Las Vegas and Boulder City assembled at the Government survey camp for a bountiful repast, and at the Six Companies' mess did they eat, and how! The 2,500 employees consumed 2,400 pounds of turkey, 300 gallons of oyster soup, half a ton of candied sweet potatoes, a case of olives, 10 crates of celery, 5 crates of lettuce, 300 pounds of cranberries, 760 pies, half a ton of plum pudding with hard sauce, 500 pounds of candy, and the same amount of nuts.

Well, maybe everyone did eat a bit too much, but the first Thanksgiving in Boulder City occurs only once in a lifetime—at least that's as good an excuse as any.

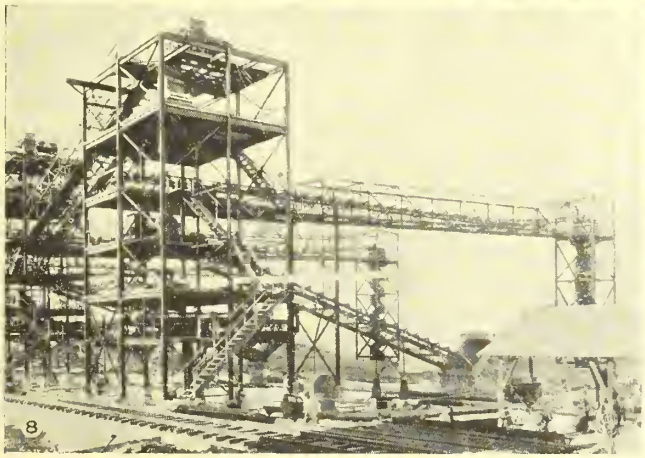
Rough grading of streets is nearly completed and rapid progress is being made in the operations of finish grading. Paving has been started on several streets and 10,000 square yards of macadam base have been laid in this construction. More than 59,300 feet of curb and gutter, 56,700 feet of concrete sidewalks, and 42,200 feet of gravel sidewalks have been constructed. The percentages of completion of these items are as follows: Rough grading, 96 per cent; curb and gutter, 66 per cent; concrete sidewalks, 32 per cent; and gravel sidewalks, 45 per cent.

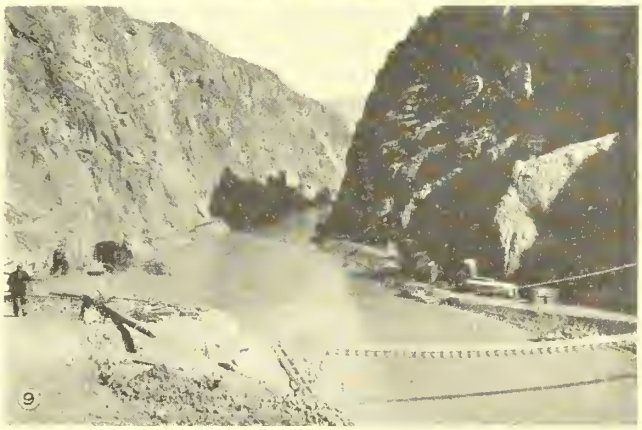
Although the tourist travel has been reduced to a large extent owing to the recent winter weather, the chief ranger of the Federal reservation reports than an average of 200 persons classified as tourists continue to visit the project daily.

Norman De Vol, of the American Society of Cinematographers, called at the Las Vegas office and interviewed the construction engineer regarding the program proposed by the society to secure a photographic record of the construction of the Boulder Canyon project. The object of the society is to secure pictures of a nature to be classed as educational, to be shown as educational reels. Mr. De Vol has agreed to furnish the bureau with duplicates of all films taken as the work progresses.

More Than a Million Dollars for One Month's Work

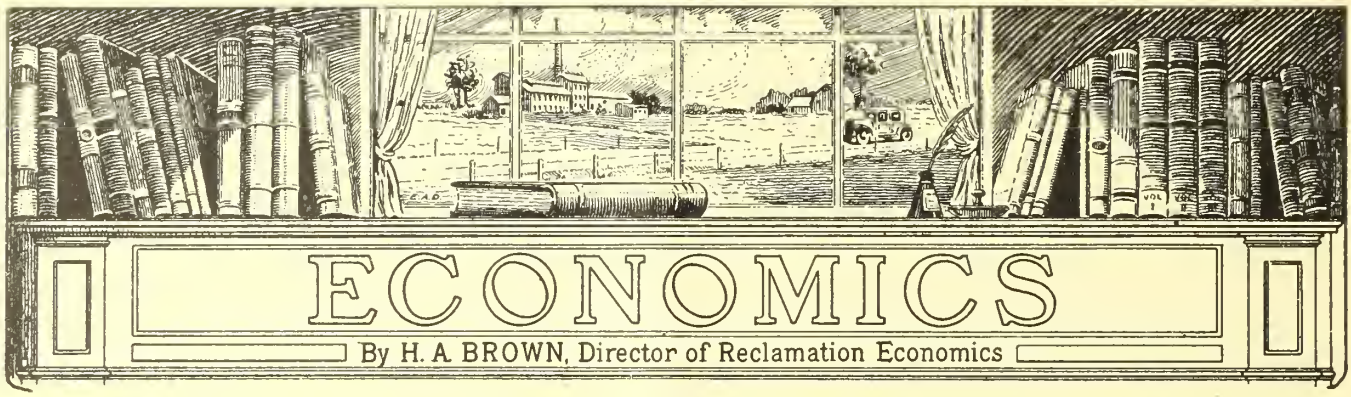
One million ten thousand eight hundred forty-four dollars and sixteen cents ($1,010,844.16) was the amount of check No. 3100, which was issued on December 9 from the Las Vegas office of the Boulder Canyon project. This check with the numerous figures was paid to Six Companies (Inc.), principally for yardage excavated during November in driving diversion tunnels for the Hoover Dam. In that month more than 174,000 cubic yards of rock were removed from the four diversion tunnels in driving 2,775 feet of 12 by 12 foot pilot headings and 1,593 feet of 41 by 56 foot enlarged headings. It is anticipated that this is the first of a series of checks for over a million dollars that will be issued to the Six Companies (Inc.) for a month's work, as it will be necessary that a similar or larger amount be earned in each of several months for the contractor to maintain its performance schedule.





BOULDER CANYON PROJECT PROGRESS VIEWS

1, Municipal Building; 2, Administration Building; 3, looking downstream from Observation Point, Black Canyon Highway at right, Six Companies' construction roads on Nevada side in center, spoil dump road leading from Arizona Tunnel outlets at left; 4, Government residences, looking west on Colorado Street from Nevada Highway; 5, portion of 48 trucks of subcontractor drawn up on Six Companies' construction road on Nevada side during blasting operations within Nevada penstock tunnel; 6, looking northeast on Nevada Highway, Six Companies' commissary at left, business buildings of lessees being erected in center, United States Administration Building, dormitory, and residences in background; 7, presedimentation tank serving Six Companies' gravel screening and washing plant at Three-way Junction; 8, detail view of Six Companies' gravel screening and washing plant, south unit shown; 9, tunnel outlets from Six Companies' construction road above presedimentation tank.



New Potato-Flour Factory on the Minidoka Project, Idaho

By Dana Templin, Associate Engineer, Minidoka Project

THE new potato-flour factory, recently opened at Burley, Idaho, by the Otato Corporation, promises to be an important feature in the disposition of one of the principal crops of the Minidoka project. The soil and climate of the project are peculiarly adapted to growing potatoes, which yield abundantly and are unsurpassed in quality. However, profits to the grower are frequently lessened or entirely eliminated by reason of the distance to market and the expense of shipment. This is especially true of those potatoes that fall below No. 1 grade. Although equal in food value to the No. 1's, the No. 2 potatoes and culls must be sold at a much lower price, and frequently they are used for stock food or are not harvested at all. Such potatoes, however, if free of disease, are wholly suitable for making into potato flour, and hence will be largely utilized in the new plant. Moreover, if these potatoes of poorer quality can thus be removed from the open market, it would tend to improve the market for those of higher grade.

POTATO-FLOUR IN THE MAKING

The plant was erected in 1929 and 1930, but for various reasons it has been operated only part of the time since its completion. Its product is a fine white or pinkish white flour, used in making bread and other branches of the baking industry. The dried flour retains its qualities indefinitely and hence can be used in localities and climates where potatoes in their natural state could not be obtained. By mixing the flour with water or milk, and heating, ordinary mashed potatoes are the result. As an ingredient used in bread-making, it produces a flour that has an increased capacity to retain moisture, a better color and flavor, and a greater content of mineral salts. The latter quality is especially valuable, as it promotes the growth of the yeast plant in bread.

Potatoes, when brought to the plant from the farms, are weighed on scales having a capacity of 20 tons, then dumped through chutes into the storage cellar, a huge building with a framework of Oregon poles and timbers, covered with earth. This building, which is 243 feet long by 80 feet wide has a capacity of 7,000,000 pounds, and is thoroughly equipped for handling potatoes in the most expeditious manner. Two endless belts, one on either side, run lengthwise of the cellar near the roof and distribute the potatoes from the chutes through which they are dumped, in two long piles beneath, while a third conveyor, operating in the center of the cellar near the floor, carries them into the mill.

At the mill, the potatoes are washed and thoroughly cleaned, after which they are dropped into the cooker, which is described as a long, insulated box, 70 feet long by 4 feet wide. The potatoes are carried through the cooker on an endless belt, where they are cooked with steam supplied from a 100 H. P. horizontal boiler, using oil as a fuel. The cooker has a capacity of 100 pounds of potatoes per minute, or 144,000 pounds per 24 hours. Because of the altitude of Burley, about 4,200 feet above sea level, the boiling point of water is only 201°, hence a superheater is attached to the steam line between the boiler and cooker to raise the steam to the proper temperature.

After cooking, the potatoes are dropped into a machine called the extruder, which removes the skins. The cooked potato, or mash, then falls into a mixing tank where water is added so as to make a moderately thin liquid known as "soup." The soup is pumped into a second tank, which is also heated with steam, and thence the thick liquid is pumped to the spray machines at the top of the drying chamber.

THE PLANT AND ITS OPERATION

The drying chamber (a huge, concrete cylindrical structure 40 feet in diameter and about 80 feet high) is the most noticeable feature of the entire plant. Five spray machines are located in the top of the drying chamber into which the potato soup is pumped, and these machines operate aluminum spray disks. These disks revolve at a speed of from 8,000 to 10,000 revolutions per minute, which cause the liquid to be thrown out in a very fine spray, while a blast of hot air is kept playing upon the spray as it emerges from the machine. In this way the water is evaporated almost instantly, and the dried potato particles fall to the floor of the drying chamber.

It is claimed that the superior quality of the flour, especially its lightness, is due in great measure to this method of instantaneous drying, so that the fine particles of potato when magnified resemble grains of puffed wheat.

At the bottom of the drying chamber is a rotating sweeper, triangular in shape and 36 feet in size. A current of hot air is forced out through each arm of the sweeper and downward against the floor, so that the floor is kept constantly swept clean, the issuing jets of air being so arranged that their reaction causes the sweeper to rotate, on the principle of the ordinary lawn sprinkler. This continuous flow of hot air entering the drying chamber, which amounts to more than 100,000 cubic feet per minute, not only acts to sweep the floor but furnishes a supply of fresh air for the chamber.

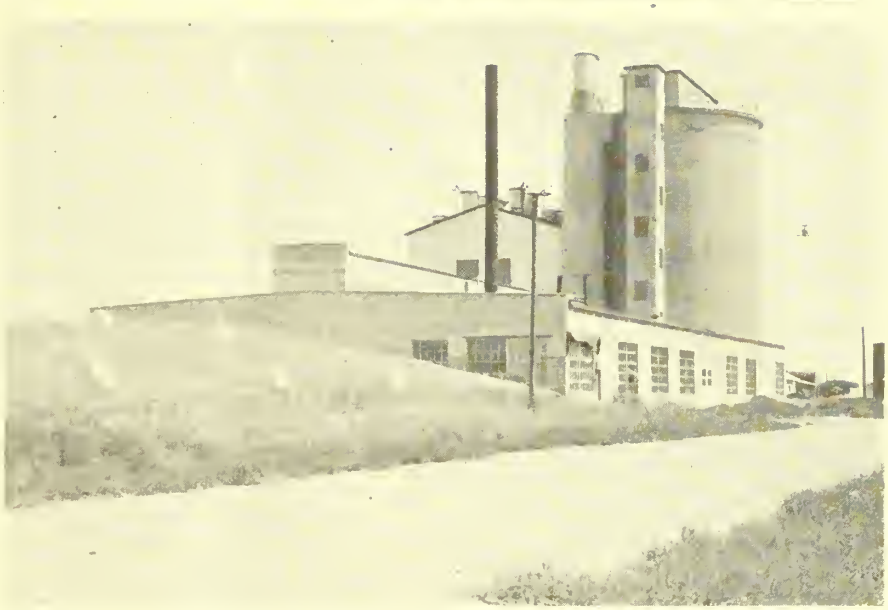
The blast of air carries the fine potato flour out of the drying chamber into a series of eight collectors which are connected so that the product falls into two screw conveyors and is carried to two sifters, where it is weighed and sacked, and then is ready for market. The

output of the plant is at the rate of 1,000 pounds of flour per hour.

In the operation of the plant, some 8,000 to 10,000 pounds of water are evaporated in the drying chamber each hour. The furnace used is of the vertical type, 1,000-horsepower capacity, and uses oil for fuel. Special motor generator sets are installed for driving the atomizers, which deliver current at frequencies that can be varied from 60 to 300 cycles. As the speeds of the atomizer are synchronous, they can thus be maintained as desired, regardless of the load.

The plant at Burley was erected and is owned by the Otato Corporation, of New York City, and is the second and largest plant the company has built in this country. A smaller one is located at Garwood, N. J. Burley was selected as the site because of the ample supply of first-class potatoes, an abundant supply of pure water, and cheap power. The plant employs from 18 to 20 men when running to capacity, and in this respect alone is a valuable asset in the community. It is thoroughly modern throughout, the factory buildings being of reinforced concrete and steel, while much of the machinery was specially designed. Besides the storage cellar and drying chamber already described, the main building that houses the machinery is 80 feet by 275 feet in size, and there are several smaller buildings.

At present, the factory is in the experimental stage, considered economically. Ample test runs have been made so that the quality of the product is assured, but a satisfactory and profitable market has yet to be developed. If this is accomplished, it is probable that other plants will be built in localities where conditions are favorable for their successful operation.



POTATO FLOUR FACTORY, BURLEY, IDAHO, MINIDOKA PROJECT

Wyoming Irrigation Products Excel at Stock Show

AT the American Royal Stock Show in November, held in Kansas City, the Wyoming booth was in charge of L. T. Olroyd, commissioner of Agriculture, and Charles B. Stafford, executive manager, department of commerce and industry, who were ably assisted by Val Kuska, colonization agent of the Chicago, Burlington & Quincy Railroad, and H. D. Comstock, superintendent of the Riverton project. Mr. Kuska arranged for the transportation of most of the exhibit material and loaned considerable equipment from his office at Omaha. H. E. Dickinson, general superintendent of the Chicago & North Western Railroad, transported a fresh shipment of potatoes and vegetables without charge.

A large number of people in attendance at the show visited the Wyoming booth, many of whom were genuinely interested in obtaining land. The exhibits of agricultural products, especially the potatoes, which were grown largely by W. T. Peyton, gate tender at the Wind River diversion dam, on the Riverton project, attracted much attention. Many farmers stated they did not realize that potatoes of such fine quality were grown anywhere. Some very large onions grown by C. E. Deardorf on the Riverton project, aroused much interest, and many visitors, until convinced by handling them, refused to believe they were not artificial. The exhibit in the Wyoming booth is shown in the accompanying illustration.

PRODUCTS OF FEDERAL IRRIGATION IN WYOMING EXHIBITED AT THE AMERICAN ROYAL STOCK SHOW IN KANSAS CITY

ONIONS produced this season on the Bully Creek West Bench, Vale project, have been sold and the yield, although not a record one, was very gratifying, the net returns to the growers from 120 acres being $26,000 to $30,000. Some of the onions weighed slightly over 2 pounds and measured approximately 5 inches in diameter, and portions of the field ran as high as 40 tons to the acre. Prices received ranged from $1.85 for grade 1 to $1 for grade 2. Culls and boilers were sold in the field at a price as low as 25 cents per hundredweight and hauled by trucks to local markets, and those not sold were given to settlers in the vicinity of the land. This record has demonstrated that the sagebrush land of the Vale project, with proper cultivation and irrigation, is capable of great productivity.

Future Farmers Are Busy at Orland

By R. W. Guilford, Director of Vocational Agriculture, Orland High School

THE Future Farmers at the Orland High School are hard at work trying to beat "Old Man Depression." In spite of the hard times, this coming group of farmers is looking ahead and hoping for better times. At the present low prices for livestock, the boys are purchasing good breeding stock very advantageously, and will establish good foundation herds for expansion when better times appear.

At the Glenn County District Fair held at Orland last September, 30 Orland boys exhibited 32 Poland China hogs, 13 Duroc Jersey hogs, 14 sheep, and 9 dairy calves, winning $175 in premium money, besides many valuable special prizes. Future Farmers from the the Redding, Red Bluff, Chico, and Willows High Schools also showed many excellent animals at this fair. The boys placed many of their animals high in the open classes over animals produced by veteran breeders.

At the Glenn County District Fair, livestock judging teams from the schools of Redding, Red Bluff, Corning, Chico, Los Molinos, Colusa, Princeton, Willows, and Orland competed for the W. S. Guilford Trophy, which is awarded annually for this event. The cup was held last year by the Red Bluff High School and previously by Gridley, Willows, and Orland. This year it was won by the Orland team, consisting of Leroy Nelson, Wallace Rawlings, and Edward Reimers.

A student desiring to study agriculture at the Orland High School may choose soils and crops, animal husbandry, horticulture, or agricultural economics. He also takes agricultural mechanics, the shop course which deals with the mechanical work of the farm. He takes two other courses in other departments of the school, besides physical education. This gives him a well rounded program.

A part of the class time, usually one period per week is spent on a field trip, at which time visits are made to points of interest in the community where farming operations, discussed in the class room, are actually taking place in the field. This gives the student practical information.

PRACTICAL EXPERIENCE

A very vital part of the student's program is the home project, which is a requirement for the student in vocational agriculture. "Learn by doing" is the motto of the Future Farmer and he does the things he studies about in the class room in actually raising crops or livestock. The fine showing made by the Future Farmers of Orland at the Glenn County District Fair, as well as by the Future Farmers in near-by communities, attests to their active interest and success in the project work. The facts these boys learn in connection with their home projects will never be forgotten.

They learn cooperation and teamwork in their Future Farmer organization. There is a Future Farmer chapter in practically every high school in the United States where vocational agriculture is taught, and the boys are very much interested in the activities of their chapter. These include judging livestock, grains, and trees competitively, interchapter basketball and baseball, exhibiting livestock at fairs and shows, camping trips, and other activities. They learn to work and play together, which teaches them the spirit of cooperation.

Courses in vocational agriculture are designed to prepare the student for a vocation which is undergoing great changes both economically and socially. The future of agriculture will depend to a great extent upon what these young men will be able to accomplish along the lines of economical production, efficient distribution, and cooperation with each other.

What Do You Know About the Onion?

FROM the earliest times of which we have authentic records the onion has been highly esteemed as an article of food. In desert regions it was early used also as a preventive of thirst by travelers and soldiers on the march.

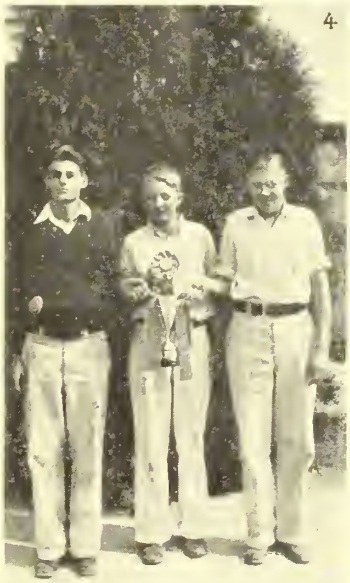
The original home of the plant, of which there are many varieties, was probably southern Asia or the borders of the Mediterranean Sea. Egyptians cultivated the onion at the dawn of their history, and now the Egyptians offer competition to the Texas producers of winter-grown Bermuda onions.

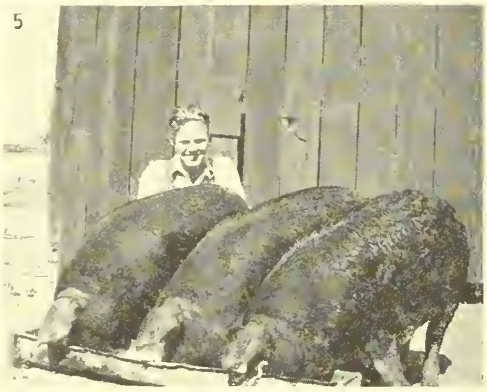
The onion belongs to a widely variable species, *Allium cepa*, which forms a part of the botanical family of plants which includes many of the lilies, the several forms of asparagus and smilax, and similar plants with a scaly or fleshy enlarged root. A characteristic of this family is that most of its species grow naturally upon soil having an abundance of moisture, many of them being natives of low-lying areas along the seashore. Another characteristic of plants like the onion and asparagus is that they will withstand considerable salt in the soils on which they grow. Conditions favorable to onion culture are found in many sections of the United States and the crop is widely grown.

Good prices for onions one year are likely to stimulate heavy production the next year. This is true not only because commercial growers expand their acreage but also because good prices will lead many individuals to plant onions in small patches or home gardens that supply more than the needs of the growers and so enter the local markets in competition with the cash crop.

Onions demand intensive culture, which makes them particularly adaptable for truck patch and back-lot cultures, in which the grower can cultivate and weed them in the time outside his usual hours of employment.

The average yield of an acre of onions is about 290 bushels, but on soils that are suitable and fertile good cultivation often results in yields of from 400 to 600 bushels an acre.





SCENES AT THE ANNUAL
GLENN COUNTY FAIR
SEPTEMBER 26, 1931
ORLAND PROJECT
CALIFORNIA

1, Students judging livestock—nine schools competed for the United States Guilford trophy; 2, Orville Myers, Orland future farmer, and his band of turkeys; 3, Carrol Sherrod, Orland future farmer, and two of his registered Poland China brood sows; 4, Orland High School livestock-judging team and United States Guilford trophy won at the livestock-judging contest—team members, left to right: Wallace Rawlings, Edward Reimers, and Leroy Nelson; 5, Melvin Olsen, Orland future farmer, and his pen of three Poland China fat barrows fitted for the Junior Livestock and Baby Beef Show held at San Francisco, November 2-4; 6, Wallace Rawlings, Orland future farmer, and his dairy calf-raising project; 7, Wallace Rawlings and his band of registered Rambouillet sheep; 8, Edward Reimers, left, Orland future farmer, and his pen of three Hampshire wethers fitted for the Junior Livestock and Baby Beef Show at San Francisco—Wayne Muchow, right, is helping to hold the sheep; 9, Edward Reimers and one of his Hampshire wether lambs which he entered at the Junior Livestock and Baby Beef Show held at South San Francisco, November 2-4

Reclamation Fund, Accretions, Repayments, and Expenditures to June 30, 1931

THE financial condition of the Reclamation Bureau may be summed up in the accompanying condensed statement of total receipts and expenditures for the fiscal year 1931, which gives a complete picture of how the fund is built up by accretions and repayments and its disposition for construction and operation and maintenance of reclamation projects.

In the table on the opposite page there is disclosed a complete summarization of the reclamation fund, since its inception, detailing by States the accretions, repayments, and expenditures. From this statement it will be observed that the difference between total accretions and collections (column 4) and total expenditures (column 7) amounts to $7,297,552.50 or an excess of $2,612,878.35 over the amount above stated available for the fiscal year 1932. This difference covers expenditures for materials, supplies, and equipment on hand in project storehouses and other assets not charged into construction, operation, and maintenance costs.

Balance available at the beginning of the fiscal year	$5,035,343.37
Accretions, sale of public land, oil royalties, etc	2,957,942.72
Construction repayments	4,337,611.14
Operation and maintenance repayments	1,327,053.28
Miscellaneous collections	1,742,024.77
Loan from general treasury	2,000,000.00
Sale of town-site lots	3,034.65
Total available during the fiscal year 1931	17,403,009.93
Disbursements for construction, operation, and maintenance during the fiscal year	12,718,335.78
Balance available for the fiscal year 1932	4,684,674.15

ALTHOUGH this year's beet crop on the Milk River project was not so outstanding as that of 1930, results were very satisfactory and a considerable increase in acreage is in prospect for 1932. It is probable that almost every acre on the Malta division which is in condition to produce a profitable beet crop will be seeded during the coming spring if favorable weather conditions continue.

YUMA PROJECT, ARIZONA-CALIFORNIA

Above: Colorado River at Yuma, looking upstream. Discharge of river 74 second-feet. Note trench being dug by Arizona Edison Co. to obtain domestic water supply for Yuma; lower left, Dome suspension bridge over Gila River, 20 miles east of Yuma; lower right: Deglet Noor date trees in Valley Division

Accretions to the Reclamation Fund, Repayments to the Reclamation Fund, and Expenditures for Construction and Operation and Maintenance of Reclamation Projects to June 30, 1931

(1) State and project	(2) Accretions to reclamation fund to June 30, 1931	(3) Collections (repayments to reclamation fund) to June 30, 1931	(4) Total accretions and collections (column 2+ column 3)	(5) Expended for construction of reclamation projects to June 30, 1931	(6) Expended for operation and maintenance to June 30, 1931	(7) Total expenditures to June 30, 1931 (column 5+ column 6)
Alabama	$66, 941. 09		$66, 941. 09			
Arizona:						
Salt River		$11, 615, 320. 53		$15, 106, 942. 10		$15, 106, 942. 10
Yuma [1]		[2] 5, 947, 198. 02		8, 470, 198. 60	[3] $2, 479, 658. 81	10, 949, 857. 41
Yuma auxiliary		24, 748. 89			167, 800. 12	167, 800. 12
Total Arizona	2, 523, 046. 52	17, 587, 267. 44	20, 110, 313. 96	23, 577, 140. 70	2, 647, 458. 93	26, 224, 599. 63
California:						
Orland		1, 402, 204. 90		2, 506, 980. 45	476, 603. 23	2, 983, 583. 68
Yuma [1]		[2] 2, 140, 118. 38		1, 620, 181. 62	[3] 946, 321. 25	2, 566, 502. 87
Klamath [1]		[2] 450, 000. 00		2, 536, 561. 00	103, 000. 00	2, 639, 561. 00
Total California	16, 111, 060. 59	3, 992, 323. 28	20, 103, 383. 87	6, 663, 723. 07	1, 525, 924. 48	8, 189, 647. 55
Colorado:						
Grand Valley		938, 537. 44		5, 354, 737. 34	174, 405. 40	5, 529, 142. 74
Uncompahgre		2, 988, 353. 77		7, 928, 760. 97	1, 137, 247. 41	9, 066, 008. 38
Total Colorado	10, 511, 370. 57	3, 926, 891. 21	14, 438, 261. 78	13, 283, 498. 31	1, 311, 652. 81	14, 595, 151. 12
Idaho:						
King Hill		130, 224. 99		1, 905, 918. 80	156, 734. 25	2, 062, 653. 05
Minidoka		12, 693, 389. 37		15, 128, 513. 42	2, 228, 724. 85	17, 357, 238. 27
Minidoka-Gooding division		295, 914. 49		3, 725, 518. 48	2, 466. 79	3, 727, 985. 27
Boise [1]		[2] 7, 754, 983. 12		16, 864, 578. 24	2, 771, 923. 44	19, 636, 501. 68
Owyhee [1]		[2] 5, 623. 30		1, 812, 437. 47		1, 812, 437. 47
Total Idaho	6, 978, 797. 76	20, 880, 135. 27	27, 858, 933. 03	39, 436, 966. 41	5, 159, 849. 33	44, 596, 815. 74
Kansas: Garden City	1, 032, 764. 48	58, 002. 27	1, 090, 766. 75	395, 831. 78		395, 831. 78
Louisiana	22, 352. 94		22, 352. 94			
Montana:						
Huntley		1, 238, 242. 82		1, 562, 302. 99	1, 014, 941. 03	2, 577, 244. 02
Milk River		687, 464. 09		7, 472, 272. 43	256, 851. 90	7, 729, 124. 33
Sun River		822, 994. 87		7, 568, 290. 14	316, 876. 88	7, 885, 167. 02
Lower Yellowstone [1]		[2] 584, 569. 43		2, 401, 788. 99	862, 309. 49	3, 264, 098. 48
Total Montana	16, 140, 181. 49	3, 333, 271. 21	19, 473, 452. 70	19, 004, 654. 55	2, 450, 979. 30	21, 455, 633. 85
Nebraska: North Platte [1]	2, 094, 928. 51	[2] 6, 179, 885. 95	8, 274, 814. 46	15, 200, 385. 76	2, 565, 092. 10	17, 765, 477. 86
Nevada: Newlands	1, 011, 021. 70	2, 781, 529. 16	3, 792, 550. 86	7, 956, 917. 16	1, 453, 490. 54	9, 410, 407. 70
New Mexico:						
Carlsbad		1, 843, 766. 96		1, 464, 649. 87	891, 160. 56	2, 355, 810. 43
Hondo		34, 956. 70		381, 573. 39		381, 573. 39
Rio Grande [1]		[2] 4, 428, 513. 49		8, 599, 060. 04	1, 803, 612. 49	10, 402, 672. 53
Total New Mexico	6, 546, 075. 12	6, 307, 237. 15	12, 853, 312. 27	10, 445, 283. 30	2, 694, 773. 05	13, 140, 056. 35
North Dakota:						
Buford-Trenton		17, 873. 93		223, 423. 06	74, 781. 07	298, 204. 13
Williston		597, 204. 59		517, 630. 09	904, 662. 04	1, 422, 292. 13
Lower Yellowstone [1]		[2] 313, 421. 88		1, 287, 739. 60	462, 334. 57	1, 750, 074. 17
Total North Dakota	12, 296, 717. 49	928, 500. 40	13, 225, 217. 89	2, 028, 792. 75	1, 441, 777. 68	3, 470, 570. 43
Oklahoma	5, 926, 388. 90		5, 926, 388. 90			
Oregon:						
Baker		5, 879. 29		71, 598. 04		71, 598. 04
Umatilla		1, 204, 130. 66		5, 137, 937. 20	693, 226. 03	5, 831, 163. 23
Vale		34, 541. 60		3, 303, 043. 62		3, 303, 043. 62
Klamath [1]		[2] 2, 469, 649. 14		3, 570, 772. 89	1, 135, 233. 50	4, 706, 006. 39
Owyhee [1]		[2] 14, 459. 91		4, 660, 553. 50		4, 660, 553. 50
Boise [1]		[2] 75, 000. 00		204, 600. 00	28, 000. 00	232, 600. 00
Total Oregon	11, 918, 189. 56	3, 803, 660. 60	15, 721, 850. 16	16, 948, 505. 25	1, 856, 459. 53	18, 804, 964. 78
South Dakota: Belle Fourche	7, 721, 678. 80	1, 647, 802. 01	9, 369, 480. 81	4, 393, 382. 64	1, 588, 290. 64	5, 981, 673. 28
Texas: Rio Grande [1]		[2] 3, 529, 649. 27	3, 529, 649. 27	7, 249, 597. 20	1, 532, 374. 40	8, 781, 971. 60
Utah:						
Salt Lake Basin		65, 774. 92		2, 793, 929. 28		2, 793, 929. 28
Strawberry Valley		2, 272, 178. 85		3, 519, 935. 39	437, 856. 39	3, 957, 791. 78
Total Utah	4, 422, 723. 36	2, 337, 953. 77	6, 760, 677. 13	6, 313, 864. 67	437, 856. 39	6, 751, 721. 06
Washington:						
Okanogan		700, 381. 52		1, 456, 465. 81	649, 647. 22	2, 106, 113. 03
Yakima		11, 836, 388. 89		14, 540, 118. 86	4, 513, 436. 04	19, 053, 554. 90
Yakima-Kittitas division		110, 776. 28		8, 006, 384. 39	48, 857. 31	8, 055, 241. 70
Total Washington	7, 436, 582. 99	12, 647, 546. 69	20, 084, 129. 68	24, 002, 969. 06	5, 211, 940. 57	29, 214, 909. 63
Wyoming:						
Riverton		180, 003. 09		3, 879, 451. 47	59, 372. 49	3, 938, 823. 96
Shoshone		2, 273, 859. 64		9, 989, 763. 65	914, 557. 82	10, 904, 321. 47
North Platte [1]		[2] 826, 000. 00		5, 009, 336. 67	215, 471. 07	5, 224, 807. 74
Total Wyoming	38, 661, 839. 07	3, 279, 862. 73	41, 941, 701. 80	18, 878, 551. 79	1, 189, 401. 38	20, 067, 953. 17
All States:						
Secondary investigations		1, 312, 692. 73	1, 312, 692. 73	2, 728, 061. 31		2, 728, 061. 31
Federal water power licenses	271, 423. 78		271, 423. 78			
Other collections (general offices, etc.)		644, 703. 48	644, 703. 48			
Loans from General Treasury		12, 000, 000. 00	12, 000, 000. 00			
Grand total	151, 694, 084. 72	107, 178, 914. 62	258, 872, 999. 34	218, 508, 125. 71	33, 067, 321. 13	251, 575, 446. 84

[1] Interstate projects, expenditures for construction and for operation and maintenance partly prorated on an area basis.
[2] Distribution between States of collections on interstate projects partly estimated.
[3] Levee maintenance reimbursed or financed by General Treasury not included.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, addressed the University of Michigan Club of Washington at its first regular monthly dinner-smoker, which was held at the University Club on Monday evening, November 30. At this, its Engineers' Night, Doctor Mead spoke informally on water rights, flood control of the Colorado River, and levee systems. Other engineers who took part in the program were Dr. Lyman J. Briggs, Assistant Director United States Bureau of Standards, and J. Rowland Bibbins, chairman of the evening.

Doctor Mead has been designated by the Secretary of the Interior as the representative for the Bureau of Reclamation on a national land-use planning committee recommended by the Conference on Land Utilization held in Chicago, November 19–21. This committee, which includes representatives from the Department of Agriculture, will study the coordination of activities in the field of land utilization.

Doctor Mead gave an illustrated talk on January 11 on the subject of the Hoover Dam before the Technology Club of Syracuse (Inc.), Syracuse, N. Y., under the auspices of the local section of the American Society of Civil Engineers.

Miss Mae A. Schmurr, assistant to the commissioner, and Dr. Hugh A. Brown, director of reclamation economics, were designated by the commissioner to represent the Bureau of Reclamation at the President's conference on home building and home ownership, which was held in Washington, December 2–5.

R. F. Walter, Chief Engineer, was in the Washington office during the latter half of December conferring with Dr. Mead on financial and administrative matters.

W. W. McLaughlin, Chief the of Division of Irrigation for the Bureau of Agricultural Engineering, Department of Agriculture, with headquarters in Berkeley. Calif.; John A. Whiting, State engineer of Wyoming; and S. D. Bechtel, director of Six Companies (Inc.), were among the recent visitors to the Washington office.

Northcutt Ely, executive assistant to the Secretary of the Interior, recently visited his father, Sims Ely, manager of Boulder City, and made a brief inspection trip over the Boulder Canyon project.

C. M. Day, mechanical engineer in the Denver office, while on a recent trip to the East visiting various steel companies in connection with the use of steel penstocks in the Boulder Canyon tunnels, called at the Washington office.

Mr. and Mrs. Henry Levy, of Yuma, Ariz., were visitors at the Washington office on December 16. Mr. Levy was appointed to the position of chief of police in Yuma 21 years ago and still holds the position.

A telegram from Western Construction News, San Francisco, to the Denver office announced the death on Friday morning, December 11, of its very efficient and long-time managing editor, Philip Schuyler.

Washington Office Christmas Fund Society

THE Reclamation Christmas Fund Society of the Washington office closed its fiscal year on November 30, paying out to its members a total of $4,360.21. Thirty-four employees of the bureau were members of the society and on November 30 the treasurer had $4,248, plus the earnings of the fund, $112.21, to be divided among the members in proportion to the amount they had saved during the year. The fund earns money in three ways—first, the interest on money in the savings bank and on certificates of deposit; second, interest on loans made to members of the society; and, third, fines assessed against members delinquent in making their payments to the fund.

A helpful feature of the society is the making of loans to members during the year. Members are permitted to borrow approximately one and one-half times the amount they will pay in during the year, but they are required to have two other members of the Society indorse their notes. At the close of the year all loans are paid or charged against the amount due the member.

The fund grows a little each succeeding year, both in membership and in the amount subscribed.

The treasurer is allowed 25 per cent of the gross earnings of the fund as salary. This position changes hands every few years in order to distribute the work.—*Mrs. Margaret G. Young, Chief, Stenographic Section.*

W. G. Ide, for nine years manager of the Oregon State Chamber of Commerce, has resigned and will engage independently in colonization work. The results of his efforts in bringing into Oregon hundreds of new families will stand as a monument to his devotion to this constructive work. The Bureau of Reclamation extends to Mr. Ide its best wishes for his continued success. The retirement of Mr. Ide is regretted by the Oregon State chamber, but the land settlement work will be continued where it is deemed necessary or advisable. This work is regarded as particularly desirable on all reclamation projects.

Among the out-of-town visitors in attendance upon the President's conference on home building and home ownership in Washington, the following called on Doctor Mead: Hugh MacRae, of Wilmington, N. C.; Dr. Alvin Johnson, president of the New School for Social Research, New York City; S. R. De Boer, city planner, who laid out the plan of Boulder City; and Mr. and Mrs. Joseph C. Gawler, of Yakima, Wash.

In the death on November 4, 1931, of D. B. Pratt, manager of the Black Hills Sugar Plant at Belle Fourche, S. Dak., not only the Belle Fourche project but the entire Bureau of Reclamation has lost a friend who was always active in promoting the agricultural interests of the project from the broad viewpoint of better practices in all branches of irrigation farming.

The Colorado River Board, composed of Maj. Gen. William L. Sibert, Charles P. Berkey, Daniel W. Mead, Warren J. Mead, and Robert Ridgway, which has been giving particular consideration to the design of Hoover Dam spillways during its session in Denver, has adjourned and the members have left for their respective homes.

Col. B. F. Fly, of Yuma, is spending some time in Washington in the interest of the Yuma project.

B. E. Stoutemyer, district counsel, with headquarters at Portland, Oreg., spent several days in the Washington office in connection with the requests for relief by the various districts under the Yakima project, the question of the sale of Jackson Lake water, and other matters.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department;
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer;
Northcutt Ely and **Charles A. Dobbel,** Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kuhach, Chief Accountant
P. W. Dent, Assistant Commissioner
C. N. McCulloch, Chief Clerk
Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Chief of Engineering Division

Denver, Colo., U. S. Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J.L. Savage, Chief Designing Eng.; E. B. Dehler, Hydrographic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Official in charge			Chief clerk	Fiscal agent	District counsel	
	Office	Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	E. M. Philebaum	R. J. Coffey	Los Angeles.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	J. R. Alexander	Las Vegas, Nev.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peck	E. A. Peck	R. J. Coffey	Los Angeles.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			J. R. Alexander	Las Vegas, Nev.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Portland, Oreg.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	Wm. J. Burke	Billings, Mont.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	H. J. S. Devries	El Paso, Tex.
Baker Thief Val. Dam	Owyhee, Oreg	F. A. Banks	Constr. engr			do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin (Echo)	Coalville, Utah	F. F. Smith	Constr. engr		Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima	Yakima, Wash	John S. Moore	Superintendent	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr		do	do	Do.
Yakima, Kennewick	Yakima, Wash	John S. Moore					
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph	C. J. Ralston	B. E. Stouemyer	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [7]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	H. O. Lambeth	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo	C. B. Elliott	do	F. D. Helm	Montrose, Colo.
Boise	Board of control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River:						
Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Geuger	Ft. Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	L. Y. District No. 1	Sidney, Mont	H. A. Parker	do	A. B. Patterson	Sidney, Mont.
Do	L. Y. District No. 2	Fairview, Mont	do	do	Jno. A. Bird	Fairview, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary M. Kinney	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo	B. L. Adams	do	Mrs. Nellie Armitage	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	D. R. Dean	do	Mrs. M. J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East Division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry, W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.			Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	J. O. Roach	Irrigation supt	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin, Wash	Spokane, Wash	H. W. Bashore	
Shoshone project extensions	Denver, Colo	J. R. Iakisch	State of Wyoming.
Colorado River Basin investigations	do	P. J. Preston	Colo., Wyo., Utah, and New Mex.
Rathdrum Prairie, Idaho	Spokane, Wash	H. W. Bashore	None.

SALLIE A. B. COE, *Editor.*

HOOVER DAM, BOULDER CANYON PROJECT, AS IT WILL ULTIMATELY APPEAR

U. S. GOVERNMENT PRINTING OFFICE: 1932

THE RECLAMATION ERA

VOL. 23, NO. 2 FEBRUARY, 1932

Clemson College Library

Photo. by O. G. Patch

BOULDER CANYON PROJECT

UNITED STATES CONSTRUCTION HIGHWAY NEAR TUNNEL RIDGE

Home Building and Civilization

It is axiomatic that in no other business does sentiment exert so strong an influence as in farming. This fact can not be ignored in considering any of the problems of cost of production of farm products; nor should it be forgotten that human lives and human happiness can not be estimated in dollars and cents.

The sentiment that impels a large proportion of every civilized race to desire to own farms, to establish homes, and to rear families upon the farms has been one of the most powerful forces in civilization. It might well be called an instinct, for it is so closely associated with the instincts of self-preservation and the perpetuation of the species that it is difficult to disassociate it from them. Considered together, they constitute, for many people, the strongest incentives in life.

E. C. CHILCOTT, Deceased,
Formerly with Bureau of Plant Industry.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 2 FEBRUARY, 1932

Interesting High Lights on the Federal Reclamation Projects

OPPORTUNITY for the development of a livestock feeding section exists in the Mesilla Valley, Tex., lying partly within the Rio Grande project. More livestock were fed in this valley last year than ever before, about 12,000 lambs having been placed on feed in November and December.

A TABULATION of the cream production on the Shoshone project at the close of 1931 shows that the Castberg Creamery purchased in December approximately 8,400 pounds of butter fat, an increase of 3,000 pounds over the total reported for the same month last year, and that the miscellaneous shipments of cream from the project were 8,088 pounds, which exceeded those of the corresponding month last year by 1,700 pounds.

THERE is considerable interest on the Sun River project in the possible establishment of a sugar factory. At the taking of the latest crop census it was ascertained that 8,475 acres on the Greenfields division were suitable and in proper shape for raising sugar beets. If a satisfactory contract is offered by the sugar company, it is believed arrangements can be made to raise 1,000 acres of this crop during the present year.

INTEREST in settlement opportunities on the Riverton project continues. Two recent applications for farm units are reported. One man who had previously made application and been accepted paid the advance water rental charge for 1932.

ADVERTISING in several western periodicals by the Vale-Owyhee Government Projects Land Settlement Association of lands on the Vale project has resulted in the receipt of a number of inquiries from interested persons, 111 requests for information having been received by mail and 11 personal visits having been made to the project office.

Columbia Basin Project Declared Feasible

Bureau of Reclamation engineers find the Columbia Basin project in the State of Washington feasible in a report released January 16. The plans call for construction of the Columbia River Dam, 450 feet high, 4,140 feet long, containing 11,266,000 cubic yards of concrete, costing $125,-750,000, and forming a reservoir 150 miles long extending from near the town of Barry to the Canadian border. The power plant would contain an installation of turbines and generators of 2,100,000 horsepower capacity. It is possible to furnish an irrigation supply to 1,200,000 acres. None of this land would be brought under cultivation until after completion of the dam, which would require about 10 years, and then only as economic conditions warranted. It is estimated that this would result in about 20,000 acres being brought in yearly, and therefore irrigation development of the entire area of 1,200,000 acres would require 60 years.

An initial development of the Quincy Flat area of 150,000 acres is planned. The cost of the entire project is estimated at $394,155,000. The report states that revenue derived from the sale of commercial power, combined with revenue from the sale of power for irrigation pumping, will be sufficient to return within a period of 50 years the investment in the dam and power plant with interest at 4 per cent and to pay the cost of operation and maintenance of the dam and power plant and leave a substantial surplus for repayment of a portion of the investment in the irrigation development.

TOURIST travel by auto through Yuma increased materially during 1931, 157,116 westbound cars having been checked through the California quarantine station as compared with 101,099 during the previous year, an increase of over 50 per cent. No comparative figures on eastbound cars are available, as the Arizona station was closed for 2½ months in 1931. However, during 1930, 94,597 eastbound cars were checked through this station, and during the 9½ months of the station's operations in 1931, 84,509 cars passed through Yuma. Allotting 3 persons per car to the westbound traffic during 1931, which is the basis used by the All-Year Club of California, about 471,348 persons passed through Yuma into California. Using the same basis for eastbound traffic for the 9½ months for which figures are available, increases this figure by 253,527 persons, or a total of 724,975 tourists passing through Yuma in 12 months, bringing, of course, a sizable revenue to the community from tourist travel.

PICKING of this season's crop of navel oranges on the Orland project has been practically completed, the yield exceeding the early estimates.

TWO cars of turkeys, containing approximately 47,000 pounds, were marketed by the Minidoka County Turkey Growers' Association before Christmas. These birds were of exceptionally fine quality, many of them weighing from 18 to 20 pounds each.

THE local Elks' lodge on the Yuma project had a large Christmas tree for all children of the community and dispensed some 1,500 stockings filled with candy, fruit, and nuts from the tree on Christmas Eve. In addition, this organization made up baskets of food which were given to needy families. They, with other civic organizations, made it possible for all destitute families in the community to enjoy a Christmas dinner.

Colorado River Investigations

By E. B. Debler, Hydraulic Engineer, Bureau of Reclamation, Denver, Colorado

THE Boulder Canyon project act (45 Stat. 1057) approved December 21, 1928, contains the following provisions:

"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 practicablle, and not later than December 10, 1931, his findings, conclusions, and recommendations regarding such project.

"SEC. 15. The Secretary of the Interior is authorized and directed to make investigations 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."

No appropriations have been made by Congress for work under section 11, but appropriations of $150,000 have been made for work under section 15 and some additional funds have been available for work in the Green River Basin in Wyoming.

PROGRAM OF INVESTIGATION

In July, 1930, at a conference in Denver, Colo., with representatives of the four upper Colorado River Basin States for an exchange of views on the conduct of the authorized investigations it developed that these States preferred the investigations to be delayed pending an effort on their part to formulate a compact for the division of waters allocated to them in the Colorado River compact. Efforts in this direction proving fruitless, the governors of all of the Colorado Basin States, exclusive of California, were on May 8, 1931, requested to designate representatives to attend a conference for futher consideration of the investigations.

This conference convened in Denver, Colo., on June 9, 1931, and was attended by representatives of the bureau and of each of the six States. Mr. Porter J. Preston, designated by the Secretary as the Government's representative, was elected chairman, and Mr. M. C. Hinderlider, State engineer of Colorado, as secretary. The organization was formally designated the Colorado River Planning Commission. This commission reconvened on September 14, 1931, for consideration of a proposed program of investigations submitted by the chairman and based largely upon suggestions prior thereto submitted to him by the State representatives. Aside from enumerating the known projects for additional investigation, this program proposed that work be carried on in Wyoming, Colorado, and northern Utah in the summer, and in Arizona and southern Utah in winter. In anticipation of approval of this program, work was started at the northerly end of the Green River Basin in Wyoming in June, 1931, and all forces were transferred to southern Arizona in November.

RESULTS TO DATE

The Wyoming work accomplished in the past year comprised topographic mapping of 60,000 acres of irrigable land west and south of Daniel, followed by a land classification of the greater part thereof, survey of a large reservoir site just below Kendall on Green River, and rough surveys of a canal line 120 miles to serve lands lying west of Green River from Kendall to Big Piney.

In Arizona the work to date has been connected with the Parker Gila Valley project area, the irrigation of which has heretofore been proposed by diversion from Colorado River near Parker at the top of a 100-foot-high dam with the waters to be additionally lifted 200 feet before reaching the Gila Valley, the canal for this purpose passing through extremely difficult country for long distances. It is also possible to provide irrigation for a large part of the same area by pumping from Colorado River at the proposed dam for the All-American Canal with relifts as water is carried easterly. Much difficult canal work would thereby be avoided. Gila River passes through a broad flood plain bordered by extensive gently sloping mesas and connected with lateral valleys of similar character to the south. These valley areas up to elevation 600, comprising nearly 1,000,000 acres of land, are being classified for irrigability. The topographic maps recently made of this region by the Geological Survey are being extended to take in the entire area. Following the classification, consideration will be given to alternative plans for irrigation.

METHODS OF WORK

The limited funds available for such extended investigations have necessitated a wide departure from standardized practices in reporting on projects proposed for early construction. There is no need for accurate cost estimates, the objective being only a comprehensive plan, the details of which can be worked out later. Land classification must necessarily be given more careful and detailed attention than canal lines.

Land corners are flagged by retracement or extension of existing surveys by means of instrument and stadia, level controls are established and elevations of intervening and interior corners established by altimeters operated on closed circuits with elevations adjusted for closure and barometric changes as recorded at neary-by stationary instruments. With this skeleton as a base, a sketcher equipped with altimeter and hand instruments sketches in topography on a scale of 1,000 feet to the inch with contour interval appropriate to the terrain. The resulting map is then surmounted by the land classification which is based on a consideration of soils and subsoils as developed by sampling, testing, and vegetation; also on topography, surface drainage, subsoil drainage, and overflow from streams. The map is also used in a study of tentative canal locations, with the more difficult localities reinforced by detailed topography or fly-line locations. Rough-cost estimates will be prepared, primarily as a guide to the relative feasibility of projects.

The field force engaged upon this work has gradually been expanded as the working program unfolded and the men became familiar with objectives. At the close of the year it comprised 13 classified and 25 unclassified employees. It will be further augmented in the coming summer when these forces will be shifted back to the colder sections of the Colorado River Basin.

Ring Bolt Rapids In Black Canyon Near Hoover Dam Site

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project, Las Vegas, Nevada

ABOUT 3½ miles downstream from the site of the Hoover Dam in Black Canyon a wash, acting as a drainage channel for the country to the east, has deposited gravel, débris, and large rocks in the form of an alluvial fan, which projects brazenly into the channel of the Colorado River.

Aiding in retarding the flow of the river at this location, a reddish-gray andesite bowlder weighing more than 80 tons has plunged from the cliff above and, at a point just to the east of the center of the river canyon, has lodged itself securely in the alluvial deposit. Here, by reason of its weight, structural composition, and embedded position, it has succesfully withstood the battering of the river floods for many years.

BOWLDER DIVIDES RIVER

The intrusion of the alluvial fan and its included andesite bowlder have dammed the flow of the river to some extent and the waters breaking over the barrier form another of those swiftly swirling rapids which has obstructed and defeated the successful navigation of the Colorado River since it was first attempted by a lieutenant of Cortez, Hernando de Alarcon, in 1540. During low water and at normal stage the river now flows to the west of the rock and the alluvial bar, extending to the east, is only covered by high floods. According to narratives of old-time trappers and dwellers along the Colorado, the river in years gone by was divided by the bowlder, and the eastern portion was used by travelers in small boats as a portage in evading the rapids.

Of greater interest than the gravel bar and its effect upon the flow of the Colorado in this location is an iron bolt and ring which is securely fastened into the top of the large rock. This contrivance, from which the turbulent waters were named "Ring Bolt Rapids," consists of a worn iron-ring bolt holding in its grasp a smooth moisture-blackened iron ring of large diameter. Directly beneath the ring of the bolt is a 5 by 10 by ¾ inch iron collar covering and protecting the lead-filled aperture in the rock which holds the body of the bolt. The ring is approximately 12 inches in diameter and both ring and bolt have been forged from a 1⅜-inch round bar.

Inquiry into the reasons for the location of such a device at this particular place disclosed a chapter in the history of the Colorado River which had its inception, attempt, and conclusion in the years between 1849 and 1868.

MORMON COLONIZATION

In 1847 a band of Latter Day Saints, commonly termed "Mormons," under the leadership of Brigham Young, crossed the Wasatch Mountains and descended into the plains to the west. Finding arable soil and water available for raising crops, the Mormons founded a settlement near Salt Lake and in a few years had sent colonists into the fertile valleys to the north, west, and south. The settlers going to the south eventually were halted from further colonization by the Colorado River on the east and the hundreds of miles of desert wastes to the south and west.

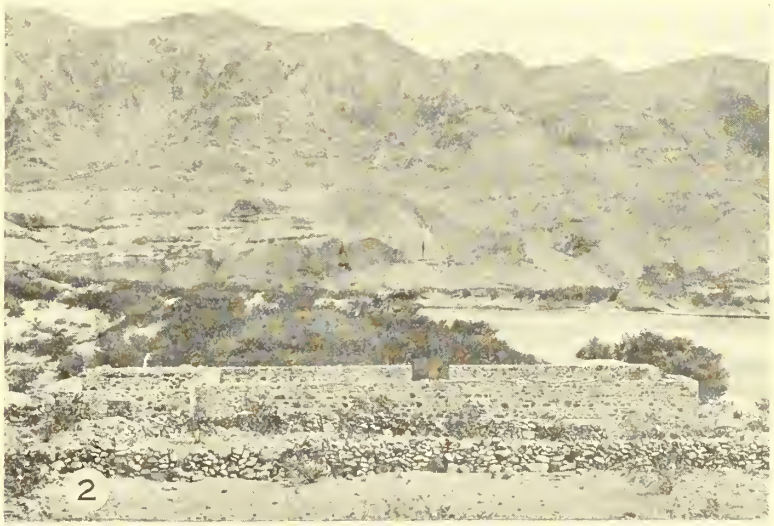
It was known from returning travelers that farther west and southwest across these deserts and beyond a high range of mountains lay a productive coastal plain which sloped gradually to the shores of the blue Pacific. One party of colonists had pushed on and after many hardships had reached and established a colony just over the mountains at San Bernardino, but another party had attempted to cross the desert to the west, and the disastrous conclusion of the venture had given Death Valley its name.

Besides colonization, other reasons for wishing to secure a satisfactory means of communication and transportation between the Mormon settlements in Utah and the Pacific Ocean were the opportunities for trade and barter with the towns along the coast and for bringing in the Mormon immigrants that had arrived in Pacific coast ports by ships from New York and England.

NAVIGATION OF RIVER FAILS

As the way across the desert was hazardous and uncertain, a plan was formu-

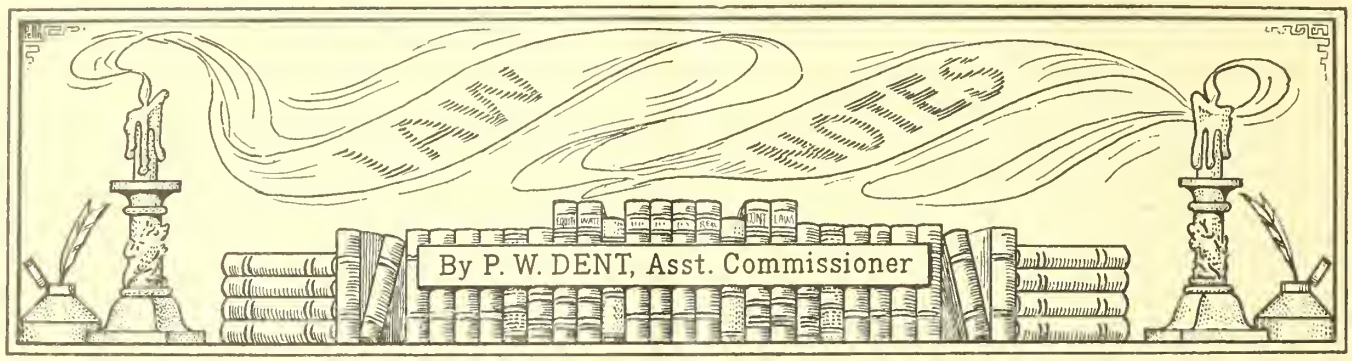
(Continued on p. 33)



COLORADO RIVER

1 - BOULDER CANYON ENGINEERS GROUPED AROUND BOLT AT RING BOLT RAPIDS.
Left to right: Walker R. Young, construction engineer; Fred Nickell, geologist; Ralph Lowry, engineer

2 - RUINS OF FORT CALLVILLE



Texas Legislation in 1931

Forty-Second Legislature—Regular Session

SEVERAL acts relating to water rights and irrigation were passed by the Forty-second Legislature of Texas in regular 1931 session. Two special sessions were subsequently held, but the first dealt principally with oil conservation and the second with cotton production questions.

The principal legislation of the character first mentioned is summarized below:

Conservation of underground waters.—S. B. 608 (approved and effective May 29, 1931), ch. 261, p. 432, 42d Leg., R. S., declares the policy and duty of the Texas State Board of Water Engineers to make and enforce rules and regulations for conservation, protection, preservation, and distribution of all underground, subterranean, and percolating waters of every kind and nature whatsoever situated within the limits of the State of Texas. Requires owners of wells which encounter salt water or substances injurious to vegetation to case or plug the wells. The act applies to wells already dug or already drilled as well as to those drilled in the future. Failure to comply with the act is made a misdemeanor.[1]

Priority rights in water.—S. B. No. 93 (approved and effective May 18, 1931), ch. 128, p. 217, 42d Leg., R. S., amends article 7471, Rev. Civ. Stat. Texas, 1925; declares the public policy of the State to be a constructive one necessitating a declaration of priorities in the allotment and appropriation of water. Gives preference and priority to the various uses in the order named in the act, commencing with (1) domestic and municipal uses, (2) water used to convert raw materials to forms having greater commercial value, including development of electric power by means other than hydroelectric, (3) irrigation, (4) mining, (5) hydroelectric power, (6) navigation, (7) recreation and pleasure. Article 7472 is amended reiterating the first in time, first in right doctrine, providing that all appropriations hereafter made for any purpose other than domestic or municipal use shall be granted subject to the right of any city, town, or municipality to make further appropriations of such water without condemnation or payment, for domestic or municipal uses. Use for domestic and municipal purposes is declared primary and fundamental. Section 4 requires the State board of water engineers to give preference, not only in order of preferential uses as declared, but also for the purposes which will effect the maximum utilization of waters. Section 5 declares the purpose and policy of the State to accomplish all surveys essential for the determination of the potential availability of water resources of the State and the distinct regional requirements to the end that distribution of the right to utilize waters of the State may be more equitably administered and uses coordinated. The provisions of section 2, relating to the paramount right of cities, towns, etc., without the necessity of condemnation, are by section 6 expressly made not applicable to any stream which constitutes or defines the international border or boundary between the United States of America and the Republic of Mexico.

Repeal of Pecos River compact.—S. B. 395 (approved April 27, 1931; effective 90 days after adjournment), ch. 92, p. 136, 42d Leg., R. S. This act repeals an act of the thirty-ninth legislature, which former act approved and ratified the so-called Pecos River compact between New Mexico and Texas, which was signed by commissioners for the respective States February 10, 1925, but has since such time failed of ratification by the Legislature of New Mexico.

Authorizing suit.—S. B. 502 (approved May 21, 1931; effective 90 days after adjournment), ch. 188, p. 317, 42d Leg., R. S. This act is prefaced by a number of recitals concerning supreme court decisions relating to interstate streams, the recital that increased diversions from the Pecos River in New Mexico are detrimental to the interests of Texas and that the Board of Water Engineers of Texas and the attorney general of the State have made and are making investigations to determine the equitable rights of the people of Texas and legal questions involved regarding the waters of the Pecos River. It is provided that after investigation the attorney general is authorized to institute legal proceedings in the name of the State of Texas or any individual, irrigation company, irrigation district, or in the name of the Board of Water Engineers of the State of Texas for the purpose of protecting the rights of the people of Texas to the waters of the Pecos River with respect to diversions by the State of New Mexico or any other agency. The attorney general is authorized to employ special counsel experienced in irrigation and water right matters.

Directors of water improvement districts.—S. B. No. 16 (approved March 10, 1931; effective 90 days after adjournment), ch. 13, p. 13, 42d Leg., R. S., provides for the nomination of directors of water improvement districts to serve under the provisions of chapter 2, title 128, Rev. Civ. Stat. Texas, 1925.

Practice in certain court cases.—H. B. 595 (approved and effective May 28, 1931), ch. 245, p. 413, 42d Leg., R. S., amends article 3269, Rev. Civ. Stat. Texas, 1925, to provide that whenever a person, corporation, or district having right of eminent domain is sued for property or damages, the property occupied by them for purposes for which they have right to exercise such power, or when an injunction suit is brought to prevent them from going on such property

[1] It will be observed that while this act, including its provisions relating to "subterranean and percolating waters of every kind and nature whatsoever," is broader in its scope than the underground water law of New Mexico enacted in the 1931 session (ch. 131, Laws, 1931, New Mexico, p. 229), which limits its application to underground waters "having reasonably ascertainable boundaries," the Texas law merely authorizes regulation and the New Mexico law provides a complete system of appropriation of the specified underground waters.

or making use of it, the court in which such suit is pending may determine the condemnation of property and assessment of damages on petition or cross-bill by defendant which shall not be an admission of plaintiff's title.

Procedure in eminent domain.—S. B. No. 586 (approved and effective June 1, 1931), ch. 275, p. 466, 42d Leg., R. S. This act contains numerous amendments to section 14, chapter 280, acts of forty-first legislature, regular session (1929), and declares its intent to clarify the same as it relates to section 132, chapter 25, acts of thirty-ninth legislature, regular session (1925). The act further establishes special "tribunals for condemnation," the personnel of which consists of three persons appointed by the district court, one of whom shall be a lawyer deemed to be learned in the law of eminent domain and the remaining two shall be men deemed to have a good knowledge of the value and uses of lands, injuries to lands, and benefits to lands to be affected by the proposed condemnation.

Permitting partial tax payments.—H. B. No. 440 (approved May 18, 1931; effective 90 days after adjournment), ch. 141, p. 237, 42d Leg., R. S., amends article 7272, Rev. Civ. Stat. Texas, 1925, making all real or personal property held or owned by any person in Texas liable for all State and county taxes due from the owner thereof, including tax on real estate, providing that any person, including a lien holder, having an interest in the property assessed with other property may pay the proportionate part of the taxes against his property without being required to pay any other taxes included in the assessment. When the collector and interested party can not agree, the commissioners' court shall make the apportionment. The provision authorizing such apportionment "shall apply to taxes due any district, municipality, or other subdivision of the State."

Tax levies in reclamation districts.—H. B. No. 370 (approved and effective April 6, 1931), ch. 311, p. 776, 42d Leg., R. S. This act relates to drainage districts, authorizing such districts to become conservation and reclamation districts under the provision of chapter 8, title 128, Rev. Civ. Stat. Texas, 1925, in which event it authorizes them to tax district lands on the benefit basis instead of upon an ad valorem basis. It is, however, of interest in connection with water improvement districts as well as drainage districts under the Texas law. This, for the reason that the use of the term "benefit basis" in the various acts has resulted in some ambiguity. In this act there appears what might be considered as a legislative interpretation of the term. The instant act contains the expression indicating that "benefit basis" is equivalent of "uniform basis," as follows: "* * * for which it may lawfully levy such taxes, on a benefit basis, *that is to say, on equal or uniform basis or rate upon each acre of land within such district*, instead of upon an ad valorem basis as now provided by law" (emphasis added).

Reports of taxing districts to the State.—S. B. No. 303 (approved and effective May 28, 1931), ch. 230, p. 385, 42d Leg., R. S. Article 838, Rev. Civ. Stat. Texas, 1925, amended to provide that among others, irrigation districts shall make an annual report to the State comptroller on each August 1, showing as of June 13 all outstanding indebtedness including bonds, warrants, scrip warrants, and amounts due banks, rate of interest and date of maturity, tax levy in force for interest and sinking fund, the amount of its credit, disbursements from such fund, amount of bonds redeemed and still outstanding, and other detailed information.

Limitation—Pleadings in tax suits.—S. B. No. 132 (approved May 29, 1931; effective 90 days after adjournment), ch. 252, p. 419, 42d Leg., R. S., amends article 7298, Rev. Civ. Stat. Texas, as amended by chapter 81, acts of forty-first legislature, second called session, and provides "that no delinquent taxpayer may plead in any court or in any manner rely on any statute of limitation by way of defense for nonpayment of tax due from him or her to the State or any * * * reclamation district, irrigation district, improvement district, and all other districts."

Water improvement bonds.—S. B. 56 (approved and effective March 10, 1931), ch. 17, p. 17, 42d Leg., R. S., amends article 7695, Rev. Civ. Stat. Texas, 1925, authorizing inclusion in bond issues of a sufficient sum to pay the first one, two, or three years' interest, and validates certain bond elections heretofore held in water improvement districts and water control and improvement districts.

Assessors and collectors of districts.—S. B. 334 (approved and effective April 17, 1931), ch. 321, p. 794, 42d Leg., R. S., amends article 7642, Rev. Civ. Stat. Texas, 1925, providing that the office of tax assessor and collector of a water improvement district is one office to be filled by one person, such officer to be appointed by the board of directors or he may be elected by an election held for that purpose; he must qualify by filing sufficient bond. Article 7880–54, relating to water control and improvement districts, is similarly amended and provides that when any such district is fiscal agent of the United States or authorized to make collections of money in connection with a Federal reclamation project, the collector and each director and officer of the district shall execute additional bonds in such sum as the Secretary of the Interior may require. Any such additional bond may be sued on by the United States or any person injured by failure of such officer of the district in performance of his duties.

TEXAS DECISIONS

During the period of 1930 and the first half of 1931 approximately 30 printed decisions were rendered by the Texas courts involving litigation the subject matter of which embraced one or more questions relating to water law or irrigation. Many of these decisions would be of little interest from a standpoint of reclamation and only a few are mentioned below:

Arneson *v.* Shary, 24 S.W. 2d 1116, holding that all property owners might join in a single suit against an irrigation company arising from the same breach of contract.

Dew *v.* American Rio Grande Land & Irrigation Co., 25 S.W. 2d 603, holding that an irrigation company is liable to landowners only for negligence and not for seepage necessarily incident in the operation of an irrigation system with dirt canals.

Hidalgo, etc., Dist. No. 1 *v.* Goodwin, 25 S.W. 2d 813, holding that as forfeitures generally are not favored by the law, and laws relating to irrigation are liberally construed and given such effect as to best promote irrigation, water rights of a water district are not forfeited without action by the State for such forfeiture or cancellation of water rights.

Reeves *v.* Pecos, etc., Dist. No. 1, 29 S.W. 2d 405, holding that owner of water rights can not invoke the powers of a court of equity to prevent use of surplus water outside of the area included in a contract upon which their water right was based.

Western Union Tel. Co. *v.* Wichita, etc., Dist. No. 1, 30 S.W. 2d 301, affirming judgment of the court of civil appeals construing water improvement district statutes and holding such statutes not unconstitutional notwithstanding failure to provide for hearings as to benefits of owners of personalty. That property need not receive direct benefits in order to be lawfully included in a water improvement district and under its taxes; that the legislature had the power to cure and make valid the organization of a water improvement district as well as its taxes and bonds even if the district was invalid in its creation; and that taxation of personalty by a water improvement district under the statute was valid. The particular subject matter in controversy in this case was the right of the district to tax telegraph poles.

Wichita, etc., Dist. No. 1 *v.* McGrath, 31 S.W. 2d 457, holding that a water improvement district maintaining a higher water level than necessary in its canal was not liable for the entire damage to plaintiffs' land from seepage and flowage where the jury found that water from a lake had seeped under plaintiff's land. The court held that the difference in market value was not a proper measure of damages where it was found that plaintiff's land, though water-logged, could be restored by drainage.

Arenson *v.* Shary, 32 S.W. 2d 907, holding that regulation of irrigation of lands of the State is within the State's police power; that landowners failing to have their lands excluded from the boundary of a water control district at the proper time lost the right to such exclusion and that "the creation of a water control and improvement district and the taking into its defined boundaries certain lands that have a source of water supply other than the district does not destroy any vested rights."

Wichita, etc., Dist. No. 1 *v.* Curlee, 35 S.W. 2d 671, holding that irrigation company was not liable for death of cattle drowned in a canal running through the cattle-owner's pasture, nor for death of cattle caused by eating of poisonous grass growing on a canal right of way.

La Salle, etc., Dist. No. 1 *v.* Gunn, 40 S.W. 2d 892, holding that where there had been a court validation of a reduction in acreage of a water improvement district, the district was liable on the original district's notes and that the legality and validity of a water improvement district can be attacked only by means of a writ of quo warranto.

Hudspeth Cons. & Recl. Dist. No. 1 *v.* Spears & Co., 39 S.W. 2d 94, where the district had by agreement accepted in settlement of some $58,000 accrued taxes, the sum of $33,000 and $25,000 in notes the proceeds of which were obligated to be used for drainage work on plaintiff's land, and an injunction granted by the trial court requiring the district to continue to furnish water to the plaintiff, it was held that compliance with the statutory requirement of presenting to the district the annual water service application was unnecessary and that such an injunction would not be interfered with where a reasonable showing had been made in support of the application therefor.—*H. J. S. Devries, District Counsel.*

THE Malta district of the Milk River project has paid in full the first half of the estimated operation and maintenance cost for the calendar year 1932. The Glasgow district paid the balance of the 1931 cost and advanced a small portion of the 1932 estimate.

Articles on Irrigation and Related Subjects

Batcheller, Willis T.:
- Columbia Basin Irrigation project, illus., Fieldman's Bulletin, November, 1931, pp. 4–6.

Beaman, Julian A.:
- Boulder City—A man-made desert oasis, illus., Western City, December, 1931, vol. 7, No. 12, pp. 22–24.

Constructor:
- Hoover Dam investigation committee finds superior living and working conditions (at Hoover Dam), illus., The Constructor, January, 1932, vol. 14, pp. 20–23.

Davis, A. P.:
- Irrigation in Turkestan, illus., Civil Engineering, January, 1932, vol. 2, No. 1, pp. 1–5.

Engineering News-Record:
- A changed problem (editorial on need of a new law for reclamation), Eng. News-Record, Dec. 17, 1931, vol. 107, p. 951.
- Significant commendation (editorial on labor conditions at Hoover Dam), Eng. News-Record, Dec. 24, 1931, vol. 107, p. 985.
- Committee praises labor conditions at Hoover Dam, J. B. Lippincott, Chairman, Eng. News-Record, Dec. 24, 1932, vol. 107, p. 1015.
- Businesslike Policy (editorial on bill for 5-year interest-bearing note instead of moratorium), Eng. News-Record, Dec. 24, 1931, vol. 107, p. 986.
- Status of Hoover Dam diversion tunnels, Dec. 12, 1931, (chart) Eng. News-Record, Dec. 31, 1931, vol. 107, p. 1052.

Gilliam, Armistead W.:
- Uncle Sam builds a town in desert, illus., Washington (D. C.) Sunday Star, Jan. 3, 1932, special illustrated section, pp. 12 and 17.

Mead, Elwood:
- Place of Federal Reclamation in a Federal Land Policy, Address Nov. 19, 1931, before representatives of land-grant colleges at Chicago, presented by Hon. Addison T. Smith, Cong. Record, Dec. 16, 1931, vol. 75, No. 8, pp. 679–681. (Printed as pamphlet, 8 p.)
- Bureau of Reclamation reports, 1931, Excavation totaling 11,691,313 yards, illus., Excavating Engineer, January, 1932, vol. 26, pp. 15–17.

Power:
- Hydroelectric projects, 1931 (table including Hoover Dam, Shoshone, Wippel & Prosser), Power, Jan. 5, 1932, vol. 75, pp. 23–26.

Sanders, S. J.:
- Construction Review, Irrigation and Power Development, illus. (including Milner-Gooding Canal, Owyhee Dam, canals and tunnels and Kittitas canals), Western Construction News, Dec. 25, 1931, vol. 6, pp. 673–675.

Schuyler, Philip:
- Hoover Dam Constructionists (long illus. article describing men working on dam), Western Construction News, Dec. 10, 1931, vol. 6, pp. 632–638.

Skerrett, R. G.:
- America's Wonder River—The Colorado, illus., Compressed Air Magazine, January, 1932, vol. 37, No. 1, pp. 3694–3700 (third of a series of long illustrated articles—first in November, 1931).

Van Leer, Blake R.:
- Work starts on a National Hydraulic Laboratory in Washington, illus., Eng. News-Record, Dec. 24, 1931, vol. 107, pp. 996–998.

Western Construction News:
- Hoover Dam progress notes, illus., Western Construction News, Dec. 10, 1931, vol. 6, pp. 647–648.
- Cle Elum Dam, Yakima project, Washington, illus., Western Construction News, Dec. 25, 1931, vol. 6, pp. 677–678.

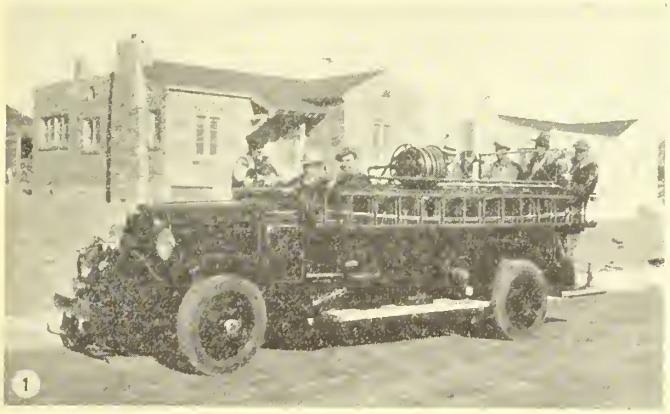
Wilbur, Ray Lyman:
- Reclamation finance will be considered, Dec. 12, U. S. Daily, Dec. 12, 1931, vol. 6, p. 2.
- Self-management, the Basis of Citizenship, address Dec. 5, 1931, presented by Senator Copeland, Cong. Record, Dec. 18, 1931, vol. 75, pp. 868–869.

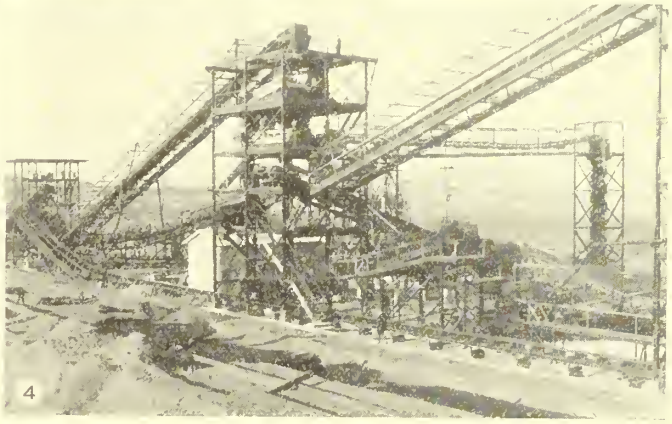
Wilbur, Ray Lyman, and William Atherton DuPuy:
- Conservation in the Department of the Interior, 160 illus., G. P. O. 1931, 253 pages (15 chapters on irrigation, the Colorado, public lands, oil, gas, parks, Indian, The Child, Territories, Geological Survey, and Land Office, price $1).

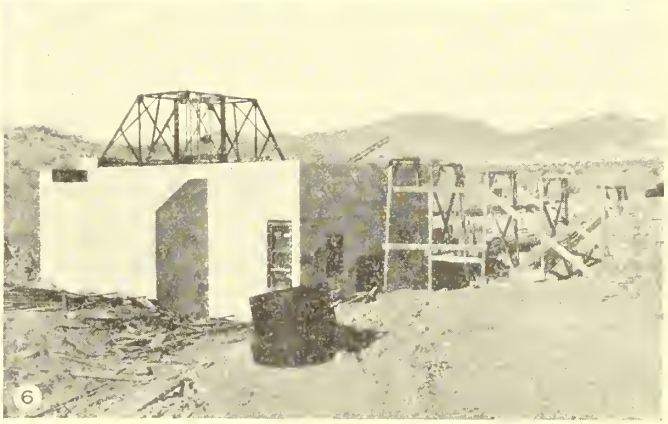
Wilmot Sidney:
- Govt. Services available to engineers, Chart of Bureau of Reclamation, Civil Engineering, January, 1932, vol. 2, No. 1, p. 60 (Manual of Eng. Practice No. 7, A. S. C. E., 36 pp.).

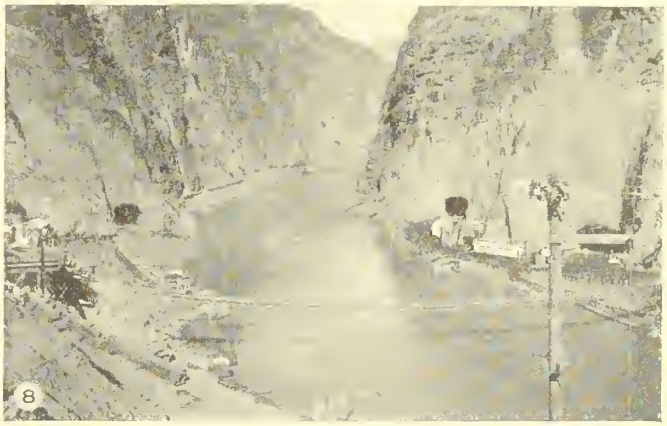
Wooton, Paul:
- Relief Plan to be drafted for Reclamation Projects (Recommendations of Dr. Mead), Eng. News-Record, Dec. 17, 1931, vol. 107, p. 982.

THE Black Hills sugar plant at Belle Fourche sliced a total of 76,530 tons of beets for the season, with an average sugar content of 16.48 per cent. This is the highest content since the factory was established.







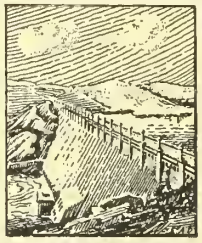


BOULDER CANYON PROJECT

Photographs by B. D. Glaha

1, Government fire-fighting equipment, Boulder City; 2, Six Companies' Executive Lodge, Boulder City; 3, Government residences at Colorado and Ash Streets, Boulder City; 4, Six Companies' gravel screening and washing plant at Three-way Railroad Junction; 5, Suspension bridge erected by Six Companies in Black Canyon immediately above tunnel inlets. Span is designed to support two loaded 6-yard trucks with no interval; 6, sewage disposal plant, Boulder City; 7, outlet portal of Nevada penstock tunnel showing timber-scaling rig at right; 8, canyon and tunnel outlets from point on Six Companies' construction road above presedimentation tank.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Dams—High, Large, and Unusual

(Part 1—United States) [1]

By P. I. Taylor, Associate Engineer, Washington Office, Bureau of Reclamation

IN THE January, 1930, number of the New Reclamation Era was an article The Highest and Largest Dams in the United States and Abroad. Since the publication of that article construction of the Boulder Canyon project has been started, with the 730-foot Hoover Dam as its principal feature, and this outstanding monument of concrete has awakened a widespread interest in dams in general and the structure to be erected by reclamation engineers in the Black Canyon of the Colorado River in particular. This mammoth dam, which is to span the Colorado River between the States of Nevada and Arizona, will be the highest in the world, in fact, about twice as high as the Diablo Dam, which at present holds that distinction. In a few months the Owyhee Dam on the Owyhee (Federal) irrigation project in eastern Oregon will be completed and it will exceed the 389-foot Diablo by 16 feet, being 405 feet from the foundation rock to crest. The Sautet Dam, a thin concrete arch, now under construction in France, will overtop the Owyhee, with a maximum height of 446 feet.

Building dams is an every-day story with reclamation engineers. Their record to date in 26 years of construction work is 124 dams, and four are now under construction—the Hoover in Arizona-Nevada, Owyhee in Oregon, Cle Elum in Washington, and Thief Valley in Oregon. Among the notable structures built by the Bureau of Reclamation are the Arrowrock, Shoshone, Pathfinder, and Roosevelt Dams. Every schoolboy is familiar with the last-mentioned structure, which was named after President Theodore Roosevelt. Many automobile tourists traveling the southern route turn aside at Phoenix, Ariz., to visit Roosevelt by way of the scenic Apache Trail. The Madden Dam being constructed by the Panama Canal bureau on the Chagres River at Alhajuela, Panama, was designed by engineers of this bureau; also the Cat Creek Dam now nearing completion by the Navy Department at Hawthorne, Nev. The engineers in the Denver (Colo.) office of the Bureau of Reclamation are often called upon to act as consultants on the design and construction of dams. In 1910, the bureau completed its first high dam, the Shoshone on the Shoshone River in Wyoming. Closely following this was the Roosevelt in Arizona, finished in 1911.

HIGH DAMS

The Diablo Dam near Rockport, Whatcom County, Wash., in the heart of the Cascade Mountains, is temporarily the highest of all dams, with a maximum height of 389 feet. It was completed in 1930 by the city of Seattle as a part of the upper Skagit River power development. The dam is located in a solid granite gorge, which is only 125 feet wide at the base of the structure. The type is a constant radius arch, with gravity wings, the length of the arch being 588 feet and total crest length, 1,180 feet. At the crest the dam is 16 feet in thickness and 140 feet at the base. There were 350,000 cubic yards of concrete placed in the structure. The construction period was from January 1, 1928, to September 15, 1930, the first concrete being placed July 12, 1928. To divert the river during construction a tunnel 20 feet in diameter and 650 feet long was driven through the canyon wall. The upstream cofferdam, 250 feet long, was faced with sheet steel and was built of great fir logs tied together and weighted to the river bed with large rock. Behind the dam 90,000 acre-feet of water can be stored and a lake 6 miles in length is formed. The installed capacity of the power plant is 167,000 horsepower with an ultimate capacity of 225,000 horsepower. Among the items of work was the excavation of 230,000 cubic yards of solid rock. The power tunnel is 19 feet 6 inches in diameter and 2,000 feet long. It is said that a trip up the Skagit River Valley to Rockport and then up the gorge to the dam will provide the visitor with some of the finest scenery in America.

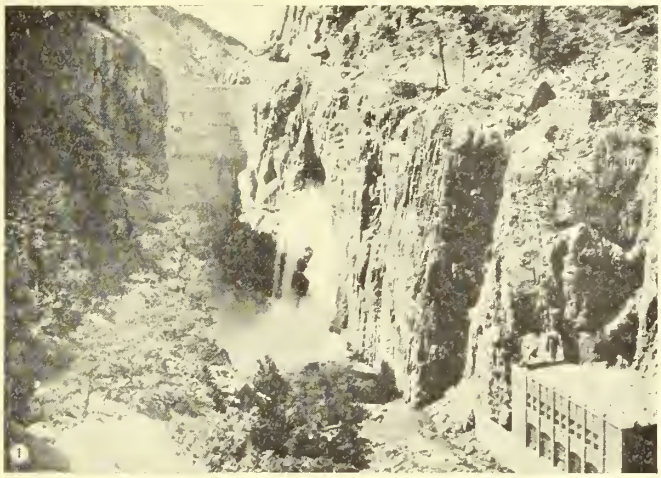
Among the nonoverflow, solid gravity, curved-in-plan dams the Pardee in California is the highest at the present time. It is a part of the Mokelumne River project, which provides a mountain-water supply to the East Bay Municipal Utility District comprising Oakland and other cities on the eastern shore of San Francisco Bay, and is located near Valley Springs, in the foothills of the Sierra Nevada Mountains. The dam is 358 feet high, 1,337 feet long on the crest, and contains 617,700 cubic yards of concrete. The structure is provided with inspection and drainage galleries. There are two 72-inch and two 42-inch cast-iron pipe sluiceways through the dam, valve-controlled at the lower end and with roller gates at the upper end. A power plant of 15,000-kilowatt capacity at the base of the dam receives water through two 72-inch pipes. The contractors placed 1,600 cubic yards of concrete in eight hours, 3,600 cubic yards in one day, 67,000 cubic yards in August, 1928, and 514,000 cubic yards in 12 months from April, 1928, to April, 1929, which was an outstanding accomplishment in mixing and placing concrete.

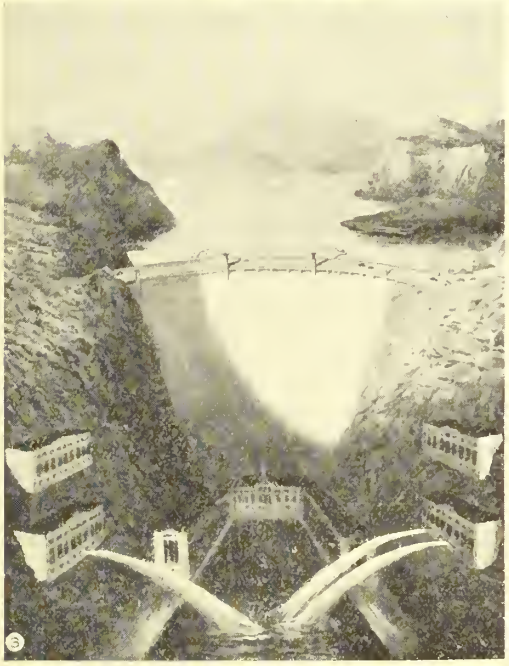
The 372-foot Pacoima Dam, near San Fernando, Calif., tops all structures of the variable radius arch type. It was completed in 1929 by the Los Angeles Flood Control District. The stream bed width at the site is only 65 feet. At the base the dam is 94 feet thick and it rests on a foundation of granite.

EARTH AND ROCK FILL DAMS

Among the earth-fill dams the Cobble Mountain near Westfield, Mass., built by the city of Springfield to store water for the city supply is the highest, towering 245 feet above Little River. It is 700 feet long across the crest, 50 feet thick at the top, and 1,500 feet at the base, and contains 1,800,000 cubic yards of earth deposited by the hydraulic method. There is a cut-off wall of concrete, and the upstream slope is faced with rock. Power development is an important feature, as the sale of power pays all the bills. Only seven earth-fill dams have been built in this country to a height of 200 feet or over.

[1] Dams—High, Large, and Unusual (pt. 2, United States, and pt. 3, Foreign Countries) will appear in subsequent issues of the Era.





TYPICAL DAMS

1, Shoshone; 2, Wilson; 3, Hoover (under construction); 4, Coolidge; 5, Diablo; 6, Pardee; 7, Owyhee (under construction)

96698—32——2

The Salt Springs Dam, 332 feet in height, is the highest rock-fill structure in the United States. It is a power dam built by the Pacific Gas & Electric Co. on the North Fork of the Mokelumne River, near Stockton, Calif. The rock is faced with concrete; the fill is 15 feet thick at the crest and 900 feet thick at the base. There are 3,000,000 cubic yards of rock in the dam. A close second to Salt Springs in height is the Morena, a 278-foot rock-fill dam near San Diego, Calif., a part of the San Diego water supply system, which was completed in 1930. Then comes Dix River, a power dam at Danville, Ky., which is 270 feet high, 910 feet long, and contains 1,747,000 cubic yards of rock. The San Gabriel No. 2 Dam recently authorized for construction by the Los Angeles County Flood Control District of California, will be of the rock-fill type and 290 feet in height. It will take the place of the San Gabriel Dam, on which construction work was started in 1929 but suspended because of unsafe foundation and abutment conditions which developed. This dam will be second in height to the Salt Springs Dam. The three dams named—the Salt Springs, Morena, and Dix River—are the only structures of the rock-fill type which have been built in the United States with heights of over 200 feet.

In the Salt River Valley near Phoenix, Ariz., is the Lake Pleasant Dam, the highest and largest multiple-arch dam constructed to date. It has a maximum height of 256 feet, and a length of 2,146 feet comprising 26 arches with hollow or double-wall buttresses between. The buttresses are spaced 60 feet apart on centers and are 18 inches thick at the top and 5 feet 6 inches thick at a distance 180 feet down. They have a uniform outside dimension of 16 feet, leaving a clear span of 44 feet for the arches. The spillway, which is located in a natural saddle about 1,000 feet from the western end of the dam, is 750 feet long and has a capacity of 150,000 cubic feet per second. Twenty-nine Taintor gates, each 23 feet long and 16 feet high, regulate the flow. The Lake Pleasant Dam is on the Agua Fria River, and was built by the Maricopa County Water Conservancy District No. 2 for the irrigation of 40,000 acres, principally citrus-fruit lands. In 1928 cracks in the buttresses endangered the safety of the structure and following the advice of a board of consulting engineers, the spillway was lowered 24 feet to provide for its present capacity of 150,000 cubic feet per second.

A considerable number of dams of the multiple-arch type have been constructed in recent years, among them being the 170-foot Big Dalton, the 180-foot Sutherland, 175-foot Little Rock, and 154-foot Florence Lake, all in California. Closely related to the multiple-arch type is the Ambursen or flat-slab reinforced-concrete type of dam, of which over 200 have been built in the United States and abroad. The upstream face is built of flat reinforced-concrete slabs instead of masonry arches, while the buttresses are similar to those of the multiple-arch dam. The Stony Gorge Dam, 125 feet in height, on the Orland (Federal) irrigation project in California is the only Ambursen dam built by the Bureau of Reclamation.

VARIOUS TYPES

A technical description of the various types of dams would be so much Greek to the layman, but there follows a description which all who read may understand. "A gravity dam is one in which the pressure of the water is resisted by the weight or 'gravity' of the dam itself," says Bligh in Dams and Weirs, page 2. This type of dam may be either straight or curved, but is always solid. By arching or curving the dam in plan there is a lateral transfer of load to the canyon walls. Hanna and Kennedy in the Design of Dams, page 87, say regarding the single-arch type: "Where the canyon span is relatively narrow and the canyon walls consist of sound rock capable of taking arch thrusts, the arch dam will require less concrete and can consequently be constructed at a lower cost than the gravity type." A multiple-arch dam is one consisting of a series of arches supported by intermediate buttresses. This type requires considerably less concrete than a gravity dam. Of late years masonry dams have been constructed almost exclusively of concrete, while some of the earlier dams were built of stone masonry. Where the foundation consists of earth, sand, or other pervious unstable material, the earth-fill or rock-fill type of dam is suitable. The earth fill is deposited in layers and compacted by rolling, or sluiced into place by water, designated, respectively, as "rolled fill" and "hydraulic fill." A hydraulic-fill dam is one in which the materials are transported and placed in the embankment by means of water. In the so-called semi-hydraulic type of earth-fill dam the materials are transported to the site by other means than water and segregated, placed, and consolidated by the use of water. The upstream face of an earth-fill dam is protected from wave action by facing the slope with rock or gravel, or concrete paving. Percolation through the structure is prevented by a puddle core or masonry cut-off wall, or both. The usual practice with a rock-fill dam is to line the upstream face with concrete and place a cut-off wall at the upstream toe. Overtopping of an earth-fill or rock-fill dam is prevented by providing ample freeboard and spillway capacity.

UNUSUAL CONSTRUCTION FEATURES

The Coolidge Dam is the first multiple-dome type to be built and consists of three egg-shaped domes supported by two intermediate buttresses and the canyon walls. It was built by the United States Indian Service on the Gila River near San Carlos, Ariz., to store 1,200,000 acre-feet of water for the irrigation of 80,000 acres of the San Carlos project. It stands 249 feet high above bedrock, was completed in 1928, and cost $2,270,000. An interesting feature of the Yuma (Federal) irrigation project in southwestern Arizona is the Laguna diversion dam. It is a type of wier which has been in successful operation in Egypt and India for many years, but was new to this country. The structure is 19 feet high above the stream bed with a maximum height of 40 feet and a crest length of 4,780 feet. Three concrete walls, each 5 feet thick, traverse the dam longitudinally, one at the crest and the others 57 and 93 feet downstream. The crest wall rests upon 6-inch sheet piling designed to prevent seepage. Between the walls is a loose rock fill. The downstream slope is 1 foot in 12 and paved with concrete. This dam was completed in 1909 and although founded on the alluvial deposits of the Colorado River, has stood firm through the years.

The Colorado River Dam near Grand Junction, Colo., is the diverting structure for the main canal of the Grand Valley (Federal) irrigation project. It is a steel roller crest surmounting an ogee concrete weir, with sluiceway and canal intake at one end. The notable feature of this dam is the roller crest by which the entire upper 10 feet of the dam can be lifted above high water, with the result that the elevation of backwater surface in flood is no greater than during operation for maximum requirements at low-water periods. Floods can be passed without endangering a near-by railroad grade. Each main roller is a hollow steel cylinder 7 feet in diameter and 75 feet long, projecting into recesses in intervening piers.

In North Carolina on the Big Pigeon River is the 171-foot Waterville Dam, a variable radius concrete arch, used for the generation of power, and completed in 1929. It was built in 48-foot sections or blocks, with 8-foot slots between for the passing of floods, and allowing for cooling of concrete. When the concrete in these blocks attained a temperature corresponding to average air temperature, the slots were then filled with concrete. The Ariel Dam on the North Fork of Lewis River, Wash., built by the Inland Power & Light Co., and completed in 1931, is of the gravity and variable radius arch type, 313 feet in maximum height. Here again the dam was built in blocks to accelerate cooling, and even though the

ture contained over 300,000 cubic s of concrete it was possible to fill the within 12 months after placing the concrete. To obtain an acceptable foundation for the Ariel Dam, it was ssary to excavate to a depth of 122 below normal river level, correspond- o 73 feet below sea level. This dam thin section, the arch being 19 feet at the top and 92 feet at the

the construction of the Santiago k Dam in Orange County, Calif., a rkable record has been made in plac- 1,056,000 cubic yards of earth. In ust, 1931, the contractor placed 400,000 yards, in September 305,000 cubic s, with a record day of 17,308 cubic s. At the Owyhee Dam on the hee (Federal) irrigation project in eastern Oregon, the contractors have been placing concrete at the rate of 50,000 cubic yards per month; the total volume of the completed structure will be 550,000. An unusual feature of this dam is the presence of a shattered zone or fault crossing the site near the center of the canyon. Material in this fault zone throughout the entire width of the base of the dam was excavated to a maximum depth of 175 feet below the river bed and refilled with concrete to form a key for the dam into the fault zone. The base of this key is about 115 feet below the base of the dam proper and 175 feet below the river bed. An interesting feature of the Owyhee Dam is a freight and passenger elevator in the dam having a total lift of 271 feet. The Shoshone Dam in Wyoming on the Shoshone (Federal) irrigation project, is the only one of the high dams in this country whose height exceeds its length. It is 328 feet high, but only 200 feet long, being located in an extremely narrow granite gorge of the Shoshone River where the width of the normal stream bed is only 70 feet. Only 78,576 cubic yards of concrete were required for this high dam.

SALMON PASS HIGH DAM

An interesting feature of the 263-foot Baker River (Shannon) Dam in Washington is the fish ladder which the salmon climb on their way to the spawning grounds. The limit of height for fish ladders in the Northwest had been about 50 feet, until a novel combination ladder elevator was devised to take the fish over this high dam. At each 2-foot step in the ladder the fish are trapped against a

TABLE 1.—*High Dams in the United States*

[All dams are constructed of concrete masonry unless otherwise noted]

Name	Location	Year completed	Purpose [2]	Type	Maximum height	Crest length	Volume	Cost
					Feet	*Feet*	*Cubic yards*	
r [25]	Arizona-Nevada	(1)	F. C., Irr., and P.	Arched-gravity	730	1,180	[3] 3,400,000	[4] $70,600,000
ee [22]	Oregon	(1)	Irr	do	405	840	550,000	5,378,125
o	Washington	1931	P	Constant radius arch, gravity wings	389	1,180	350,000	
na	California	1929	F. C	Variable radius arch	372	640	226,140	2,514,770
e	do	1929	W. S. and P	Arched-gravity	358	1,337	617,700	6,240,000
rock [25]	Idaho	1915	Irr	do	349	1,100	585,130	4,327,710
ughnessy	California	1923	W. S. and Irr	do	344	605	398,516	7,000,000
prings	do	1931	P	Rock fill [5]	332	1,300	3,000,000	6,930,000
quer	do	1926	Irr. and P	Arched-gravity	330	960	396,000	5,118,073
one [25]	Wyoming	1910	Irr	Constant radius arch	328	200	78,576	1,439,135
	Washington	1931	P	Gravity and variable radius arch	[6] 313	1,250	307,000	
co	New York	1916	W. S	Gravity, straight [7]	307	1,843	900,000	6,735,000
ant Butte [25]	New Mexico	1916	Irr	do	306	1,155	618,536	4,149,180
Mesa [24]	Arizona	1927	P	Variable radius arch	305	784	147,357	2,873,000
roton	New York	1927	W. S	Gravity, straight [8]	297	[9] 710	855,000	7,631,185
abriel No. 2	California	(10)	F. C	Rock fill [11]	290		1,300,000	3,000,000
edro	do	1923	Irr	Arched-gravity	288	1,040	296,552	3,097,419
velt [22]	Arizona	1911	Irr	do	280	1,080	342,000	3,890,187
nan	Washington	1926	P	Variable radius arch	280	1,110	90,000	
Canyon	California	(10)	W. S	Gravity, straight	280	900	600,000	5,770,000
a	do	1930	W. S	Rock fill [12]	278	530	324,000	1,250,000
Spaulding	do	1919	P	Variable radius arch	275	800	191,772	2,353,776
lver	Kentucky	1925	P	Rock fill [13]	270	910	1,747,000	7,000,000
ijunga No. 1	California	1931	F. C	Variable radius arch [14]	265	800	108,250	1,117,025
River (Shannon)	Washington	1926	P	Semigravity arch, overflow	263	450	132,000	[15] 8,000,000
Pleasant	Arizona	1927	Irr. and P	Multiple arch	256	[16] 2,146	98,400	
Bridge	New York	1912	W. S	Gravity, straight [17]	252	[18] 1,000	390,000	
oitan	California	(10)	W. S	Earth and rock fill	250	1,300	[22] 2,405,000	3,700,000
ge	Arizona	1928	Irr. and P	Multiple dome	249	932	187,000	2,270,000
e Mountain	Massachusetts	1931	W. S. & P	Earth fill, hydraulic	245	700	1,800,000	
No. 1	California	1922	P	Variable radius arch	236	415	70,312	1,544,000
nan	Colorado	1904	W. S	Arched- gravity [19]	232	710	103,000	1,000,000
nta Anita	California	1927	F. C	Variable radius arch	230	612	76,184	1,208,000
rwood	Tennessee	1930	P	Thin section arch, overflow	230		400,000	
on Flat [25]	Arizona	1925	P	Variable radius arch	225	664	43,500	1,559,000
es	California	1926	Irr	Constant radius arch, overflow	222	590	92,913	1,575,000
[22]	Washington	1925	Irr	Earth and rock fill, semihydraulic	222	905	1,995,000	3,756,256
n River	Idaho	1912	Irr	Constant radius arch	220	490		
eras	California	1925	W. S	Earth fill, semihydraulic [23]	220	1,200	3,461,000	
ablo	do	1920	W. S	Earth fill, hydraulic	220	1,250	2,200,000	
nder [25]	Wyoming	1922	Irr	Constant radius arch [20]	218	432	60,210	1,755,306
n Narrows	North Carolina	1919	P	Arched-gravity, overflow	217	1,400	525,000	
San Leandro	California	1926	W. S	Earth fill, part hydraulic	215	660	1,248,000	
t	do	1922	W. S	Arched-gravity	213	773	139,569	1,650,000
	South Carolina	1930	P	Earth fill, semihydraulic [21]	208	7,800	11,000,000	
isett	Massachusetts	1906	W. S	Gravity, straight [24]	207	971	266,663	2,378,206
tlah	North Carolina	1927	P	Variable radius arch, 2 overflow gravity tangents	202	340		
Bridge	Vermont	1924	P	Earth fill, semihydraulic	200	1,250	1,950,000	
Arrowhead	California	1922	P	Earth fill, hydraulic	200	720	1,000,000	
h	North Carolina	1918	P	Arched-gravity, overflow	200	700		
hland	California	1924	W. S	Arched-gravity	200	930	173,462	1,112,231
Canyon	Washington	1927	P	Semigravity arch	200	555		
un	Oregon	1929	W. S	Arched-gravity	200	1,000	230,000	1,480,776

[1] Under construction.
[2] F. C.—Flood control, P.—Power, Irr.—Irrigation, W. S.—Water supply.
[3] 4,400,000 including appurtenant works and power house.
[4] Not including interest during construction.
[5] Upstream slope paved with 15-foot layer of placed rock surfaced with concrete slab.
[6] Arch section 313 feet, gravity section 140 feet.
[7] Upstream face, precast concrete blocks.
[8] Stone masonry facing.
[9] Not including earth embankment 490 feet.
[10] Authorized for construction.
[11] Concrete facing on upstream slope.
[12] Concrete core wall.
[13] Upstream slope has hand-packed rock faced with concrete.
[14] Gravity section at each end.
[15] Includes cost of power plant.
[16] Does not include 750-foot spillway.
[17] Faced with concrete blocks.
[18] 4,650 feet with earth wings.
[19] Granite in Portland cement mortar.
[20] Granite random rubble masonry with coursed rubble faces.
[21] Clay puddled core.
[22] 1,500,000 earth, 850,000 rock, 55,000 concrete.
[23] Lower half hydraulic fill. Upper half dry earth and rock fill.
[24] Rubble masonry, ashlar facing downstream.
[25] Bureau of Reclamation dam.

return downstream. After climbing part of the distance, the salmon go through 700 feet of flume and then enter a steel car which is hauled to the top; there the fish are delivered into a hopper and pass through a chute into the lake above the dam. The young migratory salmon on their way downstream successfully make the 200-foot drop over the dam.

The 344-foot O'Shaughnessy Dam of the Hetch Hetchy water supply system of the city of San Francisco was designed for, and will later be raised to, a height of 430 feet. At that time a bank of eighteen 10-foot siphon spillways on the crest will be filled with concrete. In the construction of the Glines Canyon Dam in Washington, concrete for the lower portion of the structure went from the mixer into a chute suspended by a cable across the canyon, then into a 15-inch vertical delivery pipe leading to a steel-lined box 70 feet below. The Keokuk power dam on the Mississippi River was built first as a viaduct and then converted into a dam, with 119 arch spans, 30 feet long, resting on piers 6 feet thick, forming a bridge with a width on top of 29 feet. The 30-foot openings were then closed with a concrete ogee-section dam or weir.

Notes For Contractors

Boulder Canyon project.—Bids under Specifications No. 553-D, were opened at Las Vegas, Nev., on December 30, 1931, for the construction of four 5-room residences of timber frame construction at Boulder City. The low bidder was V. O. Brunzell, of Gardena, Calif., the total amount of the bid being $2,584, and he has been awarded the contract.

Bids were opened at Denver, Colo., on January 5, under advertisement No. 3333-A, for 5,000 barrels of Portland cement in sacks, and 375,000 barrels to be shipped in bulk, for the Hoover Dam. The Riverside Cement Co., California-Portland Cement Co., Southwestern Portland Cement Co., and Monolith Portland Cement Co. submitted a joint bid of $1.78 for item 1 (5,000 barrels) and $1.28 for item 2 (375,000 barrels) both f. o. b., southern California mills. The Utah-Idaho Cement Co., of Ogden, Utah, was low on 40,000 barrels of item 2, with a bid of $1.12 per barrel f. o. b. Bakers, Utah. Eight bids were received.

Specifications No. 557-D have been issued covering the construction of one 20-car garage and two 12-car garages, at Boulder City for the use of the Government employees occupying residences constructed by the Government.

Specifications have been prepared for the construction of an 8-room schoolhouse at Boulder City.

Engineers—Contractors Committee Finds Hoover Dam Conditions Satisfactory

THE committee on public information about the Hoover Dam, recently appointed by the Associated General Contractors of America and the American Engineering Council to investigate conditions on the Boulder Canyon project, has made its report. Three engineers—B. L. Brown, of St. Louis; H. S. Crocker, of Denver; and J. B. Lippincott, of Los Angeles—and three general contractors—George B. Walbridge, of Detroit; Arthur S. Bent, of Los Angeles; and Henry W. Horst, of Philadelphia—comprised the committee.

Some highlights of the report follow: Up to December 1, 1931, the Government has expended on Boulder City $1,135,000, and Six Companies (Inc.) $780,880, making a total of $1,915,880. It is now being equipped with paved streets, sidewalks, and curbs, modern sanitary water and sewerage plants, electric lights, and a telephone system. The dormitories are equipped with General Electric water coolers, electric lights, toilets, and hot and cold water showers. Meals served in the dining room are excellent, the menus being changed each day. Three meals a day are furnished to the day and night shifts, with an extra lunch to the latter. The lunches can be selected by each man, and any amount of food may be taken. The quality of the supplies is of high grade and include eggs, butter, milk, cream, fresh vegetables, and fruits.

A pay-roll deduction of $1.60 per day is made for the men, which includes individual room and janitor service in the dormitories, board, and transportation in motor busses to and from work. The contractor has built over 400 cottages to house employees and their families, with reasonable rental charges. Prices in the contractor's stores and laundry are fair. Recreation hall is equipped with billiard tables, reading and card tables. At present all the required modern necessities have been introduced for the comfort and health of the men, and these are being continually improved. The care of the men and the sanitary arrangements are equal or superior to those on any other construction job which with the committee has been acquainted.

The minimum wage on the project is $4 per 8-hour day. In excess of 40 per cent of the employees are ex-service men. No aliens are being employed. A department of insurance and safety has been created which is responsible for the health, safety, insurance, hospitalization, and fire protection. A hospital has been constructed with accommodations for 35 beds, with complete modern equipment and a competent staff of doctors and nurses. At the river camp is a first-aid station. Water is pumped from the Colorado River, settled twice, filtered and chlorinated, and distributed by gravity. It is of good quality, and periodical tests are made to determine freedom from impurity and dangerous bacteria.

In summarizing the results of its investigation the committee states: "In less than eight months this region has been so organized that every man who is properly engaged in any capacity in the work itself is well housed and better fed than the greater average of his fellows. In dormitories that are steam heated for the penetrating cold of the desert winters, ventilated with conditioned air, cooled and moistened to produce the maximum comfort in the summer's heat, these men are supplied with individual rooms, comfortable beds, clean linen, electric lights, janitor service, modern toilet and bathing facilities, in a way which marks the new 'high' in the curve of construction-camp accommodations. The dining room, through a singularly fortunate concession, which is guarded by a contract, which can be terminated on 24 hours' notice, is serving better food than the average American home enjoys."

Grand Valley project.—Designs and specifications have been prepared for the construction of the Grand Valley power plant. The hydraulic and electrical equipment for the plant was purchased under Specifications No. 528.

Minidoka project.—Bids were opened at Denver on January 18 for furnishing electrical apparatus for the substation at south side pumping station No. 1. The items on the schedule were transformers, oil circuit breakers, air break switches, disconnecting switches, and switchboard apparatus.

Owyhee project.—Bids under specification No. 530 were opened at Nyssa, Oreg., on December 23, 1931, for earthwork, tunnels, and structures, from station 4+20 to station 242+20 of the North Canal, Mitchell Butte division. Seventeen bids were received. The low bidder for schedule No. 1 was J. A. Terteling & Sons, of Spokane, Wash., whose total bid was $133,430, and for schedule No. 2, the General Construction Co., of Seattle, Wash., at $151,050.

The Montgomery Elevator Co., of Moline, Ill., submitted the low bid of $8,394 f. o. b. Moline, for the combined freight and passenger elevator for the Owyhee Dam (specifications No. 529). Six bids were received at the opening on December 4.

(Continued on p. 33)

Water-Purification Plant at Boulder City

The water for Boulder City, Nev., is pumped from the Colorado River to a presedimentation basin at the bottom of the canyon where a large portion of the silt is settled out. The water is then pumped to a 100,000-gallon tank, at Boulder City, from which it flows by gravity to a purification plant located a short distance northeast of the Government warehouse. The water-purification plant consists principally of a series of reinforced-concrete tanks and chambers constructed mainly below the ground surface, including two 45-foot diameter clarifier tanks separated by 2 narrow recarbonization chambers, 4 chemical-mixing tanks, a clear well, 4 rapid sand-filter chambers, a pipe gallery, and minor compartments and chambers, combined in one monolithic reinforced concrete structure about 100 by 115 feet in size. A 2-story building about 19 by 54 feet in size, with a tank tower extending an additional story, is constructed over the pipe gallery, with a 1-story wing about 18 by 41 feet in size, extending over the rapid sand-filter chambers, and another 1-story wing at the end of the building for a storage room and loading platform. The first floor of the main part of the building is utilized as an operating room and the second floor for storage. Access to the first and second floors and the pipe gallery is by means of an electrically operated freight elevator and a metal spiral stairway. The mechanical equipment consists of 2 dry chemical feeders, 4 chemical mixing units, 3 clear-well pumps, 2 sludge pumps, and 4 control tables.

Water from the 100,000-gallon storage tank enters the purification plant through the pipe gallery and thence to two of the mixing chambers, where soda ash and lime are added automatically by the dry-chemical feeders. From the mixing chambers the treated water passes to one of the 45-foot clarifier units where more silt is settled out, and then to one of the narrow recarbonization chambers. From this chamber the water goes through the pipe gallery to a second set of mixing, clarification, and recarbonization units and thence through the pipe gallery to the rapid sand filters. The water then passes to the clear well where it is chlorinated, and from which it is pumped to the 2,000,000-gallon storage tank or to the city water mains. The above-described operation is the normal operation, but piping and control works have been provided by means of which the two sets of units can be operated in series or in paralell, one set operated at a time or the entire plant by-passed.

Ring Bolt Rapids

(Continued from p. 23)

lated to use the Colorado River as the route for transportation. Bishop Anson Call commenced the construction of a stone fort and warehouse at a point on the river approximately 8 miles above the entrance to Black Canyon. The fort was named Callville and was intended for the upper point of embarkation for the barges plying the river. A man by the name of Adams secured a contract with the Mormon Church to transport freight and immigrants and put a steamer, the *Esmeralda*, into service for this purpose. In order to gain passage and control of the boat through the rapids, large rings were fastened by ring bolts to rocks or cliffs at the head of the rapids. Towlines unwound from the drum of a steam winch on the boat were securely anchored to the rings and the boat was controlled in dropping down the rapids or guided and hauled up the rapids, respectively, by directed winding or unwinding of the line around the drum of the winch.

Several trips were made with the steamer, but the rapids, rocks, sand bars, and frequent floods of the river discouraged the navigator and he finally abandoned his contract with the Mormon Church.

At the time this navigation project was attempted the boundaries of the empire which the Mormons hoped to control were being constantly limited and narrowed by subdivision of the southwest territory into States and by Government surveys delineating the boundaries of these States. As one effect of these surveys the area including Callville was found to be located in Nevada and not in Utah. It was also becoming increasingly evident that the rails being pushed from the east by the Union Pacific Railroad and from the west by the Southern Pacific would, in the not far distant future, reach a junction by which act a transcontinental line would cross the State of Utah and furnish more ready transportation to the Atlantic and Pacific Oceans. As a result of these conditions, Mormon control along the Colorado River was lost and, as the new railroad would accomplish the mission for which the river navigation was intended, the project on the Colorado was abandoned. Fort Callville was deserted and the Mormon settlers who lived in the Moapa Valley near the fort soon after abandoned their farms and withdrew into Utah.

Once more the Colorado had won in its ceaseless battle to maintain its splendid isolation. At the present time only the walls left standing at Fort Callville and the iron ring anchor in the andesite bowlder at Ring Bolt Rapids remain to bear witness of another futile attempt to develop an inland empire by navigation of the Colorado River.

Notes for Contractors

(Continued from p. 32)

Yakima project—Kittitas division.—Specifications have been prepared covering the purchase and installation of approximately 940 feet of 45-inch diameter and 2,100 feet of 42-inch diameter steel pipe for penstocks and discharge pipes, respectively, for the Wippel pumping plant. The concrete piers and anchors will be constructed under a separate contract, notice of which was published in the January issue of the New Reclamation Era.

Yakima project—Kennewick division.—Bids under specifications No. 547–D were opened at Yakima, Wash., on December 30, 1931, for the construction of the Prosser power canal, power plant, and diversion dam. Fifteen bids were received. The contract was awarded to the General Construction Co., of Seattle, Wash., whose total bid was $131,386.50.

Bids under specification No. 555–D were opened on January 15, 1932, for the purchase of a 20-ton traveling crane for the Prosser power plant.

SOME of the outstanding crop yields on the Belle Fourche project for 1931 give E. T. Mott, on Horse Creek, the honors for sugar beets, with 22 tons per acre. Louis Maas, in the same vicinity, had a yield of corn estimated at 50 bushels per acre, and Eugene Adams, of Vale, reported 60 bushels of barley per acre. John Bentz, of the Butte Hall country, gets the blue ribbon for potatoes with 330 bushels per acre, and Louis Larson, of Nisland, is among the winners with 132 bushels of pickles per acre. For general all-around production, based on crop values, the farm of Dr. L. J. Townsend, near Nisland, tops the list with an average return of $37 per acre on 192 acres.

Cheese Factories on the North Platte Project, Nebraska-Wyoming

By J. A. Keimig, Junior Engineer, Bureau of Reclamation

THE original cheese factory on the North Platte project, which was located 7 miles east of Scottsbluff, Nebr., and was known as the Fairview Cooperative Cheese Factory, was started in 1924. This factory was watched with a great deal of interest by the project farmers in general, and as the success of the enterprise became known, other factories were started at Morrill, Henry, Bayard, and Gering, Nebr. In 1926 these various factories were organized into one unit known as the North Platte Valley Cooperative Cheese Co., and a centralizing plant was constructed at Gering, Nebr., illustrated on opposite page. To and including the year 1930, the whole milk was delivered to the local factories and the finished cheese product was taken to the centralizing plant for curing.

The following table shows the output and approximate prices paid to the farmers for butterfat for the years 1924 to 1930, inclusive.

Year	Price paid per pound of butterfat	Output of cheese, in pounds
1924	$0.60	24,000
1925	.60	85,000
1926	.52	500,000
1927	.56	800,000
1928	.555	1,454,000
1929	.50	1,340,000
1930	.375	1,200,000

In 1931 the company decided to install a butter and ice cream making equipment at the Gering plant and in February started production of these two products.

The total amount invested in all the plants and equipment is $105,000, of which $69,000 was expended on the Gering plant.

FACTORIES CONSOLIDATED AT GERING

In order to keep down production costs it was decided in 1931 to operate only the Gering plant. This would reduce the number of employees and by operating one plant instead of five the fuel consumption was also reduced. In order to place this plan in operation it was found necessary to provide for the hauling of the whole milk to the Gering factory. At the present time 11 trucks are delivering milk, the hauling being paid for at the rate of 15 cents per hundredweight for the shorter hauls and up to 40 cents per hundredweight for the longest hauls. The milk producer pays 15 cents per hundredweight toward the cost of delivering the milk to the factory, and the remainder, if any, is paid by the company.

The capacity of the Gering plant is as follows: Cheese, 4,000 pounds daily; butter, 1,000 pounds daily; ice cream, 60 gallons per hour.

The plant has been operating one shift daily, varying from 10 to 12 hours per shift. The operating force consists of 3 cheese makers, 1 butter maker, 1 ice-cream maker, and 2 butter wrappers, in addition to 2 deliverymen and 3 office employees.

The production of butter was started in February, 1931, with 1,924 pounds for the month. This quantity has been rapidly increased, 23,261 pounds being made in October, 1931. The total quantity for the period, May to October, inclusive, was 115,696 pounds.

CHEESE PRODUCTION

The cheese produced at the Gering plant is a full cream cheese. Upon receipt of the milk it is flash pasteurized, then heated to a temperature of 160° F., and later cooled to a temperature of 86° F. Coloring is then added at the rate of 1 ounce to 1,000 pounds of milk. A starter of 2 per cent lactic acid is then added and after the acidity of the milk is correct, rennet is added in the proportion of 3 ounces to each 1,000 pounds of milk. This mixture is then allowed to set or clabber for 20 to 30 minutes. It is then cut with wire curd knives into ¼-inch cubes. After being cut, it is stirred with agitators, heat then being added to a temperature of 120° F. This product is then firmed and the whey drawn, leaving the cheese in the bottom of the vat. It is then cut into slabs 8 by 18 inches and piled three deep, then it is put through a curd mill which cuts the cheese into 1-inch cubes. Three pounds of salt is then added to each 1,000 pounds of milk, after which it is put into hoops and pressed into various shapes and sizes, ranging in weight from 5 pounds to 22½ pounds each. The cheese is then taken to the curing room and after 2 to 4 days is taken to the warehouse, graded, paraffined, and packed ready for shipment. The product is usually about 6 weeks old before reaching the retailer.

The cheese is disposed of to local wholesale dealers in small lots and in carload lots to dealers all over the country; some going as far south as Texas and as far east as New York.

There are 210 patrons selling milk and 200 others selling cream to the North Platte Valley Cooperative Cheese Co. It is estimated that the average price paid for butterfat in 1930 was 37½ cents per pound, this price being 6 to 8 cents per pound higher than other local markets and about 10 cents higher than the remainder of the State.

Mr. Eben D. Warner is president of the company and Mr. Linden is manager.

THIRTY-ONE carloads of feeder cattle were shipped into the Yuma project during a recent month for pasturing and fattening for market, and 4 carloads of fattened stock were shipped to Pacific coast markets. Pasture on the project brings from 3 to 5 cents per head per day, depending upon the type of forage, which ranges from cotton stalks to alfalfa hay.

Sun River Products Excel at State Fairs

Many of the settlers on the Montana projects have shown considerable interest in the recent State fairs held at Helena and Great Falls. At the Montana State Fair in Helena Howard Riphenburg took third place in 72 entries 4-H club baby beef Hereford class. In 10 entries of county groups of 5 Hereford calves the group from the Fairfield (Sun River) community took second place.

At the North Montana Fair in Great Falls, which was visited by an average of more than 20,000 a day, the following prizes were carried off by the Sun River project:

4-H club baby beef.—Howard Riphenburg took first place (champion) in Hereford class; reserve grand champion; third place in open class. Lloyd Austad took third place in the Hereford class. A. L. Meyer, jr., took fourth place in the Hereford class.

In the county group of 5 calves the Fairfield group took third place.

4-H milking shorthorn calf club.—Dick Jenkins took first place; Grant Cline took second place.

Best display of vegetables from one farm.—Mrs. W. W. Cole, first; Rufus Marsh, second.

Best display of zinnias.—Mrs. W. W. Cole, first.

Potatoes.—Early Ohio, Rufus Marsh, first; Irish Cobbler, Rufus Marsh, first; Bliss Triumph, Rufus Marsh, third.

Beets.—Table, H. L. Halladay, first; sugar, Lloyd Cox, third.

Head lettuce.—Rufus Marsh, first.

Sweet corn.—W. T. Jenkins, first.

Peas.—Herman Nelsen, second.

Community collection booths (12 communities entered), Fairfield took first for largest registered attendance August 25, and fourth for quality of entered and non-entered products.

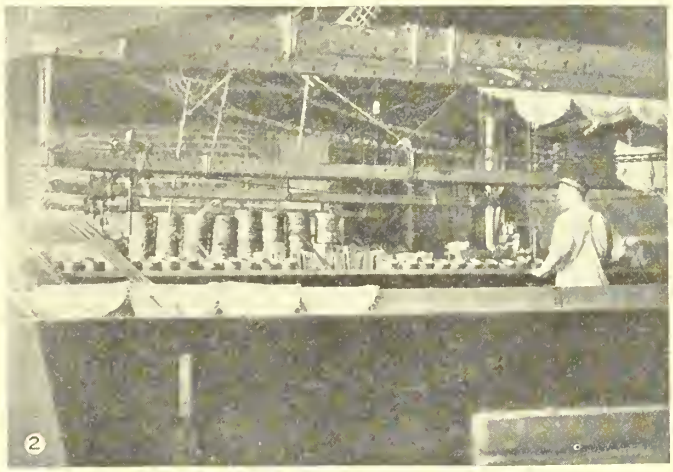
Honey Exhibit at Fall Fair Wins First Prize

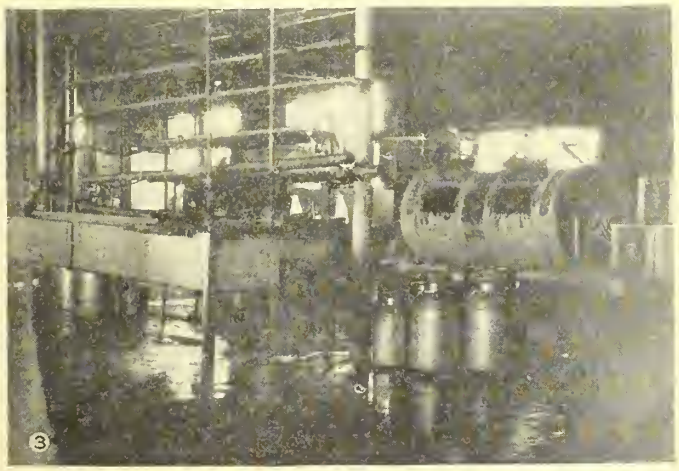
By H. H. Keck
Bee Inspector, Paul, Idaho

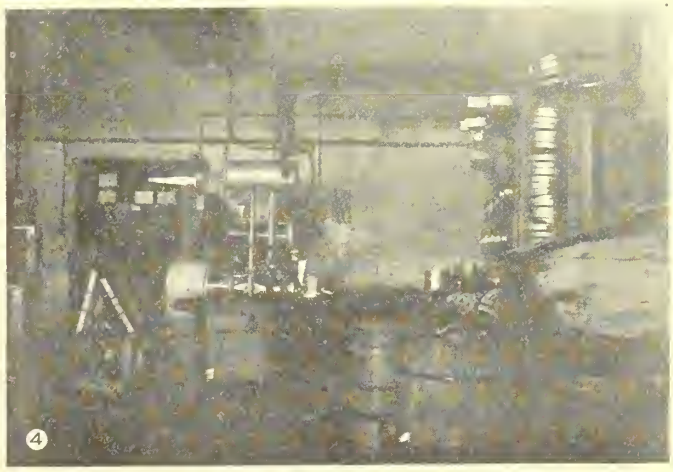
The photograph appearing on the back cover of this issue of the Era, taken at the Burley fair, September 16–18, represents the honey produced last summer on a Minidoka project farm by H. H. Keck, of Paul, Idaho.

The picture in black and white in the back of the exhibit is the State Capitol of Idaho. The large basket in the center is a golden color with white baby breath and African daisies. The large queen is made of golden brown satin. The latticework is white with green ferns for a background. The wax is of a very light yellow, and the wax queen worker and drone bees are modeled from wax by Mrs. Keck, the producer's wife, who does all the handwork. Cakes, jelly, fruit, pickles, candies, pie, doughnuts, and cookies are sweetened with honey instead of sugar.

The honey booth won first prize at the exhibit.







NORTH PLATTE VALLEY COOPERATIVE CHEESE CO., GERING, NEBR., NORTH PLATTE PROJECT. (See p. 34)
1, Exterior of factory; 2, interior, showing vats in which cheese is made, drums or hoops in which it is pressed, and overhead mechanism for driving agitators through cheese; 3, butter churn; 4, ice-cream machine.

Kittitas Creamery Makes Record

By E. E. Mundy, Secretary Chamber of Commerce Ellensburg, Wash.

EARNING $28,167.54 and distributing $24,660.78 as dividends to its members is the 1931 record of the Kittitas County Dairymen's Association, a cooperative creamery in its eighth year following organization. Since its beginning the association had distributed dividends each year and the total amount paid to members as dividends amounts to $177,194.06. The market price for butterfat has been paid and for several weeks the members were receiving a few cents above the market price.

How can the dairy association located at Ellensburg accomplish such an outstanding record? The question is logical and can be answered quite fully by stating that a good volume has been handled, that a high quality product has been manufactured, that the cost of production has been lowered, and good marketing conditions have been developed. The volume of butter manufactured has increased from 240,000 pounds in 1924 to 946,151 pounds in 1931. The cost of manufacturing this butter has been decreased from 4.1 cents in 1924 to 2.7 cents during the past year.

The membership is composed of 518 dairymen, and the business of the association is delegated by the membership to a board of five directors and a manager. The present board of directors consists of Morris Sorenson, J. H. Prater, James L. Kay, L. L. Sharp, and D. W. Brunson. Dan C. Bates is manager and he has held the position for several years.

The dairy industry in the Kittitas Valley, which is the irrigated, diversified valley surrounding Ellensburg, has increased steadily during the past 10 years. Another expansion which is taking place in the central Washington Valley consists of the addition of 72,000 acres of fertile valley lands which are being included under the Federal reclamation project. In reality, the project is adding 40,000 acres of new lands and furnishing a steady flow of irrigation water to 32,000 acres which have been farmed for many years and received a partial supply of irrigation water from creek rights.

The reclamation project will be entirely completed during this year and additional opportunities will be created for new settlers to locate in an irrigated, diversified valley already noted for its success, where homes, schools, churches, good roads, markets, and other advantages are already developed. It is expected that the dairy industry and other livestock lines will increase as the project becomes more fully settled.

Engineering Activities for Bicentennial Book

W. I. Swanton, of the Washington office, who compiled a chart of the United States Government which was published in the Era for August, 1931, is cooperating in the preparation of a chapter on Federal Engineering Activities, to be published in a book entitled "The Planning and Building of Washington," which is being issued by the Washington Society of Engineers in connection with the George Washington Bicentennial.

This chapter will contain information about the activities of the Federal engineering and technical bureaus and independent establishments located in Washington, including the Office of the Supervising Architect, Treasury Department; Chief of Engineers, War Department; Bureau of Yards and Docks, and Hydrographic Office, Navy Department; Geological Survey, and Reclamation Bureau, Interior Department; Forest Service, Bureau of Soils, Bureau of Public Roads, and Bureau of Agricultural Engineering, Agricultural Department; Bureau of Standards, Coast and Geodetic Survey, and Patent Office, Department of Commerce; and such independent establishments as the Interstate Commerce Commission, Valuation Division; Panama Canal; and Federal Power Commission.

Elephant Teeth Remains Found on Yakima Project

By John P. Thompson, Research Assistant
Department of Geology, State College of Washington

IN THE November issue of the Era we published a short statement regarding the finding on the Newlands project, Nevada, of a fossil elephant skull. In line with this Mr. Frederick W. Haversack, one of our engineers on the Kittitas division of the Yakima project, reports that he has recovered from the excavation for a structure in Badger Pocket two teeth from a prehistoric elephant. The specimens were sent to the department of geology of the State College of Washington, from which we have received the following report:

The teeth remains recently discovered east of the town of Kittitas in NW ¼ NW ¼ of sec. 16, T. 16 N., R. 20 E., and donated to the department of geology, State College of Washington (by Mr. R. B. Williams, construction engineer, United States Bureau of Reclamation) are from a prehistoric elephant, in all probability Elephas columbi (Columbian elephant).

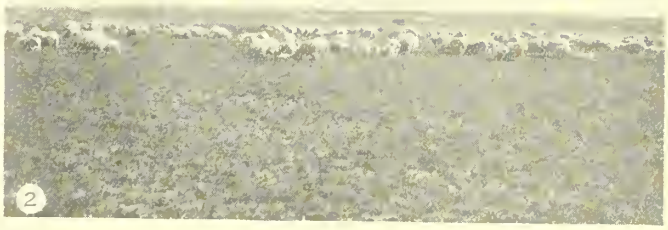
The two pieces of teeth weigh about 7 pounds, and although some parts of each have not been preserved, enough is left for purposes of identification.

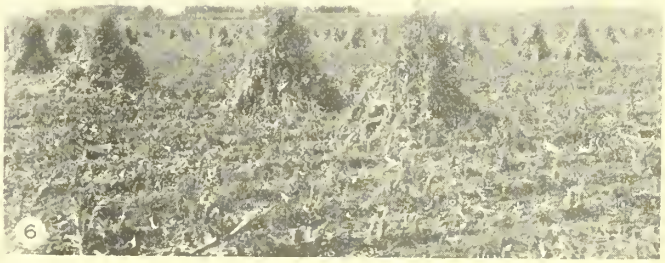
On one of the teeth the grinding surface has been remarkably preserved while the root portions have been lost. On the other fragment the reverse is true, the grinding surface has broken down and disintegrated while the root portions are intact. The remains show remarkably well some of the peculiarities of elephant teeth, not exactly like the teeth of any other animal. A single grinder has a peculiar structure, especially fitted to give long service in grinding coarse, wearing food. These grinders are larger than those of any other animal. They are made up, as can best be seen by cutting a tooth in half, of 10 to 27 vertical plates or folds of ivory (dentine) surrounded by a layer of enamel and set into a solid mass of softer cement. This alternation of hard ridges and softer valleys keeps them from becoming smooth and inefficient when they wear down.

At the time elephants roamed about the gently rolling plain we now know as Kittitas Valley, the climate was probably more humid because of the proximity of the continental ice sheet to the northward. During this time the streams which came into the valley from Menastash Creek around the north to Park Creek were flowing with torrential force, bringing down great loads of alluvial material which was deposited in fan-shaped accumulations where the streams entered the valley. These alluvial deposits are still conspicuous features of the topography, the fan of Green Canyon Creek being especially characteristic.

The drainage in the valley proper may not have been too well organized, and the probability is strong that, during part of the year at least, shallow lakes and ponds existed over considerable areas.

The flora, during the time the Columbian elephant lived in this part of the State, must of necessity have been different from that of to-day. So far as is known to the writer, no plant fossils have been reported from the Pleistocene of Kittitas Valley. The finding of elephant teeth east of Kittitas, during construction of a lateral of the high-line canal system, constitutes the first find in Kittitas County that has ever been reported. Further search may disclose more remains of the Badger Creek elephant or of others of the same species.

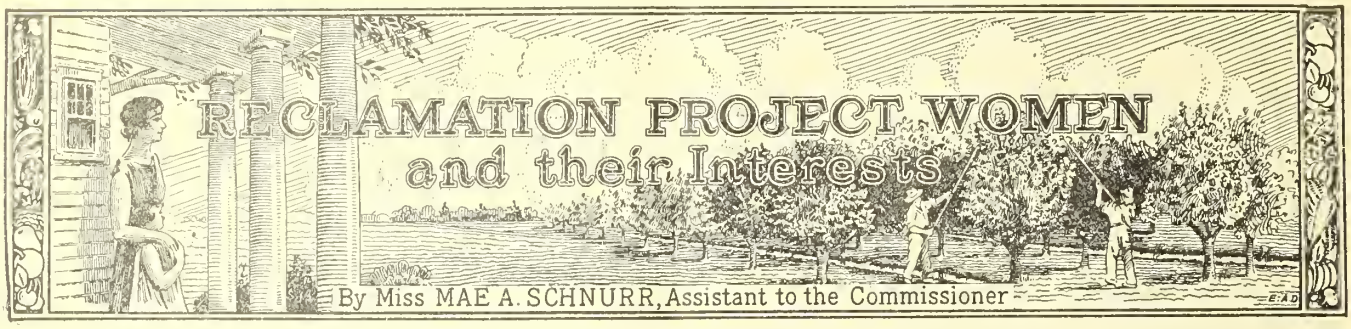




BELLE FOURCHE PROJECT, SOUTH DAKOTA

Photographs by F. C. Youngblutt

Holstein cow at dairy show; 2, sheep on Townsend farm near Nisland; 3, Roswell Holstein dairy herd; 4, irrigating cucumbers on Miller farm near Vale; 5, oats on William Schmele's farm; 6, corn in shock, Empire District; 7, hogs on Sherling farm near Newell; 8, turkeys on Avery farm near Newell.



Yuma Project Schools Since 1910

By Frankie B. Priest, Yuma, Arizona [1]

STOP! Think for a moment of the changes you would make in your life if you were suddenly given an entirely new chance to grow up after you had reached maturity. Think of the changes you would make in your home, Mr. and Mrs. Homemaker, if you suddenly came into enough money and you could carry out all of the cherished ideas and plans that you have thought out during all those years while you were making the best of the things that you had. No one will ever have the former opportunity, and only a few will be fortunate enough to have the latter. But in the public schools of the Yuma project we have had just that opportunity.

People have come here from Eastern and Southern States where they have spent their lives in attending, building, and observing school systems that have been accomplishing results for years. Don't you think they came to Yuma with definite ideas based on those observations and were interested in building a school system profiting by all the mistakes of the East? To aid them in a financial way was $65 per capita for children of school age allotted by State and county, and bond after bond voted for buildings.

The far-sighted pioneers of 1910, dissatisfied with the little red lumber schoolhouse on Main Street, built the Second Avenue School, a building of Spanish architecture, and so beautiful that in the next few years it was pictured in the Ladies Home Journal as among the five or six most beautiful school buildings in the United States. Another Arizona school was pictured in the same group, leaving possibly four as coming from the other 47 States.

By 1930 Yuma had so outgrown this school that the Fourth Avenue School was built, having 15 classrooms besides a large auditorium, gymnasium, cafeteria, cooking and sewing rooms, and offices. In five years the Roosevelt School followed with 10 classrooms and a most complete primary and kindergarten. These buildings were necessitated by the steady growth of the community as shown by the increase in attendance.

In the city schools in 1910 there was an average attendance of 415 pupils and 13 teachers. In 1920 it had almost doubled, with an average of 808 pupils. In 1930 it still showed a steady increase with an average of 1,356 pupils and a total enrollment of 1,798 pupils with 44 teachers employed.

Besides these city schools the Union High School has built entirely new buildings and there are four wonderful valley schools at Crane, Rood, Gadsden, and Somerton, to which children are brought daily in busses, thus enabling them to attend large, well-organized, well-supervised schools that would do credit to a city system. There are also four smaller schools in more isolated districts, Sunnyside, The Mesa School, and South and North Gila Valley Schools.

Several of these project schools have cafeterias. In the Fourth Avenue School cafeteria the children get well-planned, carefully prepared lunches with a bottle of milk for each child, all for 15 cents. Last year the local Elks' lodge paid for a good lunch each day for from 28 to 37 children from poor homes. There was no limit set on this number. Every child was fed whose name was turned in after a careful study.

With little poverty such as is known in the large cities and weather so delightful that children play out of doors practically every day of the year, there is little sickness and our average attendance stays high compared with our enrollment, in spite of a large floating population that, touring the West in flivvers, enjoys stopping in Yuma for the winter months.

Our building and planning have been for the future and each school is the most comfortable, efficient school that could be planned by an intelligent people who had sufficient funds for all needs.

Can you wonder then that Arizona schools rank with the three highest of the Nation's schools?

Some of Yuma's representative schools are grouped on the opposite page.

Senator Brookhart Defends Federal Reclamation

IN A recent discussion on the floor of the Senate the statement was made that aiding irrigation projects will increase the agricultural surplus and thus add to the difficulty which the Government is trying to obviate under the Federal Farm Board act. This statement was challenged by Senator Brookhart, of Iowa, who said:

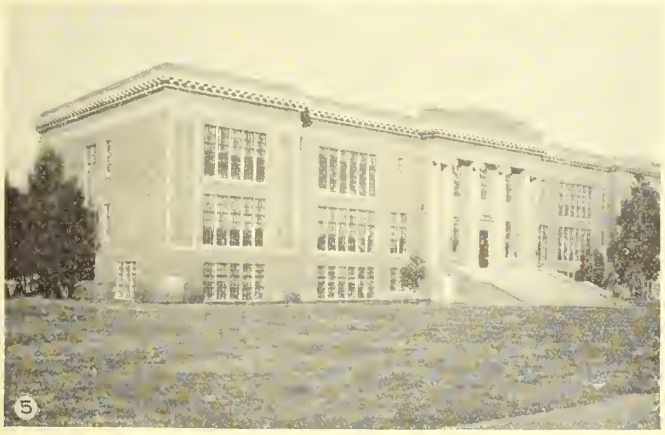
"I have heard that argument and have met it many times. The Chicago Tribune particularly has hauled me over the coals regularly about once a month for that same inconsistency. So I had an analysis made—and I am going to ask the Senator from New Mexico when I shall have stated it if it does not set forth the facts—of all the irrigation projects in the United States. From that analysis I found that every one of them developed a greater demand for agricultural products than it supplied. Those projects develop cities and communities which would not have existed but for reclamation and yet, while in some cases the commodities produced might have more than supplied the immediate needs, on the whole, the projects themselves created a market for other agricultural products in my section of the country and in Ohio, which is the home of the Senator who has just interrupted me.

"Mr. Bratton. Mr. President, let me say that I agree with the Senator. The products of irrigation projects do not come in competition with the heavy commodities produced in other States, especially in the eastern part of the country, and there is no overproduction in that broad sense created by those sparsely located reclamation projects in the West. So that it is wholly incorrect to say that the encouragement of reclamation projects adds to overproduction throughout the country."

[1] Wife of the superintendent of the Yuma project.

PUBLIC SCHOOLS IN THE YUMA VALLEY

YUMA PROJECT, ARIZONA



1, Public school in Yuma Valley; 2, Roosevelt Grammar School; 3, Union High School (original building); 4, Union High School, showing later addition to school; 5, Fourth Avenue Grammar School; 6, Yuma Union High School gymnasium and athletic field (see opposite page)

Methods of Repaying Construction Charges and of Financing Operation and Maintenance

THE original reclamation act of June 17, 1902 (32 Stat. 388), provided that the building or construction charges be repaid by the landowners benefited through the construction of irrigation works in annual instalments not exceeding 10. This method of repayment is generally known as the 10-year plan. During the period of 1907 to 1914, construction charges were announced under this plan for 15 projects and divisions of projects.

The reclamation extension act of August 13, 1914 (38 Stat. 686), revised the original 10-year plan of repayment. Lands under public notice, the landowners of which accepted the extension act, were granted 20 annual instalments in which to repay that portion of the construction charges remaining unpaid, and all lands subject to the terms and conditions of the reclamation law when the act was passed and for which construction charges had not been announced and the landowners accepted the terms of the extension act, were granted 20 annual instalments in which to repay the charges. In the above cases the first 4 instalments were to be 2 per cent each, the next 2 instalments 4 per cent each, and the next 14 instalments 6 per cent each. For lands becoming subject to terms and conditions of the reclamation act after August 13, 1914, the extension act provided that construction charges be repaid in 20 years, an initial instalment of 5 per cent of the announced construction charges being payable at the time of filing water-right application, the next instalment of the remaining 15 being payable the fifth calendar year after the initial instalment. The first 5 of the remaining 15 instalments were to be 5 per cent each and the last 10 instalments 7 per cent each. The major part of lands paying construction charges at the time of the enactment of the extension act of 1914 elected to accept the revised plan of repayment; only a small number of landowners on some of the projects elected to remain under the 10-year repayment plan. The extension act also provided for supplemental construction, repayable in annual instalments concurrent with the instalments payable for original construction or in annual instalments beginning the first year subsequent to the year in which the final instalment of the charge originally announced became due and payable. The plans of repayment under the extension act are generally referred to as the 20-year plan.

Although the extension act of 1914 authorized the Secretary of the Interior to designate and appoint legally organized water users' associations or irrigation districts under any reclamation project as fiscal agents of the United States to collect the annual payments of construction and operation and maintenance charges, this plan of collection was accepted by only five water users' associations.

The acceptance of water-right applications from each landowner required the Bureau of Reclamation to establish tens of thousands of water-right accounts, which required annual billing and collection. A large corps of bookkeepers, clerks, and fiscal agents were necessary, which proved expensive and troublesome. Means of compelling project lands which had not applied for water rights to pay construction charges or to contribute their share toward operation and maintenance were somewhat circuitous, being dependent upon the enforcement of the provisions of recorded stock subscription contracts by which the lands were pledged to repayment of construction charges. In cases of nonpayment, the only remedies were individual suits or cancellation of water rights. About 1917 the bureau adopted the policy of contractual relations between water users' associations or irrigation districts for the assumption as principals or guarantors of project indebtedness. The first of such contracts was with the Salt River Valley Water Users Association, which assumed the operation and maintenance of the Salt River project in Arizona. The association and irrigation district plan made collection of charges a function of the association, district, or county machinery provided for the collection of stock assessments or taxes, and offered one contract in place of many.

The act of December 5, 1924 (43 Stat. 672), provided for repayment of construction charges on the basis of crop production. This act provided that the instalment of the construction charge per irrigable acre payable each year shall be 5 per cent of the average gross acre-income for the 10 calendar years first preceding, or for all years of record, if fewer than 10 years are available. This plan is generally known as the crop-production plan. Sixteen projects and divisions of projects accepted this plan before it was repealed by the adjustment act of May 25, 1926.

Although this act did not expressly require joint-liability contracts, in all cases where the benefits of the act of December 5, 1924, were extended to a project, contractual relations were between the United States and associations or irrigation districts whereby the associations and districts assumed liability for the payment of construction charges without regard to individual default, generally referred to by the water users as joint liability.

The plan of repaying construction charges was again modified by the adjustment act of May 25, 1926 (44 Stat. 636). This act authorized the Secretary of the Interior to amend any existing contract to provide for increase in the time for payment of construction charges, which had not become due and payable, to the extent necessary under the conditions in each case, subject to the limitation that there be allowed for repayment not more than 40 years from the date the first payment matured under the original contract. As a condition precedent to the amendment of any existing water-right contract, the act required a contract with a water users' association or irrigation district whereby such association or district be

Method of Repaying Construction Charges and of Financing Operation and Maintenance

State, project, division, and agency	Manner of collecting and paying construction charges				Manner of operation and maintenance					Remarks
	Joint liability contracts		Individual payments made direct to United States	District or association as fiscal agent of United States	Operated by United States with appropriated money	Operated by United States with money advanced by water users	Reserved works operated by United States with advanced money. Main part of project operated by water users	Project turned over to and operated by water users	Contracts executed for turning over operation and maintenance in future	
	Assessments									
	Stock	Tax								
Arizona:										
Salt River—Water Users' Assn	35 yrs							1917		
Arizona and California:										
Yuma—										
Valley Div. (Ariz.)—Water Users' Assn	30 yrs					X				
Reservation Div. (Calif.)			20 yrs		X					
California:										
Orland—Water Users' Assn			do	X	X					15 yrs. add. to pay S. C.
Colorado:										
Grand Valley—Water Users' Assn	40 yrs								1937	
Orchard Mesa I. D		40 yrs						1922		
Uncompahgre—Water Users' Assn	40 years							1932		S. C. additional.
Idaho:										
Boise—										
Arrowrock Div. 6 I. Ds		Crop					X	1926		
Payette Div., Emmett I. D			20 yrs			X				
Minidoka—										
So. S. Pumping, Burley, I. D		Crop					X	1926		
No. S. Gravity, Minidoka I. D			20 yrs	X			X	1926		
Gooding Div. American Falls—Resv. Dist. No. 2		40 yrs			X				(1)	
Montana:										
Huntley—Irrigation Dist		do						1927		10 yrs. add. to pay S. C.
Milk River—										
Malta & Glasgow I. D's		do				X			1936	
Chinook Div. 5 I. D's		do					X		1936	
Sun River—										
Fort Shaw I. D		Crop						1927		
Greenfields I. D		do						1931		
Montana-North Dakota:										
Lower Yellowstone—I. D's. No. I and No. 2		do						1932		
Nebraska-Wyoming:										
North Platte—										
Interstate Div.—Pathfinder I. D		do					X	1926		
Fort Laramie Div. 3 I. D's		do					X	1927		
Northport Div. I. D		do					X	1927		
Nevada:										
Newlands—Truckee-Carson I. D		40 yrs						1927		S. C. additional.
New Mexico:										
Carlsbad—Pecos Water Users' Assn			20 yrs	X	X					
New Mexico-Texas:										
Rio Grande—Elephant Butte I. D. and El Paso County W. I. D. No. 1		27 yrs			X					
Oregon:										
Umatilla—										
East Div. Hermiston I. D		Crop						1926		
West Div. Extension I. D		do						1926		
McKay Storage—										
Westland I. D		40 yrs					X			
Stanfield I. D		20 yrs					X			
Vale—Vale-Oregon I. D		39 yrs			X					
Owyhee—7 I. D's		do							(1)	
Oregon-California:										
Klamath—										
Main Div. Klamath I. D		40 yrs				X				
Pumping Div. 5 I. D's		do				X				2 I. D's on 20-yr. basis.
Langell Valley Div.—										
Langell Valley I. D		do				X				
Horsefly I. D		do				X				
South Dakota: Belle Fourche I. D		do				X			1934	S. C. additional.
Utah:										
Salt Lake Basin—Weber River W. U. Assn	20 yrs							1932		
Strawberry Valley—Strawberry W. U. Assn	Crop							1927		Part 20 and 30 yr. basis.
Washington:										
Okanogan I. D		40 yrs						1927		
Yakima—										
Sunnyside Div.—Sunnyside Valley I. D		20 yrs		X	X					
Tieton Div.—Tieton W. U. Assn	20 yrs			X	X					
Kittitas Div.—Kittitas Recl. Dist		Crop			X				(1)	
Wyoming:										
Riverton—Midvale I. D		40 yrs			X				1935	
Shoshone—										
Garland Div.—Shoshone I. D		Crop					X	1927		
Frannie Div.—Deaver I. D		do					X	1931		

[1] End of construction.

Key for abbreviations: U. S.—United States, I. D.—Irrigation district, S. C.—Supplemental construction, Div.—Division, W. U.—Water users, Assn.—Association.

obligated to pay to the United States, without regard to default in the payment of charges against any individual farm unit or tract of irrigable land, the entire charges against all productive land in the project. In the case of new projects or new divisions of projects, this act requires contracts with irrigation districts providing for payment by the districts of the cost of constructing, operating, and maintaining the works during the time they are in control of the United States, such cost of construction to be repaid within such term of years as the Secretary may find to be necessary, in any event not more than 40 years. This plan is generally known as the 40-year plan. The joint-liability contracts executed between the United States and associations and irrigation districts have made possible the consolidation of thousands of individual accounts. One contract now takes the place of many, and the United States has been relieved of dealing with the individual water users except upon a few projects.

FINANCING OPERATION AND MAINTENANCE

Section 6 of the original reclamation act provided that the reclamation fund be used for the operation and maintenance of irrigation works constructed under the provisions of the act, and that when construction payments were made for the major portions of the lands irrigated, then the management and operation of such works shall pass to the owners of the lands irrigated, to be maintained at their expense under such form of organization as may be acceptable to the Secretary of the Interior. No project was transferred for local management under this provision.

This provision of the original act was amended by the extension act of 1914, which authorized the Secretary, in his discretion, to transfer the management upon request of a legally organized water users' association or irrigation district. Prior to 1924 the management of only two projects or divisions of projects had been assumed by the water users. The annual demand upon the reclamation fund to finance operation and maintenance had increased rapidly until it had exceeded $2,500,000. This retarded construction work. The benefits of the act of December 5, 1924, were extended to projects upon condition that the water users' organizations assume the management of the project at their own expense or advance sufficient money annually to the United States for operation and maintenance until such time as the water users' organization could assume such management. The adjustment act of 1926 requires the payment of operation and maintenance charges annually in advance.

Since 1924 the management of 18 projects or divisions of projects has been assumed by the water users at their expense, and 6 projects or divisions of projects are advancing the money necessary to finance operation and maintenance by the United States. The annual demand on the reclamation fund to finance operation and maintenance has decreased to about $1,000,000, of which $700,000 is necessary for the annual operation and maintenance of the Rio Grande project in Texas-New Mexico and the Yakima project in Washington, two large projects, the operation and maintenance of which has not been assumed by the water users.

The accompanying table shows the various methods of repaying the construction charges and of financing operation and maintenance.

MISS MAJORIE SORENSON, of Nisland, S. Dak., Belle Fourche project, the county champion 4-H club member, was awarded a trip to Chicago to attend the national club congress. Miss Marjorie Brandsburg, of Fruitdale, was awarded first place in the national contest on her exhibit of canned meat.

Conservation in the Department of the Interior

Conservation has been briefly defined as wise use. Secretary Wilbur and William Atherton DuPuy, executive assistant, have collaborated in writing a book entitled "Conservation in the Department of the Interior" which points the way to wise use of the natural and human resources under this department.

The book is an authentic presentation of what is being done by the Bureau of Reclamation, the General Land Office, the Geological Survey, the National Park Service, the Indian Service, the Office of Education, and other collateral branches in the administrative organization to carry on the work of the department in the best interests of the Nation as a whole. The book, which is bound with an attractive cloth cover and contains 253 pages and 160 illustrations, is written in popular style and should have a wide circulation as the latest and most up-to-date textbook on Federal conservation.

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at $1 each.

COMMERCIAL canning in the Yakima Valley during the past year assumed large proportions, the industry furnishing employment to upward of 2,000 persons. The aggregate value of fruits processed was $2,171,000. Canning of asparagus and tomatoes and the pickling of cucumbers added $200,878, bringing the total to $2,371,878. It is estimated that 606 cars will be required to ship this tonnage. Dehydrated fruits and by products of grape juice and cider vinegar, valued at $630,850, will fill an additional 597 cars.

GROWTH OF POPULATION AND AREA IRRIGATED IN THREE DECADES IN THE EIGHT MOUNTAIN STATES

State	1899			1909			1919			1929		
	Population in 1900	Area irrigated (acres)		Population in 1910	Area irrigated (acres)		Population in 1920	Area irrigated (acres)		Population in 1930	Area irrigated (acres)	
		Total	Per capita		Total	Per capita		Total	Per capita		Total	Per capita
Arizona	122,921	185,396	1.5	204,354	320,051	1.6	334,162	467,565	1.4	435,573	577,263	1.3
Colorado	539,700	1,611,271	3.0	799,024	2,792,032	3.5	939,629	3,348,385	3.6	1,035,791	3,426,022	3.3
Idaho	161,772	602,568	3.7	325,594	1,430,848	4.4	431,866	2,488,806	5.8	445,032	2,152,176	4.8
Montana	243,329	951,154	2.8	376,053	1,679,084	4.5	548,889	1,681,729	3.1	537,606	1,580,321	3.0
Nevada	42,335	504,168	11.9	81,875	701,833	8.6	77,407	561,447	7.3	91,058	487,241	5.4
New Mexico	195,310	203,893	1.1	327,301	461,718	1.4	360,350	538,377	1.5	423,317	551,420	1.3
Utah	276,749	629,293	2.3	373,351	999,410	2.7	449,396	1,371,651	3.1	507,847	1,323,703	2.6
Wyoming	92,531	605,878	6.5	145,965	1,133,302	7.8	194,402	1,207,982	6.2	225,565	1,233,604	5.5
Total	1,674,647	5,293,621	3.2	2,633,517	9,518,278	3.6	3,336,101	11,665,942	3.5	3,701,789	11,331,750	3.1

Boulder Canyon Project Notes

At the meeting on January 11 of the Boulder City American Legion Post permanent officers were elected as follows: R. F. Skinner, of the Bureau of Reclamation staff, commander; A. C. Looze, adjutant; H. C. Lawton and E. J. McDonald, first and second vice commander, respectively; Jim Lee, H. C. Young, and J. E. Way, executive committeemen, for three, two, and one year, respectively; Police Chief G. E. Bodell, service officer; J. L. Courtney, chaplain; George Alexander, sergeant at arms; E. H. McAdams, employment officer; Frank Zeller, finance officer.

Retiring Commander George Cass thanked the members for the interest and support that had been forthcoming during his commandership. He was presented a past commander's emblem.

The new commander came to Boulder City from the Kittitas division of the Yakima project, Bureau of Reclamation.

Plans for the canyon wall outlet works have been revised and it has been decided to eliminate entirely the upper valve installation on both sides of the river. In lieu thereof an additional installation will be placed on both the Nevada and Arizona sides at an elevation just above river level. These lower outlets will be located upstream from the original lower outlets at elevation 820. All needle valves in the canyon wall outlet works will point downstream at an angle of about 60° with the direction of the river.

On January 12 a gale with an estimated velocity of 60 miles an hour, visited the Hoover Dam site and vicinity, doing some damage in Boulder City to buildings and tents.

In addition to Boulder City which is now a community of some 500 buildings and 5,000 residents, there are two other settlements in the vicinity of the dam site, known as River Camp and Williamsville, each of which has a population of about 500.

The Six Companies (Inc.) has appointed C. J. Seymour as safety engineer and J. J. Rosedale as assistant safety engineer.

The directors of the Imperial Irrigation District, El Centro, Calif., have set February 11 as the date when the proposed All-American Canal contract will be submitted to district voters for approval.

Construction work at the dam site is about six months ahead of schedule. Three shifts of workmen are employed daily, each working eight hours. There is a labor turnover of only nine men daily, which has caused the Six Companies officials to issue a warning that idle workers stay away from the project.

A recent survey in Boulder City showed 228 children of school age and 61 under school age. By the beginning of the next school year it is expected that the town will have a modern school building. At the present time many of the children are accommodated in the Las Vegas schools.

Consulting Geologist F. L. Ransome has recently made a detailed geological study of the Hoover Dam site, to be used in connection with the locations and designs of various features of works appurtenant to the dam.

Up to January 9 the contractors had completed 8,170 feet of the 41 by 56 foot section of the 56-foot diameter diversion tunnels, and an additional 7,735 feet of the 12 by 12 foot pioneer bore. Tunnel excavation was about 43 per cent completed on January 9.

S. O. Harper on January 9 closed the switch which started the initial operation of the 500-ton per day gravel-screening plant, which has been built at the 3-way railroad junction in Hemenway, Wash.

Work on the highway from Boulder City to Las Vegas has been suspended until weather conditions are more favorable for the mixing of the oil-gravel surfacing. This surfacing can not be satisfactorily mixed when temperatures are below 45° F. The principal part of the highway that remains unsurfaced is that from railroad pass to Boulder City, a distance of about 4 miles.

Decision has been made to provide 30-foot diameter plate-steel penstocks in the penstock tunnels, which will involve plate thickness up to 2¾ inches. This will avoid the condition of having concrete-lined tunnels under full water pressure.

Shelter houses are being provided at Observation Point and Lookout Point for the comfort of visitors to the project.

The Elks' Lodge of Salt Lake City, Utah, will join with Nevada lodges in holding a celebration of Washington's Birthday on February 22, with appropriate ceremonies at the Hoover Dam site. It is proposed to erect a flagpole with a suitable plaque commemorative of the occasion. The pole will be placed on top of a small hill on the Nevada side, where it will be visible from practically all points in the vicinity of the dam site. About 2,000 Elks and friends are expected for the ceremonies.

A recent report by the six companies gives the number of men employed by the principal contractors as follows: Six companies Inc., 2,827; Carl K. Bryan, truck subcontractor, 132; General Construction Corporation, road subcontractor, 147; Anderson Supply Co., mess subcontractor, 147. Of the total of 3,121 there were 1,050 ex-service men, and 3,057 were American citizens. The average daily pay roll is $13,100.

Chief Landscape Gardener W. W. Weed, of the Las Vegas office, is supervising the preparation of maps, plans, and specifications for landscape requirements for Boulder City.

According to present plans, the Bureau of Reclamation headquarters will be transferred from Las Vegas to Boulder City on March 1.

The City of Los Angeles and the Southern California Edison Co. have been asked for advice as to the number and size of generating units they will desire to have installed in the power plant, in order that final location of penstock tunnels may be made, and the contractors permitted to proceed with excavation.

Percentages of completion on the Boulder City contracts are as follows: water filtration plant 65, sewage disposal plant 75, rough street grading 97, concrete sidewalks 74, and gravel sidewalks 95. The water distribution and sewer systems were completed on January 9, the administration and post-office buildings on January 10, and the dormitory on January 1.

Reclamation Organization Activities and Project Visitors

DR. ELWOOD MEAD, commissioner, and Miss Mae A. Schnurr, assistant to the commissioner, were bureau representatives and guests of the Zionist Organization of America at a dinner at the Mayflower Hotel on January 17. The party of about 100 was made up of the Vice President, Cabinet officers, Senators, Congressmen, educators, and leaders of the industrial world. Congresswomen Ruth Bryan Owen, of Florida, and Florence P. Kahn, of California, Miss Lola Williams, secretary to the Vice President, Miss Bess Goodykoontz, Assistant Commissioner of Education, Department of the Interior, and Miss Schnurr represented the women's contingent.

The program included addresses on the Palestine situation in its international aspects, by Prof. Felix Frankfurter of Harvard University, and Emmanuel Neumann, American member of the World Zionist Executive. The sponsoring committee was made up of Hon. Charles Curtis, Hon. William E. Borah, Hon. Hamilton Fish, jr., Hon. William H. King, Hon. Robert M. LaFollette, jr., Hon. J. Charles Linthicum, Dr. Elwood Mead, Hon. Henry T. Rainey, Hon. Claude A. Swanson, Hon. Henry W. Temple, and Hon. Robert F. Wagner.

Doctor Mead has been technical adviser to the Zionist organization for a number of years.

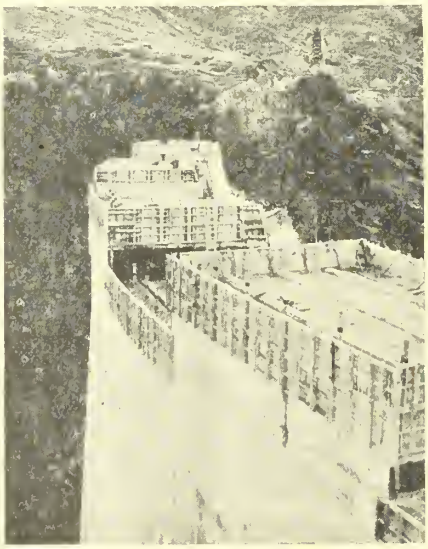
Commissioner Mead left Washington on January 28, going direct to Sacramento, where he met with E. B. Debler, hydraulic engineer, who had started for the West from the Washington office on January 22 to consult with State Engineer Edward Hyatt, Professor Frank Adams of the University of California, and F. E. Bonner, of the Department of Public Works of California, relative to the completion of the report on the San Joaquin Valley. Arrangements had been made to have fairly complete data on this report to place before Doctor Mead on his arrival in Sacramento.

An important feature of Doctor Mead's western trip was his attendance in Salt Lake City on February 8 upon the water users' conference sponsored by the American Farm Bureau Federation. Doctor Mead addressed this group on the subject of proposed relief measures for settlers.

During Dr. Mead's absence Assistant Commissioner Porter W. Dent was designated acting commissioner.

Porter W. Dent, assistant commissioner, will represent the Bureau of Reclamation at the twenty-first session of the National Drainage, Conservation, and Flood Control Congress to be held at the Brown Hotel, Louisville, Ky., February 17–19. Mr. Dent will address the conference on the subject of the benefits which the East derives from western irrigation through the vast amount of manufactured products which those developments require.

L. H. Mitchell, who has been in charge of the Shoshone project, Wyoming, for the past 8½ years, has been transferred to the Washington office, where he has been assigned to the position of assistant director of reclamation economics to succeed George O. Sanford, now chief of the engineering division. Mr. Mitchell's new assignment took effect on January 25.



Owyhee Dam, Owyhee project, Oregon-Idaho, 91 per cent complete

H. W. Bashore, engineer, of Spokane, Wash., spent several weeks in the Denver office in the preparation of his report on the Columbia Basin investigations, of which he is in charge.

J. R. Iakisch has returned to Denver from the State of Washington, where he made an investigation of the Oroville-Tonasket irrigation district.

The board of control of the Lower Yellowstone project having effected its organization, assumed the care, operation, and maintenance of the project on January 1, 1932. The project offices will henceforth be located at Sidney, Mont.

L. N. McClellan, chief electrical engineer, and E. B. Debler, hydraulic engineer, conferred at the Washington office on January 14–15 with A. C. Clogher and C. N. Phillips, chief hydraulic engineer and engineer, respectively, of the Electric Bond & Share Co., on matters connected with the production and sale of power from the Columbia Basin project, which contemplates a continuous output of 800,000 kilowatts of firm power for commercial uses.

George L. Evans, chief of the mails and files section, Denver office, was recently in Washington in the interest of the National Federation of Federal Employees.

Col. George B. Walbridge, of Detroit; Messrs. A. E. Horst, of Philadelphia; A. S. Bent and J. P. Lippincott, of Los Angeles, B. L. Brown, of St. Louis, and H. S. Crocker, of Denver, members of the Hoover Dam public information committee of the Associated General Contractors of America and the American Engineering Council, were recently on the Boulder Canyon project.

Northcutt Ely, executive assistant to the Secretary of the Interior, and Mrs. Ely were recent visitors on the Boulder Canyon project.

C. M. Day, mechanical engineer, has returned to the Denver office from Pennsylvania, where he spent some time in the investigation of electrical welding and design methods on large pipe lines and penstocks with special reference to Hoover Dam penstocks.

N. O. Anderson, chief clerk of the Lower Yellowstone project, has been transferred to Yuma.

SHIPMENTS of turkeys from the Orland project for the Christmas trade amounted to 270,000 pounds, which is 70,000 pounds in excess of the previous month's turkey shipments. Only two cars were shipped by rail, most of the dressed turkeys being forwarded by motor truck.

A NEW show house and a new hospital were erected at Belle Fourche during 1931.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department; **E. K. Burlew**, Administrative Assistant to the Secretary, and Budget Officer; **Northcutt Ely, Charles A. Dobbel**, and **Wm. Atherton DuPuy**, Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubaeh, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division
Hugh A. Brown, Director of Reclamation Economics

L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	E. M. Philebaum	R. J. Coffey	Los Angeles.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	J. R. Alexander	Las Vegas, Nev.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	R. J. Coffey	Los Angeles.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			J. R. Alexander	Las Vegas, Nev.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	do	Do.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			Wm. J. Burke	Billings, Mont.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	H. J. S. Devries	El Paso, Tex.
Baker, Thief Val. Dam	Owyhee, Oreg	F. A. Banks	Constr. engr			do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	do	Do.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	Wm. J. Burke	Billings, Mont.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas Div	Ellensburg, Wash	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	do	Do.
Shoshone [8]	Powell, Wyo	I. B. Hosig	Acting supt	W. F. Sha	Denver office	Wm. J. Burke	Billings, Mont.
						do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

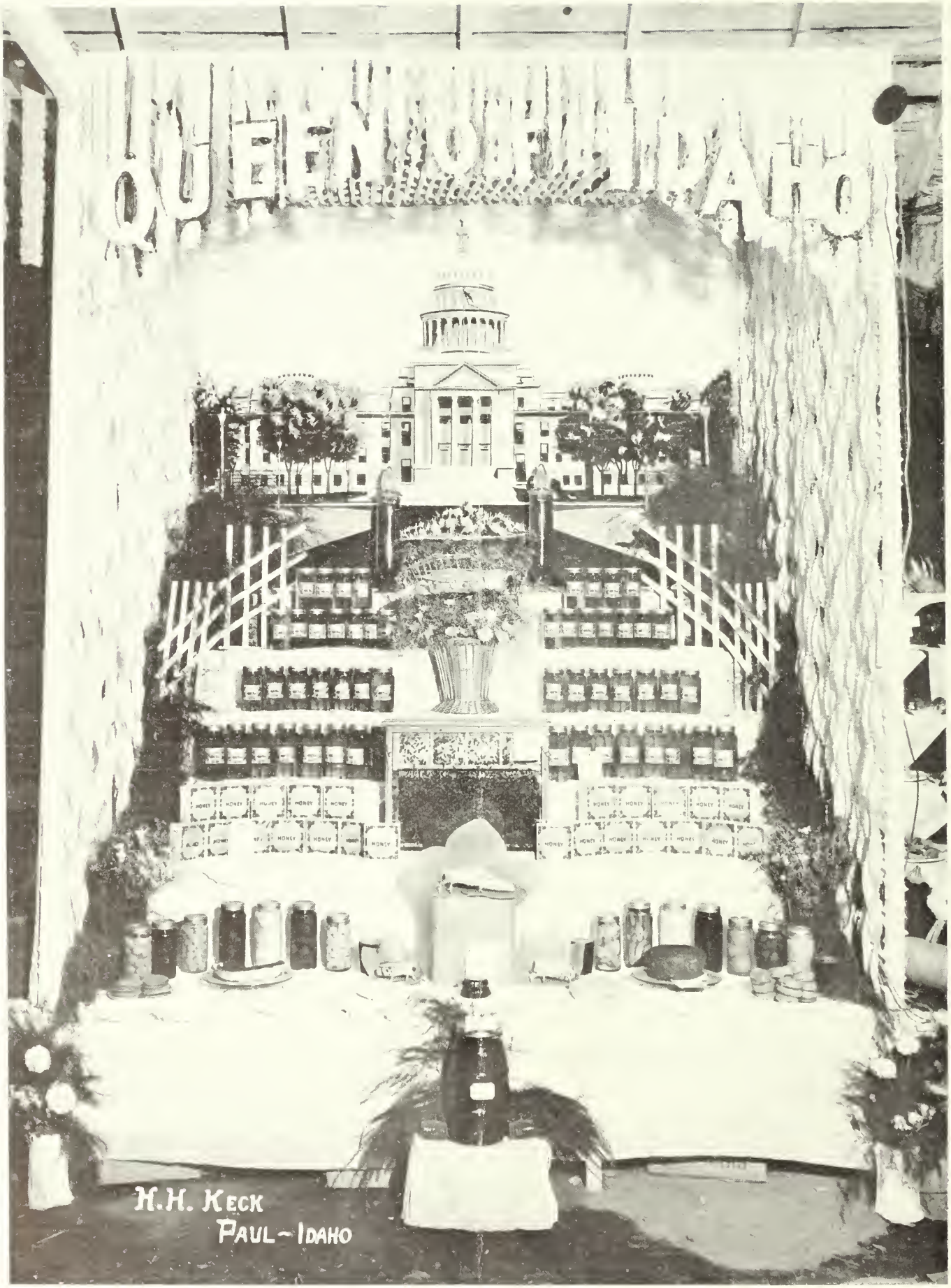
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	H. O. Lambeth	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo	C. B. Elliott	do	F. D. Helm	Montrose, Colo.
Boise	Board of control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Bentou	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chincok, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Ft. Shaw div	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	L. Y. District No. 1	Sidney, Mont	H. A. Parker	do	A. B. Patterson	Sidney, Mont.
Do	L. Y. District No. 2	do		do	Jno. A. Bird	Fairview, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary M. Kinney	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo	B. L. Adams	do	Mrs. Nellie Armitage	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	D. R. Dean	do	Mrs. M. J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla, East div	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Jno. B. Hooper	Hooper, Utah.
Strawberry Valley	Strawberry W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.			Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	J. O. Roach	Irrigation supt	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin, Wash	Spokane, Wash	H. W. Bashore	
Colorado River Basin investigations	Denver, Colo	P. J. Preston	Colo., Wyo., Utah, and New Mex.
Rathdrum Prairie, Idaho	Spokane, Wash	H. W. Bashore	None.
Seminoe Reservoir, Wyo	Denver, Colo	Denver office	None.

SALLIE A. B. COE, *Editor.*



MINIDOKA PROJECT, IDAHO, WINS PRIZE ON HONEY EXHIBIT AT FALL FAIR (SEE PAGE 35)

U. S. GOVERNMENT PRINTING OFFICE: 1932

THE
RECLAMATION ERA

VOL. 23, NO. 3 MARCH, 1932

Photo by R. B. Dame

LEVELLING THE LAND FOR IRRIGATION

The Reclamation Service

WITH respect to certain agencies in the Government, I recommend a separate legislative reorganization of policy. The first of these is the Reclamation Service. Reclamation should have a broader import than that of bringing unproductive land under cultivation. We do not need further additions to our agricultural land at present. Additional agricultural production except such marginal expansion as present projects warrant is inadvisable.

The conservation of water by storage is required, not alone in the West, but in all parts of the country.

The effective development of water conservation through storage is largely an interstate question in the aid of domestic and industrial water supply, transportation, irrigation, and flood control. Where construction work for storage relates to these larger issues, it is properly the work of the Federal Government. Where water power is developed as a by-product it should be disposed of in advance by contracts which will fairly reimburse the Government for its outlay. The Reclamation Service should be extended to cover these broad purposes of storage and conservation of water rather than the narrow purpose of irrigation. Such important projects as the dam at Boulder Canyon, the dam at Cove Creek, the development of the Columbia should ultimately be undertaken when there is need for such service and when contracts can be made for the sale of power to amortize construction to the Government. The actual construction work under this plan should be carried out by the public works administrator and the completed projects administered by the Reclamation Service.

Extracts from the President's Message to Congress, February 17, 1932.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 3 MARCH, 1932

Interesting High Lights on the Federal Reclamation Projects

THE California Oregon Power Co. has constructed a 1,500-kilowatt capacity substation near Stronghold, Calif., and is now engaged in the construction of 22 miles of new transmission line in the Tule Lake area of the Klamath project. The work will involve an expenditure of about $40,000.

FINAL shipments of the season's crop of olives and navel oranges have been made from the Orland project. Of recent shipments oranges predominated, 15 cars going forward from the local packing house. Four cars of lemons, 2 of olives, and 1 of dried prunes were also shipped.

ON THE Yuma project picking and marketing of the winter lettuce crop have been completed and the spring crop was ready to market early in March. Prices for winter lettuce were very satisfactory, the minimum price being $1.75 per crate. Present indications are that the spring lettuce will bring good returns. Gross returns of approximately $253,000, or $600 per car, were received for 421 cars shipped from the project. With an estimated $118,000 paid out locally for labor and marketing the crop the net returns from winter lettuce amounted to approximately $71,000, half of which went to the grower and the other half to the packer.

SEVERAL applications for units on the Willwood division of the Shoshone project were received recently from residents in that vicinity. These projects are considered good and the approval of their applications seems assured.

A GENERAL summary of the monthly progress reports indicates that the available water supply in storage or that will be available when the snow melts, is much in excees of that of last year, and that there will probably be no shortage of water in 1932.

SUNNYSIDE, Yakima project, Washington, had a recent 2-day dairy school, conducted by Donald L. Saunders, field manager of the Yakima Valley Dairy Development League, in cooperation with the dairy extension department of the Washington State College. A very instructive and interesting program was given and the sessions were attended by about 100 farmers.

Imperial Irrigation District Approves All-American Canal Contract

As the ERA *is about to go to press, information is received that the voters of the Imperial irrigation district in southern California at a special election held February 11, 1932, authorized the execution of a contract with the United States for the construction of the All-American Canal to furnish a Boulder Canyon project water supply for the district lands. It is reported that the contract carried by a majority of 5 to 1. This clears the way, so far, for the development of an irrigation unit of the Boulder Canyon project.*

The All-American Canal is so called because it will supersede the existing canal which runs in part through Mexico. It will cost, as now estimated, around $34,000,000, and will cross an area of shifting sand dunes. When completed it will be one of the most notable artificial waterways in existence, and will be capable of floating a ship drawing 20 feet of water.

COMMUNITY organizations on the Klamath project are showing considerable interest in cooperative buying and in purchasing, in a limited way, by the poultry association, feed and poultry supplies for their members. The Grange purchasing committee has issued advertisement asking for bids furnishing tires, gas, and oil.

SEVERAL hundred acres of Valley division lands on the Yuma project have been prepared and planted to paper-shell pecans.

NUMEROUS inquiries from all parts of the country have been received concerning opportunities for settlers in the Yakima Valley of Washington.

AS A RESULT of the continued advertising activities of the Vale-Owyhee Government Projects Land Settlement Association many inquiries are being received relative to Vale project lands. Six settlers recently purchased 320 acres on the Bully Creek East Bench unit. Homestead entry of one public land farm unit on the Bully Creek West Bench was allowed by the local land office.

THE annual award of a plaque offered by the Dairy Tribune to the owner of highest producing herd in Idaho was won for the second time by Haven Leigh, of Burley, Minidoka project. Mr. Leigh's herd average for 10 registered and grade Holsteins was 12,723 pounds of milk and 501.6 pounds of butterfat. The cow having the lowest record produced 370 pounds of fat. The Mini-Cassia Cow Testing Association in 1931 rated highest of the 12 State associations in average butterfat production per cow.

THE Great Northern Railway Co. has started construction of a roundhouse and shops at Klamath Falls, Klamath project, Oregon, at an estimated cost of $100,000.

INQUIRIES concerning opportunities for settlers continue to be received on the Sun River project. Three new farm units have recently been allotted. New settlers are developing their farms as weather conditions permit.

Proposed Relief Measures for Settlers on Federal Irrigation Projects

DR. ELWOOD MEAD, Commissioner of Reclamation, attended the third annual water users' conference held under the auspices of the American Farm Bureau Federation at Salt Lake City, Utah, on February 9, when he addressed the conference on the subject of proposed relief measures for settlers on Federal irrigation projects, referring specifically to the Thomas-Hall bill which provides for a moratorium of one year on charges for the calendar year 1931 and 50 per cent of the charges for the calendar year 1932.

Doctor Mead called particular attention to the fact that reclamation project settlers should make a determined effort to pay their construction charges to the Government and refrain from agitating too persistently for relief from payments, or the constructive work of the Bureau of Reclamation in upbuilding the West would be discredited. Among other things, Doctor Mead said:

"I fully realize the distress which besets you reclamation project farmers. But one of the difficulties in dealing with your troubles is the fact that this distress is not confined to reclamation projects. You must remember that the farmers on private projects are in distress, also, and whereas your obligations are interest-free the private project farmer must pay from 6 to 7 per cent on his investment.

"You must realize, too, that there is a strong feeling in the East against reclamation. This fact is plain to see every time our appropriation bill comes before Congress. The farmer on the private project feels that he is being discriminated against by being compelled to compete against reclamation project lands, which do not have a heavy interest burden to carry.

"The statement has been made in this conference that you can not live and pay the construction charges. If this is true, it means that only one agency can continue in reclamation work; and that agency is the Government. Certainly no project can be financed from outside sources if it can not pay interest and repay the capital investment.

"If the work is to continue, it is up to you men here to take an attitude which will overcome the hostility in the East. It is my conviction that abolishment of the Reclamation Service would be a real calamity to the West, and it is for this reason that I have been resisting your efforts to obtain relief which would react against the cause of reclamation.

"I have been Commissioner of Reclamation for the past eight years. One of the first things done after I came into the service was the cutting of construction charge payments in half. Next, we wiped out $27,000,000 of the construction debt. But almost every year since that time there have been appeals from some of the projects for relief. We have granted this relief in only a few instances, and those which did not get relief have met their payments.

"Low prices have brought distress and discouragement to our reclamation settlers, but they have brought the same thing to those on the outside. The question now is just how far can we go in relieving the reclamation project settlers without arousing more antagonism and hostility on the outside.

"I did not believe, when it was first proposed, and I do not now believe that there is a chance of getting a 3-year moratorium bill through Congress. I am in accord with the plan for a 1-year moratorium and, while I am not so wholeheartedly in favor of an additional 50 per cent moratorium for 1932, I will agree to that."

In conclusion, Doctor Mead pointed out that the bureau has only $4,000,000 on hand, and that unless legislation postponing payment is enacted, the bureau must this year resume payments of $1,000,000 a year on the $20,000,000 bond loan. Under these conditions the bureau would have only about $3,000,000 to meet contract obligations of $5,000,000, which would necessarily mean curtailment of construction.

Curtailment of construction work would necessarily fall most heavily upon projects which in recent years have been undertaken purely as a means of furnishing land already under cultivation with an adequate water supply. Doctor Mead asserted that failure to carry on this work would mean that these farmers suffering from an inadequate supply of water must continue to suffer until the moratorium periods carried in the Thomas-Hall bill have expired and payments are again resumed by the water users.

Photograph by George A. Beyer

Dr. Elwood Mead, Commissioner of Reclamation, and L. N. McClellan, Chief Electrical Engineer, passengers on plane from Washington, D. C., to Chicago, a 4-hour flight

Some Economic Aspects of Western Federal Irrigation

By Porter W. Dent, Assistant Commissioner, Bureau of Reclamation, Department of the Interior

THIS subject has been selected because of the belief that there exists at the present time very incomplete general knowledge regarding the Federal reclamation law and policy and a widespread misconception concerning the effect of these activities upon agriculture and industrial development in general. The hope is indulged that discussion will bring about a more complete understanding of these important activities and serve to allay what are believed to be unsound objections heretofore voiced in some quarters to the construction and operation of such projects. The term Federal reclamation projects as here used is intended to refer only to those projects under the supervision of the Bureau of Reclamation.

As a background for the discussion that follows and for the benefit of those who are without fundamental information on the subject it may be not amiss to outline briefly the general plan on which Federal reclamation is predicated. The reclamation act of June 17, 1902 (32 Stat. 388) set aside the receipts from the sale and disposal of public lands in the Western States to form the nucleus of the reclamation fund. Additional laws were later enacted whereby the revenues from oil, from mineral leases, and from other sources of lesser importance are to be covered into and supplement the reclamation fund. These moneys are designed to constitute a revolving fund to be utilized in the construction of irrigation projects in the 17 Western States named in the original act and its amendments, from whose resources (with the exception of Texas) the fund has its origin. From the foregoing it will be seen that funds for the construction of such projects are not appropriated from the General Treasury, as is commonly supposed, but from the special fund created in the manner stated. This is an important factor to keep in mind. There is an almost universal assumption that Federal irrigation projects are constructed from funds raised by taxation. It is not surprising that this misconception should gain considerable currency because the financial plan is a departure from that on which public works and improvements are usually financed. This bureau is one of the very few agencies of the Federal Government whose activities are self-supporting.

Funds expended by the Government in the construction and operation of projects are repaid by the entrymen of public lands and private owners whose lands are benefited. This is a further departure from the general rule, which is that expenditures for public works and improvements are not reimbursable. The present reclamation law requires repayment of the construction cost in not more than 40 years, without interest. Some earlier contracts called for payments in 10 years some in 20 years, and still others on the basis of crop production, the period of which is indeterminate but which would be seldom, if ever, less than 40 years. Operation and maintenance charges are paid currently or in advance.

WORKS CONSTRUCTED

The Bureau of Reclamation has constructed 125 dams of which 65 are diversion dams and 60 are storage dams. The highest of the dams now constructed is the Arrowrock, in Idaho, 349 feet high. There is under construction at the present time the Owyhee Dam in Oregon, the height of which when completed will be 520 feet from the lowest point in the foundation. Work is now in progress on the Hoover Dam on the Colorado River in Nevada and Arizona, the height of which will be 730 feet. This will be by far the highest dam ever undertaken. This dam will create a reservoir with a capacity of more than 30,000,000 acre-feet, an amount sufficient to inundate the State of Connecticut to a depth of 10 feet. Three thousand six hundred miles of main canals have been constructed with 10,000 miles of laterals, 4,000 miles of waste water ditches and drains, and over 165,000 incidental canal structures. Of all the dams that have been constructed it is noteworthy that not one has failed or developed any major engineering defects. This is no mean achievement. It is a tribute to the skill, care, and efficiency of the engineers who have designed and constructed them.

IRRIGATION BENEFITS HUMID SECTIONS INDUSTRIALLY

The 24 projects constructed by the bureau have created some 41,000 homes in which reside more than 160,000 people. The cities and towns springing from this development comprise a population of almost 500,000. In these cities and towns are to be found in round numbers 700 schools and an equal number of churches. In the 120 banks within this area deposits aggregated in 1930 some $135,000,000.

Records compiled sometime ago on 17 of these projects show that during one year the railroads shipped in 95,000 carloads of manufactured goods, consisting of farm machinery, clothing, furniture, automobiles, and other products, valued at $120,000,000. These manufactured articles came from factories in the East and elsewhere whose workers consumed agricultural products emanating not from the western irrigation projects but from near-by localities. During the same year the 17 projects in question shipped out 112,000 carloads of crops the value of which was estimated to be $158,000,000. This record does not include goods and crops conveyed by trucks, of which no records were available. Commerce aggregating more than 200,000 carloads during one year thus had its origin in 17 of the 24 projects for which records were compiled. That this exerts a tremendous influence in the matter of railroad traffic and in providing an outlet for goods manufactured in the humid regions can not be denied. If the 160,000 people on these projects were not so engaged they would be on farms, in factories, or in other occupations elsewhere in the humid sections, undoubtedly contributing to the perplexing problem of unemployment.

OVERPRODUCTION NOT INCREASED BY FEDERAL RECLAMATION

The assertion is often made that the crops grown upon Federal irrigation projects add to the surplus of agricultural products and thus aggravate the problem of overproduction, to which the present low ebb in the prices of such products is largely attributed in some quarters. Such statements have the ring of plausability until the facts are known and analyzed. But before discussing these facts I wish to make the observation that there is by no means unanimity of opinion concerning the proposition that overproduction in agricultural products is the controlling element in establishing and maintaining prices. By some economists the view is held that lack of purchasing power on the part of the consumer, coupled with inadequate transportation and distribution of such products, exerts far more influence on the present unhappy situation than the alleged surplus. Certain it is that there are now no fewer mouths to feed or bodies to clothe than hitherto when production was equal to that of the present and when no cry of overproduction or surplus was heard and when prices were much higher. It is likely that a restoration of the purchasing power of the mass of consumers will so stimulate consumption that the surplus will quickly be dissipated. Admitting,

however, that there is a present surplus of certain agricultural products, both local and general, it is submitted that crops grown upon Federal irrigation projects have no appreciable effect on the regulation of prices generally for the following reasons:

First. The total cropped area on Federal reclamation projects constitutes only about four-tenths of 1 per cent of the total area in cultivation in the United States. This is less than the famous Volstead content of one-half of 1 per cent. The value of crops produced on such projects is only about 1 per cent of the total value of agricultural products in the United States. Even if the crops grown on these projects were of a character or class competitive with those in the humid sections and of which a surplus exists, the effect on the general situation would perforce be negligible.

Second. The crops so produced are of particular or specialized kinds, of which for the most part no surplus exists, or they are seasonal in character, and are not competitive with those crops grown elsewhere. A large portion of the areas of these projects is given over to the production of alfalfa and other forage crops consumed locally. These crops comprise 31 per cent of the cropped area of the Federal projects and constitute 18 per cent of the total crop value, but they amount to only somewhat less than 4 per cent of the total national production. Alfalfa, because of its bulk and of the freight rates applicable, can not be shipped long distances. It is accordingly consumed largely on the farms where raised or in the locality, in the feeding of livestock and in other ways. Alfalfa and other forage crops are necessary to support the ranges tributary to the projects. The range country and the projects are complementary each to the other and both are indispensable to the development and welfare of the West.

Five and one-tenth per cent of the project areas are planted to sugar beets. The Western States produce the greater part of the total tonnage of this crop. Large quantities of sugar are imported annually. Hence it can not be said either that there is an overproduction of sugar beets in the United States or that this product of the Federal projects operates to the prejudice of the humid sections.

Wheat is the crop of which an overproduction is perhaps more accentuated than any other. Of this commodity Federal projects produced in 1929 only 3,910,000 bushels, just under one-half of 1 per cent of the total. The United States is a wheat-exporting country, and normally it must be assumed that the price of this product is fixed by the world supply and demand. Certainly no one can seriously contend that the quantity of wheat grown on Government projects could have any material effect on the agricultural situation. It is likely that there will always be some wheat grown on the projects, largely to supply local markets. But the constant trend is toward lesser production. In 1930 the production dropped to 3,614,000 bushels. Of this amount 75 per cent is produced on projects located west of the Rocky Mountains. The Montana projects produce almost entirely hard spring wheat, for which there is a steady demand and which sells at a premium based on the protein content.

The production of barley and oats shows a slight increase on the projects, partly in substitution for wheat. These crops, which constitute less than 1 per cent of the total production, are fed largely to livestock on the farm and do not come into competition with production in the humid sections. The basic industry of Federal projects is the production of forage crops to be fed to livestock.

Cotton is produced only on those projects situate in the Southwest. These projects are the Carlsbad in New Mexico, the Rio Grande in Texas and New Mexico, and the Yuma and Salt River projects in Arizona. It is only in recent years that this staple has been produced on the Rio Grande. It is quite likely that this project will revert to the raising of alfalfa and diversified crops after the manner of the former practice. The cotton raised on these projects is of the long and medium staple variety. Accordingly they do not come into sharp competition with the short-staple production, of which the surplus or overproduction is the most acute.

Vegetables produced on the southwestern projects, such as winter lettuce, cabbage, cantaloupes, strawberries, and other small fruits, reach the early markets and furnish a very desirable variety of food at a price within the reach of all. They are in general not competitive in character, but they do fulfill a real demand which could not be supplied from other sources at prices the average consumer can afford to pay.

The foregoing is a general statement merely concerning the chief crops produced. For the information of those who may desire to have a more complete statement the following tabulation is appended showing the agricultural production on Federal reclamation projects as compared with the entire production for the United States for 1929 and 1930:

		Entire United States	Federal reclamation projects	Per cent reclamation projects
Value of crops	1929	8,088,494,000	88,459,390	1.1
	1930	5,818,849,000	64,971,470	1.1
Acres in crop	1929	357,827,000	1,512,250	0.42
	1930	359,927,000	1,550,967	0.43
Bushels of corn	1929	2,535,386,000	1,254,496	0.05
	1930	2,060,185,000	1,635,595	0.08
Bushels of wheat	1929	812,573,000	3,910,036	0.48
	1930	858,160,000	3,613,865	0.44
Bushels of barley	1929	280,242,000	2,713,374	0.97
	1930	304,601,000	2,888,129	0.95
Bushels of oats	1929	1,118,414,000	1,709,249	0.15
	1930	1,277,764,000	1,654,161	0.13
Bushels of rye	1929	34,950,000	66,855	0.19
	1930	45,379,000	92,440	0.20
Bushels of alfalfa seed	1929	982,400	136,328	13.9
	1930	1,145,400	499,029	43.5
Bushels of flax	1929	15,910,000	25,987	0.16
	1930	21,240,000	41,783	0.20
Tons of hay	1929	87,308,000	63,631	0.07
	1930	74,214,000	69,024	0.10
Tons of alfalfa	1929	23,854,000	1,303,946	5.5
	1930	22,871,000	1,312,415	5.5
Bushels of sweetclover seed	1929	1,167,300	70,502	6.0
	1930	848,300	59,107	7.0
Bushels of beans	1929	20,514,000	390,067	1.9
	1930	23,063,000	778,071	3.4
Bushels of potatoes	1929	329,134,000	8,302,196	2.5
	1930	333,210,000	12,556,237	3.8
Bushels of apples	1929	135,622,000	4,971,050	3.7
	1930	155,982,000	6,658,319	4.1
Bushels of pears	1929	21,172,000	1,028,000	4.8
	1930	25,540,000	1,423,211	5.6
Bushels of peaches	1929	45,026,000	465,720	1.0
	1930	53,864,000	344,354	0.7
Tons of sugar beets	1929	7,366,000	956,719	13.0
	1930	9,262,000	1,043,847	11.3
Bales of cotton	1929	14,828,000	173,732	1.2
	1930	13,932,000	170,056	1.2

PRESENT POLICY CONCERNING RECLAMATION PROJECTS

In 1926 the department formulated a 10-year program of construction which provides for the use of funds available for the completion of projects already undertaken or authorized by Congress. The policy so adopted does not contemplate the construction of new projects or divisions bringing into cultivation additional lands. This policy has been adhered to with but minor variations. Present activities are directed particularly toward supplying additional water for areas already settled and the rehabilitation of private projects in financial difficulties. The Bitter Root project in Montana aptly exemplifies this idea and plan. This is a project constructed by private enterprise some years ago. The irrigation district, through which the project functions, after operation for some years became unable to make payment of principal and interest on bonded and other indebtedness and to finance necessary repairs and replacements. Investigation showed that the project was fundamentally sound. Congress accordingly authorized the appropriation of $750,000 for funding the outstanding indebtedness of the district at an amount not in excess of 75 per cent of its face value, and for the advance of funds sufficient to make necessary repairs and betterments to place the system in a safe and economical operating condition. The money thus advanced is to be repaid by the district in 40 years with interest at 4 per cent per annum. This, it will be noted, is a departure from the plan of financing with interest-free money. The rehabilitation of the Bitter Root project does not bring additional areas into cultivation. The objective is to avert loss of the development that has taken place, to save investments made by the settlers, and to counteract the other economic ills that would follow the collapse of the project. That such use of money in the reclamation fund contributes in a most effective way to the general welfare of the country can not be doubted.

ACHIEVEMENTS OF FEDERAL RECLAMATION

The value of any activity should be measured by the results achieved. Appraised in these terms the Federal reclamation policy is not found wanting. The cost of works constructed to the end of 1931 aggregates $206,000,000. Crops grown in 1929 on land irrigated from the works of the bureau had a total value of more than $161,000,000, an amount falling not far short of the total construction cost. It is estimated that the expenditures thus made have created property values of more than $1,000,000,000. An activity contributing to local and national welfare to the extent and in the manner shown merits continuation.

THE demand for farms to rent on the Belle Fourche project continues very good, and it appears that some places will be occupied next season that have heretofore been idle. This no doubt is the result of drought and the desire of dry landers to locate where crops are more certain. Small buildings are being erected here and there for living quarters and for stock shelter.

AT THE latest report from the Minidoka project 5 of the 23 farm units on the Gravity division recently opened to entry had been awarded to applicants, and 16 formal applications for entry had been received.

Photograph by Bucyrus Erie Company.

Constructing Cle Elum Dam, Yakima project, Washington

Idaho Industry Overcomes Depression

Idaho has not been overlooked in a national survey to find outstanding cases of business institutions that have made good in spite of the bugaboo labeled depression. In the February 13 issue of Collier's Weekly, the Dairymen's Cooperative Creamery of Boise Valley in Caldwell is held up as an example of prosperity in dull times. A portion of the article, What business they made, written by John T. Flynn, follows:

"Out in Caldwell, Idaho, in the Boise Valley, the dairy farmers have a cooperative of their own. 'We organized it,' says J. R. Brown, its manager, 'in 1925 and made less than a million pounds of butter. In 1930 we found it necessary to increase our plant, but the word depression was in the air. Farm prices had gone down. An increase meant an expenditure of $350,000, and loud were the protests from some of our dairymen when such an expenditure was proposed at such a time.

" 'I visited every leading creamery in the United States and Canada for ideas and we went ahead. We are now in our new plant. We made in six months more than twice as many pounds of butter as in the whole year of 1925. We saved 0.00651 cent on every pound, enough to pay the interest on our loan, and our Boise Valley dairymen have consistently received from 3 to 10 cents a pound more for their butterfat than producers in many other States.' "

The article continues with a variety of examples of American merchants who have improved trade when faced with the challenge of hard times, but there is no answer any brighter than the one which came out of Idaho.—*Idaho Daily Statesman, February 9, 1932.*

Moon Lake Project Reports

An engineering report by E. O. Larson and a land classification and economic report by W. W. Johnston on the Moon Lake project in Utah have been completed. The project is located in northeastern Utah on the north side of the Duchesne River between the Uintah and Lake Fork tributaries. It involves the storage of the surplus waters of the West Fork of Lake Fork in a reservoir at Moon Lake, and the distribution to about 22,000 acres under existing canals diverting from the Lake Fork, and possibly to 10,000 acres under canals on the Uintah River side. Investigation of this project was conducted under a cooperative contract with the State of Utah.

Federal Reclamation

Presented to Land Use Planning Committee, February 18, 1932, by Miss Mae A. Schnurr, Assistant to the Commissioner, Bureau of Reclamation, substituting for Commissioner Mead.

RECOMMENDATION No. 11 on reclamation, passed on by the National Conference on Land Utilization held at Chicago, Ill., November 19 to 21, 1931, and which after further consideration by the two committees, the Land Use Planning and Legislative and Advisory Committee, in session in Washington at present, has been adopted with a slight change, now reads:

"It is recommended that the Reclamation Service confine its efforts to finishing projects *now authorized by Congress* for construction and to rehabilitating deficient water rights on lands now cultivated and occupied, but that new lands or new colonization projects not be undertaken through irrigation and drainage until they are justified by the agricultural needs of the Nation."

Contrary to general belief, this precisely covers the present reclamation policy, namely, the salvaging of private projects through refinancing operations, the development of supplemental storage for projects having an inadequate water supply and the completion of projects authorized by Congress, in which the Government already has a heavy investment. However, in effect, reclamation is more effectively restricted by the small amount of money we have available in the reclamation revolving fund. That means we are not even doing everything that ought to be done to complete projects already started. On the contrary, we have this situation that in one-third of the country, in the arid region, water is the fundamental resource and many of the other resources that built up that country have disappeared or are disappearing. Among those are mines, the range industry, and the forests. Something must take the place of these to support the railroads, the factories, and the industries of that part of the country.

WATER A FUNDAMENTAL RESOURCE

That one resource is water. Every country that prospers does so by the development of its natural resources. When it ceases to develop, it ceases to grow, and the attempt to throttle the West by restricting the development of its one fundamental resource is unpatriotic and will not redound to the benefit of this country. It is a manifestation of the same narrow spirit that led Pennsylvania to object to the development of Ohio and Indiana, and that now leads these mid-western States to object to the development of the arid region. It can not prevail because it is contrary to the spirit and purpose of this country.

An illustration of what is meant is the development of the Colorado River. If that were not done, Los Angeles would have to cease to grow, so would San Diego and the whole of the Southwest. That is not to the interest of any part of this country and certainly would be destructive to the Southwest.

Another case in point is the development of 2,000,000 horsepower on the Columbia River. The Chicago recommendation, as amended by the Washington legislative and advisory committee, in effect would postpone the development of this natural resource, at present so vital to the Northwest, and which would not injure the farmer of the East. On the contrary, it would create a market for materials that would benefit the business of the Middle West and the East. The agriculture that goes with that industrial development is not going to affect the East because the 12,000 farms involved would be a gradual development over a period of 25 or 30 years, and the demand created by that industrial development for the farm products of the East will be greater than any competition developed.

IMPORTANCE OF RECLAMATION

Reclamation by irrigation has such an important place in the economics of the country that we only have to think of what the West would be without irrigation to know how much better off it has made the whole country. Further development is going to create benefits just as it has done in the past.

The 27 Federal irrigation projects developed over a period of 30 years' operation of the Bureau of Reclamation are traversed by 2,361 miles of railroad, many of these projects being on the main line of one or more of the transcontinental roads and in addition being served by branch lines which bring practically every farm within reasonable distance of a shipping point. In a recent year 208,098 carloads valued at $278,914,995 were shipped to and from stations on 17 of the Federal reclamation projects. The incoming shipments, largely of manufactured products from the humid States, totaled 95,496 carloads, valued at $119,619,362. These shipments are distributed by projects in the accompanying table:

CARLOAD SHIPMENTS TO AND FROM FEDERAL IRRIGATION PROJECTS IN 1928

State and project	Carloads of products shipped to project		Carloads of products shipped from project	
	Total number	Total value	Total number	Total value
Arizona: Salt River	23, 604	$48, 097, 360	24, 590	$45, 080, 990
Arizona-California: Yuma	1, 328	2, 856, 700	3, 559	3, 698, 000
California: Orland	302	243, 850	657	1, 620, 950
Colorado: Grand Valley	2, 152	3, 225, 500	5, 465	6, 517, 650
Idaho:				
Boise	13, 141	18, 747, 885	10, 104	27, 963, 910
Minidoka	2, 840	2, 126, 347	6, 302	5, 509, 709
Montana: Sun River	95	97, 700	391	424, 800
Nebraska-Wyoming: North Platte	10, 739	7, 591, 890	14, 283	30, 139, 650
New Mexico: Carlsbad	1, 816	1, 828, 600	1, 063	2, 218, 175
New Mexico-Texas: Rio Grande	7, 758	9, 997, 650	3, 850	2, 218, 175
Oregon:				
Umatilla	456	461, 520	731	283, 173
Vale	90	178, 000	101	239, 000
Oregon-California: Klamath	23, 220	17, 152, 690	13, 581	15, 855, 790
South Dakota: Belle Fourche	398	398, 000	815	1, 614, 800
Utah: Strawberry Valley	4, 072	2, 771, 595	4, 825	3, 817, 880
Washington: Yakima	3, 052	3, 114, 700	20, 400	10, 037, 300
Wyoming: Shoshone	433	729, 375	1, 885	1, 055, 680
Total	95, 496	119, 619, 362	112, 602	158, 295, 632

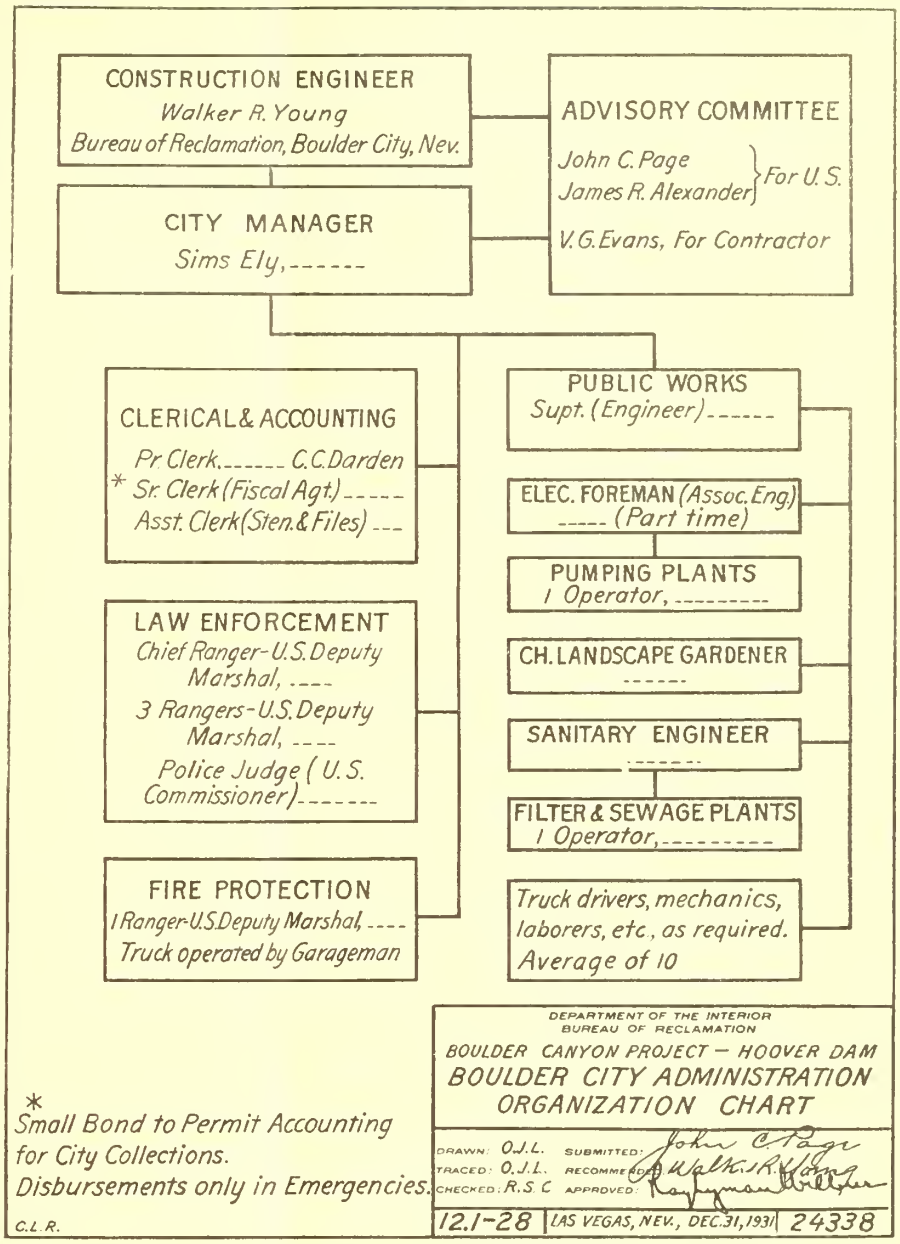
The Federal reclamation projects have improved and increased transportation by railroads, and are directly responsible for an immense revenue tonnage for transcontinental carriers through regions of otherwise sparse traffic, thus to an appreciable extent lowering the rate levels on other commodities moving over their entire systems.

In 1923, there were shipped into only one of the Federal irrigation projects—the Salt River project, Arizona—7,935 cars of manufactured articles from 42 States. Five years later, incoming shipments totaled 23,604 carloads, valued at nearly $50,000,000.

In 1928 it was estimated by the Chamber of Commerce of Yakima, Wash., that eastern firms took about $30,000,000 from the Yakima Valley, where the Yakima Federal irrigation project is located, in return for goods and merchandise of all descriptions purchased by the residents of Yakima, Benton, and Kittitas Counties. These included motor cars to the number of 1,929, valued at $2,500,000 which were shipped into Yakima County alone. Tires and accessories shipped to these counties were valued at $2,000,000; farm machinery at $1,000,000; hardware, building, and plumbing supplies, $2,050,000; groceries and canned goods, $4,000,000; clothing, $4,500,000; furniture, $1,700,000; drugs, $750,000.

On the Federal irrigation projects are 213 towns and cities with a population of 472,723, created wholly or in large part because of the adjacent or surrounding irrigation development, supported by the products of irrigated agriculture, and furnishing a market for eastern goods. The deposits in the 120 banks on the projects in 1931 totaled nearly $135,000,000, an index of the purchasing power of these projects.

Any land use planning policy that seeks to stifle the normal growth and prosperity of one-third of the country can not succeed.



ORLAND PROJECT, CALIFORNIA
Processing and grading plant, Orland Olive Growers' Association

LIVESTOCK on the Lower Yellowstone project is in good condition. The Holly Sugar Co. has fed about 550 head of steers on beet pulp and alfalfa hay and marketed them at an average price of $8.75 per hundred in Chicago. This price was considered very satisfactory.

BUILDING permits in the city of Yakima, Yakima project, totaled $1,413,270 during 1931, being only slightly less than those for 1930, which were the highest of record.

WORK on the Owyhee Dam was temporarily suspended on account of winter weather. The contractor, however, was prepared to resume concrete placing in the dam in the early spring.

Columbia Basin Project Report Shows Feasibility

THE proposed Columbia Basin project is located adjacent to and east of the Columbia River in eastern Washington and is a combination of irrigation and power development. As outlined in the bureau's report, released on January 16, a fundamental requisite for either power or irrigation is the construction of the Columbia River Dam near the town of Barry. This structure will be 450 feet in height, 4,140 feet long, of the straight-gravity type, and will contain 11,266,000 cubic yards of concrete. It will raise the low-water surface of the river 355 feet and form a reservoir that will extend to the Canadian boundary, a distance of 150 miles.

Hydraulic and electrical machinery is to be installed progressively at the dam for the generation of power. It is contemplated that the firm power will be sold at the dam to agencies engaged in the distribution of electrical energy. Pumping machinery for irrigation requirements will also be installed progressively at the dam, and this machinery will utilize the seasonal power available during the high-water season of the Columbia River.

Water for the irrigation project is to be pumped from the Columbia River Reservoir through large discharge pipes to the Grand Coulee Canal, extending a distance of 1.7 miles to Grand Coulee Lake. This lake will be created by the construction of two dams, one at the north end of the Grand Coulee near the Columbia River, and the other near the south end of Grand Coulee, 4½ miles north of Coulee City. This lake will be about 23 miles long, and the difference between the high-water surface of the Grand Coulee Lake and the low-water surface of the Columbia River will be about 362 feet.

CONSTRUCTION OF DAM WILL REQUIRE 10 YEARS

From the south end of the Grand Coulee Lake water is to be conducted through concrete-lined canals, steel-pipe siphons, and reinforced-concrete pipe siphons to the lateral distribution system, which finally delivers water to 981,000 acres of land, including that part of the area suitable for irrigation and cultivation. At a number of places on the larger canals there are drops where the falling water can be utilized for development of power. This power can be utilized for repumping to 219,000 acres of high lands, making the total irrigable area of the project 1,200,000 acres. None of this land would be brought under cultivation until after completion of the Columbia River Dam, which will require 10 years, and then only as economic conditions and settlement requirements justify. It is estimated that this would result in about 20,000 acres being brought in yearly, and therefore irrigation of the entire project area would require 60 years. An initial development of the Quincy Flat area of 150,000 acres is planned.

OTHER ENGINEERING FEATURES

Some of the principal engineering features of the project, in addition to the 450-foot Columbia River Dam, are the following: The Columbia River power plant containing an installation of turbines and generators of 2,100,000 horsepower capacity. The Columbia River pumping plant will contain an installation of motor-driven pumps of 16,000 cubic foot-seconds total capacity. Pipe lines will lead from the pumping plant to a supply canal which itself leads to the Grand Coulee Reservoir. The Grand Coulee Reservoir will be formed by the 92-foot North Grand Coulee earth-fill dam and the 97-foot South Grand Coulee earth-fill dam. The main canal, 11 miles in length, branches into the main west and main east canals. Power plants and transmission lines will be built at suitable places along the canals for the generation and distribution of about 26,000 kilowatts of seasonal power. Motor-driven pumping plants will be located at suitable places along the canals to repump water to highlands.

As a result of the construction of these features the following uses of power are proposed: (1) The production of 800,000 kilowatts of firm continuous power available for commercial sale at the power plant at the Columbia River Dam; (2) the use of the secondary power generated at the Columbia River Dam to pump water from the Columbia River Reservoir to the Grand Coulee Reservoir; (3) the use of the water pumped into the Grand Coulee Reservoir to furnish an irrigation supply for 1,200,000 acres; (4) the seasonal power generated at power plants at various drops on the project canals to be transmitted to pumping plants to lift water for the irrigation of 219,000 acres of highlands.

MARKET FOR POWER

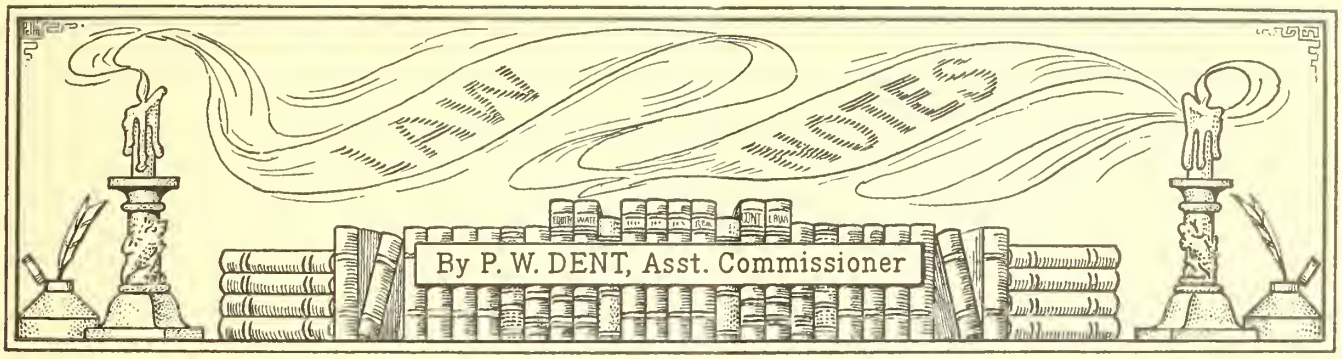
The territory considered as the market area for the Columbia River power includes the area within a radius of 300 miles of the dam site, embracing all of the State of Washington, the northern part of Oregon, the northern part of Idaho, and the western part of Montana. Within this territory the present installed capacity of municipal and utility plants is about 1,000,000 kilowatts, and during the period 1920 to 1930 power requirements increased at an average rate of 9.5 per cent per year, compounded annually. For the present report a gradually decreasing rate of increase was assumed, beginning with 8 per cent in 1930 and decreasing to 4 per cent in 1960. Practically all of the power of the major hydroelectric developments on which construction has been started by the various power companies and municipalities will have been absorbed by 1940, which is the earliest date that power from the Colorado River development could be made available. Additional generating capacity required during the 16-year period 1940–1955, would amount to about 3,000,000 kilowatts, whereas the proposed installation at the Columbia River Dam is 1,500,000 kilowatts, or only one-half of the expected increase. With proper cooperation on the part of the various power companies and municipalities the proposed Columbia Basin development should be absorbed in this 16-year period.

POWER SALES TO REPAY COST IN 50 YEARS

Comparative estimates indicate that a price of 2.25 mills per kilowatt-hour should be sufficiently attractive to induce the power companies and municipalities to purchase energy in lieu of constructing additional power plants and to insure that the Columbia River power will be absorbed as rapidly as the growth of load will permit. Based on the absorption of 800,000 kilowatts of continuous power in 15 years, a price of 2.25 mills per kilowatt-hour for firm power, a price of $1 per acre per year for secondary power used for irrigation pumping, which is equivalent to approximately .050 mills per kilowatt-hour, and land settlement at the rate of 20,000 acres per year, the revenue from power would be sufficient to repay the cost of the Columbia River Dam and Power Plant with interest at 4 per cent per annum in 50 years, in addition to providing for the operation, maintenance, and depreciation of the dam and power plant, and also provide a surplus of approximately $144,000,000, which would be available for repayment of the cost of the irrigation development and other purposes.

With the estimated surplus power earnings available for liquidating a portion of the irrigation investment, the annual construction charges to be paid by the land beginning 4 years after settlement and continuing for 4 years at a rate of $2 per acre, and thereafter at $2.50 per acre for 32 years, will repay half of the cost of the investment in the irrigation project within 40 years from the time

(Continued on page 54)



Summary of 1931 Legislation in California Concerning Matters of Interest to the Bureau of Reclamation

By Richard J. Coffey, District Counsel, Los Angeles, Calif.

California legislation enacted in 1931, relating to irrigation districts, water conservation and related subjects, was prolific. There were no changes materially affecting the operations of the bureau, but the following chapters of statutes and amendments to the Codes, California, 1931, are of interest.

IRRIGATION DISTRICTS

Bonds.—Chapter 88 repealed section 32½ of the California irrigation district act (1887) relating to election on sale of bonds at less than par. Chapter 89 repealed chapter 489, Statutes of 1919, entitled "An act to authorize irrigation districts to refund outstanding bonded indebtedness." Chapter 90 repealed chapter 254 of the Statutes of 1897, which provided for the issuance and sale or exchange of funding bonds of irrigation districts. Chapter 127 amended sections 52 and 67 of the California irrigation district act (1897) relating to the redemption or purchase of bonds and payment of interest and to the creation of funds. Chapter 172 amended sections 61b and 61c of the California irrigation district act (1897) relating to the acquiring of property and exchange of bonds therefor and the judicial determination of the legality of such bonds. Chapter 207 is a new act entitled "An act to validate bonds, including refunding bonds, of irrigation districts and all proceedings relative thereto, and to provide for the levy and collection of taxes to pay the principal and interest on such bonds."

Chapter 318 amends sections 31 and 32a of the California irrigation district act of 1897, and adds four new sections—32b, 32c, 32d, and 32e—"relating to the issuance of bonds for irrigation districts, including funding and refunding bonds, prescribing the form and manner of execution of such bonds and the procedure for the payment and retirement thereof, providing for the adoption of plans for funding or refunding bonds of such districts and for the incurring of indebtedness for the purpose of carrying out such plans, prescribing the terms and conditions upon which bonds may be issued by such districts authorizing limitations and conditions upon the payment of the principal and/or interest, or any part thereof, of any such bonds, providing for the designation of paying agents of such districts for the purpose of receiving funds thereof and applying the same to the payment of the principal and/or interest of any bonds of such districts, and declaring this act to be an emergency measure." Chapter 1074 amends section 30a of the California irrigation district act relating to reports to the California Bond Certification Commission for certification as legal investments; and chapter 1073 creates the California Districts Securities Commission to approve bonds of irrigation districts for certification as legal investments, repeals the act of June 13, 1913, and as amended, entitled "An act relating to bonds of irrigation districts, providing under what circumstances such bonds shall be legal investments," etc., and provides that the California Districts Securities Commission shall succeed to and be vested with all the duties, powers, and responsibilities of the California Bond Certification Commission.

Assessments.—Chapter 91 amended section 39 of the California irrigation district act (1927), relating to the levying of assessments. Chapter 166 amended sections 35, 37, 38, 41, and 78 of the California irrigation district act (1897) relating to assessments and exclusion of land, and added two new sections, numbered 35b and 35c, relating to assessments. Chapter 209 adds a new section, 47a, which provides for partial redemption of land sold for delinquent assessments. Chapter 253 amends sections 45, 47, and 48, relating to certificates of sales of lands sold for delinquent assessments and deeds issued pursuant thereto. Chapter 171 amends section 55, relating to tolls and charges for water.

Organization.—Chapter 92 amended section 6 of the California irrigation district act (1897), relating to election on organization. Chapter 174 is a new act establishing and validating the organization and existence of irrigation districts organized and acting for at least one year under the California irrigation district act.

Lands and property.—Chapter 191 adds to the California irrigation district act a new section, 48a, relating to title to property owned or claimed by an irrigation district. Chapter 1053 adds a new section, 93a, relating to the inclusion of lands; it provides that under certain conditions protest against inclusion of lands shall be ineffective.

Contracts.—Chapter 883 amended section 52 of the California irrigation district act relating to contracts. It requires that before contracts for construction may be entered into advertisement for bids must be published for three weeks in a newspaper published in the county in which the office of the district is located.

Cooperation with United States.—Chapter 93 repealed chapter 341, Statutes of 1919, the California irrigation district act, providing for cooperation between the State of California and the United States in the diversion and distribution of water for irrigation and other beneficial uses, generation, and manufacture of electrical power, etc.

The Palo Verde irrigation district act (Statutes of 1927, p. 978) was amended by chapters 51 and 881, California 1931 Session Laws.

Improvement districts.—The following chapters relate to the organization and operation of improvement districts within irrigation districts: 1931 Session Laws, chapters 53, 55, 206, 289, 877.

WATER CONSERVATION DISTRICTS

Chapter 1020 provides for the creation, organization, and government of water

conservation districts by the boards of supervisors of any counties.

COUNTY WATER DISTRICTS

Chapters 72, 73, 319, 838, and 1198 changes to some extent the procedure under the provisions of chapter 592, Statutes of 1913, as amended, entitled "An act to provide for the incorporation and organization and management of county water districts, and to provide for the acquisition of water rights or construction thereby of water works and for the acquisition of all property necessary therefor, and also to provide for the distribution and sale of water by said districts."

WATER COMMISSION ACT

The water commission act of 1913 (ch. 586), and as amended by chapter 153 of 1917, chapter 365 of 1921, and chapter 832 of 1927 statutes, was amended by chapters 804, 1135, and 1136 of the 1931 laws, all relating to the appropriation and distribution of water in accordance with court decree or written agreement.

TAXES

Chapter 108 amends section 2716 of the Political Code, relating to the operation of taxes as a judgment or lien against property, by providing that the tax lien shall expire at the end of 30 years from the date the lien became effective. Chapter 226 amends sections 3746 and 3756 of the Political Code, relating to taxes, to provide that when the delinquent dates specified, namely, April 20 and December 5, fall on Saturday, all taxes then unpaid shall become delinquent at 12 o'clock m. on either date. Chapter 433 adds a new section to the Political Code, No. 3817a, relating to extension of the period of redemption of property sold for taxes; provides for additional periods of one year by payment of taxes, plus costs, penalties, and interest.

INJURING IRRIGATION WORKS

Chapter 735 amends section 607 of the Penal Code, relating to the destroying or injuring of reclamation or drainage ditches; it provides that any person who wilfully destroys or injures any irrigation works or structures is guilty of a misdemeanor and punishable by a fine of not less than $100 and not exceeding $1,000, or by imprisonment not exceeding two years, or both.

Columbia Basin Feasible

(Continued from page 52)

that water is available for each unit or division.

The investment in the project would be as follows:

Columbia River Dam	$125, 750, 000
Columbia River Power Plant	42, 616, 000
Subtotal	168, 366, 000
Interest during construction on above	17, 524, 000
Subtotal	185, 890, 000
Irrigation development, without interest (1,200,000 acres)	208, 265, 000
Total investment	394, 155, 000

The maximum estimated investment in the combined power and irrigation project up to the time when power revenues are sufficient to reduce the investment is $260,000,000.

In submitting the report to the commissioner on January 7, Chief Engineer Walter states that the project is physically and financially feasible. The project would be similar to the Boulder Canyon project, as it is proposed that construction of the Columbia River Dam and power plant shall not be undertaken until satisfactory contracts are executed for sale of power which will insure sufficient revenue for annual expenses and repayment of the investment in the dam and power plant with interest at 4 per cent within 50 years, also that construction on the irrigation development shall not be undertaken until the power revenues are assured and a suitable contract for repayment of the investment in irrigation works within 40 years has been executed by the district.

On January 11 Senators Jones and Dill introduced in the Senate, and Congressman Hill in the House, a bill providing for construction, operation, and maintenance of the project.

IT IS expected that the payment of $3,129,482.87 to the contractor for work during January, the greater part of which was for excavation of 455,640 cubic yards of rock removed in driving the four diversion tunnels, will be the largest payment for one month's work that will be made under the $49,000,000 contract.

THE Six Companies has completed its present building program, and at the end of January the only construction in progress was the addition of a wing and basement to the hospital. This addition will increase the capacity from 20 to 60 beds. The contractor has now built in Boulder City the following: Four hundred and sixteen residences of 2, 4, and 6 room size; 10 dormitories of 1,500 persons total capacity; a mess hall seating 1,300 persons; commissary; laundry; clubroom; hospital; offices; warehouse; and garage.

Normal Flow and Storage, Snake River and Tributaries, 1931

The 1931 report of district 36, comprising Snake River and its tributaries above Milner Dam, shows that the water supply for that year, in terms of annual run-off, was the lowest in 28 years, the entire period for which records are available. The run-off at Moran, the outlet of Jackson Lake Reservoir, was only 54 per cent of the mean for the 28-year period. At Neeley, the gaging station below American Falls Reservoir, it was 53 per cent of the 28-year mean.

A tabulation of the irrigated acreage and seasonal diversions during 1931 shows that 383,000 acre-feet were diverted into the North Side Minidoka Canal and 302,000 acre feet into the Minidoka South Side Canal. The irrigated areas under these two canals are given as 57,000 and 50,300 acres, respectively. The average in acre-feet diversion per acre is 6.7 for the North Side Canal and 6 for the South Side Canal.

These figures are not representative of the amounts delivered to the Minidoka and Burley irrigation districts, however, as a part of the Minidoka irrigation district is under the South Side Canal. Computations made at the office of the Bureau of Reclamation indicate that a total of 270,000 acre-feet was diverted for the Burley district and 415,000 for the Minidoka district. On the basis of the irrigated area in each district, the diversions per acre were 5.99 acre-feet for the Burley district and 6.85 acre-feet for the Minidoka district.

These diversions were at the heads of the canals. The average delivery at the farmers' headgates in the Burley irrigation district was 3.34 acre-feet per acre.—*Burley (Idaho) Bulletin, January 28, 1932.*

A PUBLIC order was issued by the Secretary of the Interior on February 9 providing for the irrigation of 6,000 acres of private land on the Bully Creek East Bench, Vale project, Oregon, and 3 public-land farm units comprising a total irrigable area of 198.1 acres and ranging in size from 59 to 75 acres. These units will be opened to entry on March 7, and ex-service men will be granted the usual 90-day preference right of entry.

Retirement of E. L. Ballard, Reservoir Superintendent, Boise Project, Idaho

By F. A. Banks, Construction Engineer

FEBRUARY 29, 1932, was just another milestone in the life of E. L. Ballard, but it marked his retirement at the age of 70, following a period of over 20 years in the service of the Government.

Born in Tennessee on February 1, 1862, Mr. Ballard trekked westward in 1881, settled in Colorado, and followed mining until 1886, when the mines of Idaho attracted him to the State that he has since called his home. After serving as sheriff, clerk of the district court, ex officio auditor, and recorder of Owyhee County, he was appointed by Governor Hunt to the position of warden of the Idaho State Penitentiary in 1902.

As camp foreman and peace officer at Arrowrock during the construction period, Mr. Ballard was largely responsible for the camp's splendid reputation for neatness and orderliness, and for 17 years since the completion of the work he has rendered conscientious and efficient service as reservoir superintendent, making all water deliveries (days, nights, Sundays, and holidays) with unfailing accuracy and promptness and maintaining all machinery in excellent shape for immediate service.

R. J. Newell, now construction engineer at Cle Elum Dam, Ronald, Wash., pays Mr. Ballard the following tribute:

"During my 5-year term as superintendent of the Boise project it was always possible and safe to forget Arrowrock for long stretches in the stress of other matters, knowing it would not be neglected for a minute.

Carter, Photographer

E. L. Ballard, Boise project (retired)

"The way the surroundings of the dam have been kept up was always a bright spot in the picture the Boise project offered.

"I believe that ever since construction was finished and the parade of visitors started from every State and many foreign lands—famous engineers, Congressmen, and governors; conventions and clubs and lodges—it has been a source of continual satisfaction to the officers of the Reclamation Service that a born gentleman would be there to meet and greet the guests and suitably represent the Government of the United States at Arrowrock."

Articles on Irrigation and Related Subjects

Barbour, Hon. Henry E.:
- Relief for farmers of irrigation and reclamation districts. (Statement of W. D. Wagner, Secy. of Irrigation Districts Asso.) Congressional Record, Jan. 15, 1932, v. 75, No. 24, pp. 2139–2140.

Beaman, J. A.:
- The Butter and Egg Brothers of the Desert, illus. (Boulder City Mess House) Union Pacific Magazine, January, 1932, v. 11, No. 1, pp. 6–8.

Bracken, Walter R.:
- Keeping law and order on the Hoover Dam reservation, illus., Union Pacific Magazine, February, 1932, v. 11, No. 2, p. 6.

Constructor:
- Hoover Dam Investigation committee finds superior living and working conditions, illus. The Constructor, January, 1932, v. 14, pp. 20–23.

Dowd, M. J.:
- Canal bank maintenance by disking on Imperial Irrigation District, illus. Eng. News-Record, Feb. 11, 1932, v. 108, pp. 206–7.

Engineering News-Record:
- Progress of Hoover Dam tunnels (chart), Eng. News-Record, Jan. 14, 1932, v. 108, p. 74.
- New construction tempo being set at Hoover Dam, Eng. News-Record, Feb. 4, 1932, v. 108, pp. 179–180.

Engineering News-Record—Continued.
- Roadway Contract awarded, Colo. Riv. Aqueduct (short), Eng. News-Record, Feb. 4, 1932, v. 108, p. 194.

Excavating Engineer:
- Lloyd Barrage opened at Sukkur, India, Excavating Engineer, February, 1932, v. 26, p. 85.

Girand, John:
- Weather records projected into the future, charts of Salt River Valley, Ariz., tree rings and run-off, Civil Engineering, February, 1932, v. 2, No. 2, pp. 76-79.

Howell, C. H.:
- New form of dam proposed for narrow rock canyons, illus., Eng. News-Record, Feb. 11, 1932, v. 108, pp. 214–216. (Editorial, p. 200.)

Imperial Irrigation District:
- Complete text of the All-American Canal Contract, 40 page pamphlet issued by Imperial Irrigation District, Jan. 1932.

Mead, Elwood:
- Columbia Basin plan upheld by engineers, Power and Irrigation project declared to be feasible. U. S. Daily, Jan. 18, 1932, v. 6, No. 269, pp. 1 and 5 (pp. 2599 and 2604).
- Reclamation Bureau favors Columbia Basin prjoect, Eng. News-Record, Jan. 21, 1932, v. 108, p. 110.

Means, Thomas H.:
- Ground and Surface Water Rights cleared by decision (Arizona Courts), Eng. News-Record, Jan. 18, 1932, v. 108, p. 126.

Olberg, Charles R.:
- Unique Leveling Method—Irrigation Canal in Armenia, "Goat leveling" (letter) — Civil Engineering, Feb. 1932, v. 2, No. 2, p. 114.

Pacific Builder and Engineer:
- Bids on North Canal, Tunnel Canyon and Owyhee siphon (Spec. 530), Pacific Builder and Engineer, Feb. 6, 1932, p. 50.

Power:
- May finish Hoover Dam a year ahead of schedule, Power, Feb. 9, 1932, v. 75, pp. 220–221.

Southwest Builder and Contractor:
- Conditions at Hoover Dam reported by A. G. C. Southwest Builder and Contractor, Jan. 8, 1932.

United States Daily:
- Construction of Moon Lake Reservoir on Lake Fork River in Utah, Approved, U. S. Daily, Jan. 21, 1932, v. 6, p. 7 (p. 2633).
- Hoover Dam may be finished one year ahead of schedule, U. S. Daily, Jan. 28, 1932, v. 6, p. 1 (p. 2685).

Vivian, C. H.:
- Construction of the Hoover Dam, illus., Compressed Air Magazine, Feb. 1932, v. 37, pp. 3719–3724 (4th of series of articles).

Boulder Canyon Project Notes

THE Denver office recently inquired of the Southern California Edison Co. and the city of Los Angeles as to the number and capacity of generating units required in the power plant at the Hoover Dam. The Edison people have advised that they will require six 80,000-kilowatt-ampere units.

ON January 20 a new record was made for the amount of excavation of 41 by 56 foot section tunnel, when the crews excavated 256 linear feet of tunnel and removed more than 16,000 cubic yards of rock in a 24-hour period. Tunnel No. 3 (Arizona) was holed through with the 41 by 56 foot section on January 31 and Tunnel No. 2 was holed through on February 5.

TRIMMING jumbos constructed of two parallel trusses of quasi-circular form and 50-foot diameter set approximately 9 feet apart and connected by a latticework of steel angles are being used in the diversion tunnels as a measuring template. The jumbo is equipped with working platforms from which rock within the 56-foot diameter section will be removed from the roof and walls. It is mounted on car wheels and travels on parallel rails which are located in exact position to center the jumbo.

ON the evening of January 23 there was a housewarming at the new municipal building, which was attended by the entire reclamation force and a number of visitors. Dancing and light refreshments were the order of the evening.

BOULDER CITY has its first newspaper, the "Boulder City Journal," and temporary quarters have been established in the west wing of the department store of the Boulder City Co. Elton Garrett is managing editor, being transferred to this position from the staff of the Las Vegas Review-Journal.

ERNEST G. WARD, of St. Thomas, was the first Moapa Valley rancher to receive payment for lands which will be inundated by the reservoir back of Hoover Dam. He was paid $1,000 for a tract of 80 acres located near the mouth of Muddy River, about a mile from St. Thomas.

THE contractors have built a pile and trestle bridge across the Colorado River from the Nevada side to the Arizona gravel pits, giving railroad connection to this area. The bridge is 37 feet above the river level and 840 feet in length. An electric drag-line scraper with an 80-foot boom and 5-cubic-yard bucket has been installed at the pits. The railroad from the bridge to the pits has been completed.

THE Denver office is drawing plans for a concrete testing laboratory to be located near the concrete mixing plant at the dam site.

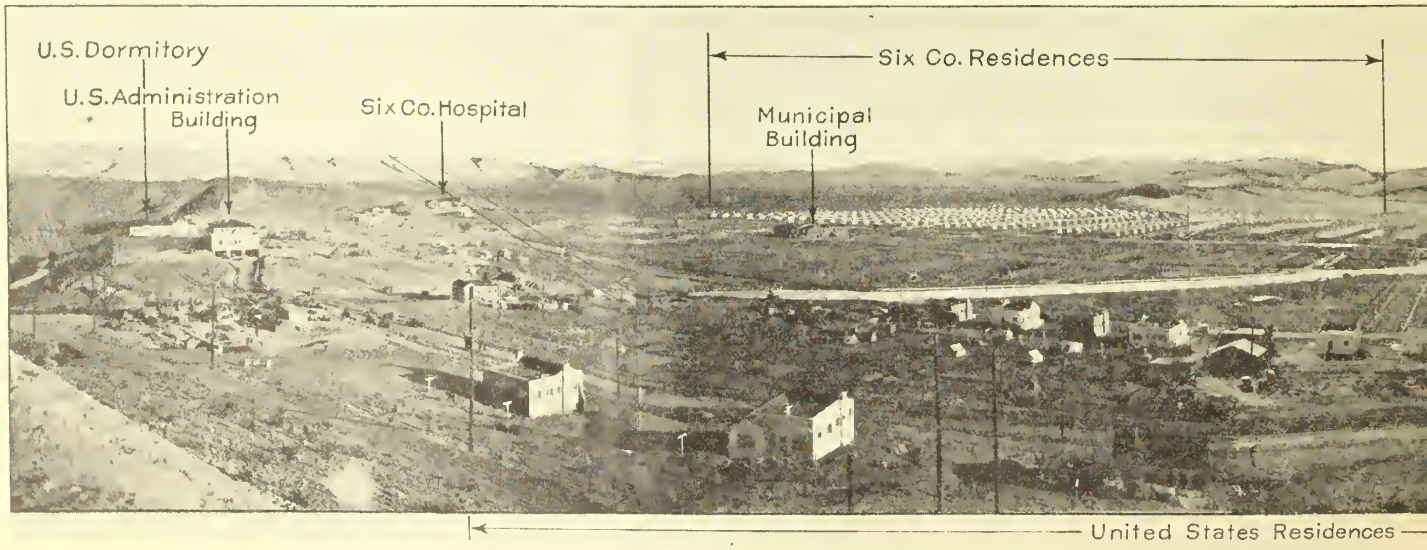
AT Boulder City for the month of January the maximum temperature was 60° and the minimum 28°.

APPROXIMATELY 4,000 employees were working on project activities during January. Of these 178 were employed by the Government, 3,200 by the Six Companies and its subcontractors, and the remainder by other contractors for Government construction and persons working for Boulder City permittees.

LEONARD T. BLOOD, in charge of the Federal-State Employment Office in Las Vegas, through whom all men are hired by the Six Companies and other contractors, says that up to January 1, 5,585 men were hired through his office, of whom 2,059 were ex-service men. Altogether over 13,000 applications for employment were filed, and more than 34,000 letters of inquiry regarding employment were received and answered.

A TREE-PLANTING project designed to completely landscape Boulder City within the next two years has been started under the direction of W. W. Weed, chief landscape gardener for the bureau. Plans call for the planting of about 2,000 trees. Quick growing shade trees, probably poplars, will be used in the park and residential sections, and small decorative trees in the business section.

REPORTS submitted by the chief ranger show that during the month of January 7,335 visitors (236 daily) were admitted to the reservation. Of these 6,601 were tourists and 734 were local visitors. Over 400 persons were not admitted, being classed as undesirables.



Boulder City, Nev. headquarters of Boulder Canyon project, located 6 miles wes

CONSTRUCTION Engineer Walker R. Young was the principal speaker at the regular meeting of the Las Vegas Rotary Club on February 4. He stated that it was the power development at Hoover Dam and not the revenues to be gained from the construction period that offered Las Vegas an opportunity to become one of the leading cities of the Southwest.

IT IS reported that the Capital Theatre Co., of Long Beach, Calif., which has the permit for a moving-picture theater in Boulder City, will construct a building approximately 60 by 160 feet, which will seat 800, and cost $35,000.

ACCORDING to figures from the assessor's office of Clark County, over 800 licenses for automobiles have been taken out by residents of Boulder City.

APRIL 1 is the dead line for campers on the Federal reservation, and by that date all must move into approved habitations. This will mean the demise of the settlement of Williamsville.

ENTERPRISES in Boulder City that were opened for business during month of January included a photographer and photographic supplies shop, a laundry agency, and dry-cleaning plant. Other stores and plants that are being constructed for permittees include a bus terminal, restaurant, barber shop, Western Union telegraph office, recreation hall, lodging house, Ford agency, lunch stand, and an oil and gasoline service station.

Flag Placed at Hoover Dam in Honor of Washington

A 65-foot flagpole with a plaque of George Washington has been placed on Lookout Point at Hoover Dam by the Salt Lake City Lodge, No. 85, associated with Las Vegas and other Elk lodges from the seven States of the Colorado River pact, and from this mast on February 22, the two hundredth anniversary of the birth of the Commander in Chief of the Continental Army and the first President of the United States of America, the flag of our country was unfolded with appropriate dedicatory services. On this occasion the following messages were received from President Hoover and Secretary Wilbur.

FEBRUARY 1, 1932.

BENEVOLENT AND PROTECTIVE ORDER OF ELKS:

Please present my cordial greetings to the representatives of the seven States of the Colorado River pact at their dedicatory exercises on February 22. I am confident that the occasion will promote patriotism and good will.

Yours faithfully,

HERBERT HOOVER,
President.

FEBRUARY 1, 1932.

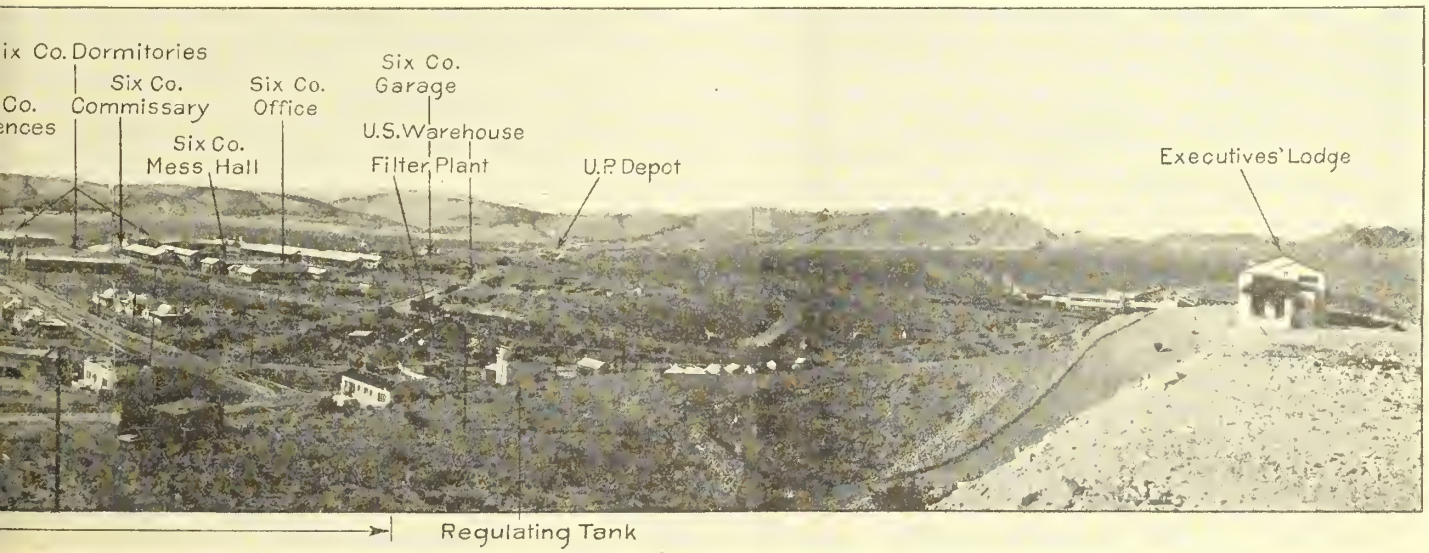
BENEVOLENT AND PROTECTIVE ORDER OF ELKS:

George Washington never saw the far West, but we know enough of him to be sure that he would applaud the placing of the flag he defended at the site where a great dam is to be erected for the benefit of millions of people. With hearty congratulations.

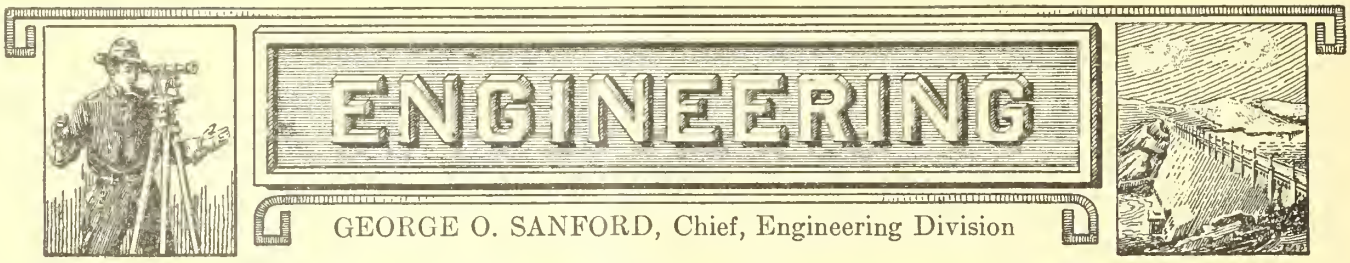
RAY LYMAN WILBUR,
Secretary of the Interior.

THE river concrete mixing plant on the Nevada side in Black Canyon has been completed. Its essential features are as follows: (1) A series of bins, each receiving gravel or sand of different size or fineness from bottom-dump railroad cars loaded at the gravel screening plant; (2) two conveyor belts which transport the gravel or sand as required from the receiving bins to a conveyor system and a similar series of bins erected at the apex of the concrete plant; (3) weighing machines to which the aggregates are released from bins and transported thence by conveyor belts to hoppers where cement is added; (4) four 4-cubic-yard Smith mixers which receive the aggregates from the hopper and water previously desilted from a water batcher, and, after 2½ minutes mixing, dump into Rex mixers, each capable of agitating 4 cubic yards of premixed concrete; (5) the Rex mixers mounted on trucks which transport the concrete from the mixing plant to the job.

AMONG the transportation equipment now in use by the Six Companies are the following: Two 85-ton locomotives, one 40-ton Shay locomotive, fifty 30-cubic-yard side-dump cars, fifty 30-cubic-yard bottom-dump cars, 10 Rex concrete mixers of 3-cubic-yard capacity, 54 dump trucks, 18 Ford trucks, 22 Ford pick-ups, 9 International transportation trucks, 7 trucks for drilling jumbos, 11 Ford touring cars and sedans, and 12 miscellaneous automobiles. A subcontractor is operating a fleet of 46 International 6 and 7 cubic yard dump trucks.



summit and near the terminus of the Union Pacific section of the branch railroad



Dams—High, Large, and Unusual

(*Part 2—United States*)[1]

By P. I. Taylor, Associate Engineer, Washington Office, Bureau of Reclamation

IN describing the Hoover Dam, which the Bureau of Reclamation is building on the Colorado River, and for the construction of which the Six Companies (Inc.) was awarded a $49,000,000 contract in April, 1931, the dimensions of the structure and appurtenant works are so extraordinary that one can not realize their immensity, except possibly by comparison. The dam will rise 730 feet above the foundation rock, approximately the combined height of the 389-foot Diablo, highest in the world, and the 349-foot Arrowrock, until 1929 the highest of all dams. The Hoover Dam will be 175 feet higher than the Washington Monument and will equal in height the 60-story Woolworth Building in New York City. With a length along the crest of 1,180 feet, a top thickness of 45 feet, and a base thickness of 650 feet, the structure will require 3,400,000 cubic yards of concrete masonry and a total of 4,400,000 cubic yards in dam, power plant, and appurtenant works. The four tunnels to divert the Colorado River around the dam site during construction will have an excavated diameter of 56 feet, a total length of 3.04 miles, total excavated volume of 1,563,000 cubic yards, and will be lined with 3 feet of reinforced concrete. The capacity of the tunnels is 200,000 cubic feet per second, which will care for the highest recorded river flood. The two inside tunnels after diversion use will be plugged and serve as power penstocks and outlet conduits, as pressure tunnels under a 600-foot maximum head, while the outer tunnels will be utilized for spillway outlets. The Arizona and Nevada spillways are designed to pass a total of 400,000 cubic feet of water per second. The upstream cofferdam will be an earth and gravel fill with steel-sheet-piling cut-off, 80 feet high above the river bed and containing 756,000 cubic yards of materials. Downstream another cofferdam similarly constructed will be 50 feet in height and contain 420,000 cubic yards. Excavation of the dam proper involves the excavation of 1,292,000 cubic yards of earth and rock.

The 3,400,000 cubic yards of mass concrete must be placed in the dam in a little over two years, a task of some magnitude. When concrete sets, a large amount of chemical heat is generated, causing a rise in temperature sometimes as much as 70°. In ordinary dams this heat is dissipated during the construction period, under natural conditions, but in the Hoover Dam, on account of the immense bulk of concrete it would take many years to dissipate the excess heat. Therefore it is proposed to artificially cool the concrete by the use of refrigerated water, pumped from the river to a cooling plant, and then through a system of pipes embedded in the concrete. This system will contain about 150 miles of pipe.

The Hoover power plant, with 16 generating units and an installed capacity of approximately 1,200,000 horsepower, will be the largest hydroelectric plant in the world. Plate-steel penstocks, 30 feet in diameter, will be installed in the penstock tunnels, which will involve plate thickness up to 2¾ inches. Water will be released from the reservoir through forty 72-inch needle valves, designed to operate under a maximum head of 570 feet with discharge capacity of 3,500 cubic feet per second. The jet of water will have a velocity of about 180 feet per second. Water passing through the power plant and outlet valves will be controlled by cylinder gates in four intake towers above the dam. These gates will be 30 feet in diameter, 12 feet in height, and will operate under a maximum head of 350 feet. The Hoover Dam will probably be completed in 1937 and will cost $70,600,000, which does not include interest during construction.

POWER DAMS

There are six dams constructed or under construction for the purpose of power development which deserve special mention—the Wilson in Alabama, Bagnell in Missouri, Keokuk in Iowa, Conowingo in Maryland, Safe Harbor in Pennsylvania, and the Rock Island in Washington. The Wilson Dam at Muscle Shoals, near Florence, Ala., on the Tennessee River, is 4,900 feet ong, including a 900-foot power-house section, and contains 1,400,000 cubic yards of concrete. The spillway has 58 gates, each 38 by 18 feet. On the Osage River near Bagnell, Mo., the Union Electric Light & Power Co. has just completed the Bagnell Dam, 148 feet maximum height, 2,543 feet over-all crest length, and containing 551,000 cubic yards of concrete. The reservoir back of this dam is 129 miles long and has a shore line of 1,300 miles and an area of 61,000 acres. The total cost of the development is said to be $75,000,000. The Conowingo Dam on the Susquehanna River at Conowingo, Md., was completed in 1928. This structure is 104 feet in height, has a crest length of 4,648 feet, and required the placing of 664,000 cubic yards of concrete. Installed capacity of the power plant is 378,000 horsepower, with an ultimate capacity of 594,000 horsepower. At Safe Harbor, Pa., also on the Susquehanna River, the Safe Harbor Dam is now under construction. This structure will be 106 feet in maximum height and 5,000 feet long, comprising 1,810 feet of spillway section and 2,270 feet of bulkhead or non-overflow section. A power house 920 feet in length is an integral part of the dam. On the crest of the spillways will be placed 28 floodgates, Stoney type, each 48 feet wide by 32 feet high, and 4 regulating gates. The discharge capacity of the spillways alone will be 970,000 cubic feet per second. In the dam, power house, and appurtenant works there are 490,000 cubic yards of concrete. The power plant will have an installed capacity of 255,000 horsepower, ultimate capacity of 510,000 horsepower, and the estimated cost of the development is $30,231,000.

The Rock Island hydroelectric project, now under construction on the Columbia

[1] Part 3, Foreign Countries, will appear in the April number of the Era.

River near Wenatchee, Wash., is an interesting power development. At the site the river divides into two channels, and a dam is being constructed across each channel. The power-house section, 100 feet wide by 883 feet long, is a part of the dam in the east channel. Spillway sections of the dam located in both channels have a capacity of 530,000 cubic feet per second. The dam will be 100 feet high, 3,590 feet long, and contain 221,000 cubic yards of concrete. The first installation in the power plant will be four 21,000-horsepower units costing $16,250,000; ultimate capacity will be 240,000 horsepower. At Keokuk, Iowa, the Keokuk Dam of the Mississippi River Power Co. spans the river from Iowa to Illinois. The total length of the structure is 4,578 feet, of which 290 feet at the east abutment is a solid gravity section, and 4,288 is spillway section 32 feet in height above the river bed, with 119 openings, each 30 feet wide, in which are steel gates 32 feet wide by 11 feet high. On the Iowa side is the power house, paralleling the river, 1,700 feet long and 125 feet wide, with 30 generating units and an ultimate capacity of 300,000 horsepower. There is also a navigation lock 400 by 110 feet. The main dam is spanned by a bridge 29 feet in width.

FLOOD-CONTROL DAMS

With the completion of the 265-foot Big Tujunga No. 1 Dam in 1931, the Los Angeles County Flood Control District of California has constructed 13 major dams, and three others, including the 290-foot San Gabriel No. 2 and the 275-foot San Gabriel No. 1, are planned for early construction. In the State of California there have already been built about 800 dams, of which 17 are 200 feet or more in height. Approval of design and granting of licenses for construction are functions of the division of water resources, department of public works. To control floods on the Miami River, the Miami Conservancy District, including parts of 10 Ohio counties, and consisting of the lowlands bordering the river and its tributaries, was formed in 1914 to combat the flood menace. The Miami flows into the Ohio River a few miles west of Cincinnati. During its flood of March, 1913, the river caused a property loss estimated at $100,000,000, and about 360 deaths were directly traceable to it. During the years 1918–1922 the conservancy district built five dams forming retarding basins to hold back flood waters. These dams—the Lockington, Englewood, Taylorsville, Huffman, and Germantown—were all built of earth by the hydraulic-fill or semi-hydraulic-fill method; they varied in height from 73 to 125 feet, and the volume of the embankments ranged from 800,000 to 3,600,000 cubic yards. Variable slopes, which are a feature of the design, are as follows: 2 to 1 for upper 20 feet; 2½ to 1 for next 30 feet; 3 to 1 for the following 30 feet; and 4 to 1 for the remaining portion down to near the toe. By making the interior portion of each dam of carefully selected and puddled materials, water-tightness was secured.

TEXAS BUILDS EARTH DAMS

In Texas, the city of Fort Worth has under construction the Eagle Mountain Dam, an immense earth-fill structure on the West Fork of Trinity River. Its purpose is storage for water supply and flood control. This dam will be 80 feet high, 4,400 feet long, and will contain 2,900,000 cubic yards of earth. It is scheduled for completion this year. The Tarrant County water-control improvement district No 1 has just completed the Bridgeport earth-fill dam near Bridgeport, Tex., for a water supply and flood-control project. The dam is 110 feet in height, 2,000 feet long on the crest, and 1,390,000 cubic yards of earth, wetted and rolled, form the embankment. The city of Dallas built the Garza Dam on the Elm Fork of Trinity River in 1926, as a part of its water-supply system. It is of the earth hydraulic-fill type, 80 feet high, 10,000 feet in length, with a yardage of 2,000,000. The Wichita Falls earth-fill dam, completed in 1924 by the city of Wichita Falls, Tex., has a volume of 1,500,000 yards, sloped 2 to 1 and 3 to 1. It is 100 feet high and 7,500 feet long. There is over a mile of arches in the Hamilton multiple-arch power dam now under construction on the Colorado River in Burnet and Llano Counties. This dam is to be 135 feet high and 9,252 feet long; this exceptional crest length made up of 28 spans of 70 feet and 97 spans of 35 feet, flanked by 2,997 feet of gravity section and 900 feet of earth fill.

Since the completion of the 280-foot Roosevelt Dam on the Salt River in Arizona in 1911 by the Bureau of Reclamation the Salt River Valley Water Users' Association has utilized the head between Roosevelt and the Granite Reef diversion dam by building three power dams, the 305-foot Horse Mesa, 224-foot Mormon Flat, and the 180-foot Stewart Mountain. In the past few years several high masonry dams have been built in North Carolina, South Carolina, and Tennessee in connection with power-development projects. The construction of a water-supply system for New York City required several up-State storage reservoirs and at least three notable dams, the 307-foot Kensico, 297-foot New Croton, and 252-foot Olive Bridge, all straight-gravity structures. The Kensico with a crest length of 1,843 feet is the longest of the solid gravity dams in this country and is also the largest of its type.

LARGEST DAMS

The largest dam in the world measured by cubical contents is the Gatun Dam on the Panama Canal, Canal Zone. It is an earth-fill embankment across the Chagres River Valley, placed in part by the semihydraulic process, 115 feet high, 8,324 feet long, and contains 22,958,089 cubic yards of material, of which 12,229,104 cubic yards were dry fill. The material in the Gatun Dam would make a pile of dirt 1 mile long, 1 mile wide, and 22 feet high. It was completed in 1912, and permits slack-water navigation for 23 miles, or more than half the total length of the canal. The dam is 100 feet thick at the top and 2,019 feet at the base. The upstream slope is protected with a rock facing 10 feet in thickness. No other dam approaches the Gatun in magnitude. In this country, the Saluda earth-fill dam built by the Lexington Water Power Co. on the Saluda River near Columbia, S. C., is by far the largest, with a volume of 11,000,000 cubic yards. It is a semihydraulic-fill structure with the middle third an impervious sluiced core, 208 feet in height, and has a crest length of 1½ miles. The maximum thickness is 1,150 feet, and the slopes are 3 to 1 downstream and 2½ to 1 upstream. A 16-foot diameter penstock pipe for power development extends through the structure. The dam was completed in 1930 at a cost of $6,000,000.

Second in size to Saluda is the Wachusett North Dike at Clinton, Mass., a part of the metropolitan (Boston) water-supply system. This earth embankment, with a timber and rolled-earth core, contains 5,500,000 cubic yards. Salt Springs Dam in California is not only the highest rock-fill structure (332 feet) but is also the largest, with a volume of 3,000,000 cubic yards. Its thickness at the base is 960 feet.

The Wilson Power Dam at Muscle Shoals, Ala., contains about 1,400,000 cubic yards of concrete, and is the largest concrete masonry dam of its type in the United States. Among the solid gravity, concrete masonry, nonoverflow type of dams, the Kensico Dam of the New York City water-supply system tops them all for bulk, as it contains 900,000 cubic yards. The New Croton Dam of the same system is a close second in size with 855,000 cubic yards. The Hoover Dam will require the placing of 3,400,000 cubic yards of concrete, which is more than the combined volume of the Wilson, Kensico, and New Croton Dams.

The 306-foot Elephant Butte Dam on the Rio Grande project, New Mexico, is the largest concrete masonry structure built by the Bureau of Reclamation and contains 618,536 cubic yards. In 1926, the bureau completed the McKay Dam in Oregon, which has a yardage of 2,304,000. It is a gravel embankment with a variable content of sand and earth as a binder, 160 feet in height and 2,600 feet long. The downstream slope is 2 to 1 and the upstream slope 1¾ to 1, the latter protected by a continuous reinforced concrete slab from 8 to 12 inches in thickness. Another interesting structure of the semihydraulic type is the Tieton Dam on the Tieton River near Yakima, Wash., on the Yakima (Federal) irrigation project. It is 222 feet in height, and contains 1,995,000 cubic yards, of which 1,570,000 are earth and gravel and the remainder rock. The embankment has a concrete core wall extending from bedrock to crest, a distance of 321 feet, and anchored in solid rock at both abutments.

HOW HIGH IS A DAM?

It might therefore be said by some that the Tieton Dam has a maximum height of 321 feet instead of the embankment height of 222 feet. Along the same line the claim might be made that the Owyhee, now under construction in Oregon by the Bureau of Reclamation, is 520 feet high. This structure will have a height of 405 feet at maximum section and a total height of 520 feet above the lowest concrete in the foundation cut-off. All of this brings us to the mooted question, "How high is a dam?" Some eminent engineers will claim that a dam is as high as it dams; in other words, the height that the water in the stream is raised by the structure. However, the generally accepted method of stating the height is to give the maximum height above foundation or the height at maximum section. A compromise plan would be to give heights above both stream bed and foundation for comparison. Expressed either way, the Hoover Dam will tower far above them all.

There follows a table listing the largest dams in the United States:

TABLE 2.—*Largest dams in the United States*[22]

Name	Location	Year completed	Purpose [2]	Type	Maximum height	Crest length	Volume	Cost
					Feet	*Feet*	*Cubic yards*	
Gatun	Canal Zone	1912	R. R.	Earth fill, semihydraulic	115	8,324	22,958,089	$9,626,678
Saluda	South Carolina	1930	P.	do.[3]	208	7,800	11,000,000	6,000,000
Wachusett North Dike	Massachusetts	1905	W. S.	Earth fill, timber core, rolled layers	80	10,000	5,500,000	
Englewood	Ohio	1922	F. C.	Earth fill, semihydraulic [4]	124	4,750	3,600,000	[28] 3,600,000
Bouquet Canyon	California	(10)	W. S.	Earth and rock fill	[26] 185	1,100	3,500,000	4,250,000
Calaveras	do	1925	W. S.	Earth fill, semihydraulic [5]	220	1,200	3,461,000	3,888,125
Hoover [25]	Arizona-Nevada	(1)	F. C., Irr. and P.	Arched-gravity, concrete	730	1,180	[6] 3,400,000	70,600,000
Standley Lake	Colorado	1911	Irr.	Earth fill, puddled core, no rolling	113	6,630	3,250,000	
Salt Springs	California	1931	P.	Rock fill [7]	332	1,300	3,000,000	6,930,000
Eagle Mountain	Texas	(1)	W. S. and F. C.	Earth fill, hydraulic	80	4,000	2,900,000	2,800,000
Lower San Fernando	California	1920	W. S.	Earth fill, part hydraulic	130	2,000	2,577,800	1,037,432
Scituate	Rhode Island	1928	W. S.	Earth fill	180	3,200	2,500,000	3,500,000
Wyman	Maine	1931	P.	do	[8] 155	2,250	2,500,000	
El Capitan	California	(10)	W. S.	Earth and rock fill	250	1,300	[9] 2,405,000	3,700,000
McKay [25]	Oregon	1926	Irr.	Gravel fill, concrete paving	160	2,600	2,304,000	1,901,000
San Pablo	California	1920	W. S.	Earth fill, hydraulic	220	1,250	2,200,000	
Garza	Texas	1926	W. S.	do	80	10,400	2,000,000	
Tieton [25]	Washington	1925	Irr.	Earth and rock fill, semihydraulic	222	905	1,995,000	3,756,256
Davis Bridge	Vermont	1924	P.	Earth fill, semihydraulic	200	1,250	1,900,000	
Catawba	North Carolina	1919	P.	do	120	1,275	1,817,000	
Cobble Mountain	Massachusetts	1931	W. S. and P.	Earth fill, hydraulic	245	700	[27] 1,800,000	
Lafayette	California	1929	W. S.	Earth fill, rolled, puddled clay core	121	1,165	1,762,875	1,776,176
Dix River	Kentucky	1925	P.	Rock fill [11]	270	1,910	1,747,000	7,000,000
Echo [25]	Utah	1930	Irr.	Earth fill, rolled	155	1,887	1,680,635	[13] 1,530,000
Belle Fourche [25]	South Dakota	1910	Irr.	Earth fill, rolled, timber core [12]	122	6,200	1,600,000	1,230,922
Big Meadows	California	1927	P.	Earth fill, hydraulic	130	1,250	1,532,800	2,632,000
Wichita Falls	Texas	1924	Irr.	Earth fill, part hydraulic	100	7,500	1,500,000	
Paddy Creek	North Carolina	1918	F. C.	Earth fill, semihydraulic	165	1,472	1,450,000	
Hardy	Michigan	1931	P.	do.[16]	120	2,800	1,410,000	
Wilson	Alabama	1926	P.	Concrete gravity, straight, overflow	140	[14] 4,900	1,400,000	[15] 47,000,000
Huffman	Ohio	1922	F. C.	Earth fill, semihydraulic	73	3,600	1,396,000	1,880,000
Bridgeport	Texas	1931	W. S. and F. C.	Earth fill, rolled	110	2,000	1,390,000	1,600,000
San Gabriel No. 2	California	(10)	F. C.	Rock fill	290	580	1,300,000	[28] 3,000,000
Taylorsville	Ohio	1922	F. C.	Earth fill, hydraulic	78	3,000	[17] 1,290,000	2,280,000
Linville	North Carolina	1919	P.	Earth fill, semihydraulic	160	1,250	1,250,000	
Upper San Leandro	California	1926	W. S.	Earth fill, part hydraulic	215	660	1,248,000	
Lower Deer Flat [25]	Idaho	1908	Irr.	Earth fill, rolled	40	7,200	1,207,606	337,104
Upper Deer Flat [25]	do	1908	Irr.	do	70	4,000	1,190,275	325,675
Santiago Creek	California	(1)	Irr.	Earth fill, reinforced concrete slab upstream	160	1,453	1,056,000	700,000
Lake Arrowhead	do	1922	P.	Earth fill, hydraulic	200	720	1,000,000	
Somerset	Vermont	1913	P.	Earth fill, semihydraulic	106	2,080	1,000,000	
Lockington	Ohio	1921	F. C.	Earth fill, hydraulic	78	6,400	1,000,000	1,280,000
Patillas	Porto Rico	1913	Irr.	Earth fill, semihydraulic	147	1,020	970,000	
Kensico	New York	1916	W. S.	Concrete, gravity straight [18]	307	1,843	900,000	6,735,000
New Croton	do	1907	W. S.	do.[19]	297	1,620	855,000	7,631,185
Conowingo	Maryland	1928	P.	do	105	[20] 4,648	664,000	
Elephant Butte [25]	New Mexico	1916	Irr.	do	306	1,155	618,536	4,149,180
Pardee	California	1929	W. S.	Arched gravity, concrete	358	1,337	617,700	6,240,000
Pine Canyon	do	(10)	W. S.	Concrete gravity, straight	280	900	600,000	[28] 5,770,000
Arrowrock [25]	Idaho	1915	Irr.	Arched-gravity, concrete	349	1,100	585,130	4,327,710
Bagnell	Missouri	1931	P.	Concrete, gravity, straight	148	[21] 2,543	551,000	30,000,000
Owyhee [25]	Oregon	(1)	Irr.	Arched-gravity, concrete	405	840	550,000	5,378,125
Keokuk	Iowa-Illinois	1913	P.	Concrete, gravity, straight	[23] 53	[24] 4,578	550,000	
Yadkin Narrows	North Carolina	1919	P.	Arched gravity, overflow, concrete	217	1,400	525,000	

[1] Under construction.
[2] Irr.—Irrigation, P.—Power, F. C.—Flood control, W. S.—Water supply, R. R.—River regulation.
[3] Clay puddled core.
[4] Puddled or rolled fill 200,000 cubic yards.
[5] Lower half, hydraulic fill; upper half, dry earth and rock fill.
[6] 4,400,000, including appurtenant works and power house.
[7] Upstream slope paved with 15-foot layer of placed rock surfaced with concrete slab.
[8] Maximum head.
[9] 1,500,000 earth, 850,000 rock, 55,000 concrete.
[10] Authorized for construction.
[11] Upstream slope has hand-packed rock faced with concrete.
[12] Concrete blocks on upstream face.
[13] $228,000 additional for reservoir.
[14] Includes 900-foot power-house section.
[15] $37,000,000 charged to power project.
[16] Steel-sheeting cut-off.
[17] Includes 215,000 cubic yards rolled or compacted by puddling.
[18] Upstream face, precast concrete blocks.
[19] Stone masonry facing.
[20] Includes 2,385-foot spillway, 1,313-foot retaining section, 950-foot headworks.
[21] Includes 520-foot spillway, 1,512-foot retaining section, 511-foot power house.
[22] United States and possessions.
[23] Spillway crest 32 feet.
[24] 4,278-foot spillway section and 290-foot solid gravity abutment section.
[25] Bureau of Reclamation Dam.
[26] Height above stream bed.
[27] Includes 400,000 cubic yards of rock.
[28] Estimated.

Satisfactory Progress of Farm Loan Association, Orland Project, California

THE project superintendent in commenting on an article in the January 22, 1932, issue of a local newspaper on the Orland project states: "The article clearly shows what can be accomplished by farmers when it is definitely and positively known by them that their payments must be met. The officials of the Federal land bank at Berkeley, of which the Orland Association is a subsidiary, have constantly and without exception required that payments due the bank, as well as those for taxes and for reclamation charges, be promptly made."

It is interesting to note that the average crop returns for the Orland project are very little above the average for all projects. The average returns for 1931 were $29.38 per acre. The article from the newspaper states:

"Nearly a million dollars out in local loans, 256 borrowers, and only 10 foreclosures during the period of more than 10 years is the record of the Orland National Farm Loan Association.

"Stockholders of the local organization held their annual meeting on Monday of this week, went over the business for the preceding year, and elected officers and directors for 1932. Officers chosen were: J. N. Cook, president; N. G. Haigh, vice president; directors, Walter Stickler, E. C. Meyer, and W. W. Allen. Arthur Edwards was reelected secretary-treasurer.

"The loan association, it was disclosed, is now composed of 256 members, who have loans from the association of about an even $900,000. Offsetting in a measure is stock, cashable at the expiration of the loan period, to the value of $44,000.

"There are and always have been some delinquencies. The number and amount of these, however, is remarkably few and small as compared with delinquencies in other obligations. Despite the trying conditions during the past year present delinquencies are only about $5,000 more than at the time of the preceding annual report. A drop of only $5,000 from the normal expectancy on a basis of nearly a million dollars is not looked upon as very alarming.

"The association has the remarkable record of having to foreclose on only 10 pieces of property since it started in business in 1921.

"NOTE.—The secretary-manager of the association advises that several of the 10 foreclosures involve lands other than project property, so that the Orland project is not to be charged with all the foreclosures.

"The very favorable terms upon which money is loaned through the association have aided many farmers through what without its help would have been almost impossible years. With a 35-year payment term, and with payments of only 6 per cent per annum, which payments amortize both principal and interest at the end of the loan period, the farm-loan plan has worked to the distinct advantage of hundreds of farmers in this section who otherwise would have been pressed for money beyond the possibility of maintaining their property intact.

"At the same time it has helped local banks in clearing up short-time loans and putting back into circulation money that has been needed in current business."

Notes for Contractors

Grand Valley project.—Award of contracts has been made for furnishing hydraulic and electrical apparatus for the Grand Valley power plant under specifications No. 528, for which bids were opened on October 20, 1931. The Pelton Water Wheel, Co., of San Francisco, Calif., was given the contract for two vertical 2,300-horsepower, 300-revolutions per minute hydraulic turbines (item 1) and two hydraulic turbine governors and governor pumps (item 2), the f. o. b. San Francisco bid being $31,170. Item 3, furnishing two 1,875-kilovolt-ampere, 300-revolutions per minute vertical, alternating-current generators went to the Electric Machinery Manufacturing Co., of Minneapolis, Minn., whose bid was $29,000 f. o. b. Minneapolis. The Standard Mechanical Equipment Co., of Dallas, Tex., was low on item 4, furnishing switchboard with auxiliary apparatus, with a bid of $9,272 less 2 per cent, f. o. b. Dallas.

Designs and specifications are being prepared for two 72-inch diameter plate-steel penstocks for the Grand Valley power plant.

Boulder Canyon project.—Plans are being prepared for 30 temporary 2 and 3 room residences and temporary 30-man dormitory at Boulder City, Nev., for the use of Government employees.

Construction of one 20-car and two 12-car garages in Boulder City for the use of Reclamation employees occupying Government cottages is being advertised for bids. Bids under specifications No. 559–D for furnishing and installing a cooling system in the administration building were opened on February 8.

Minidoka project.—The following awards have been made for furnishing electrical apparatus for the South Side Pumping Station No. 1, under specifications, No. 556–D, bids opened January 18: item 1, three 1,333-kilovolt-ampere transformers, General Electric Co., $10,452; item 1–A, one 1,333-kilovolt-ampere transformer, General Electric Co., $3,484; item 2, oil-circuit breaker, Pacific Electric & Manufacturing Co., $2,412; item 3, air-break switch, Pacific Electric & Manufacturing Co., $132; item 4, disconnecting switches, Bowie Switch Co., $126; item 5, switchboard apparatus, General Electric Co., $256. All bids are f. o. b. factory shipping points.

Yakima project, Kittitas division.—Bids will be opened at Denver, Colo., on April 4 for furnishing and erecting plate-steel penstocks and discharge pipe for the Wippel pumping plant, located about 12 miles southeast of Ellensburg. Two penstocks are required, each 45 inches in inside diameter, and 469.16 feet in length. The discharge pipe will be 42 inches in inside diameter and 2,078.38 feet in length. The specifications are numbered 532.

Bids will be opened on March 30 for construction of the Wippel pumping plant and appurtenant structures and the Wippel pump lateral under specifications No. 531.

Yakima project, Kennewick division.—Contract for construction of the Prosser power canal, diversion dam, and power plant, under specifications No. 547–D, has been awarded to the General Construction Co., of Seattle, Wash., for $214,094.75.

Award under specifications No. 551–D for three automatic check valves for the Kennewick Highlands pumping plant was made to the Automatic Cone Valve Co. for $3,085.60.

Contract for the 20-ton traveling crane for the Prosser power plant was awarded to the Euclid Armington Corporation for $2,240 f. o. b.

Specifications and designs are being prepared for the purchase of materials and erection of 1 wood-stave discharge line, 2 wood-stave siphons, and 8 wood-stave flumes, to be constructed on the distribution system.

Klamath project.—Contract for furnishing two motor-driven screw pumping units for Pumping Plant No. 5, under specifications No. 550–D, was awarded to the Worthington Pump & Machinery Corporation at a total price of $3,500.

THE Minidoka project held a beginner's meeting in keeping farm records, at which E. T. Benson, farm management specialist, was present and helped seven farmers set up a system of keeping farm records. It is expected that they will continue these throughout the year and that at the close of the year Mr. Benson and the county agent will assist them in summarizing the year's records.

Are the Efforts of the Bureau of Reclamation Worth the Cost?

By L. H. Mitchell, Assistant Director of Reclamation Economics

IN the summer of 1930 when Dr. Richard R. Lyman, of Salt Lake City, was a visitor to the Willwood division of the Shoshone Federal reclamation project, he asked the question, "What is this raw land worth before a homesteader has done the necessary land leveling and constructed habitable buildings, and what is it worth after this has been done?" The writer's answer to this inquiry was, "The desert lands of Wyoming have no value unless water is available for the irrigation of crops. However, the Bureau of Reclamation in constructing reservoirs and other irrigation works, while interested in having the cost of such undertakings repaid as provided by law, is also vitally concerned in providing homes. That is, in repaying the United States Bureau of Reclamation for its efforts the unit of measurement is not alone the return of the money expended but includes also the number of homes established."

During these trying times, when so many are out of employment, it is obvious that the home builders and owners on the various Federal reclamation projects are, in addition to being vastly better situated than those working for wages in the large industrial centers, doing their share in helping stabilize the Nation's economic structure.

The new Willwood division of the Shoshone project contains 157 farms, of which 68 have been recently entered. During the year 1931 there were 13 new home builders added to this small community. The number of livestock and poultry also increased as follows: Beef cattle, from 10 to 69; dairy cows, from 98 to 126; sheep, from 688 to 799; chickens, from 2,613 to 2,955; and turkeys, from 363 to 737. This slow but sure and steady growth in number of home owners and this increase in livestock is the result of the act of December 5, 1924, which authorized the Secretary of the Interior to select the settlers. Prior to the passage of this act anyone having a homestead right, regardless of his qualifications, could file on these lands which were of value after the Bureau of Reclamation had furnished water. Many filed prior to 1924 for purely speculative purposes. This kept deserving home builders from securing homes and greatly retarded the carrying out of the true intent and purpose of the original reclamation act of June 17, 1902.

Too many people came then and still come west to get rich quick and return to their old homes. In this respect they are comparable to the foreigners who come to the United States, hoping to return some day to their native land with wealth. The old maxim, "Get a farm for a home and you have a home and money; get one for the purpose of making money and you probably lose both money and home," is just as true on an irrigated farm as anywhere.

H. T. Cowling, Photographer.

Old and new home on the Shoshone project, Wyoming

IMPORTANCE OF QUALIFIED SETTLERS

On every irrigated project there is some land owned by individuals and companies for speculative purposes. These people generally have very little invested in comparison with the investment of the United States, and they are interested chiefly in providing homes only to the extent that having a prosperous family on a farm helps sell other property. Prior to the close cooperation now existing between the bureau and project commercial clubs and other agencies, certain of these, desiring to bring "outside money" into the community, advertised in newspapers, printed truck loads of circulars, and broadcast waves of information and advice on how to get rich on an irrigated farm with an abundance of water furnished by the United States. They hoped that some prosperous farmer or the son of some rich dad from another locality might be attracted. In this campaign to secure "new blood" very little consideration was given to the qualifications of the prospective settler. The new prospect must have adequate capital for a down payment, but little consideration was given to other

more important qualifications This fact, more than any other condition, has been the cause of the few but much advertised demands for relief. In recent years project civic organizations, the railroads, and the bureau have worked in close cooperation in advertising a project and bringing the facts concerning its opportunities to the attention of worthy settlers with the required qualifications.

The opinion seems to prevail among some people that the policy of the U. S. Bureau of Reclamation is a failure and that the results are not worth the efforts, even though the money to construct the various irrigation works is derived from the sale of Government property in the States where the irrigation expenditures are made. As a matter of fact, in the creating of over 40,000 farm homes the bureau added more to our national wealth in the building of towns and cities with about 80,000 homes, and in the use of machinery, equipment, and other necessities incident to the development of these homes than any other undertaking which has had either governmental or private supervision.

What more philanthropic undertaking could be carried on by some of our men of wealth than that of buying a large tract of farm land for resale to qualified and deserving home owners? If such a project, being free from politics, were properly conducted it could be an investment as well as a home-making enterprise. The money received from sales could be used, if conditions warranted, in repeating the much needed work and thus would form a revolving fund. Chain banks, stores, and other commodity companies may be successful and necessary. It is hoped, however, for the good of our country that chain farming will not be a financial success. It has been truthfully said, "The home is that rich soil which nourishes and determines the yield of any nation—economically, morally, spiritually, and patriotically—and contributes most to whatever prestige a country may enjoy among other nations of the world."

There is much being written and said about overproduction of every conceivable commodity, but we hear nothing of the overproduction of homes. To-day, as never before, the leaders of our country realize that the families living in their own homes are the powers that keep the machine of our Nation's prosperity revolving. There has never been a time when the influences of a home were more conducive to the development of right-thinking citizens, capable of meeting the problems of society, than now. In times of depression or war wealth can not solve the problem. It is those thrifty, honest people in the home, those who pay their just share of taxes to maintain good schools and their cost of the county, State, and National Government, who are the governors in the machine of our Nation's economic structure.

J. E. Stimson, Photographer.

A new home on the Riverton project, Wyoming

Fire Protection in Boulder City

By W. R. Nelson, Assistant Engineer

BOULDER CITY, the base camp from which the Hoover Dam is being built, is primarily a construction camp and the greater number of its buildings, by reason of their temporary occupancy, are of light frame construction. These conditions of impermanence have made necessary the dependence on other means than fireproof construction for fire protection and have required the use of efficient and up-to-date preventive measures and fire-fighting methods to quickly confine and extinguish any fires that might occur.

ADEQUATE WATER AVAILABLE

It was recognized that the primary requisite for an effective fire-fighting organization was a water system that was widely distributed, readily accessible, and of large capacity and adequate pressure. Bureau of Reclamation engineers, in planning and supervising the construction of the water supply and distribution system for Boulder City, made certain that these requirements were met in full.

Four pumping stations, capable of lifting more than 1,500 gallons of water per minute, now supply Boulder City with water from the Colorado River through nearly 7 miles of 10 and 12 inch pipe line, raising the water from elevation 645 at low-water stage of the Colorado to elevation 2,670 at the top of a 2,000,000-gallon storage tank in Boulder City, a maximum lift against static pressure of 2,025 feet.

The distribution system in Boulder City consists of a 12-inch supply line from the storage tank connecting with 10, 8, and 6 inch cast-iron mains, all arranged in loops with no dead ends. For fire protection, 6-inch lines are also laid to all public buildings, where they connect with 1½ and 2 inch standpipes. Fire hydrants of compression type, each with revolving head and equipped with two 2½-inch nozzles and 5-inch valve opening, are installed at or near the junction of all intersecting streets and between intersections, when the blocks are of unusual length, placing all points in the inhabited portion of Boulder City within a distance of 350 feet from one or more hydrants.

BUILDINGS PREPARED TO MEET FIRE HAZARD

In all their large buildings, such as dormitories, garages, warehouses, and offices, the Bureau of Reclamation and Six Companies Incorporated, the principal contractor, have installed 1½ and 2 inch standpipes that are equipped with hose and so located that a fire in any part of the building may be reached and extinguished. For additional protection, fire extinguishers are placed in all these buildings and the principal contractor has placed a fire extinguisher in each or every other one of its residences throughout the town. To provide further protection, Six Companies Incorporated has

placed barrels filled with salt water on the porches of all its dormitories and between all its residences. These barrels are inspected each week, and water that has evaporated is replaced.

TWO FIRE DEPARTMENTS EFFICIENT AND WELL EQUIPPED

Boulder City has placed its principal dependence for fighting fires in two well-equipped and efficient volunteer fire departments, one organized by the Bureau of Reclamation and the other by the principal contractor. The Bureau of Reclamation has provided its department with a triple combination pumping, chemical, and hose-carrying fire truck mounted on a Reo chassis. The pump is capable of delivering variable capacities at variable pressures from 117 gallons per minute at 250 pounds pressure to 350 gallons per minute at 120 pounds pressure. The hose body carries 800 feet of 2½-inch cotton-jacketed, rubber-lined hose in one compartment and 400 feet of 1½-inch hose of similar construction in another compartment. A 100-gallon copper chemical tank is mounted on the truck and connected with the suction of the pump. Three 50-foot lengths of ¾-inch chemical hose are furnished for use with this tank.

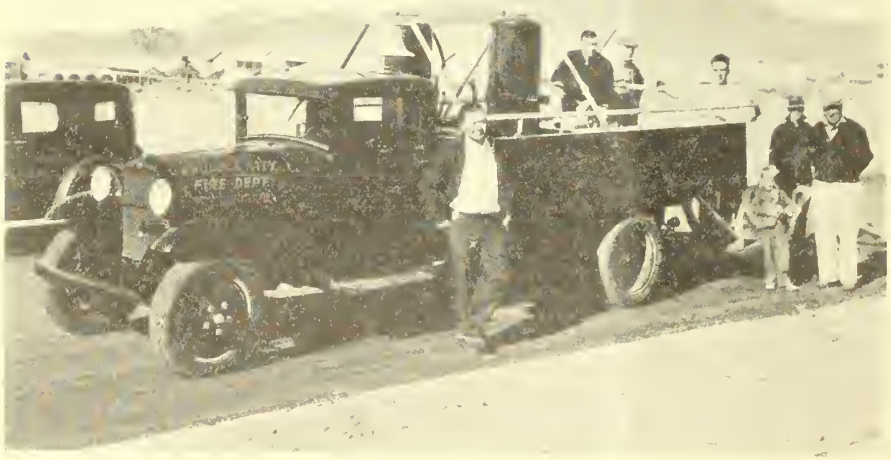
The piping of the pump is so arranged that water can be forced through two 2½-inch discharge valves or through the ¾-inch chemical hose. Two 2½-gallon fire extinguishers are carried on the truck, as well as the usual complement of electric siren, ladders, axes, nozzles, couplings, and other equipment.

The personnel of the Reclamation fire department consists of a fire chief who is on other duties near the fire engine during the day time and quartered near it at night, and a group of volunteer firemen who are employed in various activities in Boulder City and ready at all times to answer a fire call.

An electric fire siren is mounted on the building which houses the fire engine. Whenever a fire occurs the telephone central is notified of its location or the fire call is sent direct to the fire station. The ringing by central of the fire number actuates a large gong at the fire station. The fire alarm is then broadcast by the siren, the volunteer crew being notified of the location of the conflagration by the number of blasts of the siren.

The equipment of the Six Companies' fire department is similar to that of the Government, the foremost exceptions being the mounting of the truck body on a Ford chassis and the omission of the booster pump. The pump has been considered unnecessary because the water pressure in the district in Boulder City occupied by the contractor is nearly 80 pounds per square inch, furnishing sufficient pressure to throw a stream from a 2½-inch fire hose over any of the contractor's buildings.

The personnel of the contractor's fire department consists of a full-time fire chief, who has had years of experience in fighting fires, and a crew of men definitely appointed to act as firemen, five of whom are on duty at night and five during the day. The duties of the fire chief, exclusive of directing the actual fire-fighting operations, are those of inspection and supervision of fire-preventive measures and the upkeep of all fire-fighting equipment. The firemen are usually employed elsewhere than in Boulder City during one 8-hour shift, and the hours in which they are available for fire call are during the hours between their regular shifts. These men are therefore paid a regular monthly bonus for being available for fire duty and in addition an amount for each fire drill and each fire call. The fire chief and firemen are quartered in adjacent rooms in one end of dormitory No. 3 near the garage in which the fire truck is housed. A fire gong and telephone are installed in the garage and in the room of the fire chief. A 4-tone electrical fire siren is mounted on the garage and when a fire occurs a number of blasts are given to designate the location of the blaze, in the same manner of signaling as that of the Government.



Photograph by B. D. Glaha.

BOULDER CITY FIRE FIGHTERS

Upper, mobile fire-fighting equipment of Bureau of Reclamation. Government residences in background; lower, fire truck of Six Companies. In distant background, commissary, dormitories, and other large buildings occupied by the contractors.

CONSOLIDATED FIRE DEPARTMENT PROPOSED

It is contemplated that the fire departments of the Government and the principal contractor will be consolidated and that the fire trucks of the two organizations will be housed in the Government

garage as soon as the construction of this building has been completed. The merging of these two departments will eliminate, to some extent, the duplication of maintenance costs and the duplicate installation of fire-alarm systems. It is also believed that the concentration of the fire-fighting equipment in one location will coordinate the efforts of the two organizations and increase the effectiveness of their combined fire-fighting operations.

Initial precautions to prevent fire from spreading among buildings were taken in the planning and laying out of Boulder City, first by grouping buildings according to the permanency of their construction and their use for various activities and second by separating the buildings as far as practical, taking into consideration the cost of city improvements and the convenience of the residents.

Only in the central business district is it expected that there will be any building congestion, and this district has been confined within designated "fire limits," within which only fire-resistant buildings of construction equal to or better than those defined as "Semifireproof construction" and "ordinary construction" are permitted.

More than 50 per cent of the residences built by the Bureau of Reclamation and all of its other buildings are of construction similar or better than the "semifireproof construction" described above. Nearly all of the buildings of the Six Companies Incorporated are of frame construction with interior walls covered by gypsum board. The principal fire-resistant features of these latter buildings are an exterior coat of stucco on all walls, composition shingles or other fire-resistant covering for the roof and the addition of fire stops in interior construction to prevent fire from progressing within walls or beneath floors.

WATER CURTAIN INSTALLED

The mess hall, laundry, and dormitories Nos. 1, 2, and 4 of the principal contractor and an office building and warehouse of a subcontractor have all been placed in one block. Here additional fire protection has been provided by installing a "water curtain" on the south end of dormitory No. 2 which will separate the group of buildings at one end of the block from the buildings at the other end and prevent fire spreading from one group to another. The "water curtain" consists of a series of spray nozzles, mounted on a 2-inch galvanized line, installed along the eaves at the south end of dormitory No. 2 and following the eaves eastward along the walls a distance of 50 feet. The 2-inch galvanized feeder connects to a 6-inch supply line, and when the apparatus is in operation the spray nozzles discharge at a rate equal to the play of six fire hoses on the walls of the building. As the covering of the roof of the dormitory is of fire-resistant materials, it is expected that a conflagration will be prevented from progressing past this "curtain."

The efficiency of the fire-fighting equipment in Boulder City and of the preventative measures established there have been demonstrated by the fact that all fires occurring to date have been extinguished with a loss of less than $100 except in one case, when the loss was slightly above this amount.

4-H Baby Beef Clubs Improve Feeding and Management Practices on Sun River Project

By D. P. Thurber, Associate Extension Agent, Fairfield, Mont.

4-H BABY Beef Club work was started on the Sun River project in the fall of 1929 with five boys, each feeding a calf which had been selected with the aid of the associate county agent. This was the beginning of baby beef feeding in Montana as well as on the project. In 1930 and 1931 eight boys who had seen the results of the first club decided to try their luck. The success which attended their efforts is apparent from the following statement:

The officers of the club are: James Graves, president; Al Meyer, jr., vice president; Olaf Norheim, secretary; and L. C. Riphenburg, local leader. Regular meetings for the purpose of discussing feeding and management practices were held by the club once a month.

In August the calves were loaded on the train and taken to Helena to be shown at the State fair in competition with 175 other club calves from all sections of Montana. After the smoke had cleared away, for the competition was hot, the Sun River project club had garnered the following prizes: Third place in the Hereford class, won by Howard Riphenburg, and second place in the county group, which consisted of five calves from each county represented.

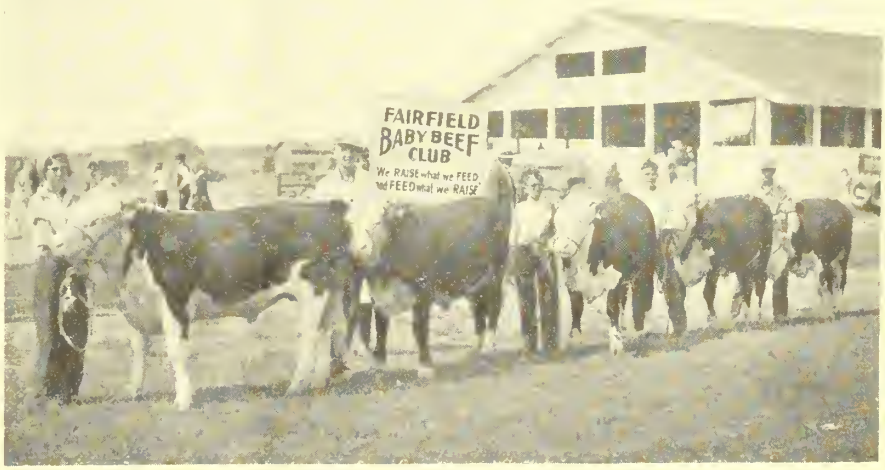
After the State fair the calves were taken to Great Falls to compete at the North Montana fair. At this show Howard Riphenburg's calf, placed first in the Hereford class, was reserve grand champion and placed third in the open class; Lloyd Austad's calf placed third; Al Meyer's fourth; and Merle Baldwin's fifth in the Hereford class. In the group competition the Fairfield Club placed third.

On October 30 the second 4-H baby beef sale was conducted at Great Falls and all the calves were sold at auction. Records kept by the members show that every single calf returned a profit to its owner above all costs. The figures quoted on page 68, taken from the club members' records, reveal some interesting facts.

The total weight of the above calves at the beginning of the feeding period was 5,300 pounds; the total weight at the end of the period was 10,735; and the total amount received for the calves was $929.15.

The average weight at the beginning of the feeding period was 530 pounds; the average weight at the end, 1,073 pounds; the average price was $92.91; the average cost incurred was $71; and the average net profit was $21.91. This profit does not include prizes won on the animals.

(Continued on page 68)



SUN RIVER PROJECT, MONTANA

Baby beeves, winners of third place in county group of five at Great Falls, North Montana Fair, and second place at State Fair at Helena. The feeding of calves by 4-H club members has stimulated interest among farmers in fattening beef cattle.

Boulder City—From a Woman's Viewpoint

By Mrs. D. L. Carmody (wife of Engineer Carmody of the Boulder Canyon Project)

FEW people have the opportunity of living in a city from its inception to its completion. In fact I do not suppose that many of our older cities ever had a conscious inception. When a group of ship-worn pilgrims knelt in the sand on the seashore thanking God for their safe arrival and asking for guidance in their perilous undertaking they little dreamed that they were laying the foundation of a mangificent city; and those hardy pioneers who built sturdy houses of logs and strong stockades for defense against the savage Indians never knew that great towns and business centers would rise upon their graves. I have heard that some of our beautiful southern cities were grants from kings, and many of our western towns followed the advent of the railroad; but Boulder City does not resemble any of these in its beginning, and partakes more of the nature of those mythological tales of ancient Greece, wherein men sprang fully equipped from the soil itself and palaces rose magically on the moonlit sands.

Picture to yourself an immense saucer containing a thousand acres and almost 2 miles across, resting on a gigantic outspread hand. This saucer tilting slightly upon the northern rim, is surrounded by unscalable mountains, grim, jagged peaks absolutely bare of vegetation, that rise unevenly in rugged outline.

CIVILIZATION DISPLACES DESERT

Less than a year ago this spot was all a part of the pagan desert, a vast area of sand spotted with scattering bunches of cactus and other stinging weeds. Here all day the chuckwalla, the newt, and the horned toad basked in the sun or played in and out of the little hills of sand and brush; here the wily scorpion hidden safely beneath a rock watched for a chance to pounce upon his prey; here the centipede, always a creature of mystery, burrowed deep under the warm sand, and here the wary tarantula emerged from her hole and reeled drunkenly to some neighboring hole whether for society or food, who can tell?

Then into this care-free desert existence there came a warning—some subtle noiseless information that man, the common enemy, was approaching. That day must have been one of frantic decision; there was no time for indecision, so some leader must have guided the creatures to comparative safety, some to the high hills, others to the rocks beside the river, some deep into the bowels of the earth, but all have disappeared, and that day there was left only the sound of the wind whistling down the arroyos.

This was all less than a year ago. Now everything is changed, and the great saucer is resounding with noise and alive with men, machines, and even horses and mules. Over on the southern rim the Six Companies have built several hundred little 2 and 3 room houses for their employees, and all in neat rows with their peaked roofs they resemble an army camp.

Further toward the west are their dormitories and their commissary department, which is a big department store where you can buy anything from a diamond engagement ring to a long-handled mop and dust brush; there are also the recreation hall, the police station, the bus station, and the mess hall where more than fifteen hundred men working for the contractor are comfortable and well fed.

SIX COMPANIES' HOMES

We have now circled around to the western rim where the road goes out of the city to Las Vegas. On the far side of the road on two separate knolls are the executive mansion for the visting officials of the Six Companies, and the home of Frank T. Crowe, their superintendent. And by "Six Companies" please understand is meant the six companies which have incorporated and are engaged in building the Hoover Dam under the supervision of the U. S. Bureau of Reclamation. There are also several other great contracting companies putting in the water mains for the city, making streets and sidewalks, and putting up buildings for the Government.

On the highest knoll of all is planted the immense tank for the city's water supply brought by pipes from the Colorado River and subjected to a course of straining and purifying to make it into splendid drinking water.

RECLAMATION EMPLOYEES' HOMES AND OTHER BUILDINGS

On the north rim of the saucer are 12 homes for reclamation engineers; they are beautiful little stucco houses supplied with every convenience in the way of iceless refrigerators, electric stoves, open fires, and lots of ventilation; they are rather quaint in design and each one is tinted a different shade from dark tan to oyster white. These houses are in groups of six separated midway by the Government administration building and dormitories—both of them beautiful structures of which we all may well be proud. On the same plateau houses are being constructed for the reclamation officials here who are now living in Las Vegas. At the east end of the saucer there are the contractor's hospital and doctor and nurse's quarters with other buildings under construction and all promising to be ornaments when landscaped and planted to trees and shrubs.

Yet another 12 houses for reclamation engineers and other employees have just been finished and face the first six, being built closer together and lending a citified appearance to that end of the town; but down in the center there is only the municipal building, an immense affair, but not yet completed, and all the rest is in a sort of chaotic activity where every variety of machine is in frantic operation.

MACHINERY WORKS TRANSFORMATION

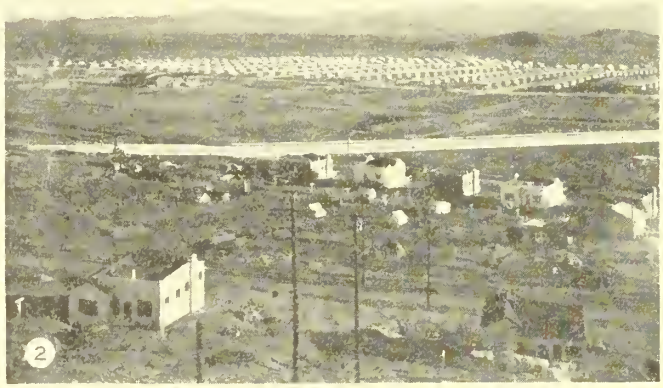
On an unsightly mound a machine resembling a dredge is perched, its long arms

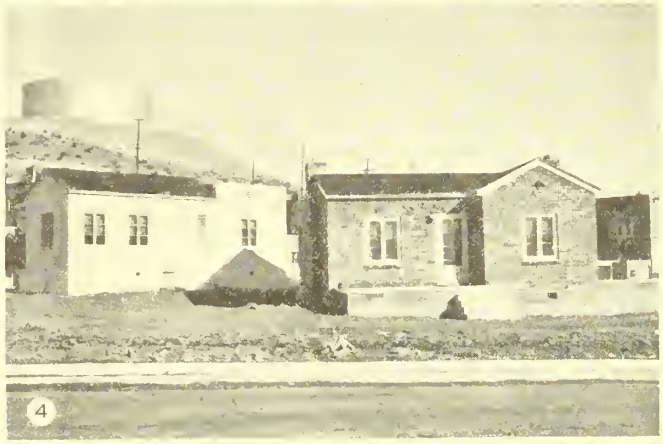
like windmills scooping rocks which are crushed and used in paving the fine new roads, thus while reducing the hump to an even expanse also furnishes necessary material for road building. Tanks and caterpillar trucks wobble drunkenly over the rough area, up and down the hollows sometimes with no apparent object save to prove that nothing can stop them, though in reality they are probably smoothing the way for more delicate apparatus.

There is a paver which looks to me like the device that used to carry the calliope in the old-fashioned circus parade; and there is another piece of mechanism which sometimes appears in the form of a light touring car and again as an ancient galleon but always with a prow in front like the cowcatcher on a steam engine, and is appropriately named a "bulldozer." It sometimes comes to within a foot of the front door sending shivers of terror down my spine, but just as I imagine I feel the walls tremble it pauses, seems to relent, turns about and goes lunging away mowing down every obstacle in its path.

Then there is a trencher which majestically and slowly marches down past our houses leaving a deep ditch in its wake; it is always accompanied by one or two acolytes on foot who continually pour libations of oil on its fiery sinews and occasionally the creature will halt and its whole army of attendants will get out and prostrate themselves before it. All these robots play their allotted parts with frequent snortings and clankings of chains, and I often think that one looking down on our city from high up in an airplane might well imagine this to be an arena where prehistoric animals indulge in their clumsy play.

(Continued on page 68)





Photographs by B. D. Glaha.

BOULDER CITY BUILDINGS

1, Boulder City site; 2, Boulder City in the making; 3, Six Companies' commissary; 4, Government engineers' homes and city water tank; 5, United States Administration Building; 6, United States Municipal Building

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, returned from his short trip to the coast on February 15. He visited the Denver office, where he conferred with the chief engineer and others on the work of the bureau; went to Sacramento, Calif., to confer with State authorities about the bureau's report on increasing the water supply for irrigation of the South San Joaquin Valley, and on February 8 addressed the Third Annual Water Users' Conference, under the auspices of the American Farm Bureau Federation at Salt Lake City, on the subject of plans for providing needed relief for farmers on Federal reclamation projects who are unable to meet construction charge payments.

He visited the Boulder Canyon project with Chief Engineer Walter.

Immediately on his return, February 15, he attended sessions of the conference called by the Secretary of Agriculture for February 15 and 16 of the National Land Use Planning Committee.

During the recent absence of the Commissioner and Assistant Commissioner, Miss Mae A. Schnurr was designated Acting Commissioner.

Dr. Elwood Mead, Commissioner, and Miss Mae A. Schnurr, Assistant to the Commissioner, attended the meeting of the Committee on Land Use Planning, appointed as a result of the National Conference on Land Utilization to which Doctor Mead was a delegate.

R. M. Priest, superintendent of the Yuma project, and Louis C. Hill, consulting engineer, are temporarily serving on a board of engineers of the International Water Commission at Yuma, Ariz., for consultation and the preparation of a report on lower Colorado River conditions.

En route to Sacramento recently, E. B. Debler, hydraulic engineer, stopped at Salt Lake City, Utah, to confer with E. O. Larson, associate engineer, on current investigations in Utah, and at Carson City, Nev., to confer with the State engineer regarding proposed investigations in that State.

J. L. Savage, chief designing engineer, in company with engineers of the Babcock & Wilcox Co., spent several days in Las Vegas, Nev., in connection with studies for the design and installation of steel penstocks.

One of the many evidences of the esteem in which L. H. Mitchell, now Assistant Director of Reclamation Economics, was held in his former position as superintendent of the Shoshone project, was the farewell banquet which was tendered him and Mrs. Mitchell by the Willwood settlers. The meeting was held in the basement of the new community house. Practically every settler was there with his family. Mr. Mitchell was presented with a beautiful gold-mounted fountain pen carrying a lifetime guarantee, and engraved with the word "Willwood."

F. E. Weymouth, former chief engineer in the Bureau of Reclamation, and now connected with the metropolitan water district of southern California, has been promoted from the position of chief engineer to that of chief engineer and general manager.

S. O. Harper, assistant chief engineer in the Denver office, made an inspection trip to the Boulder Canyon project and returned to Denver.

Edward M. Philebaum, fiscal agent of the Bureau of Reclamation at Yuma, Ariz., has been retired, having served the Government continuously and efficiently for a period of 40 years. Effective May 21, 1906, Mr. Philebaum was transferred from the War Department to the Reclamation Service, being assigned to the Yakima project as fiscal agent. From Yakima he was transferred to Yuma in the same capacity. On January 15 he passed his seventieth birthday and was retired effective January 31.

Miss Bell, one of the experts of the Bureau of Efficiency, spent several hours recently in the Washington office making a study of the filing system of the bureau. She was furnished with copies of the forms used, together with a copy of the book descriptive of the office system and the filing system of the mails and files section, Washington office, Bureau of Reclamation, prepared by J. W. Myer, chief, and J. C. Beveridge, jr., assistant chief, of the mails and files section.

J. A. Keimig, of the North Platte project, has been temporarily detailed to Yuma in connection with Colorado River Basin investigations.

Boulder City Nev.

(Continued from page 67)

Out of this seeming chaos each day brings changes so complete as to seem magical. Beautiful paved streets emerge from what was an inchoate mass of rock and sand; imposing buildings rise from where were once but walls of rock; and as soon as the spring season arrives green grass and flowers will replace sand and gravel.

On the northern rim of Boulder City one can look down 2,000 feet to where the river like a brown rope twists and turns between the uprising cliffs seemingly almost stagnant, giving no indication of the violent currents in its depths, the deadly whirlpools nor the velocity that sometimes equals that of a cataract.

The little city so newly born lies amid this bleak and changeless scenery like a jewel on a savage breast. One can scarcely realize that in 10 months or less, where the desert lay remote, unconquered, is now the nucleus of a modern city already having a population of 3,000 and at least 500 finished buildings. We ask the question, What mental caliber went to conceive this almost impossible undertaking? What master minds worked out this gigantic problem? There were only a few men who planned it all, and we ask ourselves if they were not inspired—has not the dust from stars fallen upon them, giving them something more than human, something finer than earth? It all makes me remember a scene in that beautiful play Peter Pan, in which Maude Adams, standing alone on the stage facing a vast audience, asked at a dramatic moment, "Do you believe in fairies?" and that audience—to a man—stood up in proof of their belief. The thrill of that heady moment is never to be forgotten. Ah, yes, somewhere deep in our secret selves we all believe in an unseen power; we all have prayed that sometime star dust may fall upon us.

I am sure that you will believe in fairies when you see Boulder City and you will surely know that star dust has fallen somewhere on someone.

Sun River Baby Beef Clubs

(Continued from page 65)

As a direct result of these feeding trials 355 head of cattle were fattened by adults on the project in 1930, and approximately 500 head are on feed at the present time. There are 17 club members feeding 29 calves at the present time.

Owner	Original weight of calf	Final weight of calf	Price per hundredweight	Selling price
	Lbs.	*Lbs.*		
Lloyd Austad	540	1,075	$8.50	$91.37
Howard Riphenburg	590	1,130	8.50	96.05
Doris Riphenburg	560	1,100	12.00	132.00
Al Meyer	540	1,160	8.10	93.96
Al Meyer	530	1,140	8.10	92.34
Merle Baldwin	530	1,040	8.10	84.24
Merle Baldwin	520	1,050	8.10	85.05
Olaf Norheim	490	940	8.10	76.14
James Graves	510	1,000	9.00	90.00
Merle Baldwin	590	1,100	8.00	88.00

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy**, Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng. C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz.	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev.	Walker R. Young	Constr. engr.	E. R. Mills	Charles F. Weinkauf.	do	Do.
						J. R. Alexander	Boulder City, Nev.
Orland	Orland, Calif.	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Owyhee, Oreg.	F. A. Banks	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont.	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex.	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Baker, Thief Val. Dam	Owyhee, Oreg.	F. A. Banks	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Umatilla, McKay Dam	Pendleton, Oreg.	C. L. Tice	Reserv. supt.		Denver Office	do	Do.
Vale	Vale, Oreg.	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owynee, Oreg.	F. A. Banks	Constr. engr.	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash.	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash.	R. J. Newell	Constr. engr.	C. B. Funk	do	do	Do.
Yakima, Kittitas Div.	Ellensburg, Wash.	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johuson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo.	I. B. Hosig	Acting supt.	W. F. Sha	Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

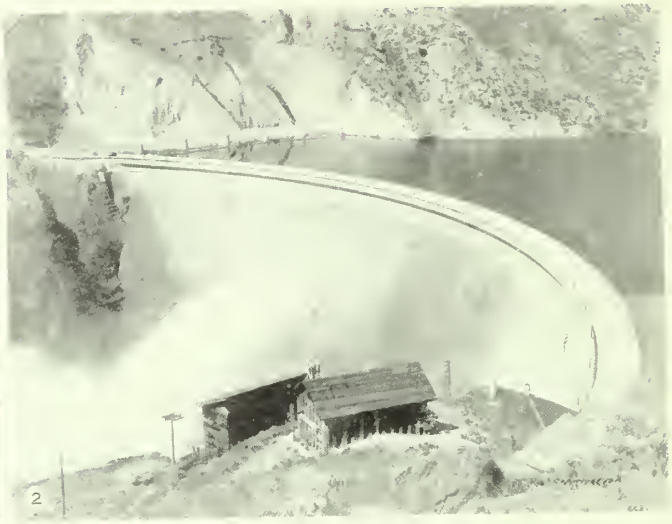
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo.	C. W. Tharp	Superintendent	H. O. Lambeth	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A.	Montrose, Colo.	C. B. Elliott	do	F. D. Helm	Montrose, Colo.
Boise	Board of control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont.	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont.	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont.	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont.	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Mary M. Kinney	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr.	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	D. R. Dean	do	Mrs. M. J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev.	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg.	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg.	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A.	Ogden, Utah			Jno. B. Hooper	Hooper, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.			Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo.	J. O. Roach	Irrigation supt.	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Custom House	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg.	E. O. Larson	State of Utah.
Columbia Basin, Wash.	Spokane, Wash., Sun Life Bldg.	H. W. Bashore	
Colorado River Basin investigations	Denver, Colo., Custom House	P. J. Preston	Colo., Wyo., Utah, and New Mex.
Rathdrum Prairie, Idaho	Spokane, Wash., Sun Life Bldg.	H. W. Bashore	None.
Seminoe Reservoir, Wyo.	Denver, Colo., Custom House	Denver office	None.

SALLIE A. B. COE, *Editor.*



DAMS—HIGH, LARGE, AND UNUSUAL (SEE PAGE 58.)

1, Saluda, South Carolina (Curtis Flying Service photo.); 2, Arrowrock, Idaho (Lubkin photo.); 3, Kensico, New York; 4, Elephant Butte, New Mexico; 5, Spillway at Gatun dam, Panama; 6, Salt Springs, California.

U. S. GOVERNMENT PRINTING OFFICE: 1932

THE
RECLAMATION ERA

VOL. 23, NO. 4 APRIL, 1932

RECLAMATION HOMESTEADING (SEE PAGES 82-83)

ABOVE: NO EVIDENCE OF HOMESTEAD PLANNING. BELOW: A WELL-PLANNED HOMESTEAD

Water Users Approve Present Federal Reclamation Policy

THE FOLLOWING resolutions were adopted by the accredited delegates of the projects represented at the Third National Water Users Conference, sponsored by the American Farm Bureau Federation held at Salt Lake City, Utah, on February 10.

WHEREAS reclamation as carried on by the United States Government has been the means of creating thousands of farm homes, which in turn support thousands of workers in cities and towns throughout the entire country; and

WHEREAS the reclaimed land of the West as it stands to-day creates millions of new wealth annually and the records show that the reclamation projects become great consumers of the manufactured products of the East, from which the whole United States profits; and

WHEREAS the crops produced on the reclamation projects are of such a nature as not to contribute to the exportable surpluses of agricultural commodities and in no way contribute to the present distressed condition of agriculture; and

WHEREAS the money used in building the irrigation projects of the West has come from the West through oil royalties, sale of public lands, and repayments from irrigation projects: Therefore be it

RESOLVED, That we indorse the present policy of Federal Reclamation in providing supplemental water for developed areas in need thereof, and we request Congress to continue this policy as rapidly as funds can be made available; and be it further

RESOLVED, That we commend the Hon. Elwood Mead, Commissioner of Reclamation, for the fair way in which he has carried out the policies of reclamation and pledge him our continued support.

THE

RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 4

APRIL, 1932

Interesting High Lights on the Federal Reclamation Projects

TREE planting in the morning and a program in the evening, both at the Veterans' Memorial in Orland, in which all fraternal, civic, and farm organizations participated, featured the Orland observance of the bicentennial birthday anniversary of George Washington.

PROJECT farms on the Belle Fourche project are in fair demand by tenants. Practically all desirable places have been taken by renters who were on the project last year.

ON FEBRUARY 20 an all-day New Settlers' Conference, sponsored jointly by the chamber of commerce, the county agent, and the farm bureau, was held at the Y. M. C. A. in Ellensburg, Kittitas division, Yakima project. After a short talk by R. M. Turner, assistant director of the extension service, Washington State College, the meeting was turned into a round-table discussion of farm problems to be met by the new settlers in bringing the raw sage-brush land into cultivation. About 75 farmers were in attendance. The local agricultural committee was assisted by R. M. Turner and Leonard Hegnaur, of the extension service, Washington State College; H. B. Singleton, director, Prosser Experimental Station; and C. C. McCormack, agricultural agent, Milwaukee railroad.

MUCH interest continues in the farm units recently opened to entry on the gravity division of the Minidoka project. At the latest report a total of 25 applications had been received and 6 units had been awarded.

OWING to heavy feeding during the past few months on the Klamath project, there is little, if any, hay remaining for sale on the project, and the price has advanced from $8.50 to $15 per ton in the stack.

Arbor Day

In view of the approaching Arbor Day celebrations, it seems especially fitting that this issue of the Era should feature landscaping in general and tree planting in particular. With that thought in mind the front cover page contrasts a homestead in which the house itself was the leading factor, no apparent thought having been expended on the surrounding buildings and grounds, with a well-arranged homestead in which thought was given not only to the house but to the setting as well. In this connection too much emphasis can not be given to the fact that proper landscaping need not require a great outlay of money. As indicated in the article on pages 82–83 on Homestead Planning, the cost of buildings, yards, and trees may be nominal if carried out in a simple way, and yet the result in a few years would be not only a picture to delight the eyes of the owner, his neighbors, and visitors, but a convenient and comfortable homestead which would fully compensate for the inconsiderable original expense.

The article in the women's department, page 86, emphasizes the importance of proper tree planning in the laying out of a town.

Arbor Day is observed in the various States generally by proclamation of the respective governors. We have taken from the World Almanac the following dates on which the day is observed in our irrigation States:

Arizona: In northern part, first Friday after April 1; in southern part, first Friday after February 1.

California: March 7, Luther Burbank's birthday.

Colorado: Third Friday in April.

Idaho: In April. Fixed by county school superintendents.

Montana: Second Tuesday in May.

Nebraska: April 22, J. S. Morton's birthday. Public holiday.

Nevada: Proclamation.

New Mexico: Second Friday in March.

Oregon: Second Friday in February in west; second Friday in April in east.

South Dakota: Usually observed in April.

Texas: Washington's Birthday.

Utah: April 15.

Washington: First Friday in May.

Wyoming: In the spring.

THE break of winter weather on the Belle Fourche project was favorable to the feeding situation and it appears that project livestock will come through in fair shape. Limited quantities of alfalfa hay are still available at $12 to $14 per ton, and beet pulp is being hauled daily to project farms. Several carloads of hay and cottonseed cake have been shipped to project towns for dry-land ranchers.

A CONSIDERABLE acreage has been planted to cantaloupes on the Yuma project, the growing cost being materially reduced because the early planting relieved the growers of the necessity of covering the plants with waxed-paper shelters. These melons will mature later, but they can be marketed at lower prices with a fair profit owing to the reduction in growing costs

---

IT IS reported that nearly 1,000 acres on the Yuma project are being planted to paper-shell pecans. This will bring the total plantings on the project to approximately 3,500 acres. This crop is increasing in popularity locally each year and promises to become one of the major crops if development continues as it has in the past few years despite general economic conditions.

THE advertising activities of the Vale-Owyhee Government Projects Land Settlement Association continue to draw many inquiries. During a recent month 239 letters were received at the association office and 11 interested persons called relative to Vale project lands.

ON THE Milk River project two farms were recently sold on contract to dry farmers and at least four other tracts were leased for 1932. Very few, if any, good farms are now available for sale on the Malta division, but requests for farms are being received almost daily.

Landscaping of Boulder City

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

AMONG the most distinctive features of Nevada landscapes are the long, flat slopes, broad alluvial fans, and wide shallow valleys, indicating slight earth movement in the more recent eras, a comparatively soft geological formation, and heavy erosive action. On these flat slopes and rounded ridges the minerals in the soil, many of alkaline character, glisten and shimmer under the intense rays of the sun, which in summer shines glaringly from a cloudless sky. The desert vegetation is sparse and lies close to the ground, furnishing practically no shade.

Boulder City has been located in the most favorable site obtainable with respect to its accessibility by highway and railroad, its building space and advantageous topography for town planning, and particularly its soil characteristics and its climate, the most moderate available.

Although the town site is the most pleasing of those in the Hoover Dam area, still the reflected sun rays from the soil minerals, accentuated by the glare from street paving and concrete sidewalks, is disagreeable and almost unendurable when coupled with the intense summer heat. Not only was landscaping desired as a remedial measure for this condition, but trees, shrubs, and grass were needed to bind the filled ground and loose soil and prevent its removal by the torrential rains that occur occasionally during the year. In addition to these practical reasons, the Government considered advisable the planting of flora of a species extraneous to the region in order to create a spot in the desert which, by its contrast and esthetic appeal, would ameliorate somewhat the necessity of living and working in the desert atmosphere.

LANDSCAPE GARDENER EMPLOYED

A project of landscaping was included in the initial planning of Boulder City, but as there were other factors of greater urgency which demanded immediate attention, landscaping was not started until December, 1931. At that time Wilbur W. Weed was appointed chief landscape gardener and arrived on the project on December 10. He proceeded at once to prepare landscaping plans, secure data of soil characteristics, and to make a study of plants that would thrive under the climatic, soil, and water conditions existing in Boulder City.

WORK PROCEEDS UNDER 11 CONTRACTS

Planting and landscaping maps were prepared and approved and advertisement issued on February 1, 1932, for approximately 9,150 trees and shrubs of about 73 varieties and 1,200 rose bushes of 16 varieties. Award was made on February 18, 1932, to 11 individuals and nursery companies, one located in Las Vegas, Nev., and the others at various towns in California. The total amount of all bids aggregated $4,205 f. o. b. shipping point and was for 11 carloads of shrubs and trees.

The first shipment of trees was received on February 28, 1932, and others followed soon after. Immediately on arrival the plants were transferred from the cars and were "heeled in" at a live storage plot. Transplanting to permanent locations was started on New Mexico Street in the southwest section of the town site. On March 10 trees had been planted the full length of this street and planting was proceeding north on Avenues G, H, and I.

TREES OF VARIOUS TYPES PLANTED

The general landscaping plan for Boulder City provides for planting deciduous trees of the varieties black locust, Arizona ash, Chinese elm, Carolina poplar, and European sycamore on all streets in the principal residential districts and in the industrial area. It is planned also to use this type of tree around the schoolhouse in block 15, and the municipal building in block 21. Approximately 1,200 street trees will be planted, spaced 40 feet apart.

In the central business district, that section of the town bounded generally by Colorado, Utah, and Wyoming Streets and Nevada Highway, the principal planting will be evergreen conifers of the varieties Guadalupe cypress, incense cedar, and *Thuya beverlyensis*, the latter a tree of the arborvitæ family. Approximately 400 trees of this type will be planted, spaced 25 feet apart.

ROSE GARDENS TO GRACE PLAZAS

North and South Escalante Plazas will be developed as formal rose gardens. The central portions will be planted to 40-inch standards, consisting of roses of several colors grafted and budded into a hardy variety. The border planting outside the walks will be ordinary roses of a dozen colors and varieties. A sundial will comprise the central motif in one plaza and a gazing globe in the other.

EVERGREENS AND GRASS ADD TO GENERAL EFFECT

The public building grounds, which include the administration building and dormitory, will be developed with a base planting of broad-leaved evergreen shrubs. Evergreen conifers and deciduous shade trees will be arranged in a naturalistic manner through the grounds.

The lots at the ends of the long blocks on the south side of Wyoming Street are to be planted with grass, shrubs, and deciduous trees. Many other small parks at street intersections will be planted in similar manner.

Wilbur Square, located between Park and Colorado Streets, will have an informal development, with large lawn areas, well shaded with deciduous trees. Around each Government residence will be planted broad-leaved evergreen and deciduous shrubs and four to six shade trees of different varieties.

Upon examination of the particular characteristics of the types and varieties of trees and shrubs selected for planting in Boulder City, it will be noted that all possess a thick leathery leaf. This characteristic leaf, like the thick hide of the cactus, allows less evaporation than other more succulent types. Preceding selection of these plants, recommendations and advice were received from nurserymen who had made successful plantings in regions of similar climatic and soil conditions, as at Hawthorne, Nev.; Palm Springs, Calif.; and Phoenix, Ariz. All shrubs and trees chosen for planting in Boulder City have been successfully grown under similar conditions in other localities.

An analysis of the soil in Boulder City was made by the Anaconda Copper Co. in its laboratories at Conda, Mont. The report of this analysis stated that humus was the principal constituent needed for successful plant growth and that alkali did not occur in harmful quantities.

The cottonwood tree, so common to the desert, will not be used in Boulder City, for, although it grows rapidly and withstands desert conditions extremely well, it is objectionable on account of the cotton it produces and its expansive root system which tends to destroy other vegetation growing near it.

SPRINKLING SYSTEMS TO BE INSTALLED

Plans have been made to install complete sprinkling systems in the four plazas, around the municipal building, in Wilbur Square, and on the grounds which include the administration building and dormitory. The Government will maintain all parks and will supervise and control the irrigation and care of all other

plantings. Individuals will be expected to maintain the trees and shrubs around the dwellings and in the parking between the sidewalk and street in front of the residences and to plant and maintain grass in these locations. The Government has suggested that Kentucky bluegrass, clover, and rye be planted where sprinkler systems are installed and that meadow fescue, chewing fescue, and rye be planted where ordinary watering methods are employed.

The planting program was initiated in the southwest section of Boulder City, in the Six Companies' residential area, where grading of grounds and parking areas had been completed. The proposed order of planting is from south to north and is planned to include the various parts of the town in the following succession: Six Companies' residential and industrial areas, central business district, four plazas, municipal building, Wilbur Square, Government residences, and grounds surrounding the administration building and dormitory. In several places on the upper and northerly slopes of the town a 1-foot blanket of soil is being imported to cover the rocky and barren surface in that section.

Although the intense heat of the desert climate is not comfortable to the people living there, it is conducive to a rapid plant growth when the proper amount of moisture is provided to compensate for the additional evaporation. It is contemplated that as a result of the planting now being done the glare and heat will be somewhat alleviated in the first year, some shade will be furnished within two years, and that the shade from adjacent trees will meet within four years.

Orland Sets Example for All Irrigation Districts

The Orland project reports that the Orland Unit Water Users' Association has decided to publish the minutes of each board meeting in the Orland Register, a local newspaper, the editor of which has offered to print these notices without charge.

THE Third Annual Young Farmers' Conference, sponsored by the agricultural committee of the Yakima Chamber of Commerce, was well attended. The conference was divided into seven groups and the discussions centered on lower production costs. Since the inception of these conferences exceptional interest has been shown and reports indicate that they are most valuable to the valley's agricultural activities.

Articles on Irrigation and Related Subjects

Cragin, C. C.:
- Hydro-electric power development as an aid to irrigation, illus. (Review of March Proceedings.) Civil Engineering, March, 1932. Vol. 2, No. 3, pp. 208, 209.

Dill, Dr. D. B.:
- Effects of heat on workers to be studied at Hoover Dam. U. S. Daily, Feb. 29, 1932, Vol. 6, p. 1 (p. 2927).

Engineering News-Record:
- Hoover Dam notes. Eng. News-Record, February and March, 1932, Vol. 198, pp. 267, 300, 335, and 380.
- Colorado River Aqueduct bond issue is again upheld (short). Eng. News-Record, Feb. 18, 1932, Vol. 108, p. 265.

Grunsky, C. E.:
- Comments on a few dams and reservoirs. Reprints from Military Engineer, September–October, 1930, and May–June, 1931. 32 pages. (Includes Belle Fourche, Shoshone, Cold Springs, Arrowrock, Elephant Butte and Laguna Dams.)

Hyatt, Edward:
- State water plan for California. Southwest Builder and Contractor, February 19, 1932, Vol. 79, p. 33.

Hyatt, Edward, Pres.:
- Proceedings of Fourth Annual Conference of the Association of Western State Engineers, Oct. 28–30, 1931, Sacramento, Calif. (Mimeographed, with index, 277 pages.)

King, Joe:
- First year of Boulder Dam, illus. Washington Sunday Star, Feb. 28, 1932. Feature section, page 3.

Mead, Elwood:
- Hoover Dam work ahead of schedule. U. S. Daily Feb. 18, 1932, Vol. 6, pp. 1 and 8 (pp. 2855 and 2862).
- Federal Reclamation. The Washington Spectator, Feb., 1932, vol. 1, No. 1, pp. 16–20.
- Development of machines for irrigation works. U. S. Daily, Mar. 3, 1932, Vol. 6, p. 8 (p. 2958).

Rohwer, Carl:
- Evaporation from free water surfaces, illus. Dept. of Agri. Tech. Bull. No. 271, December, 1931, 96 pages. (Includes observations at East Park Reservoir and data on projects at Yuma, Deer Flat and North Platte.)

Rose, Howard B.:
- Here's status of Metropolitan Aqueduct, illus. Western Highways Builder, February, 1932, fourteenth year, pp. 22–23.

Sanders, S. J.:
- Hoover Dam progress notes, illus. Western Construction News, Feb. 10, 1932, vol. 7, pp. 75–77.

U. S. Daily:
- State engineers discuss use of North Platte River (short). U. S. Daily, Mar. 5, 1932, vol. 7, p. 3 (p. 11).

Vivian, C. H .:
- Construction of the Hoover Dam, illus. Compressed Air Magazine, Mar., 1932, vol. 37, No. 3, pp. 3742–3748.

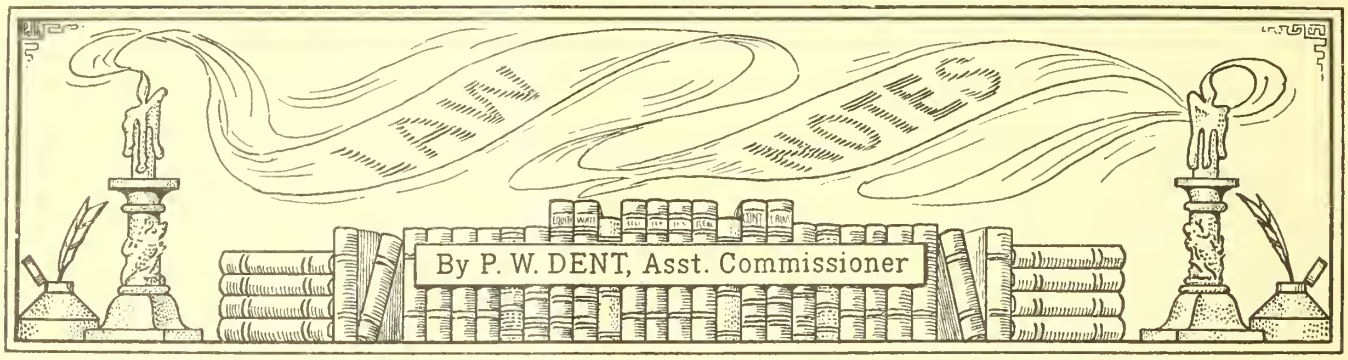
Walter, R. F.:
- Bureau of Reclamation Construction Program, Portraits of 11 Engineers in Denver and Field, Western Construction News, Jan. 10, 1932, v. 7, No. 1, pp. 19–21 and p. 3.
- Reclamation projects. Table of current and proposed appropriations and feasibility of Columbia Basin project. Pacific Builder and Engineer, Mar. 5, 1932, vol. 38, No. 10, pp. 49 and 50.

Western Construction News:
- Bids on Prosser Dam and Power Plant, Yakima project, Western Construction News, Jan. 10, 1932, v. 7, p. 38.

Western Highways Builder:
- Two tunnels holed through on Boulder project. Western Highways Builder, February, 1932, fourteenth year, p. 25.

Wilbur, Ray Lyman:
- Findings of President Hoover's Conference on Home Building. The Architect and Engineer, Feb. 1932, vol. 108, No. 2, pp. 43–46.
- Mr. Wilbur advocates bureau (including Reclamation) grouping for Federal construction. U. S. Daily, Mar. 11, 1932, vol. 7, pp. 1 and 5 (pp. 51 and 55).
- Land conservation on public domain in West is urged. (Book on Conservation) U. S. Daily, Jan. 27, 1932, v. 6, p. 4 (p. 2678).
- Natural Resources (Review of "Conservation in the Department of the Interior"). N. Y. Times, Book Review, Feb. 17, 1932, p. 13.

Every project served by the Bureau of Reclamation was originally a treeless plain. There is no possible outlay of time and money that can add so much to the value, the attractiveness of the country, protect it from winds, cold, and sun, and contribute to the comfort of its people as the planting of trees has always done and always will do.



Summary of Session Laws of Colorado, 1931, of Interest from Viewpoint of Federal Reclamation[1]

By Armand Offutt, District Counsel, Denver, Colorado

CHAPTER 14. *Defense and conservation of water resources of State.*—H. B. 553 (approved and effective May 23, 1931). Appropriates $10,000 for the purpose of paying expenses of the executive department of the State incurred in protection of waters of natural streams of the State and in maintaining the right of appropriation and use of such waters for beneficial purposes within the State and incurred in making investigations for such purposes and in preparing for the defense, defending and protecting certain rights, suits, and actions or any of them, with respect thereto, and to meet the expenses of any suit which may have been or shall be brought and prosecuted by any other State or by the citizens of any other State against the State of Colorado or its citizens or the expenses incident to the prosecution of any suit which has been or may be instituted by the State of Colorado for the protection of the right to the use of the waters of the State for domestic, irrigation, power, or other purposes wherever threatened, and for the purpose of defraying the expenses of the State and the compensation and expenses of the commissioner for Colorado and his assistants in preparing for or participating in any interstate commission authorized or appointed for the purpose of negotiating interstate compacts or agreements respecting the use and disposition of the waters of Colorado streams or for the purpose of paying any cost incident to any interstate river controversy involving the waters of Colorado streams.

By the same act there was also appropriated the sum of $65,000 for the purpose of compiling data and making investigations concerning the waters of the Laramie, Colorado, Rio Grande, and Arkansas Rivers and their tributaries, and for the expense of prosecution of any suit or action pending or which may be brought by the State of Colorado or any other State or citizens thereof relative to the use of the waters of such rivers for domestic, irrigation, power, or other purposes.

It is provided in the act that if it shall be found that either of the respective funds is insufficient to cover the expenses for which appropriated and there shall be a surplus in some other fund, then and in that event the auditor, upon the joint direction of the governor, the State engineer, and the attorney general, shall transfer moneys, so far as necessary, from such fund or funds having a surplus to such fund as may have a deficit.

Section 21 of chapter 70. Concerning corporations.—S. B. 297 (approved and effective May 12, 1931) amends section 2364, Compiled Laws of Colorado, 1921, relating to renewal of corporate life of ditch and reservoir companies, so that the section referred to shall read as follows:

"SECTION 2364. Whenever the corporate life of any such ditch or reservoir company has expired or is about to expire, as aforesaid, the stockholders of such company may vote upon the question of extending the life of such corporation for another twenty years, or for any other term provided by statute therefor, by first giving notice of such intention by publication, for two successive weeks, in the newspaper printed nearest the place where the principal operations of said company are carried on. Such notice shall be signed by stockholders owning at least ten per cent (10%) of the entire capital stock of said company, and shall state the place where and the time when the question of renewal shall be submitted to the votes of the stockholders of said company, at the meeting held in pursuance of such notice, provided a majority of the stock of the corporation be represented. The votes shall be taken by ballot and each stockholder shall be entitled to as many votes as he owns shares of stock in said company, or holds proxies therefor; and if a majority of the votes cast shall be in favor of a renewal of the corporation, the president and secretary of said company shall, under the corporate seal of said company, certify the fact, and shall make as many certificates as may be necessary, so as to file one in the office of the recorder of deeds in each county where they may do business, and one in the office of the secretary of state; and thereupon the corporate life of said company shall be renewed, upon filing the declaration aforesaid, and all stockholders shall have the same rights in the renewed corporation as they had in the company as originally formed: *Provided,* Upon filing such certificate such corporation shall pay to the secretary of state a fee of three dollars fifty cents ($3.50), and such fee shall entitle the corporation to receive a certificate from the secretary of state as evidence of the filing of such certificate of renewal."

Chapter 73. Water users' associations.—H. B. 13 (approved and effective February 13, 1931), provides that, where any water users' association organized under the laws of the State of Colorado has entered into, or proposes to enter into, a contract with the United States for the payment by the association of construction and other charges of a Federal reclamation project constructed or under construction within the State, and where funds for the payment of such charges are to be obtained by the association from assessments levied upon the stock of such association and constituting liens upon the lands of such stockholders, the association, in any case where the contract or proposed contract would modify or affect any individual contracts between the

[1] To be continued in May issue.

United States and such stockholders or between the association and such stockholders may file in the district court in the county wherein is situated the office of such association a petition entitled "——— Water Users' Association against the stockholders of said association and the owners and mortgages of land within the ——— Federal reclamation project." No other or more specific description of the defendants shall be required. In the petition it may be stated that the association has entered into or proposes to enter into a contract with the United States, to be set out in full in the petition, with a prayer that the court find said contract to be valid, and a modification of any individual contracts between the United States and the stockholders of the association or between the association and its stockholders, so far as such individual contracts are at variance with such association contract. Thereupon a notice in the nature of a summons shall issue under the hand and seal of the clerk of the court, stating in brief outline the contents of the petition and showing where a full copy of the contract or proposed contract may be examined, such notice to be directed to the defendants under the same general designations, which shall be deemed sufficient to give the court jurisdiction of all matters involved and parties interested. Service shall be obtained (*a*) by publication of such notice as in the case of publication of summons in an action to quiet title to real property, and (*b*) by the posting of the notice and a complete copy of the said contract or proposed contract in the office of the association, and at three other public places within the boundaries of such Federal reclamation project. Any stockholder in the plaintiff association, or owner, or mortgagee of land within the Federal reclamation project affected by the contract proposed to be made by the association may demur to or answer the petition within 20 days or such further time as may be allowed by the court. The failure of any person affected by the contract to answer or demur shall be construed, so far as such person is concerned, as an acknowledgment of the validity of the association contract and as a consent to the modification of the said individual contracts with the association or with the United States to the extent that such modification is required to cause the individual contracts to conform to the terms of the contract or the proposed contract between the plaintiff and the United States. All persons filing demurrers or answers shall be entered as defendants in the case and their defenses consolidated for hearing or trial. Upon hearing the court shall examine all matters and things in controversy and shall enter judgment and decree as the case warrants, showing how and to what extent, if any, the individual contracts of the defendants or under which they claim are modified by the association contract or proposed contract with the United States. In reaching his conclusions the court shall follow a liberal interpretation of the law and shall disregard informalities or omissions not affecting the substantial rights of the parties, unless it is affirmatively shown that such informalities or omissions led to a different result than would have obtained otherwise. The Code of Civil Procedure shall govern matters of pleading and practice as nearly as may be. Costs may be assessed or apportioned among contesting parties, in the discretion of the court. Review of the judgment of the district court by the supreme court may be had as in other civil causes.

It is further provided, in section 2 of the act, that any water users' association now organized under the laws of the State may amend its articles of incorporation so as to extend the life of such association to any date not later than one hundred years from the date of approval of the act.

Section 3 of the act provides that any acts or parts of acts inconsistent with the present act are repealed.

Chapter 88. Drainage districts.—S. B. 283 (approved and effective April 11, 1931). This chapter amends section 2188, Compiled Laws of Colorado, 1921, relating to payment of bonds of drainage districts, and is as follows:

"SECTION 2188. Said bonds and the interest thereon shall be paid from annual assessments upon the real property within the drainage district, and the real property within the district shall be and remain liable to be assessed for such payments as herein provided: *Provided*, Such bonds and coupons shall be receivable in payment of the assessments levied in payment of the interest and the redemption of the bonds."

Chapter 109. Irrigation districts.—H. B. 501 (approved May 21, 1931). Amends section 1963, Compiled Laws of Colorado, 1921, relating to elections in organization of irrigation districts under the irrigation-district act of 1905, and is as follows:

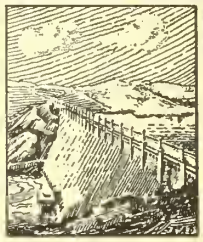
"SECTION 1963. The board of county commissioners shall thereupon cause a notice embodying said orders in substance signed by the chairman of the board of county commissioners and the clerk of said board to be issued, given, and published, giving public notice of said election, the time and places thereof, the matters submitted to the vote of the electors; said notice and order shall be published once a week for at least four weeks prior to such election in a newspaper of general circulation in said county, and if any portion of such proposed district lies within any other county or counties, then such order and notice shall be published in a newspaper of general circulation published within each of said counties. No election, the purpose of which is to issue bonds or purchase sites, water rights, reservoirs, or rights of way, shall be held, nor shall any bonds be issued or purchased or contract of purchase be made for reservoirs, water rights, sites, or works before or until the board of directors shall have submitted to the State engineer a complete and detailed plan of the project and complete and detailed information of the property to be leased or purchased; and any other information required by the State engineer and decision rendered by him as to the feasibility of the project. No election thereon shall be held nor purchase contract or lease made until sixty (60) days have expired after the rendition of such decision by the State engineer.

"At all elections held under the provisions of this act every owner or entryman of agricultural or horticultural land within said district, over the age of twenty-one years, who is a citizen of the United States, or has declared his intention to become a citizen of the United States, and is a resident of the State of Colorado, and who shall have paid property taxes upon real property located within said district during the calendar year preceding any such election shall be entitled to vote at such election in the precinct where he resides, or, if a nonresident of the precinct, then in the precinct within which the greater portion of his land is located; and any such person so qualified to vote, and who shall reside in any county into which said district shall extend, shall be eligible to election as a director in and for the division in such district in which he is entitled to vote. All lands platted or subdivided into residence or business lots shall not be considered agricultural or horticultural land. The ballots to be used and cast at such election for the formation of such district shall be substantially as follows: 'Irrigation district—Yes,' and 'Irrigation district—No,' or words equivalent thereto, and shall also contain the names of the persons to be voted for as members of the board of directors of said district; each elector may vote for three directors, one from each division, and shall indicate his vote by placing a marginal cross upon the ballot for or against any question submitted or name voted upon and opposite thereto at any election held under this act."

Chapter 110. Irrigation districts.—H. B. 502 (approved May 21, 1931). Amends section 2096, Compiled Laws of Colorado,

(Continued on p. 78)

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Dams—High, Large, and Unusual

(Part 3.—Foreign Countries)

By P. I. Taylor, Associate Engineer, Washington Office, Bureau of Reclamation

SWITZERLAND still retains the honor of having the highest dam outside of the United States and the second highest dam in the world. In 1931 the Spitallamm power dam, near Handeck, in Canton Berne, was completed with a maximum height of 374 feet above foundation, which is only 15 feet lower than the Diablo in the State of Washington. It is of the arch-gravity type, 846 feet long, and contains 445,000 cubic yards of concrete. This dam is a part of the Oberhalsi power project on the Aare River. Another notable Swiss dam is the Schraeh or Waeggital, which is 216 feet high above stream bed and 362 feet above the lowest part of the foundation. This structure was completed in 1924 as a part of a project to develop power for the city of Zurich. It is a straight gravity structure of triangular cross section 511 feet in length, with a base width of 246 feet, and contains 309,000 cubic yards of concrete. It was necessary to excavate 146 feet below the river bed in order to obtain a satisfactory foundation. No interior drainage was provided in this structure.

FRANCE BUILDS 446-FOOT DAM

The Forces Motrices Bonne et Drac is now building the Sautet power dam on the Drac River near Mens, France, which will have a maximum height of 446 feet and overtop the Spitallamm by 72 feet. This French dam, which will be 41 feet higher than the Owyhee in Oregon, is a thin concrete constant-angle arch with a crest length of 262 feet, which narrows to 82 feet at the base. At the crest the structure is 10 feet thick and only 56 feet at the base. The dam contains only 78,000 cubic yards of concrete, or about 14 per cent of the volume of concrete in the 405-foot Owyhee Dam. A section of the extremely narrow canyon in which this dam is being built shows that the lower two-thirds of the canyon has an average width of about 40 feet, which is being widened to an average width of 100 feet to accommodate the structure. About 400 feet downstream is an auxiliary dam 121 feet in height.

France at the present time is engaged in building a number of water-power projects which involve the construction of high masonry dams. These include nine over 200 feet in height, of which the 446-foot Sautet will be the highest. Another important structure is the Chambon Dam under construction on the Romanche River in the French Alps, which will have a maximum height of 394 feet and contain about 379,000 cubic yards of concrete. A third dam of extreme height is the Sarrans, a 377-foot concrete arch now being built near Orlhaguet on the Truyere River. All three of these dams will exceed in height the 374-foot Spitallamm and 362-foot Schraeh dams in Switzerland, the last named having the distinction up to 1931 of being the highest dam in the world outside of the United States, but now being overtopped by the Spitallamm, completed last year. The French are building a 305-foot dam in Algeria, known as the Oued Fodda (Fodda River), which is a straight gravity concrete structure. It will store water for irrigation and is estimated to cost $4,400,000. Up to 1926, France had only one high dam, the 200-foot Eguzon, and another under construction, the 279-foot Chavanon.

SPAIN, GERMANY, ITALY

In Spain there are several dams which closely follow the Spitallamm and Schraeh Dams in height, including the 333-foot Camarassa and the 328-foot Talarn (San Antonio), both of the arch-gravity type; also the recently completed Esla Dam, which has a maximum height of 328 feet. The Camarassa Dam is located in the Pyrenees Mountains in northern Spain on a water-power project and is a concrete masonry structure. On the crest are two automatic gates for discharging flood waters, each 88 feet by 22 feet. The Talarn Dam stores water for both power and irrigation uses. It was completed in 1917 by the Ebro Irrigation & Power Co. There is no information available regarding the Esla Dam, except its height.

The highest dam in Germany is the 215-foot Schwarzenbach built in 1925–26 for power development and flood control, while the largest is the Ottmachau, an earth-fill structure completed in 1931 and containing 8,890,000 cubic yards. Belgium has two well-known dams, the Gileppe, a stone arch 162 feet in height, and the 179-foot Robertville Dam, a concrete arch, completed in 1930 for power development. There are six power dams in Norway over 100 feet in height, of which the 148-foot Solbergfoss is the highest. The highest dam in Austria is the Vermunt, a 164-foot structure completed in 1930 and located in Vorarlburg.

Italy has a number of high dams, most of them built for power development. We have record of 16 with maximum heights of 200 feet or over, but only one, the Salvatore, over 300 feet in height. The 283-foot Suviana Dam noted in Transactions A. S. C. E. 1924, page 398, is the highest multiple-arch dam in the world, overtopping the Lake Pleasant in Arizona by 27 feet. The 239-foot Tirso multiple-arch dam in Sardinia, Italy, is distinctive in that its buttresses are built of cut-stone masonry. Information concerning Italian dams could not be obtained from governmental sources because of objections made by the Ministry of War.

In Japan there are three power dams over 200 feet in height, of which the highest is the 260-foot Komaki, a concrete structure of the curved gravity type in Toyama, built by the Shokawa Hydroelectric Co. The length along the crest is 1,000 feet and the volume of concrete is 400,000 cubic yards.

There is mention in the technical press of a new high dam in New South Wales, Australia, the Warragamba, a 310-foot constant-radius concrete arch, but information concerning the structure is not available. The Burrinjuck Dam on the Murrumbidgee River is one of the best known structures in Australia. It is 247 feet high, built of concrete, of the curved-gravity type, and was completed in 1927. The dam forms a storage reservoir for the Murrumbidgee irrigation project. The city of Sydney, New South Wales, in

constructing a water supply system, has built three high dams, the 230-foot Avon, 182-foot Cordeaux, and 154-foot Cataract. There is also under construction the Nepean Dam, which will have a maximum height of 219 feet, and the Woronora Dam, which will be 249 feet high. Both of these structures are of the curved gravity type.

The highest dam in India is the Bhandardara on the Pravara River, which was completed in 1926. It is 282 feet high, 1,663 feet long, and is a concrete straight gravity structure. Another noted Indian dam is the 239-foot Mettur on the Cauvery River, in the Madras Presidency. It is a straight gravity structure with the same section as the New Croton, of the New York City water supply system. Probably the best known dam in India is the Lloyd, on the Yelwandi River, near Poona, an irrigation structure 190 feet in height, with a crest length of 5,333 feet and containing 800,000 cubic yards of concrete masonry.

CHILE AND MEXICO

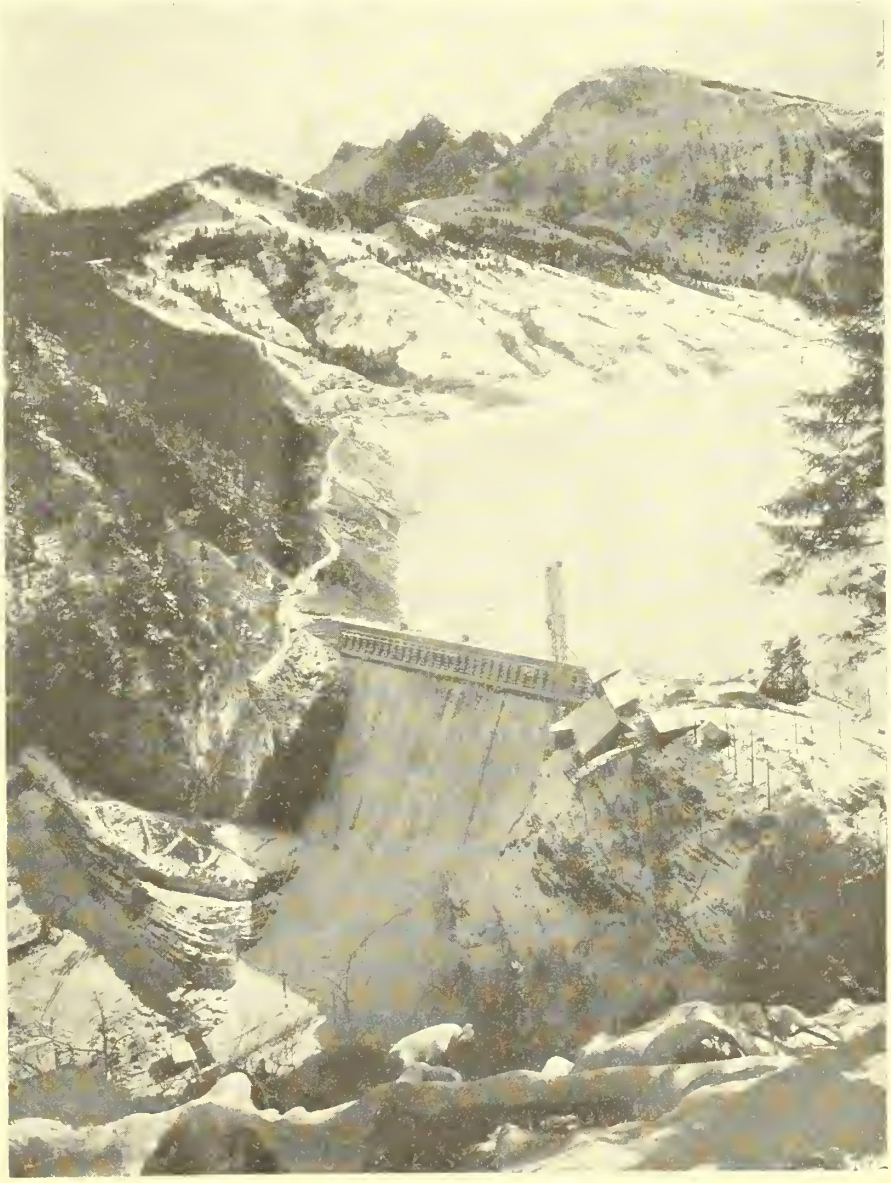
Under a national reclamation act, Chile has planned the construction of a number of storage dams, most of which are of the rock-fill or earth-fill type, while others are of the Ambursen, or flat-slab, reinforced-concrete type. The Cogoti Dam will be 248 feet in height and is designed to be earthquake-resisting. The main fill is composed of 1,081,000 cubic yards of dumped rock, with a thick surface fill of gravel and a laminated concrete pavement. From the natural slope of the main fill, an auxiliary stone fill, the gravel fill, and the pavement each have increasingly flatter slopes. Other high dams included in the Government program are the 207-foot Pachica Dam now under construction, the Puente Negro Dam, a 200-foot hollow reinforced concrete (Ambursen) structure, and the 200-foot Choapa Dam, also of the Ambursen type. Venezuela has only one structure of any considerable height, the 108-foot Petaquire power dam, owned by the Cia. de Electricidad de Caracas.

Mexico is also engaged in extensive irrigation work and in 1928 completed the President Calles Dam in the State of Aguascalientes. It is a concrete variable-radius overhung arch with gravity abutments; height 215 feet, crest length 928 feet, which includes 192 feet of spillway. The Don Martin is another irrigation dam in the State of Coahuila, a concrete-faced earth embankment, 131 feet high, 3,231 feet long, with a concrete round-head buttress spillway section 768 feet in length. In volume the dam contains 1,630,000 cubic yards of earth and 144,000 cubic yards of concrete. The Don Martin cost $5,500,000 and was completed in 1930. The highest dam in Mexico is the Boquilla, a concrete power dam of the straight gravity type, which was completed in 1914. It has a maximum height of 261 feet, and the length along the crest is 840 feet. An interesting dam of the Ambursen type now under construction is the Rodrigues on the Tia Juana River about 11 miles south of the international boundary. It will be 256 feet high, 2,400 feet long, and will store water for both irrigation and domestic water supply. This Mexican dam is the highest Ambursen type structure in the world.

CANADIAN POWER DAMS

Canada has an important hydroelectric power development project under construction on the Abitibi River in northern Ontario, about 100 miles southwest of Moose Factory. The Abitibi Canyon Dam will have a maximum height of 250 feet above the river bed, and the combined crest length of the nonoverflow, power-house, and spillway sections is 850 feet. There will be a water head of 210 feet, and the power-house installation includes five 66,000-horsepower vertical turbines and five 48,500-kilovolt-ampere generators. To divert the river around the construction work it was necessary to excavate two tunnels, each 30 feet in diameter and 1,200 feet long. It is estimated that the project will cost $23,000,000.

The Ruskin power dam near Vancouver, British Columbia, is the highest dam in Canada. It is a concrete gravity structure with a maximum height of 190 feet, of which 35 feet is due to Taintor gates. It is a part of the Alouette-Stave-Ruskin development of the Western Power Co. of Canada (Ltd.), which required the construction of four dams. The Chats Falls power dam on the Ot-



Schraeh Dam in Switzerland

tawa River, 40 miles north of Ottawa, Canada, has a total length along the crest of 12,100 feet, the second longest dam on record. Another lengthy structure is the Great Falls power dam in Manitoba, with a crest length of 4,489 feet.

LARGE FOREIGN DAMS

In August, 1931, the German Government completed the Ottmachau earth-fill dam on the Neisse River in Silesia, which was started in 1927 to provide work for the unemployed. It is only 56 feet high, but is 21,326 feet, or a little over 4 miles, in length and contains 8,890,000 cubic yards of earth, which ranks it as the largest of foreign dams and the longest dam in the world. As far as available records show, there are only two larger dams, the Gatun in the Canal Zone and the Saluda in South Carolina.

We go to Japan to find the second largest dam outside of the United States, surpassed in size only by the Ottmachau in Germany, namely, the Kandenkei Dam, which stores water for the irrigation of the 360,000-acre Kanan project on the island of Taiwan. This immense embankment contains 6,720,000 cubic yards of earth. It crosses the Manden River in the Kandenkei Valley. The height is 184 feet and the crest length 4,174 feet, with a top thickness of 30 feet and base thickness of 994 feet. A concrete core extending 24 feet below and 65 feet above the river bed has a thickness of 5 feet at the base and 2 feet at the top and contains 31,000 cubic yards. The inner and outer slopes are 1 in 3 for the lower section, 1 in 2½ for the middle section, and 1 in 2 for the upper section. Earth and rubble used in construction were brought by railroad a distance of 10 miles, dumped, and placed by the hydraulic process. There is a 14-foot diameter outlet structure, a combination tunnel-culvert, with two large iron pipes at the outlet end. Flow of water is regulated by a butterfly valve in the tunnel and needle valves at the pipe ends. The dam cost $9,240,000 and was completed in 1930. In December of that year Taiwan was visited by a number of earthquakes unprecedented in violence. This caused a slide of several thousand cubic yards of material from the upper face of the dam into the reservoir and radiating cracks appeared over the entire surface of both upstream and downstream slopes. The reservoir was then drained and the structure repaired at a cost of about $250,000.

ASSUAN DAM RAISED TWICE

Every one has heard of the famous Assuan Dam on the Nile River in Egypt, built by the Egyptian Government. It was completed in 1902, enlarged and raised 16 feet in 1907, and in 1930 work was begun on a second enlargement and raising the structure an additional 33 feet. The completed dam will have a maximum height of approximately 144 feet. Its length along the crest is 6,398 feet, comprising a solid masonry section of 1,800 feet, and a 4,598-foot sluiceway section, with 180 sluiceways and a lock. Before the second raising the volume of masonry in the structure was 1,203,268 cubic yards. The dam is constructed of granite rubble masonry laid in Portland cement mortar, faced with square granite blocks laid in courses. When completed to its ultimate height it is said that the dam will store 4,360,000 acre-feet of water.

The Mettur Dam on the Canvery River in the Madras Presidency, India, is the largest masonry dam in the world, its 1,850,000 cubic yards of concrete exceeding in size both the Wilson Dam in this country and the Assuan Dam in Egypt. This huge structure is of the straight gravity type, 239 feet high and 5,300 feet long. The capacity of the reservoir back of the dam is 2,150,000 acre-feet. The Sarrans Dam, now under construction in France, will be the largest foreign dam of the arch-gravity type, with 585,000 cubic yards of concrete masonry.

The Sennar Dam in the Egyptian Sudan and the Tansa Dam in India are notable because of their extreme length, being 9,925 and 8,800 feet long, respectively. In India there are two Lloyd dams, one at Bhatgar, on the Yelwandi River, in Bombay Deccan, and the other at Sukkur, in Sind, on the Indus River. The latter dam, which was dedicated on January 13, 1932, has a masonry floor with an overbridge of 66 spans, each 60 feet wide, and the spillway section is designed for a discharge capacity of 1,500,000 cubic feet per second. The Lloyd (Sukkur) barrage is nearly a mile in length and with its gates closed will divert water into a distribution system comprising 6,400 miles of canals. Of the seven main canals, one has a greater width than the Panama Canal and two are wider than the Suez Canal. The canal system involved the excavation of 211,000,000 cubic yards of earth, enough material to build a road 20 feet wide, 2 feet above ground, and 26,000 miles in length. The total cost of the entire project is $73,000,000 and the area benefited is 5,000,000 acres, including 1,500,000 acres of virgin soil, the project area being as large as the State of Massachusetts. Of the foreign dams, the Necaxa No. 2 in Mexico, located 100 miles northeast of Mexico City, is now the third largest earth-fill dam. It is 190 feet in height, has a crest length of 1,220 feet and contains 2,300,000 cubic yards placed by the hydraulic-fill method. The widths are 54 feet on the top and 975 feet at the base. During construction about 700,000 cubic yards of the upstream portion of the embankment slid into the reservoir, which was empty at the time. This break was successfully repaired.

The River Murray Commission, of the Australian Government, is completing a huge project near Albury, New South Wales, on the Murray River. The Hume Dam of this project has a concrete spillway section and earth embankment, with a combined crest length of 5,300 feet. Because of lack of funds the structure is now being built only to a height of 180 feet to store 1,250,000 acre-feet. The dam when completed will be 200 feet high and will contain 533,000 cubic yards of concrete and 3,900,000 cubic yards of earth. Ultimate reservoir capacity will be 2,000,000 acre-feet. The estimated cost of the project is $17,500,000.

Chile has begun the construction of several large earth-fill dams, all for the purpose of storing water for irrigation. The public works program of the Ibanez administration included the construction of a number of dam projects. However, at the present time work has been discontinued and it is not known when operations will be resumed. The Recoleta Dam, now partly constructed in the Province of Coquimbo, will be 148 feet high, 2,952 feet in length, and contain 2,120,300 cubic yards of earth. It is an earth embankment with clay core and reinforced concrete facing on the upstream slope. Not only will it be the largest dam in Chile, but in all South America. Other Chilean dams of exceptional size are the 207-foot Pachica Dam, now being built in the Province of Terapaca with its 1,716,000 cubic yards of material, and the 98-foot Lautaro Dam, in the Province of Atacama, which will have a crest length of 2,657 feet and a volume of 1,177,000 cubic yards. The 248-foot Cogoti Dam will be the highest rock-fill dam outside of the United States and also the largest, with a fill containing 1,081,000 cubic yards.

UNUSUAL CONSTRUCTION FEATURES

In Greece is to be found an unusual dam, the Marathon, an arch-gravity type, concrete masonry structure, faced with mosaic marble, the only structure of its kind in the world. It is 177 feet in height above stream bed and 935 feet in length. The dam was completed in 1930 to store water for the city of Athens water-supply system. The concrete was made from marble found near the work, finely crushed marble being used in place of sand.

An interesting feature of the construction of the Schraeh Dam in Switzerland was the building of the body of the dam before the foundation. The main foundation rock is from 80 to 100 feet below

stream bed, while an inner gorge of crushed rock descended 50 feet farther. Excavation for the dam was carried down only to the top of the inner gorge, where an arch was built across, abutting against its vertical walls. Above this arch concrete for the body of the dam was placed. Afterward the inner gorge under the dam was entered by a shaft and tunnel, cleaned out to solid rock, and filled with concrete through shafts which had been left in the dam.

The Moehne Dam in Germany, on the Moehne River, a tributary of the Ruhr, located near Guenne, in the Soest district, is a power dam of the arch-gravity type, 132 feet high, with the extreme crest length of 2,132 feet, and is built of concrete masonry.

TABLE 3.—*High dams in foreign countries*

Name	Location	Year completed	Purpose [2]	Type	Maximum height	Crest length	Volume
					Feet	*Feet*	*Cubic yards*
Sautet	France	(1)	P	Concrete, gravity, curved	446	262	78,000
Chamhon	do	(1)	P. & F. C	do	394	964	379,320
Sarrans	do	(1)	P	Arch gravity	377		585,000
Spitallamm	Switzerland	1931	P	do	374	846	445,000
Schraeh	do	1924	P	Concrete, gravity, straight	362	511	309,000
Camarassa	Spain	1920	P	Concrete, gravity, curved	333	460	283,140
Talarn	do	1917	Irr. & P	do	328	676	352,000
Esla [3]	do		P		328		
Salvatore [3]	Italy				310		
Warragamba	New South Wales			Constant radius concrete arch	310		
Oued Fodda	Algeria	(1)	Irr	Concrete, gravity, straight	305	656	338,000
Jandula	Spain	1930	P		295		
Dixence	Switzerland	(1)	P		285	1,476	
Suviana	Italy		P	Multiple arch	283	590	340,000
Bhandardara	India	1926	Irr	Concrete, gravity, straight	282	1,663	444,444
Burquillo	Spain	1930	P		279		
Chavanon	France	1927		Concrete, gravity	279		
Montejaque	Spain	1924	P	Variable radius concrete arch	273	256	35,000
Pont de Brion	France	(1)	P	Arch	[4] 266		
Grimsel	Switzerland	1921	P	Concrete, gravity, curved	266		
Castillon	France	(1)	P	Arch	[4] 262		
Mareges	do	(1)	P. & F. C	Arch, concrete	[5] 262		
Boquilla	Mexico	1914	P	Concrete, gravity, straight	261	840	390,000
Komaki	Japan		P	Concrete, gravity, curved	260	1,000	400,000
Barherine	Switzerland	1925	P	do	259	933	269,000
Rodriguez	Mexico	(1)	Irr. & W. S	Hollow reinforced concrete (Ambursen)	255	2,400	300,000
Ahitihi Canyon	Canada	(1)	P	Nonoverflow and spillway sections, concrete	[4] 250	850	
Prince Alfonzo	Spain	1914	P	Concrete arch	249	492	
Woronora	New South Wales	(1)	W. S	Concrete, gravity, curved	249	1,343	376,520
Cogoti	Chile		Irr	Rock fill, gravel slope, concrete paving	248		1,081,000
Burrinjuck	New South Wales	1927	Irr	Concrete, gravity, curved	247	765	320,000
Camplicciolli	Italy	1929	P	Concrete, arch-gravity	246	1,830	316,000
King River	New South Wales			Constant radius concrete arch	240		56,675
Cardanello [3]	Italy				240		
Soyama	Japan		P	Concrete masonry	240	379	
Tirso	Italy	1923	P	Multiple arch, stone masonry buttresses	239	930	221,000
Mettur	India	(1)	Irr	Concrete, gravity, straight	239	5,300	1,850,000
Monte Spluga [3]	Italy				[6] 236		
Chorro [3]	Spain				236		
St. Pierre	France	(1)	P	Arch	[4] 230		
Avon	New South Wales	1926	W. S	Concrete, gravity, curved	230	690	214,000
Chaudanne	France	(1)	P	Arch	[4] 230		
Castrola	Italy		P	Multiple arch	226	680	
Maddon	Panama	(1)	F. C. & P	Concrete, gravity, straight	220	950	489,000
Mesce	Italy	1917		Concrete, arch-gravity	[7] 220		117,000
Nepean	New South Wales	(1)	W. S	Concrete, gravity, curved	219		
Barasona [3]	Spain				217		
President Calles	Mexico	1928	Irr	Variable radius arch, gravity abutments	215	[8] 928	60,000
Schwarzenbach	Germany	1926	P. & F. C	Concrete, gravity, curved	215	1,246	387,000
Poco dos Paus	Brazil				214	1,970	780,000
Foradada [3]	Spain				213		
Bleiloch	Germany	1932	P	Arch-gravity	213	738	228,000
Ghrib	Algeria	1932	Irr	Rock fill, concrete facing upstream	213		817,500
Arapuni	New Zealand	1930	P		210		
Pachica	Chile	(1)	Irr		207	1,312	1,716,000
Vado [3]	Spain				207		
Nathan	New South Wales			Constant radius concrete arch	205		110,000
Taishakugawa	Japan		P	Concrete masonry	205	125	
Bullileo	Chile		Irr	Earth fill	204	716	
Mauer	Germany	1912	F. C. & P	Arch-gravity	203	918	327,000
Barbellino	Italy				[9] 203		
Murg	Germany				202		380,000
Choapa	Chile	(10)	Irr	Multiple arch	200		
Puente Negro	do	(10)	Irr	do	200		
Chute a Caron	Canada	1931	P		200		
Little Nerang [3]	New South Wales				200		
Fusenko River	Japan		P	Concrete, gravity, straight, overflow	200	1,308	640,000
Dnieper	Russia	(1)	P	Concrete, gravity, curved	200	[11] 5,000	
Richmond [3]	South Africa				200		
Ridgeway	Tasmania	1918	W. S	Reinforced gravity arch, gravity wings	200	728	
Marathon	Greece	1930	W. S	Concrete, arch-gravity [12]	[13] 200	935	231,400
Sorpe	Germany	(1)	P		200		
Coghinas	Italy	1927		Concrete, gravity, straight	[14] 200		149,000
Cighana	do	1929		Concrete, gravity, curved	[15] 200	1,224	204,000
Cancano	do	1930		do	[16] 200		347,000
Tartano	do	1930		do	[17] 200		
Rochemolles	do	1930		do	[18] 200		200,000
Eguzon	France	1926	P	do	[4] 200	780	274,000
Caroser [3]	Italy				[19] 200		
Val Nocl [3]	do				[20] 200		

[1] Under construction
[2] Irr.—Irrigation, F. C.—Flood control, P.—Power, W. S.—Water supply.
[3] Noted in technical press. No data except height.
[4] Height above stream bed. Maximum height not available.
[5] Height above stream bed 230 feet. Maximum height approximate.
[6] Probably height above stream bed.
[7] Approximate maximum height. Dam is 205 feet above stream bed.
[8] Includes 193-foot spillway.
[9] Height above stream bed.
[10] Authorized for construction.
[11] Includes 2,005-foot spillway.
[12] Faced with marble.
[13] Approximate maximum height. Dam is 177 feet above stream bed.
[14] Approximate maximum height. Dam is 190 feet above stream bed.
[15] Approximate maximum height. Dam is 177 feet above stream bed.
[16] Approximate maximum height. Dam is 175 feet above stream bed.
[17] Approximate maximum height. Dam is 187 feet above stream bed.
[18] Approximate maximum height. Dam is 193 feet above stream bed.
[19] Approximate maximum height. Dam is 197 feet above stream bed.
[20] Approximate maximum height. Dam is 184 feet above stream bed.

108000—32——2

Five aerial cableways, 3,100 feet between masts, 182 feet in height, were used to transport men and materials in the construction of the Nag Hammadi barrage in the Nile River, Egypt. These steel masts could be swung either to right or left a distance of 25 feet by means of ball and socket at the base. Eleven dams form the Lake Kenogami storage reservoir on a power project in Canada, including the Portage des Roches, a concrete structure 80 feet high and 1,500 feet long.

At the Mettur Dam, in the Madras Presidency in India, the largest masonry dam in the world, the concrete is placed by the use of two steel towers 306 feet high, which travel on rails along the downstream toe of the dam, and can be utilized in building a section 126 feet long up to full height without moving position. Materials arrive by train at the foot of the tower and are dumped into skips, which hoist them 70 feet, where they are distributed into bins. Below the bins is apparatus for measuring out exact quantities of materials into the concrete mixers. Each mix is discharged into a skip, which is then raised the required height to pour into a hopper at the top of the chutes down which it flows into place. For a masonry dam 239 feet in height the length along the crest of 5,300 feet is exceptional.

The most interesting hydroelectric power development outside of the United States is probably the Dnieper River project in the Ukraine, which Soviet Russia has under construction. A power plant of 800,000 horsepower ultimate capacity will have ten 75,000-kilovolt-ampere generating units, which are the largest yet constructed. American engineers are acting as consultants on this project, which will cost about $110,000,000. In addition to power development, the reservoir will improve navigation on the river. The dam will be 200 feet in height and 5,000 feet long, of which 2,005 feet is spillway section.

The accompanying two tables list the highest and largest dams outside of the United States.

TABLE 4.—*Largest dams in foreign countries*

Name	Location	Year completed	Purpose [2]	Type	Maximum height	Crest length	Volume
					Feet	*Feet*	*Cubic yards*
Ottmachau	Germany	1931	F. C. & P.	Earth fill	56	21,326	8,890,000
Kandeukei	Japan	1930	Irr.	Earth fill, semihydraulic	184	4,174	6,720,000
Eume	Victoria-New So. Wales	(1)	Irr.	Earth embankments, concrete spillway section	[4] 180	5,300	[5] 4,000,000
Necaxa No. 2	Mexico	1909	P.	Earth fill, hydraulic	190	1,220	2,300,000
Recoleta	Chile	(1)	Irr.	Earth fill, clay core, reinforced concrete facing	148	2,952	2,120,000
Mettur	India	(1)	Irr.	Concrete, gravity, straight	239	5,300	1,850,000
Don Martin	Mexico	1930	Irr.	Earth fill and buttressed spillway section	131	4,080	[6] 1,774,000
Silvan No. 1	Victoria	1932	W. S.	Earth fill	145	2,100	1,738,000
Pachica	Chile	(1)	Irr.		207	1,312	1,726,000
Assuan	Egypt	[3] 1902	Irr. & R. C.	Granite rubble masonry straight, sluice and lock sections	[7] 144	[8] 6,398	[9] 1,400,000
Lautaro	Chile	(1)	Irr.	Earth fill	98	2,657	1,177,000
Cogoti	do		Irr.	Rock fill, gravel slope, paved with concrete	248		1,081,000
Horseshoe Bend	Canada		Irr.	Earth fill	45	7,000	1,000,000
Ghrib	Algeria	1932	Irr.	Rock fill, concrete facing upstream	213		817,500
Lloyd (Bhatgar)	India	1928	Irr. & P.	Concrete bulkhead and spillway sections	190	5,333	800,000
Poco dos Paus	Brazil				214	1,970	780,000
Alexander	Canada	1930	P.	Earth fill, semihydraulic	85	900	749,600
Santo Amaro	Brazil	1908	P.	Earth fill, hydraulic	63	5,300	737,500
Niederwartha	Germany	1929	P.	Earth fill	164		715,000
Laguna	Chile	(1)		Earth fill	134	754	670,000
Fusenko River	Japan		P.	Concrete, gravity, straight, overflow	200	1,308	640,000
Sarrans	France	(1)	P.	Arch-gravity	377		585,000
Rochemolles	Italy			Concrete, gravity, straight	180		573,000
Sennar	Egypt	1925	Irr.	Granite rubble masonry straight, earth fill and masonry abutments.	130	9,925	[10] 552,000
Coquitlan	Canada	1913	P.	Earth fill, hydraulic	99	1,200	544,710
Alexander	Hawaii	1929	W. S.	do	128	620	525,000
Madden	Panama	(1)	F. C. & P.	Concrete gravity straight	220	950	489,000
Spitallamm	Switzerland	1931	P.	Arch-gravity	374	846	452,000
Bhandardara	India	1926	Irr.	Concrete, gravity, straight	282	1,663	444,444
Tansa	do	1891	W. S.	Gravity, uncoursed rubble masonry	118	[11] 8,800	408,520
Rio Tercero	Brazil	1931	Irr.	Rock fill	164	1,200	400,000
Komaki	Japan		P.	Concrete, gravity, curved	260	1,000	400,000

[1] Under construction.
[2] Irr.—Irrigation, P—Power, W. S.—Water supply, R. C.—River control.
[3] Completed in 1902; enlarged and raised in 1907. Now being raised a second time.
[4] Ultimate height, 200 feet.
[5] Ultimate volume, 4,433,000 cubic yards.
[6] Includes 144,000 cubic yards of concrete.
[7] Approximate ultimate height.
[8] Includes 4,598 feet of spillway.
[9] Approximate ultimate yardage.
[10] Masonry.
[11] Includes 1,650-foot waste weir.

Session Laws of Colorado

(Continued from p. 73)

1921, relating to "miscellaneous" provisions of the irrigation district act of 1921, and is as follows:

"Section 2096. This act shall apply only to irrigation districts hereafter organized and no existing acts in any manner relating to irrigation districts shall apply to or affect irrigation districts hereafter organized, but said existing laws and all amendments thereto hereafter made shall be and remain in and have full force and effect as to all irrigation districts organized prior to the time this act originally took effect: *Provided, however,* That whenever resident freeholders, representing a majority of the number of acres of the irrigable land, in any irrigation district heretofore organized under chapter 113, Session Laws of Colorado, 1905, entitled 'An act in relation to irrigation districts,' approved May 3, 1905, shall petition the board of directors to call a special election for the purpose of submitting to the qualified electors of said irrigation district, who, for the purpose of this section, are defined as the owners or entrymen of agricultural or horticultural land within said district, exclusive of lands platted or subdivided into residence or business lots, a proposition to vote, at any regular or any special election called and notice given for such purpose upon the question whether or not such irrigation district shall thereafter operate under the provisions of this act, and if two-thirds of said qualified electors of such irrigation district as hereinbefore defined, voting upon such question shall vote in favor of coming under the provisions of this act, upon the filing of a statement of the results of such election in manner as provided by section 1969, Compiled Laws of Colorado, 1921, such irrigation district shall thereafter be governed by the provisions of this act, but the election of such district to come under the provisions of this act shall not invalidate any act or proceeding theretofore done under the laws governing such irrigation district prior to such election and shall not impair any obligation of such irrigation district or any right thereunder."

Notes for Contractors

Boulder Canyon project.—The Frigidaire Corporation was low bidder, with a bid of $4,672.01, for furnishing and installing a cooling system in the administration building at Boulder City.

Bids were opened at Las Vegas on February 15 for furnishing trees and shrubs for landscaping in Boulder City. The following individuals and firms were awarded contracts, varying from one-half to two carloads each: San Fernando Nursery Co., San Fernando, Calif.; Peterson Bros., Inglewood, Calif.; Las Vegas Nursery Co., Las Vegas, Nev.; H. L. Baake & Son, West Los Angeles, Calif.; San Pedro Nursery Co. (Inc.), Compton, Calif.; R. D. Clarke and Page Nursery Co., Chino, Calif.; Whittier Nursery, Whittier, Calif.; Edward H. Rust Nurseries, Pasadena, Calif.; Armstrong Nurseries Ontario, Calif.; Hobbs, Greeg Nursery (Inc.), San Dimas, Calif.; Howard & Smith, Montebello, Calif.

Bids under specifications No. 564–D for the construction of thirty 3-room residences of timber frame construction were opened at Boulder City, Nev., on March 28, 1932.

Specifications have been issued for the construction of a 34-room dormitory at Boulder City.

V. O. Brunzell, of Gardena, Calif., was low bidder, under specifications No. 557–D, with a bid of $3,218 for building one 20-car and two 12-car garages in Boulder City.

Bids will be received until April 18 at Boulder City, Nev., for the construction of a school building (specifications No. 566–D). This building will be 1-story, 57 feet by 180 feet, of brick and timber construction, with the foundation and part of the main floor of concrete. The work must be completed within 100 days.

Grand Valley project.—Specifications have been issued for the construction of the Grand Valley power plant and appurtenant structures, except the plate-steel penstocks, and a separate specification has been issued covering the purchase and installation of the two penstocks, each of which will be 78 inches in diameter and approximately 230 feet long.

Yakima project, Kennewick division.—Bids under specifications No. 561–D were opened on February 25 for furnishing and installing approximately 8,000 linear feet of continuous wood-stave pipes and flumes on the distribution system of the Kennewick division of the Yakima project. Three bids were received and contract was awarded to the low bidder, the Federal Pipe & Tank Co., of Seattle, Wash., whose total bid was $14,877.

The Commercial Iron Works of Portland, Oreg., was low bidder on furnishing structural steel and cast-iron gates for the Prosser power canal and power plant, with f. o. b. bid of $2,105 for three items. Bids were opened March 3 under specifications No. 563–D.

Yakima project, Cle Elum Dam.—Specifications have been issued for the cylinder gates and hoists for the Cle Elum Dam.

Bids will be opened at Ronald, Wash., on April 7, under specifications No. 565–D, for constructing the Flow Line Road at the Cle Elum Reservoir site.

Yakima project, Kittitas division.—On March 30 bids were opened at Ellensburg, Wash., under specifications No. 531, for constructing the Wippel pumping plant, appurtenant structures, and pump lateral.

Bids were opened at Denver, Colo., on April 4 for furnishing and installing two 45-inch plate-steel penstocks, each 469 feet long, and one 42-inch discharge pipe, 2,078 feet long, at the Wippel pumping plant.

Secondary Projects

A conference was held at Berkeley, Calif., on February 2 and 3, by Commissioner Mead and Engineer Debler, with Edward Hyatt, State engineer of California, A. D. Edmonston, deputy State engineer of California, and Frank Adams, professor of irrigation, University of California, to formulate plans for the continuance of investigations in the San Joaquin Valley during the coming season to complete the report on "Central California Water Resources Investigations" conducted in pursuance of contract dated May 15, 1930, with the State of California. Tentative arrangements were made to complete the Bissell-Bonner report. Reports on the Twin Springs Reservoir investigations and the Salmon River diversion, both on the Boise project, Idaho, have been completed. J. R. Iakisch has completed his report on the Musselshell River investigations, also a report on Tongue River, both of these in Montana. Other investigations in progress include Yakima project extensions, Washington; North Platte River power investigations, Colorado-Wyoming; and Rathdrum Prairie, Washington.

Why Plant Trees?

THEY add value to the property; they add beauty and comfort to the streets and the country home; they cool the air in summer and radiate warmth in winter; they furnish homes for thousands of birds that help man in his fight against injurious insects; they furnish homes for many animals that are useful to man for food and clothing; they help man in his fight for better sanitation; they furnish lumber for man's home and fuel for his fire.

Retirement of Edward M. Philebaum

Special Fiscal Agent, Yuma Project, Yuma, Ariz.

EDWARD M. PHILEBAUM, special fiscal agent on the Yuma project, was retired from the Government service at the close of January 31, having attained the age of 70 years on January 15, and having given nearly 50 years of efficient service to the United States.

In July, 1882, Mr. Philebaum entered the employ of the Government with the Weather Bureau, then a branch of the Signal Corps. Subsequently he was with the United States Engineers engaged in construction of coast defense; also spending some time in Alaska during the construction of lighthouses. He entered the Reclamation Service on the Yakima project on May 21, 1906, and all of his service with the bureau was on the Yakima and Yuma projects, with the exception of a short period spent in the Denver office in February, 1916.

In future Mr. Philebaum will reside with his family at 1268 West Thirty-ninth Place, Los Angeles, Calif.

Photograph by A. W. Bainbridge

E. M. Philebaum, retired

Boulder Canyon Project Notes

ON account of high water, excavation of the diversion tunnels was stopped on February 9. The flood in the Colorado River reached Black Canyon on that date and caused a shutdown of tunnel operations and the laying off of about 1,200 men. The river was up 11 feet on February 10, dropped 5 feet on the 11th, and a second flood arriving on the 12th brought the river up 16 feet above normal, with a peak of 57,000 second-feet. Besides flooding the diversion tunnels, a temporary bridge at the upper portals was washed out. Work in the tunnels was resumed on February 16, and at the end of the month the entire tunnel force was again at work. All piling damaged or carried away by the floods has been replaced, and a new bridge has been built across the river. Low concrete cofferdams are being built at the outlets of tunnels Nos. 2, 3, and 4 and at the inlet of tunnel No. 3. A dike of tunnel muck has been raised in front of the inlets of tunnels Nos. 1 and 2, which is expected to divert any flood up to 90,000 second-feet.

ON March 12 the 41 by 56 foot sections of the four 56-foot diversion tunnels were 94.5 per cent completed and the 15 by 56 foot invert sections were 27 per cent completed. Trimming operations had advanced 4,287 feet, or 33.6 per cent of the total length. Tunnel No. 3 (Arizona) was holed through on January 31, and tunnel No. 2 (Nevada) was holed through on February 3.

THE contractors completed their railroad construction to the gravel deposits in February and started shipments of concrete aggregate to the screening plant on February 6.

THE Nevada Construction Co., successful bidder for construction of the Boulder City theater, has the building well under way. It is expected that the initial performance will be given in May.

THE Six Companies (Inc.) has found it necessary to construct 250 additional 2-room cottages in order to house its working force. The bureau will also erect 30 temporary 3-room residences for Government personnel.

OFFICES of the Bureau of Reclamation were moved during the last week in February from the Beckley Building in Las Vegas to the administration and municipal buildings in Boulder City.

CONSTRUCTION of a Catholic church is under way in Boulder City on a triangular lot at the intersection of Wyoming and Utah Streets. The building is to be 28 feet by 62 feet in plan, with a seating capacity of 150 persons. It will cost about $6,000 and will be completed about May 1.

FROM February 8 to 17, inclusive, 1.88 inches of rain fell in Las Vegas and 1.16 inches in Boulder City. According to weather records from these towns, 7.32 inches of rain have fallen in Las Vegas since August 1, 1931, and 4.47 inches in Boulder City. The average annual rainfall at Las Vegas ranges from 2.5 to 3 inches.

THE Los Angeles Water & Power Bureau is planning to have a vote taken on a bond issue of $34,400,000 on May 3, of which sum it is proposed to use $17,500,000 for the construction of transmission lines for use by 1936 to convey power from Hoover Dam to Los Angeles.

THE Six Companies (Inc.) is building for the bureau a concrete testing laboratory at the Hoover Dam site, and construction work was started in March.

ON Tuesday, March 8, the Six Companies placed the first concrete of the 4,400,000 cubic yards that will go into the dam, power plant, and appurtenant works. The workmen on that date began pouring concrete at the intake portal of diversion tunnel No. 2.

ON February 22 at the dam site the Elks dedicated a memorial to George Washington with appropriate ceremonies. The flag raising was quite impressive, a bugle sounding "To the colors" as the flag was raised, followed by the assemblage singing the national anthem. As the singing was finished, a series of heavy blasts from the canyon added a fitting finale. Following addresses by representatives of B. P. O. E. officials of Utah, California, Nevada, and Arizona, and Construction Engineer Young, the 530 visitors to the project were taken on a tour of inspection of construction activities.

THE Los Angeles Bureau of Power & Light has decided that generators in the power plant at the Hoover Dam rated at 82,500 kilovolt amperes (77,500 horsepower) will best suit its requirements and the requirements of the Metropolitan Water District. The Southern California Edison Co. has selected a generator rated at 80,000 kilovolt amperes, but it is probable that the company will be willing to accept 82,500-kilovolt ampere units in order to have all of the main generating units in the power plant of the same capacity.

ARTHUR P. DAVIS, former director of the Reclamation Service and now consulting engineer for the Metropolitan Water District, recently visited the dam site and inspected the construction work. He was impressed with the driving of 56-foot diameter tunnels without the use of any timber to support the ceiling. The rock of the canyon walls is so hard that this can be done.

Sewage disposal plant, Boulder City, Nev., showing clarifier tank and traction apparatus

A PARTY of scientists from Harvard University at Cambridge, Mass., will make a study this coming summer of the effects of temperature on the workmen at the dam site. Dr. D. B. Dill, who is connected with the fatigue laboratory of the university, is to be in charge of the work.

THE number of men now employed by the Six Companies (Inc.) at the dam site and in Boulder City is about 3,000. Employees of other contractors and the Government total 1,000, making a working force of 4,000.

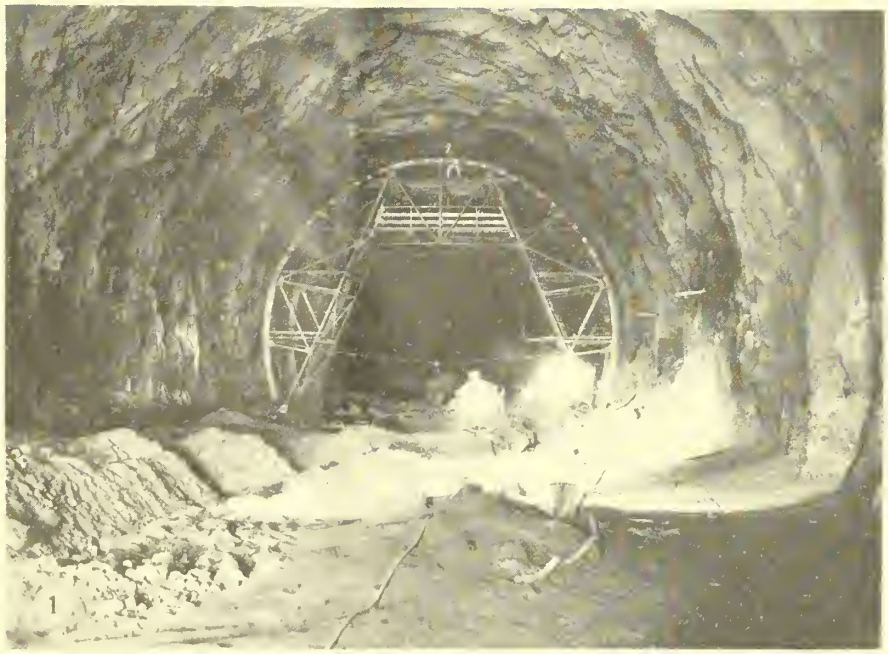
VISITORS to the project number over 200 daily. Of the 7,630 visitors in February were 530 Elks, 75 members of the Orange County (Calif.) Farm Bureau, and the board of supervisors of the Los Angeles County Flood Control District.

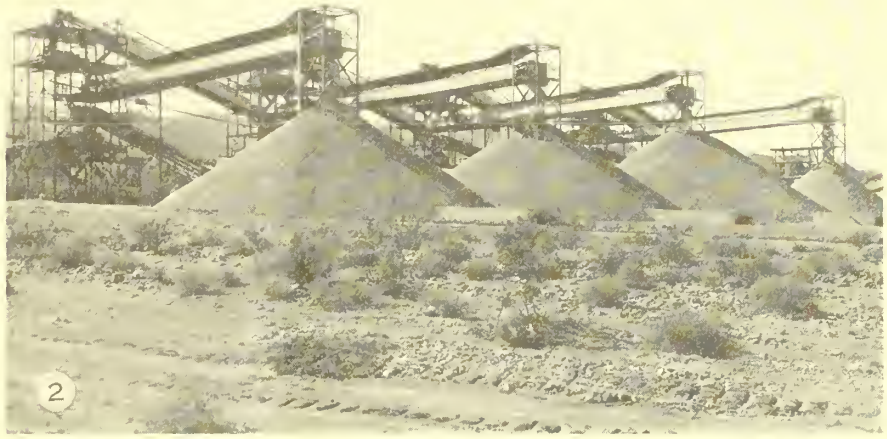
FILTERED and treated water was pumped from the filtration plant to the 2,000,000-gallon storage tank at Boulder City for the first time on March 2, and the plant has been operated continuously since that date.

Hoover Dam Consulting Board to Meet at Berkeley, Calif.

A meeting of the Hoover Dam Consulting Board has been called to convene at Berkeley, Calif., on April 9. After considering the concrete research program in progress at that place under Prof. R. E. Davis, the board will proceed to Boulder City, where it will spend April 11, 12, and 13 considering structural design features, particularly those relating to the proposed penstocks.

TWO contracts with the State highway department have been awarded for paving portions of the Ellensburg Canyon Highway on the Yakima project. A later contract will complete the paving of the road between Yakima and Ellensburg, a 35-mile stretch which has been very difficult to maintain on account of heavy traffic between these cities. The work under the three contracts, involving an estimated expenditure of over $1,000,000, will be completed by July 1. This job is especially significant for the reason that it will furnish a concrete highway linking the newly constructed Kittitas division with the older divisions of the Yakima project.





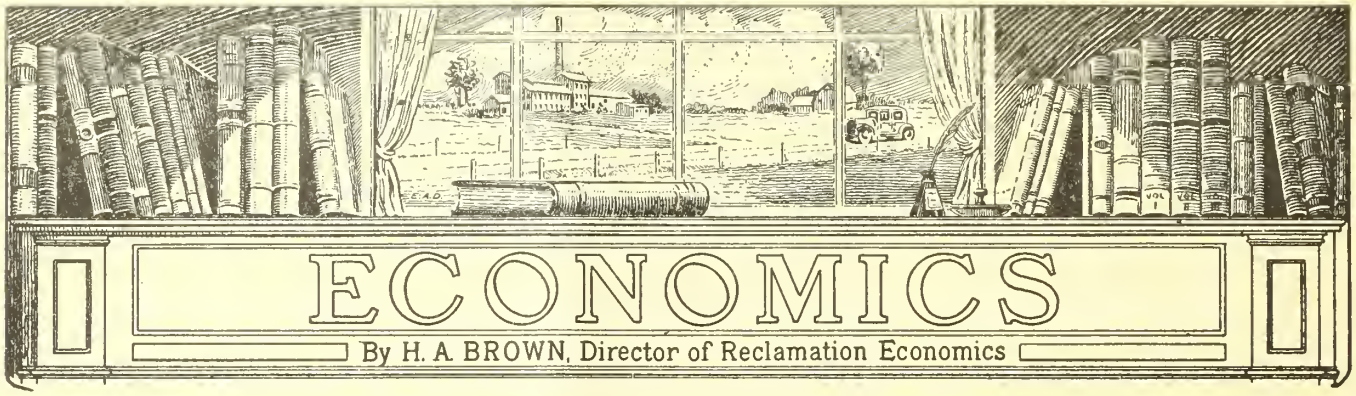
Photograph by B. D. Glaha

BOULDER CANYON PROJECT

1. Steel frame measuring and trimming templet in place near outlet portal of Nevada penstock tunnel, showing deposit of silt left in tunnels by high water of February 10; 2, stock piles at Six Companies' gravel screening and washing plant at Three-Way Junction.

Minidoka Project Holds Farm Management Conference

THE first Farm Management Conference to be held in Minidoka County, Idaho, was in session on February 15 and 16. In addition to the necessary preliminary work, detailed farm business analyses were obtained on 20 farms in August, 1931. The data thus collected were of considerable value in working out farm budgets in the conference. Eight committees of farmers representing the leading farm enterprises in the county were selected. About 75 farmers took an active part in the committee work. Recommendations for the best practices in each of these enterprises were made by each committee. It is expected that these recommendations, together with several sample budgets for different sized farms for the two principal soil types of the county, will be published either in mimeographed or printed form. Especial credit is due to Dr. Paul A. Eke, head of the department of agricultural economics at the University of Idaho; E. T. Benson, farm management specialist, and the various other extension specialists who assisted in this conference and helped to make it a success.



Homestead Planning on Federal Reclamation Projects

By L. H. Mitchell, Assistant Director of Reclamation Economics

A NEW settler on a Federal reclamation project before starting on the construction of buildings should devote some time and study to many important features. The most important of these are: (*a*) Location with respect to highways; (*b*) surface water drainage; (*c*) underground water; (*d*) prevailing winds; (*e*) location of trees.

Considering each feature in the order given, the following suggestions are worthy of careful consideration:

(*a*) If the ground surface conditions will permit, the location of the buildings should be reasonably close to a highway. A mistake is often made by having the house and other buildings so close that they preclude the possibility of having a lawn or shrubbery and shade trees between the buildings and the highway. The advantages of having the buildings fairly close to the highway are: First, easy accessibility to the school bus and mail box if the project has these advantages; and, second, the saving of considerable time and money in constructing and maintaining a road, telephone line, and possibly some day a power line leading from the main highway to the home. Consideration should be given to the disadvantage of having the buildings so close to the highway where there is considerable traffic and where the highway is unsurfaced that during the dry periods, especially during the harvest season, there is considerable dust. Should the prevailing winds carry this dust in the direction of the residence, the housework could be greatly lightened by having the home at least 400 feet from the highway.

(*b*) Heavy rains, sometimes called cloudbursts, occur on nearly every Federal reclamation project. Whenever these happen, the lower lands of the farms become temporarily flooded; especially is this true if the farmer is irrigating at the same time. In order to avoid having possible damage to livestock, poultry, yards, and basements in such cases, all other conditions being equal, the ground selected for the buildings should be where there is little likelihood of flooding either from waste water or heavy rains.

(*c*) If it is contemplated, either at the time of settlement or at some future date, to obtain water for domestic purposes from shallow wells, the location of such sources of water supply should be not only reasonably close to the house but on the upstream side of the underground flow of water. It is not always true that the direction of flow of underground water is in the same direction as the slope of the farm, although it is generally safe to assume that such is the case. The project superintendent or district manager can no doubt give new settlers valuable information on this subject. On some of the irrigated projects, owing to lack of sand and gravel strata, there is very little or no movement of underground water. The best surface water for domestic purposes is found in gravel strata. Some knowledge of the movement of underground water supplying domestic wells is essential to prevent the water becoming contaminated. This feature should be carefully considered when planning the farmstead.

(*d*) In order to keep the house as free as possible from dust and to reduce to the minimum the unpleasant inhaling of stock and poultry yard odors, all settlers when planning the location of buildings should first consider the direction of the prevailing winds.

(*e*) The most important of all subjects under consideration is the location of trees. Too often it is the one which receives the least planning. Nearly every section of the country some time during the growing season has winds that injure and occasionally ruin a fruit crop. On every project some fruit for home use can and should be grown on every farm. For the protection of this fruit against destructive winds, trees, sometimes called a shelter belt, should be planted at the earliest possible date after settlement. The settler when planning such a windbreak should, in addition to considering the general direction of prevailing winds, carefully consider how these trees should be placed to permit their irrigation. Some ground leveling may be necessary before all the trees can be irrigated. Obviously, this leveling should be done before the trees are set out.

TREE SELECTION

The selection of trees, both for windbreaks and fruit, requires careful study. Only trees should be planted that are known, through years of severe weather tests peculiar to the locality, to be adapted to the soil and climatic conditions.

The drawing accompanying this article illustrates a suggested windbreak that, by changing the kind of trees adapted to the locality, could be used on nearly every reclamation project. Settlers on some of the older projects who are planning to have more attractive and home-like surroundings may gain some helpful suggestions from this drawing.

It is not uncommon in an old settled irrigation section to find what was at first intended for a windbreak, but which in later years developed into unsightly trees that serve only as shade and shelter from the hot sun. The most effective shelter trees should be arranged as shown in the illustration. The first row, and what is sometimes called the first line of defense, should be a golden willow or caragana. Another advantage of having for the first row a hedge-like tree is that there will never be the necessity of trimming as is often necessary with trees planted too close to telephone and transmission lines. The next row should probably consist of trees that grow a little higher than those in the first row. These might be hardwood like the ash or elm, provided they are adapted to the locality. The next row might be quick-growth trees of the poplar family. The next row might be either a hardwood or an evergreen, providing, of course, these trees are known to be adapted to the climate in question. Following this shelter belt the settler can have as many fruit trees, either cherry,

plum, or apple, as can be used for his home requirements. Following the fruit trees, small fruit like strawberries, raspberries, etc., can be placed.

On northern projects, where frequently the roads have considerable snow, it is quite imperative that there be no shade trees on the south side of the road so close to the highway that the shadow from the trees will prevent the snow from melting in the early spring. Oftentimes the trees are so planted that the prevailing winds cause drifts in the highway. The mistake of planting trees too close to the highway is often made on the Federal reclamation projects. This might be good business on land worth several hundred dollars an acre, but, generally speaking, the land is not of sufficient value to justify the planting of trees that grow tall just inside the property line.

Before planting a tree or erecting a single building a new settler should indicate on a prepared sketch the desired space between the trees and the distance of the trees from the property line, as well as the location of the house and other buildings. On nearly every project there is either a Federal employee or county agent who can spare the time and will be glad to make a sketch that will carry out on paper what the settler has in mind. A settler must realize, however, that it takes some years to grow trees to a point where they will fully conform to the picture presented to him as he observed some fully developed buildings and grounds. The cost of planting, irrigating, and other work necessary to the growing of trees is relatively small, but the finished product pays the best dividends of any effort or investment on a farm.

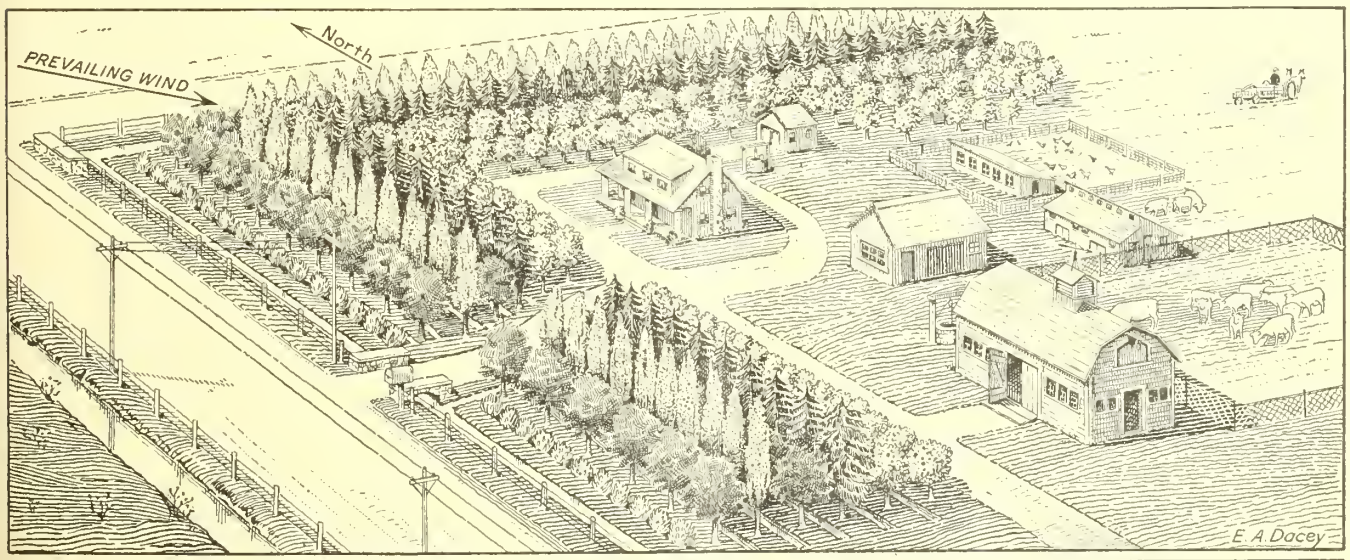
The illustrations on the front cover page of this issue of the Era are striking examples of a homestead where no apparent thought was given to landscaping and of a homestead which is attractive because of a well-conceived plan of buildings, trees, and driveways. It is not expected that many homesteads on our reclamation projects will have fountains or other expensive outdoor attractions. The second view was selected to bring out the result attained by planning the essential features such as those named above.

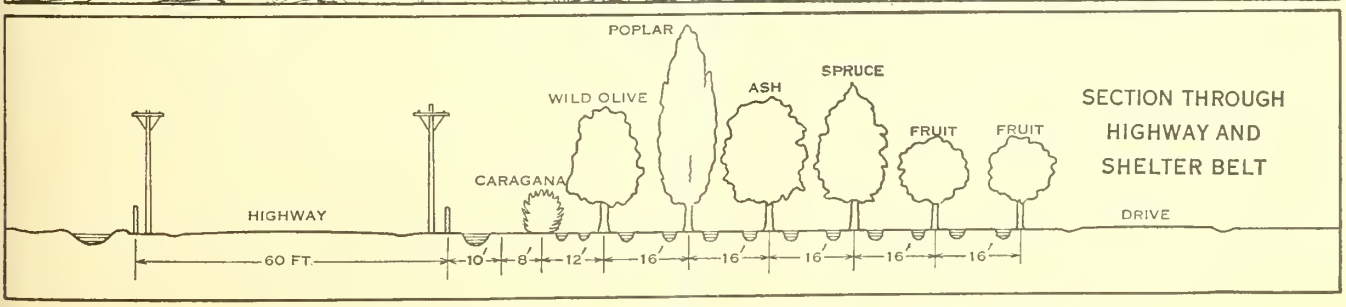
What is true about planting trees is likewise true about the residence and other buildings. It is not expected that buildings similar to those outlined in the sketch will be on every irrigated farm for several years after the settler has begun development. New settlers occasionally make the mistake of using all their resources in constructing buildings. It would be wiser to construct in the beginning simple and less expensive buildings. However, as the cost of planning the location of buildings, yards, and trees is nominal, although the work is necessary before the settler can have an attractive homestead, surely no mistake will be made if each and every item as outlined above is carefully weighed before a definite plan is mapped out.

Vale Enjoys Near-by Co-ops

The Vale project, Oregon, is one of our newest projects and the settlers have not yet organized for the purpose of cooperative marketing. However, they are enjoying the opportunities offered by cooperative organizations operating in the older established agricultural sections, among which are the Farmers' Cooperative Creamery, of Payette, Idaho; the Intermountain Agricultural Credit Association; the Northwest Turkey Growers' Association, of Salt Lake City, Utah; the Idaho-Oregon Turkey Growers' Association, of Boise, Idaho; the Hay Growers' Association, of Caldwell, Idaho; the Seed Growers' Association, a local organization of Ontario, Oreg.; the Snake River Grain Growers (Inc.), of Boise, a subsidiary of the Northwest Grain Growers which is a subsidiary of the National Grain Growers; the Idaho Bean Growers' Association; and the Idaho Egg Producers' Association, of Caldwell.

These organizations have trained field men who work with their members instructing them in the newest and most effective methods employed in their particular industries.





Layout for a new settler as suggested by L. H. Mitchell, Assistant Director of Reclamation Economics

Cooperative Marketing on the Yuma Federal Irrigation Project

The Yuma County Farm Bureau Marketing Association

By R. M. Priest, Project Superintendent

THIS association was organized during 1923 as a marketing association for alfalfa hay, seed, and straw, and at present also markets bermuda grass seed. The present organization, successor to two other similar organizations of an earlier date which were in financial straits, is a member of the Arizona State Farm Bureau Federation.

The association owns no stock and the only requirements for membership are that the member be an alfalfa hay or seed or bermuda grass seed grower and sign the required marketing agreement. The present agreements cover a period from 1931 to 1961, inclusive, and provide that all alfalfa hay, alfalfa seed, bermuda grass seed, or straw grown by a member, or in which he has an interest, be marketed through the association, with the exception of any of these commodities he may wish to retain for his own use or may elect to sell for local consumption only. The grower, however, may, upon written notice, terminate his contract with the Association in March of any year.

The annual membership dues are $5, distributed as follows: Fifty cents to the American Farm Bureau Association, $1.50 to the Arizona State Farm Bureau Federation; $1.50 to the county farm bureau; and $1.50 to the local farm bureau, of which there are seven on the project and in contiguous territory. These locals are of a social nature in the main and are composed of groups of ranchers which meet and discuss their agricultural problems and topics of local interest, and receive advice from the county farm agent as well as State and National agencies of this type.

OPERATING EXPENSES

The Yuma County Farm Bureau Marketing Association meets all its operating expenses through a 5 per cent charge made on all members on the gross sales of the individual's crops through the marketing association. At present this Association has 130 members representing approximately 8,000 acres devoted to the growing of alfalfa hay and seed and Bermuda grass seed. The net worth of the association, including cash on hand, office fixtures, and two lots in the city of Yuma, is $13,500.

The association grants a cash advance of 60 per cent of the market value to the member on cleaned alfalfa seed and Bermuda grass seed upon presentation of warehouse receipts covering his crop of cleaned seed. From this advance is deducted cleaning and sacking costs amounting to less than 1 cent per pound. To grant this advance the association borrows from the Federal intermediate credit bank on warehouse receipts, paying from 4 to 5½ per cent on funds so secured, while the association requires 6 per cent interest from the growers on their cash advances. Upon a breach of contract by any of the growers the association may, under the existing laws, impose a penalty of 20 per cent of the gross returns of any hay or seed sales made by the grower in violation of his contract.

All alfalfa seed and Bermuda grass seed are marketed in seasonal pools. Distributions of earnings from the pools are made each month when marketing conditions justify, and deductions from the 5 per cent association charge, insurance, and warehouse charges are made from the final distribution of the season, which closes on May 31 for all seed marketed during the preceding 12 months. However, the association by virtue of its contract with the grower can carry over any portion of the crop in the interest of orderly marketing.

The association does all its own seed grading. The method is very thorough and somewhat ingenious. A 10-gram sample of each member's cleaned seed is taken and the sample separated into three classes as follows: Inert, composed for the most part of small particles of earth; well-formed seed; and foreign seed, which is further divided as to its noxious and non-noxious character. The inert and foreign seeds are weighed independently and the percentages thus established. Penalties are then applied to the grading of the seed for the presence of inert material, foreign seed, and general appearance and germination quality of the remainder of the sample. The grade of the seed is then determined on the basis of perfect seed rating, 100 per cent. The total weight in pounds of the member's cleaned seed is then multiplied by the grade of the sample and the result is termed 100 per cent pounds. This is the figure carried on the association's books and the figure used in computing returns on the individual's seed when marketed. Seed when sold in carload lots is bulked; that is, seed of various grades is bulked together and sold under an average grading. By the use of the 100 per cent pounds rating, each member receives not the average price paid for all seed so bulked, which would penalize the grower with superior quality seed, but receives his share based upon the quality of his seed which may be more or less than the average price paid depending upon the grade of his seed.

ASSOCIATION'S SALES PROGRAM

The markets for alfalfa seed and Bermuda grass seed have been established by the marketing association in California and through the Southern States. In the past sales for the most part have been with large seed houses, but the association is developing a sales program that will deal with the smaller retailers. For this purpose the manager has made several extensive trips through the Southern States interviewing all retail seed dealers who handle alfalfa seed. There are three varieties of seed grown locally, namely, hairy Peruvian, smooth Peruvian, and common.

The marketing association has proved a distinct value to local hay and seed growers inasmuch as their sales have established and maintained the local seed market and has prevented manipulation of the market to the detriment of the growers.

Alfalfa hay and straw are handled by the association principally on a consignment basis, their market being at Los Angeles. The hay is picked up at the ranch by large freight trucks and transported to the Los Angeles market by these trucks. The association makes direct sales as well, whenever possible. At present government inspection as to grade and condition is available at Los Angeles for a nominal sum and it is the practice of the association to request this inspection. The returns from each shipment, less freight, inspection, and association charges, are then paid the grower. The association charges are 5 per cent of the gross returns.

A FARM without trees is a place to work, but never a home. A family that will plant and properly care for trees is the family which a community can not afford to lose. People who plant trees are not apt to be a migratory class.

Time, care, intelligence, and appreciation of beauty and comfort—these are among the requisites in tree culture. Without the influence of trees our literature, our earliest recollections, our home life, our religion would be barren. Deprive for a few generations a people of the inspiration trees have brought to mankind and barren lives are sure to be the result.—*From a Lover of Trees.*

DURING a recent month the Mini-Cassia Dairymen's Association purchased 58,974 pounds of butter fat at the Burley and Rupert plants of the Minidoka project, an increase over the preceding month of 3,778 pounds.

Construction Power for Hoover Dam

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project, Bureau of Reclamation

ELECTRICAL energy for construction purposes at Hoover Dam is obtained from power plants of the Nevada-California Power Co. and the Southern Sierras Power Co. These power plants are located more than 200 miles from the Hoover Dam site and feed into a substation located at San Bernardino, Calif.

In order to deliver the electrical energy required for construction purposes at Hoover Dam, it was necessary for the Nevada-California Power Co. to construct a transmission line from the San Bernardino substation to the Hoover Dam site. This line has been constructed and is now in operation. After the dam is completed this line will be used to transmit power from the Hoover power plant to San Bernardino and into the power system of the Nevada-California Power Co. for supplying a portion of the light and power to be used in southern California.

The transmission line is single circuit, 3-phase, 60-cycle, and 88,000-volt. From San Bernardino to Victorville, Calif., it crosses the San Bernardino range, reaching an altitude of 5,500 feet at El Cajon Pass, from which point it drops rapidly to a substation near Victorville, then following a northeasterly course crosses 191 miles of desert wastes and rocky foothills, including one mountain pass east of Baker, Calif., to the rim of the Black Canyon above Hoover Dam site.

PROVISIONS FOR SEVERE WINTER WEATHER

The line structures and conductors will be subjected to heavy wind and ice loads during the winter months at points where the line crosses the mountain passes, and at such points it was necessary to shorten the span between towers and to use heavier supporting structures. In addition to this protection against heavy loading, it was found desirable to make other provisions for insuring continuous service between San Bernardino and Victorville, where winter conditions are very severe. This was done by providing another available circuit in case the main line should be out of service. To date this auxiliary transmission line has been used once to a decided advantage.

The supporting structures are of galvanized steel, and for additional protection all steel used in footings was treated with a heavy coat of petrolastic asphaltum before erection.

The standard type of structure is an H-frame consisting of two latticed masts each 2 feet square which support a horizontal trussed crossarm 34 feet in length at a height of 52 feet above the ground surface, and terminate at the base in a wedge-shaped spade made of steel plates. The total weight of this type of structure is, 2,610 pounds.

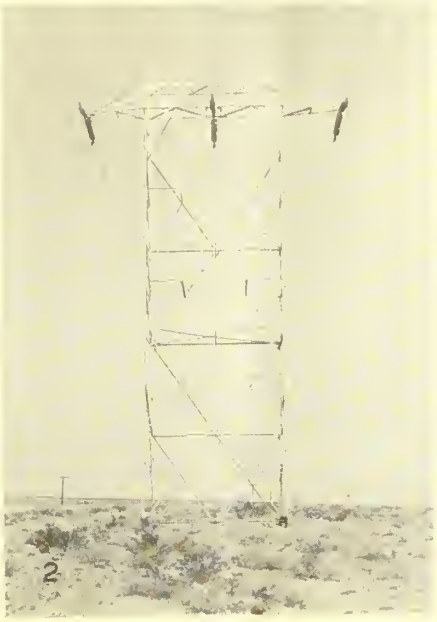
Structures used at horizontal angle points in the line, for angles up to 50°, or at other points where additional strength is required, are of the A-frame type. For angles up to 25° a structure weighing 5,775 pounds is used, and for angles between 25° and 50° a structure weighing 6,325 pounds is used. For angles greater than 50° or where exceptional stability is required, the structure is made up of three vertical masts tied together at the top of the horizontal arm. All the masts are guyed and each conductor dead-end assembly is connected direct to the mast top. The bases of the A-frame type towers rest on concrete footings.

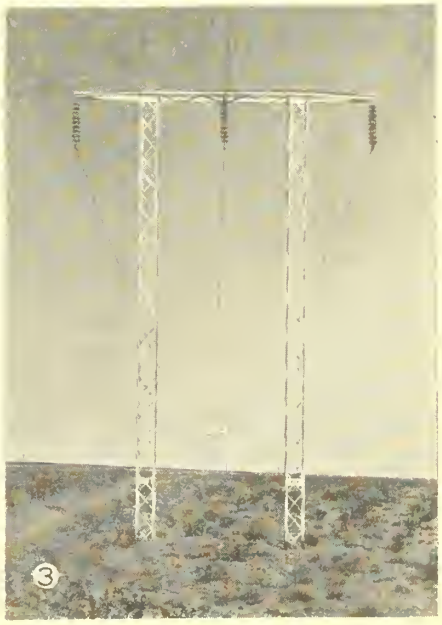
All masts of the H-frame type of tower and side members of the A-frame type of tower were shipped to the field in two sections. Field erection consisted of assembling the masts and side members, raising them into position, and connecting them at the top with the trussed crossarm. No further connection was made between the masts of the H-frame towers, but increased strength and stability was secured for the A-frame towers by the addition of horizontal and transverse lattice frames between the two side members.

On line tangents at least one standard structure in every mile is storm-guyed. Guys are seven-sixteenths inch, high-strength, double galvanized steel strand, and are connected to 1 inch by 10 foot galvanized anchor rods and reinforced concrete anchors.

The line is now being operated at 88,000 volts. However, it is insulated for 132,000 volts, which is the voltage to be used for transmission of power from the

Continued on p. 88)





WORK AT HOOVER DAM

1. Hoover Dam substation; 2, frame-type supporting tower; 3, H-frame-type supporting tower

THE following article was written by Mrs. M. Olive Schnebly, wife of a reclamation farmer in the Kittitas reclamation district, Wash., who is a leader in the development program of the valley:

Ellensburg, the center of the Kittitas project, is an old town as western towns go, surrounded by thousands of acres of fertile farm lands. Some of this land has been farmed since 1860, the first settlers homesteading where there were springs and good creek water rights. These were naturally found near the hills, as this valley, some 60 miles in length, is set among the foothills of the Cascade Mountains.

Residents in this community are essentially a rural, home-loving people and the homes of these people reflect this love.

TREE PLANTING TO BEAUTIFY SURROUNDINGS

Wherever there was water there you will find beautiful old trees. The creeks which flow from the hills winding down through the valley have their banks lined with native or scrub willow. These trees grow close together and are from 20 to 25 feet tall. These brush trees are very valuable on large cattle ranches, as the cattle are fed in among them in winter. The close-matted branches serve as a natural shelter. So, again, beauty and utility go hand in hand.

Here and there one finds a pine or fir standing alone. Sometimes out in the center of a golden grain field it stands like a sentry on duty, but more often a farm home has been built near it. All over the countryside are windbreaks of various kinds. The pioneers usually planted the tall, sky-pointing poplar, but to-day new settlers are planting evergreen trees, Norway spruce being one of the favorites.

In the city of Ellensburg there are many beautiful trees. On several avenues the trees almost touch in the center, and the arch effect is truly beautiful. Since the completion of the Kittitas project and the watering of 72,000 acres, it is not only the farmer with good creek rights who may have beautiful trees and lawns and shrubs, but it is the privilege of everyone who has the love of the beautiful in his heart and the will to make things lovely about him, because water, the land's lifeblood, now covers almost every acre in this beautiful valley.

ORGANIZED EFFORTS BEAR RESULTS

New interest has been aroused; women's clubs, both in the town and in rural communities, are talking and thinking in terms of shrubs and bulbs. The chamber of commerce and various service clubs are doing their share to help in this worthwhile project.

During National Better Homes Week the past two years tours have been taken when several homes were visited, stressing beautiful yet inexpensive gardens. Extension workers from the State College of Washington at Pullman have helped, giving the simple rules for better planting and advising the correct shrubbery and trees for use in this soil and climate.

The whole community has become landscape conscious, and many lovely things have been done, and we know it is but a beginning.

A park with swimming and wading pools has been built and landscaped. More trees are being planted in the parkings, each home owner on a given street planting the same kind of tree.

A beautiful golf course has recently been built. It has a wonderful setting in among old natural trees. It gently slopes in natural terraces to the banks of the Yakima River, which gracefully forms its east boundary.

ELLENSBURG MAKES VANTAGE POINT ACCESSIBLE

Rising in the center of the valley and just on the outskirts of Ellensburg is a low flat hill, approximately 200 feet high. A good road has been built up to this

Photograph by J. E. Stimson

Left: Home and grounds of Mrs. Olive Sander, one of the first settlers in Kittitas Valley; right, view of Kittitas Valley

vantage point. A most impressive scene is the panoramic view from this hill. The farms below form a checkerboard—green, gold, and black. Here and there the sun catches and reflects itself in one of the big ditches as it carries the water through the distribution system as though it were a huge mirror.

Around the edge of the valley low sagebrush-covered hills blend into large wooded ones and finally into the snow-capped peaks of the Cascade Mountains.

Ellensburg lies just below on one side of the central hill. The well-kept county fair grounds and buildings, the large rodeo arena, parks, the State normal school, and the beautiful avenues lined with shade trees leading out to highways, which in turn lead into the hills and mountains or through canyons, form another picture.

Ellensburg is the exact center of the State, and excellent highways lead through this veritable agricultural paradise in every direction.

Kittitas is truly a wonderful project, bringing true a dream which leading pioneers have had for 30 years. The realization of this dream is very valuable to the land owners and home-loving people within the 72,000-acre project, and numerous opportunities for new families to establish themselves in this beautiful and prosperous valley have been created. The farm women are taking an active part in community work and the wives of new settlers will be welcomed into the business and social women's organizations.

Photograph by J. E. Stimson

Street scene in Ellensburg, Wash.

IN some sections of this country and in several of the European countries it is quite common to see the roadsides lined with fruit trees, which make a most attractive sight at blossoming time and give much comfort and profit as the fruits ripen. The custom of bordering lanes and fence lines with fruit or nut trees is becoming more common.

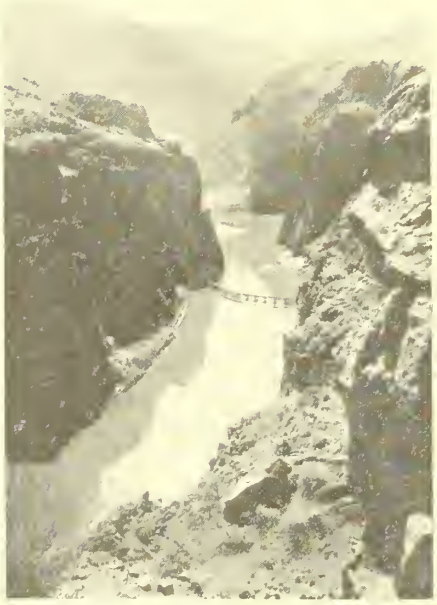
Some Planting Suggestions

The beauty of a shade tree depends upon its normal and symmetrical growth. In order to insure this, before planting cut off the ends of all broken or mutilated roots, remove all side branches save upon evergreens, so that a straight whiplike stalk alone remains. Dig holes at least 2 feet in diameter and 1 foot deep in good soil, and make them 4 feet across in poor soil. The sides of holes should be perpendicular and the bottom flat. Break up soil in the bottom of the hole to the depth of the length of a spade blade. Place 2 or 3 inches of fine top soil, free from sods or other decomposing organic matter, in the bottom of the hole. On top of this place the roots of the tree.

I AM indebted to Mrs. Allen Johannesen, wife of Chief of Field Party Johannesen, on the Owyhee project in Oregon, for sending in the following poem on the beauty and grandeur found in the Owyhee Canyon in Oregon, where we are building a dam 405 feet high which will harness the water of the Owyhee River and create a lake 52 miles long.

Miss Ethel Yeargain, visiting the project, voiced her appreciation of the scenery and constructed the poem. Mrs. Johannesen, loyal to reclamation, immediately sent it in for publication in "our" Reclamation Era that it might be shared with others.

Miss Ethel Yeargain's Inspiration



Photograph by F. C. Bohlson

Owyhee Canyon and Dam Site, Oregon

Beautiful, beautiful canyon
  With your walls of lava and stone
By what great upheaval fashioned
  To man may not be known.

But the deepening shades of evening
  Fill the soul with pure delight
And we gaze in silent rapture
  As the day creeps into night.

When the moonbeams light your hilltops
  And advance from peak to peak,
Yes, we love this short-lived hour
  And we find no words to speak.

Lest we miss the gentle magic
  Of the silent moonlight tread
Adding, adding to the picture
  As the moon sails overhead.

Here the glories of the sunrise
  Surpass our wildest dream
And in our hearts we're thankful
  For the beauty we have seen.

And the river called Owyhee
  As it winds through hill and plain
Knoweth not that on the morrow
  It will not be free again.

For the brain of man hath fashioned
  From a site by nature placed
A great dam to store the waters
  To reclaim the desert waste.

Where the sage and greasewood flourish
  There'll be homes and orchards gay
By this store of waters nourished
  Then you'll come into your day.

Tell the people to plant trees, and then more trees.

Reclamation Organization Activities and Project Visitors

R. F. Walter, chief engineer, has returned to the Denver office from the Boulder Canyon project, where he made an inspection of the work in progress.

J. L. Savage, chief designing engineer, and R. S. Lieurance, engineer, spent some time at Cambridge, Mass., for the purpose of inaugurating a course on dam design at the Massachusetts Institute of Technology. Later Mr. Savage, accompanied by L. N. McClellan, chief electrical engineer, left Denver for Los Angeles to attend a conference of contractors for power on designs for the Hoover Dam power plant and machinery.

H. F. Parsons and T. F. Neighbors have been in Washington for some time seeking assistance in rehabilitating the Farmers' irrigation district in the vicinity of the North Platte project.

John A. Whiting, State engineer of Wyoming; R. H. Willis, chief of the Bureau of Irrigation, Bridgeport, Nebr.; and M. C. Hinderlider, State engineer of Colorado, were in a several days' conference in the Washington office regarding the division of the waters of the North Platte River between the States of Wyoming, Nebraska, and Colorado.

Porter J. Preston, who has spent some time in Yuma making investigations under section 15 of the Boulder Canyon project act to determine the feasibility of irrigation lands in the Gila River Valley in southwestern Arizona by diversion from the Colorado River at the proposed Imperial Dam of the All-American Canal system, has returned to his headquarters in Denver. Mr. Preston stopped at Boulder City on his return trip. He was accompanied by Mrs. Preston.

William J. Burke, district counsel, of Billings, Mont., spent several days in Washington, during which he represented the Secretary of the Interior as intervenor in the case before the Interstate Commerce Commission with respect to requiring the railroads to construct a branch line through the Riverton project.

Leo J. Foster, superintendent of the Uncompahgre project, was transferred to the Denver office, effective February 1.

Oro McDermith, formerly connected with the Kittitas reclamation district and for the past few years employed under a contract to build the subway at Buenos Aires, Argentina, was in the Washington office on March 14 on his return to his home in Denver.

Construction Power, Hoover Dam

(Continued from p. 85)

Hoover power plant to San Bernardino after completion of the plant. The line insulation consists of 9 Jeffrey-Dewitt suspension insulator units in suspension strings, and two strings of 10 units each, in parallel, in dead-end assemblies.

The line conductors are 4/0 aluminum cable steel, reinforced, having an ultimate strength of 8,435 pounds and an elastic limit of 5,940 pounds. The stringing tension used conformed closely with that recommended by the California Railroad Commission in General Order 64–A. The total length of the line is 222.26 miles and the average span length is 750 feet. The total weight of the conductors used on this line is approximately 1,250,000 pounds. The line is patrolled by men with patrol cars located at the Hoover Dam substation and near the half-way point at Yucca Grove. Patrol men are also available at Barstow, Victorville, El Cajon, and San Bernardino. Since the line for the most part follows the main highway between Las Vegas and San Bernardino, patrol service is easily maintained.

CONSTRUCTION SUBSTATION

The Hoover Dam construction substation is located on the rim of the Black Canyon. It is 815 feet above the Colorado River and 1,400 feet west of the dam site. This substation consists of an outdoor high-voltage switching and transformer station and an indoor synchronous condenser and low-voltage switching station complete with control room, battery room, etc.

The 88,000-volt line enters the substation through a 132,000-volt automatic oil circuit breaker to an overhead bus from which a bank of three single-phase, 5,000 kilovolt-ampere, 60-cycle transformers are energized. One spare transformer has been provided, and arrangements have been made on both the high-tension and low-tension sides for cutting in the spare unit without moving it from its normal position.

Immediately back of the transformer bank is the substation building, which is 45 feet by 72 feet in plan and of steel frame construction covered with heavy metal lath and a double plaster coat. A 2,300-volt, 3-phase bus is located directly over the oil circuit breaker rooms, which are a portion of the building proper. These rooms contain the control equipment for the synchronous condensers, and connection is made from the overhead bus to the oil circuit breakers through roof bushings just below the bus. Two 7,500 kilovolt-ampere, 2,300-volt synchronous condensers are housed in the main operating room of the building. One of these units has sufficient capacity to maintain satisfactory voltage under normal operating conditions so that the other unit serves as a spare.

At one end of the building a bus room, 18 feet by 45 feet in plan, is reserved for the use of the Six Companies (Inc.) and the Bureau of Reclamation. Two 2,300-volt, 3-phase busses are installed in this room, one for the Six Companies (Inc.), feeders, and the other for the feeders of the Bureau of Reclamation. Electrically operated, frame-mounted, remote-controlled, oil circuit breakers for the eleven 2,300-volt outgoing feeders are installed in this room. Connections between the main outdoor 2,300-volt transformer bus and the two busses are made through the wall of the bus room. The panels and switchboards for controlling the 132,000-volt oil circuit breaker, all 2,300-volt oil circuit breakers, two synchronous condensers, and all auxiliary equipment, are located in one switchboard room.

TELEPHONE LINE

A double circuit telephone line running parallel to the main transmission line has been constructed by the Nevada-California Power Co. to aid in the operation and maintenance of the transmission line. Should an outage occur at any point on the transmission line between San Bernardino and the Hoover Dam construction substation, it is possible by alternately closing the sectionalizing switches located at Victorville, Daggett, Midway, Wind Mill, and State Line, and reporting the results by telephone, to quickly locate the section in which the trouble has occurred.

CONSTRUCTION PROGRESS

The final surveys and preliminary construction of the line were started on October 30, 1930. The entire transmission line and substation were completed 238 days later. On June 27, 1931, Mr. A. B. West, president of the Nevada-California Power Co., closed a switch which by means of control relays, energized the transmission line.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young.	Constr. engr.	E. R. Mills	Charles F. Weinkauf.	do	Do.
Orland	Orland, Calif.	R. C. E. Weber.	Superintendent	C. H. Lillingston	C. H. Lillingston.	J. R. Alexander.	Boulder City, Nev.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek.	R. J. Coffey	Los Angeles.
Boise [1]	Owyhee, Oreg.	F. A. Banks	Constr. engr.			J. R. Alexander.	Boulder City, Nev.
Minidoka [2]	Burley, Idaho.	E. B. Darlington.	Superintendent	G. C. Patterson.	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Milk River [3]	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	do	Do.
Sun River, Greenfields	Fairfield, Mont.	A. W. Walker	do			Wm. J. Burke	Billings, Mont.
North Platte [4]	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	H. J. S. Devries	El Paso, Tex.
Baker, Thief Val. Dam	Owyhee, Oreg.	F. A. Banks	Constr. engr.			do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt.		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg.	F. A. Banks	Constr. engr.	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	do	Do.
Yakima [7]	Yakima, Wash.	John S. Moore	do	R. K. Cunningham	C. J. Ralston	Wm. J. Burke	Billings, Mont.
Yakima, Cle Elum Dam	Ronald, Wash.	R. J. Newell	Const. engr.	C. B. Funk	do	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas Div.	Ellensburg, Wash.	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	do	Do.
Shoshone [8]	Powell, Wyo.	L. B. Hosig	Acting supt.	W. F. Sha	Denver office.	Wm. J. Burke	Billings, Mont.
						do	Do.

[1] Reserve l works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo.	C. W. Tharp	Superintendent	H. O. Lamboth	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A.	Montrose, Colo	C. B. Elliott	do	F. D. Helm	Montrose, Colo.
Boise	Board of control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho.	F. L. Kinkade	Manager	Chas. Stout.	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district.	Rupert, Idaho	R. L. Willis	do	W. C. Trathen.	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont.	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont.	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont.	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Mary M. Kinney	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	D. R. Dean	Manager	Mrs. M. J. Thompson.	Bridgeport Nebr.
Newlands	Truckee-Carson irrig. district.	Fallon Nev.	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A.	Ogden, Utah.			Jno. B. Hooper	Hooper, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah.	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.			Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district.	Powell, Wyo	J. O. Roach	Irrigation supt	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations is progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Custom House	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg.	E. O. Larson	State of Utah.
Columbia Basin, Wash	Spokane, Wash., Sun Life Bldg.	H. W. Bashore	
Colorado River Basin investigations	Denver, Colo., Custom House	P. J. Preston	Colo., Wyo., Utah, and New Mex.
Rathdrum Prairie, Idaho	Spokane, Wash., Sun Life Bldg.	H. W. Bashore	None.
Seminoe Reservoir, Wyo	Denver, Colo., Custom House	Denver office	None.

SALLIE A. B. COE, *Editor.*

Photograph by J. E. Stimson

TREES IN THE MOUNTAINS ACT AS SPONGES IN THE HOLDING OF WATER FOR IRRIGATION

U. S. GOVERNMENT PRINTING OFFICE 193

AGRICULTURAL LIBRARY
CLEMSON, S.C.

THE RECLAMATION ERA

VOL. 23, NO. 5 MAY, 1932

R. B. Dame, Photographer

SPRAYING AN APPLE ORCHARD ON A FEDERAL IRRIGATION PROJECT

FEDERAL RECLAMATION POLICY INDORSED

WHEREAS during the past 30 years the Bureau of Reclamation has been a material factor in the upbuilding of the West, through the construction of Federal irrigation works, as a result of which 41,000 farms have been made available for country-minded people of small means upon which to make a home under economic conditions which will insure a reasonable opportunity for success; and

WHEREAS the cropped acreage of these Federal irrigation projects represents only four-tenths of 1 per cent of the national crop acreage as a whole and the value of the mainly specialized and seasonal crops grown represents only 1 per cent of the total value of crops grown in the United States, and can, therefore, have no appreciable effect on the surplus problem, but does give the arid West the opportunity to produce crops needed for its own use, compensates in part for the timber and mineral resources now fast being depleted, makes for a balanced agriculture, and affords an opportunity to the mid-western and eastern farmer, struggling for a livelihood on submarginal land and adding to the surplus of corn and wheat, to locate on an irrigated farm where he can become economically independent; and

WHEREAS these Federal irrigation projects afford an ever-increasing market for the sale annually of thousands of carloads of automobiles, farming implements and machinery, furniture, and other articles manufactured in the East and South and valued at more than $1,000,000,000 annually; and

WHEREAS, under the present reclamation law and policy, no projects are constructed until their feasibility has been definitely determined from the standpoints of economics, engineering, and financial ability of the settlers to repay their costs; and

WHEREAS no new projects are now being constructed, but, on the contrary, the bureau is engaged solely in completing projects heretofore authorized by Congress, in furnishing an adequate water supply to develop projects whose supply has been found inadequate to meet their needs, and in aiding in local flood control through the construction of storage reservoirs; and

WHEREAS the reclamation fund is made up of money coming directly from the irrigation States and not from the General Treasury: Therefore, be it

RESOLVED, That the National Drainage, Conservation, and Flood Control Congress, at its twenty-first annual meeting, commends the work of the Bureau of Reclamation and the present conservative Federal reclamation policy and urges that it be continued along the same general lines.

Resolution adopted by National Drainage, Conservation, and Flood Control Congress
in annual convention assembled at Louisville, Kentucky,
February 17–19, 1932.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 5 MAY, 1932

Interesting High Lights on the Federal Reclamation Projects

MARCH was characterized by abnormal precipitation on all except the eastern and extreme southern projects. At the higher altitudes of the watersheds additional snows were added to the already heavy snow cover. Heavy rains, especially throughout the Northwest, together with rising temperatures, which caused melting of snows at the lower altitudes, increased stream flow during the month and added materially to the storage catch. For reservoirs with concurrent data available the total storage content on March 31 was 4,800,000 acre-feet compared with 5,300,000 acre-feet for the same date in 1931.

THE Minidoka project reports that a large acreage will doubtless be planted to sugar beets this year. About 3,800 acres have been contracted for and it is expected that this area will reach 7,000 acres.

EMPLOYEES of the University Extension Service held a meeting with the settlers at Pavillion, Riverton project, to promote the planting of trees and to give assistance in securing such trees. This meeting was well attended.

ON THE Vale project 238 inquiries were received by mail by the Vale-Owyhee Government Projects Land Settlement Association last month, and 10 persons interested in the purchase of project lands called at the office.

CONTRACTING for the 1932 sugar beet crop on the Milk River project was started in March and good progress has been made. Contracts were signed for approximately 5,000 acres in the factory territory, of which 1,300 are within the Malta and Glasgow divisions. While this does not as yet equal the acreage contracted for 1931, it exceeds considerably the harvested acreage of last year.

THE Mini-Cassia Dairymen's Association on the Minidoka project during a recent month purchased 31,314 pounds of milk butterfat and 25,719 pounds of cream butterfat at both the Burley and Rupert plants. The association paid out $6,889 for the milk fat and $4,629 for the cream fat, or a total of more than $11,500. In addition, the casein factories at Burley and Rupert manufactured about 550 pounds of casein per day during March.

PREPARATORY work for planting approximately 650 acres of alfalfa with nurse crops on the Bully Creek east bench, Vale project, is in progress, and a carload of certified seed potatoes has been received from Montana for planting on the Bully Creek west bench. On the project as a whole much of the land will be seeded to alfalfa, potatoes, onions, and head lettuce.

LAMBING among flocks on the Minidoka project is ended and it is reported that the percentage of increase is quite satisfactory. Some 1,300 of the lambs that were fattened at the Burley feed lots during the winter have been shipped to California. The experiment of feeding has been successful and has yielded a good profit to the owners and feeders.

THE Grange, which has been strongly represented for a number of years on the gravity division of the Minidoka project, but only slightly on the pumping division, is making an active campaign to establish a number of branches on the pumping division. These organizations of the Grange take an active part in all matters affecting the welfare of the farmers on the project.

THE construction of an $80,000 creamery in El Paso, Rio Grande project, has been started by the Mistletoe Creamery Co. (Inc.).

SURFACING work on the Carlsbad Cavern Highway, Carlsbad project, is nearing completion. The contractor has been engaged in the placing of the foundation for the new potash refinery.

THE Pecos Water Users' Association on the Carlsbad project has circulated a petition for the organization of an irrigation district. Sufficient signers were secured for the petition and the request for organization has been advertised.

THE sheep industry of western Colorado is one of its biggest assets. According to the Federal veterinarian, the sheep movement from the higher ranges of western Colorado to the winter ranges in eastern Utah approximates about 421,000 head per annum. In addition to this annual migration from the mountainous areas to Utah, it is estimated that some 200,000 head were left in western Colorado for the winter.

CONSIDERABLE activity throughout the Orland project has been evidenced this spring in the way of leveling new lands, together with releveling and reseeding alfalfa fields.

THE Castberg Creamery at Powell, Wyo., on the Shoshone project has installed an artificial ice machine at a cost of about $6,000. This machine has a capacity of 4 tons per day.

ALFALFA on the Orland project continues to command high prices of $16 per ton for loose and $19 for baled hay. There was little hay available for sale even at these attractive prices. With the supply of last year's alfalfa entirely depleted, the prospects for a remunerative price for the first cutting of alfalfa are favorable.

Power Development on Federal Reclamation Projects

By L. N. McClellan, Chief Electrical Engineer, Denver Office, Bureau of Reclamation

POWER development is becoming one of the most important factors in the economic feasibility of Federal irrigation projects. Most of the proposed new projects which are being investigated at the present time include power development either as a means of providing cheap power for pumping water for irrigation purposes, or to provide power for sale commercially, the revenues from which can be used to repay part of the cost of the project, and thereby relieve the water users of a portion of the financial burden which otherwise they would be forced to bear. For example, the proposed Columbia Basin project in eastern Washington contemplates a great dam across the Columbia River at the head of the Grand Coulee which would make available approximately 1,500,000 kilowatts of power. Half of this power would be utilized for pumping 15,000 second-feet of water from the Columbia River above the proposed dam into a regulating reservoir in the Grand Coulee, from which the water would flow by gravity to the 1,200,000 acres of land to be irrigated. The other half of the power would be sold for commercial purposes and the resulting revenues would be used to repay the cost of the dam and power development and part of the cost of the irrigation development. This project would not be economically feasible without the proposed power development.

The Boulder Canyon project now under construction on the Colorado River will provide flood control and storage for irrigation and domestic purposes and, incidentally, will make available 500,000 kilowatts of continuous firm power. Contracts have been entered into providing for the sale of this power, which will provide sufficient revenues to repay the entire cost of the Hoover Dam and power plant, with interest at 4 per cent, within a period of 50 years. It is expected that the revenues from power will average more than $7,000,000 per year over the 50-year repayment period.

The Bureau of Reclamation has constructed 14 hydroelectric power plants on the various projects to date. Some of these have been turned over to the water users along with the projects which they are now operating, and at the present time the bureau is operating nine hydroelectric plants.

BOISE PROJECT PLANTS

On the Boise project in Idaho there are two hydro-electric plants. The first, known as the Boise River plant, was built primarily to supply power for the construction of the Arrowrock Dam and was operated for this purpose from May, 1912, until November, 1915, at which time the construction of the dam was completed. During this period considerable surplus power was sold to the Idaho Oregon Power Co., and, through an interchange arrangement with this company, power was furnished for the construction of drainage ditches in the Pioneer and Nampa-Meridian irrigation districts. Following completion of construction work on the Arrowrock Dam, this plant was leased to the Electric Investment Co. and was operated by this company and its successor, the Idaho Power Co., until May 1, 1921. From May 1, 1921, to March 31, 1926, the plant was operated by the Minidoka project, and power was transmitted over the lines of the Idaho Power Co. to the Minidoka project, under an interchange agreement. At the expiration of this contract the power plant was leased to the Idaho Power Co. for stand-by service, and during the 1930 and 1931 irrigation seasons it was operated by the Government to furnish power for construction purposes on the Owyhee project to supplement the output of the Black Canyon plant which was below normal owing to the low run-off of the Payette River. The Boise River plant contains three generating units which operate under heads varying from 25 to 30 feet and the total installed capacity is 1,875 kilovolt-amperes. The entire capacity will ultimately be required for pumping water to the Hillcrest division of the Boise project.

The second power plant on the Boise project is the Black Canyon plant located on the Payette River at the Black Canyon diversion dam. This plant was built to provide cheap power for the Gem irrigation district for pumping irrigation water. The plant contains two generating units which operate under heads of 82 to 92 feet and the total installed capacity is 10,000 kilovolt-amperes. The plant was placed in service in the summer of 1925, and since that time has furnished power to the Gem irrigation district at about half the cost at which power was formerly obtained from the local power company, and it has been largely instrumental in preventing the abandonment of the lands in this district. The Government reserves 1,000 kilowatts of power from this plant for construction purposes on the Owyhee and Boise projects, and power is supplied to the Ontario-Nyssa irrigation district in addition to the Gem irrigation district. The power is transmitted over the lines of the Idaho Power Co. to these districts, and in return for this transmissoin service and the payment of $600 per month during the nonirrigation season the company receives all of the surplus energy available over and above the amounts required by the United States and the various irrigation districts. Eventually the entire output of this plant during the irrigation season will be required to operate the pumping plants which will furnish water for the Payette division of the Boise project. The revenues from this plant are being used to repay the cost of the Black Canyon power plant, one-half the cost of the Black Canyon diversion dam, and all of the cost of the Deadwood Dam and reservoir.

A new hydro electric power plant is now under construction on the Grand Valley project, which will be placed in service during the fall of 1932. Funds for the construction of this plant are being advanced by the Public Service Co. of Colorado, and this company will operate, maintain, and receive the entire output of the plant for a period of 25 years. The contract with the power company provides for the annual payment of $15,000 by the company for the delivery of power water. The Grand Valley power plant will have two generating units which will operate under a head varying from 73 to 79 feet, and the total installed capacity will be 3,750 kilovolt amperes.

The Minidoka power plant, located at the Minidoka Dam on Snake River, was constructed to furnish power for the operation of electric pumping plants which supply water for the irrigation of the South Side division of the Minidoka project. The plant has a total installed capacity of 10,000 kilovolt amperes and contains six generating units which operate under heads varying from 44 to 50 feet. In addition to the power used for pumping purposes, power is sold to several towns and mutual power companies serving rural districts on the Minidoka project and surplus power is sold to the Idaho Power Co. under an interchange agreement. The gross revenues from sale of power from the Minidoka plant have amounted to over $2,000,000 since the plant was placed in service in 1909. The net revenues are credited annually to the Burley and Minidoka irrigation districts and have been largely instrumental in providing funds for additions and betterments to the project irrigation and power systems.

LINGLE AND GUERNSEY PLANTS

There are two hydro electric power plants on the North Platte project. The smaller of these, known as the Lingle power plant, located on the Fort Laramie Canal, was originally built to furnish

cheap power for the operation of electric excavators engaged on the construction of the Fort Laramie Canal. The plant was placed in service on May 1, 1919, and on December 4, 1919, service was begun to the town of Torrington, Wyo. As the main transmission lines were extended eastward, additional towns contracted for power and the Government is now supplying power to 9 towns, 4 companies, and 2 irrigation districts. The original Lingle power plant contained two generating units having a combined installed capacity of 750 kilovolt amperes. In 1925 the plant was rebuilt and two additional units were added, making the total installed capacity 1,750 kilovolt amperes. The turbines operate under a head of 107 feet.

The Guernsey power plant, located at the Guernsey Dam on the North Platte River, was placed in operation on July 26, 1927. It contains two generating units operating under heads varying from 70 to 90 feet, and the total installed capacity is 6,000 kilovolt amperes. Net power revenues on the North Platte project now average well over $200,000 per year. Since the Lingle plant was first placed in service in 1919 to the end of 1931 the net revenues from sale of power over and above the amounts required to provide for operation and maintenance, have amounted to over $1,000,000. The net revenues, after setting aside suitable amounts to cover the estimated depreciation of the power system, are credited to the irrigation districts on the North Platte project and applied on their annual construction payments.

The power possibilities at the Elephant Butte Dam on the Rio Grande have been investigated at various times, but nothing has materialized thus far, due primarily to the small amount of firm power available during the nonirrigation season and to the long distance that the power would have to be transmitted in order to reach a market. At the present time there is installed at the Elephant Butte Dam a small hydro electric unit of 187 kilovolt amperes capacity which supplies power for the operation of the gates and pumps at the dam and for lighting the dam and camp.

The Pilot Butte power plant, located on the main canal of the Riverton project, was built to furnish cheap power for the operation of electric excavators engaged on the construction of the project canal and drainage system. The plant contains two generating units which operate under a head of 103 feet and the total installed generator capacity is 2,000 kilovolt amperes. Surplus power is sold to the Mountain States Power Co. for use in the near-by towns of Riverton, Shoshoni, Hudson, and Lander. Net revenues to the end of 1931 amounted to $42,722. The net revenues are applied to repayment of the cost of the power development which is not included in the cost of the project to be repaid by the water users.

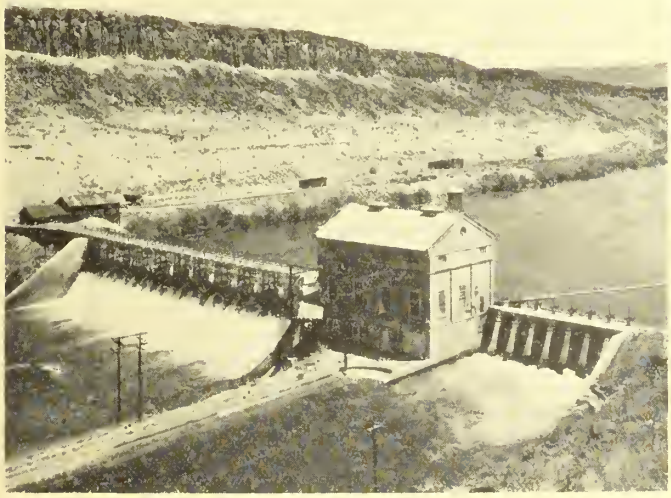
PLANT AT SHOSHONE DAM

The Shoshone power plant, located at the Shoshone Dam on the Shoshone River near Cody, Wyo., was built to furnish power for the construction of project canals and drainage ditches. The original installation consisted of two units operating under heads varying from 120 to 230 feet, and having a total capacity of 2,000 kilovolt amperes. In 1931 a third unit of 5,000 kilovolt amperes capacity was added in order to provide adequate generating capacity to take care of the increasing commercial load. Net revenues from the Shoshone power plant to the end of 1931, amounted to $289,523. Net revenues from this power development are applied to the repayment of the cost of the Shoshone power plant and the Shoshone Dam, and the water users on this project are not charged with these features.

A new power development on the Yakima project near the town of Prosser is now under construction and will be ready for operation in the fall of 1932. It will contain a single generating unit of 3,000 kilovolt amperes capacity and the turbine will operate under a head of 42 feet. Power from this plant will be supplied to the Kennewick and Franklin County No. 1 irrigation districts for pumping irrigation water, and surplus power will be sold to the Pacific Power & Light Co. An interchange agreement has been entered into with the power company which provides for the transmission of power from the Prosser power plant over the lines of the company within a radius of 50 miles to the various points of use. The cost of the Prosser power development is to be repaid out of net power revenues.

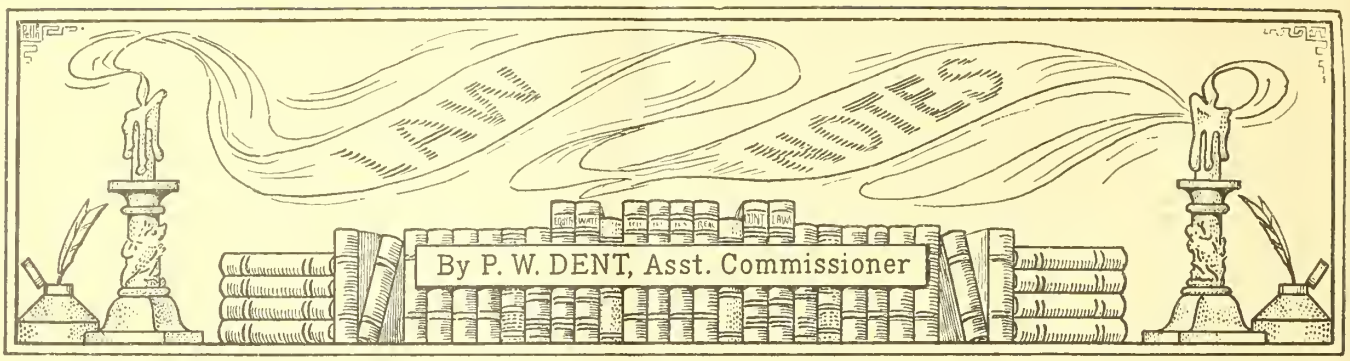
The siphon drop power plant, located at a drop in the main canal on the Yuma project, was placed in regular operation on July 26, 1926. The plant contains two generating units having a combined capacity of 2,000 kilovolt amperes. The turbines are of the high-speed or propeller type and operate under a head of only about 9 feet. Power from this plant is used for pumping water to the lands on the Yuma Mesa and also for pumping drainage water over the levees into the Colorado River. Surplus power is sold to the Southern Sierras Power Co. Net revenues from the sale of power to the end of 1931 amounted to $226,438. Net revenues are credited annually to the lands of the Yuma project.

With the completion of the Grand Valley and Prosser power plants which are now under construction, there will be a total of 11 hydroelectric power plants, aggregating 38,000 kilowatts, on the various irrigation projects operated by the Bureau of Reclamation. The net revenues from the sale of power from these plants, after providing for the cost of operation and maintenance, will amount to about $600,000 per year.



Photograph by J. E. Stimson

Left, Boise River diversion dam and power house, Boise project, Idaho; Right, interior of Minidoka power plant, Minidoka project, Idaho



Summary of Session Laws of Colorado, 1931, of Interest from Viewpoint of Federal Reclamation

By Armand Offutt, District Counsel, Denver Colo.

[Continued from April issue]

CHAPTER 165. *Floating of logs or timber in streams.*—H. B. 17 (approved and effective Apr. 2, 1931). Amends section 1242, Compiled Laws of Colorado, 1921, and section 1461, Compiled Laws of Colorado, 1921, as amended by chapter 99, Session Laws of 1925, relating to floating of logs or timber in streams.

Section 1 of the act provides that all streams in the State of Colorado capable of being used for driving or floating logs or other timber products therein may be used for said purpose by complying with the terms and provisions of the act, with the proviso that such use shall be subject to any right acquired by prior appropriation of water for domestic, agricultural, or manufacturing purposes, with the right of any such appropriator to take and divert the waters of any stream for such purposes to the extent of said prior appropriations, and to make, maintain, and operate solid dams for the diversion of water for such purposes, whenever needed or required, and that use of the stream for driving or floating operations shall not interfere with, injure, or damage any dam, headgate, or appliance used by any appropriator to divert water from the stream or to interfere with or damage any public or private road, bridge, or other structure along, on, or over said stream.

Section 2 provides that it shall be unlawful for any person or corporation to use any stream in the State of Colorado for the purpose of floating logs or other timber products therein until a permit therefor shall have been procured from the State engineer to use any stream for such purpose, and the permittee shall comply with all the terms and provisions of the act in relation thereto and shall give a bond as provided by the act.

Section 3 provides that any person or corporation desiring to procure a permit to use any stream in the State of Colorado for the purpose of driving or floating logs or any other timber products shall file with the State engineer an application in writing, describing the stream upon which the log-driving operations are to be conducted and the location and character of any boom or other structure to be used in said operations, together with plans and specifications and a map designating the stream and showing the locations of such appliances, and shall show thereon the general location of all existing dams, headgates, and appliances of any appropriator taking water from the stream, and all roads or bridges, public or private, on or over the stream, and the petition shall give the names of all owners of such structures and appliances, with post-office addresses, so far as ascertainable.

Section 4 provides that, upon the filing of the petition, the State engineer shall fix a date not less than 30 days thereafter and a place for hearing, and shall cause notice to be issued stating in substance the nature and purpose of the application and the date and place of hearing thereon, and the applicant shall cause said notice to be served personally or by registered mail upon all the owners of dams, headgates, appliances, bridges, or other structures in or over said stream, stating that a hearing on the application will be held at the place and upon the date fixed in the notice, or any date to which it may be adjourned. At the hearing any appropriator of water from the stream or any persons having a dam, headgate, or appliance on said stream used for diverting water therefrom, and any persons having a road, bridge, or other structure on or over the stream, may appear and file objections in writing and resist the application.

Section 5 provides that the State engineer shall consider the application and all objections thereto, and the evidence for or against the same, and if need be shall make a personal inspection of the stream and of the location of any boom or appliance mentioned in the application, as well as all other appliances and structures on the stream, and shall determine whether the granting of the application will injuriously affect any existing dam, headgate or irrigation appliance, or appropriation of water, or any road, bridge or other structure in, on, or over the stream; and if the State engineer shall determine that the granting of the application will not injuriously affect the property or rights of any other person using the stream or its waters, or any appliance used in connection therewith, or any road or bridge or other structure thereon, then he shall grant the permit; but if he shall determine that the use of the stream for the purposes stated in the application will injuriously affect the property or rights of any other person using the stream or its waters, or having any road, bridge or other structure in, on, or over the stream, he shall deny the application. It is further provided in this section that if the State engineer shall determine that the mode of use, or the appliances to be used, may be modified to avoid such injury, then he may grant such permit upon such conditions as he shall deem necessary for the protection of the rights of others, and shall further provide that the applicant shall furnish a good and sufficient bond before issuing the permit. It is further provided in the same section that the State engineer shall make his decision in writing and file the same in the proceeding.

Section 6 provides that before any permit shall be granted the applicant shall execute and file with the State engineer a bond with good and sufficient security, running to the State of Colorado, for the use and benefit of any and all persons and corporations, public or private, having any interest in the waters of said

stream as appropriator or otherwise, or having any dam, headgate, appliance, bridge, or other structure in, on, or over said stream, which might be injured or damaged by driving or floating logs or other timbers in the stream, or the erecting of any boom or other appliance to facilitate the log-driving operations in the stream, conditioned to pay any and all damages sustained by any appropriator of water, or any person having any dam, headgate, or appliance in the stream for the diversion of water, or any road, bridge, or structure in, on, or over said stream, which bond shall be a continuing bond, and any person injured or damaged by said log-driving operation on the stream shall have a right to maintain an action for any injury or damage sustained thereby, and that successive suits may be maintained by the same or different persons upon the bond as injury or damage shall arise, such bond to be in such sum as shall be fixed by the State engineer, and when executed and filed with him shall be approved by him.

Section 7 of the act provides that the granting of the permit shall not relieve the permittee from liability for any injury or damage caused by log-driving operations, and that the State engineer is authorized to suspend or annul any permit in case the permittee shall fail or refuse to comply with any of the conditions therein provided, or shall so negligently carry on operations thereunder as to injure or damage the property or rights of any appropriator or user of the stream or any appliance therein or thereon. It is further provided in this section that any person whose rights, property, or appliances in, on, or over the stream shall be injured or damaged by the log-driving operations shall have the right of recovery against the holder of the permit, and upon the bond, for any injury or damage sustained, and shall have the right to apply for an injunction against any injury or threatened injury which may arise on account of any such operations or injury or damage to his appliances, and suits for injunction and damages and for recovery on the bond may be joined in the same action.

Section 8 of the act provides that the permittee or any other person who has filed objections in the proceedings before the State engineer may appeal from the decision of the State engineer to the district court of any county where the log-driving operations are sought to be carried on, by giving written notice of such appeal to the State engineer within 30 days after decision by the State engineer on the application, and filing with the State engineer a cost bond as required in civil actions in courts of record, and thereupon the State engineer, upon payment to him of all costs incident to the appeal shall transmit the record of the proceedings in his office, and all papers and files connected therewith and his ruling thereon with his certificate attached thereto to the clerk of the district court. When the record is filed in the district court the clerk thereof is required to prepare a notice that the proceedings have been appealed to that court, which notice shall be directed to and served upon all persons who have theretofore filed objections to the granting of the permit at least 20 days prior to hearing thereon. After service is made, the court shall proceed to hear and determine the application in like manner as other civil actions, and the trial thereof shall be *de novo*, and other persons claiming to be injured or affected thereby may appear at any time before the hearing and file their objections to the granting of the permit. The court, after having heard the cause, shall make and enter its judgment therein, refusing or granting the permit or fixing conditions upon which the same may be granted, and if granted shall direct the State engineer to proceed and fix the bond and issue the permit in accordance with such decision, and unless appeal is taken the clerk of the court shall transmit the decision to the State engineer for his action.

Section 9 provides that in case the State engineer shall grant a permit and an appeal is taken to the district court, then the filing of the record in the district court shall operate as a stay on the permit until final determination by the court. A writ of error from the judgment of the district court shall lie in like manner as in other civil actions, and in the hearing in the district court the rules of procedure for trial of civil actions shall apply as near as may be.

Section 10 provides that anyone violating any of the provisions of the act shall be guilty of a misdemeanor, and upon conviction be fined in a sum not exceeding $1,000 or be imprisoned in the county jail for a term not exceeding six months, or both, at the discretion of the court.

CHAPTER 172. *Leasing of water by municipalities.*—H. B. 499 (approved and effective May 12, 1931). This act provides that in the event any municipal appropriator of water having a population of in excess of 200,000 people shall hereafter lease water not needed by it for immediate use, no rights shall become vested to a continued leasing or to a continuance of the conditions concerning any return water arising therefrom, so as to defeat or impair the right to terminate the leases, or change the place of use, with the proviso that any leasing shall not injuriously affect rights theretofore vested in other appropriators, and that nothing contained in the act shall authorize an appropriator to recapture water for a second use after it has once been used by it.

Summary of Decision of Supreme Court of Colorado Rendered June 1, 1931 (Rehearing Denied June 22, 1931) in Case Entitled "Trinchera Ranch Co. Et Al. v. Trinchera Irrigation District" (300 P. 614)

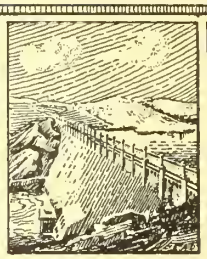
At the January 1928, term, the supreme court set aside a decree of the district court of Costilla County which granted to the irrigation district permission to change 13 different points of diversion of its irrigation ditches that take water from three streams, and directed that if a further hearing below was desired, additional evidence could be introduced, but if petitioner did not elect to introduce additional evidence the lower court was directed to find the issues for the protestants. Trinchera Ranch Co. et al. *v.* Trinchera Irrigation District (266, P. 204).

Upon further hearing below, the district produced further evidence, but the protestants declined to introduce further evidence on the ground that the additional evidence was of no probative force. The court below found for the petitioner irrigation district.

The supreme court held that the further evidence introduced at the second hearing below did not justify a decree authorizing the changes sought, and reversed the decree of the district court and remanded the case with instructions. In the decision it was stated that by statute and repeated decisions of the court changes of points of diversion may lawfully be made only under a decree of court permitting it. It was also stated that a decision of an appellate court on a former appeal is conclusive when the case comes up for review a second time and the evidence is substantially the same. It was further stated that an applicant for an order permitting change of point of diversion of water has the burden of proof to show that rights of junior appropriators will not be injured by the change and that an irrigation district can not, under the guise of a petition for change of point of diversion, acquire rights of junior appropriators or substantially impair such rights without rendering adequate compensation.

—*Armand Offutt, District Counsel.*

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Concrete for Hoover Dam

(Part I—Concrete Aggregates)[1]

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

THE concrete which was poured on March 5, 1932, in the foundation for the 100-foot high trash rack at the inlet portal of the Nevada inner diversion tunnel was the first concrete to be poured under the contract for construction of Hoover Dam, power plant, and appurtenant works.

This operation was the commencement of concreting which will continue until approximately 4,400,000 cubic yards have been poured. It also marked the culmination of the investigations and studies that have been conducted since 1929 for the location of a deposit of suitable concrete aggregates, the building of a railroad for transportation of these aggregates, the construction of a screening plant for segregation and classification of sand and gravel, and the building of a mixing plant capable of manufacturing, in the required quantities, the quality of concrete designated in the specifications of 2,500 pounds per square inch compressive strength for mass concrete and 3,500 pounds per square inch for thin sections.

Aggregates of sand and gravel for the concrete are taken from the Arizona deposit by a 5-cubic-yard electric dragline, dumped into 50-ton side-dump cars, transported across the Colorado River on an 850-foot pile-trestle bridge and then over 6 miles of railway to the screening plant. Here the aggregates are dumped into bunkers, thence transported by a series of lateral belt conveyors to rotary and vibrating screens which separate the pit material into sand and four sizes of gravel, and then by another series of transverse conveyors deposit each in a separate stock pile. Sand and each size of gravel are loaded by belt conveyors into separate railroad cars and transported 4.7 miles to a concrete mixing plant located in Black Canyon approximately 1 mile upstream from the Hoover Dam site. The sand and gravel are dumped from the cars into their respective bins below the track and then elevated by belt conveyors to storage at the top of the concrete plant. The sand, gravel, and cement are conveyed to batchers and to the mixers where water is added. Mixing of each batch is carried on for a minimum of two and one-half minutes in 4-cubic-yard mixers. The concrete is then dumped into an agitator drum mounted on an 8-ton truck and transported to the site for pouring.

ARIZONA GRAVEL DEPOSIT

The Arizona deposit, from which all aggregates for the construction in Black Canyon will be obtained, is located on the Arizona side of the Colorado River 6 miles by air line north of the Hoover Dam site. The deposit lies along the river, covers an area of more than 100 acres, and, from investigations by test pits, has an average depth of more than 30 feet. It is expected that not more than 3 feet of this depth will be discarded by surface stripping or removal of silt pockets; thus there will remain approximately 4,500,000 cubic yards of aggregates available for use in the dam, all of which will be needed. This deposit was chosen after extensive search had been conducted of the region for 50 miles in all directions from the dam site and tests had been made of aggregates from more than 20 different deposits.

An electrically driven dragline equipped with a 5-yard bucket is used for stripping and for loading aggregates. The pit is operated with three shifts daily, and at present an average of one hundred and fifty to two hundred 50-ton cars are shipped to the screening plant each 24 hours. The aggregates are transported in side-dump cars pulled by 90-ton locomotives. The railroad line from the deposit to the screening plant is 7 miles in length and was constructed by the Six Companies (Inc.), contractors on the dam.

SCREENING PLANT—GENERAL DESCRIPTION

The location of the screening plant is in the flat area at the lower end of Hemenway Wash about 2 miles west of the river and 2½ miles by air line northeast of the Hoover Dam site. It is situated at Three-Way Junction on the contractor's railroad, from which point one line leads to the Arizona deposit, another to the concrete plant in Black Canyon, and the third to the United States construction railroad connecting with Boulder City.

The screening plant essentially consists of a scalping station with its attendant crusher, four classification towers, sand washer, sand shuttle conveyor, four live storage piles east of the classification towers, and sand storage piles across the gravel loading tracks west of the towers. The aggregates from the Arizona deposit are either dumped at a raw storage site adjacent to the screening plant or into bunkers at the north end of the plant.

A 42-inch belt conveyor running in a concrete tunnel beneath the bunkers receives the aggregates through gates and hoppers installed in the roof of the tunnel and transports the material to the scalping station, dumping the aggregates into a 20-foot cylindrical revolving screen. This screen allows all material less than 9 inches in size to pass through its perforations, and dumps cobbles above this size onto a transverse conveyor leading to a gyratory crusher. After going through the jaws of the crusher, the broken cobbles are conveyed by belt to the 42-inch principal conveyor and return through the scalping station.

From the scalping station the material less than 9 inches in size is conveyed by a 36-inch belt conveyor to the first classification tower which is equipped with 2 vibrating screens. The first screen allows aggregates less than 3 inches in size to pass and dumps the 3 to 9 inch material on to a transverse conveyor which transports it to the stock pile. The second screen allows all sand less than ¼ inch in size to pass through its perforations and dumps all gravel onto a lateral conveyor leading to the second classification tower. In a similar manner the vibrating screen

[1] Parts 2 and 3, describing the concrete mixing plant and lining diversion tunnels with concrete, will appear respectively in the June and July issues of the ERA.

and transverse conveyor at this second station remove the ¾ to 3 inch gravel to a stock pile and the lateral conveyor transports the material less than 1½ inches in size to the third tower. Here gravel of ¾ to 1½ inch size is removed to a stock pile and all materials passing through the screen are conveyed laterally to the fourth tower, where a transverse conveyor transports this gravel of ¼ to ¾ inch size to its stock pile.

SAND WASHING

The sand removed by the vibrating screens in the first classification tower is chuted to a series of mechanical sand washers or classifiers. Water is added to the sand after it leaves the screen, and the sand and wash water enter the lower end of a mechanical sand washer consisting of drag blades installed on eccentrics. This arrangement, by reciprocating action, moves the sand progressively up the sloping bottom of the washer tank and out over the end to a chute through which the sand is conveyed by water to a second washer of the same type. The water and silt separated from the sand in the tanks overflows at the lower end of the sand washer to a flume and thence to a sedimentation tank equipped with a traction clarifier and sludge pump. From this clarifier the water runs to a sump tank and is then pumped to a sedimentation tank located on a hill southeast of the plant for reuse. The sand after passing the second sand washer is transported by a belt conveyor through a concrete tunnel underneath the railroad tracks to a conveyor running parallel to the tracks. This conveyor connects with a tripper equipped with two transverse conveyors, all of which are mounted on a framework and rails supported by a steel trestle. This arrangement for sand storage permits piling the sand into stock piles, one on each side of the lateral supply conveyor and parallel to the railroad tracks.

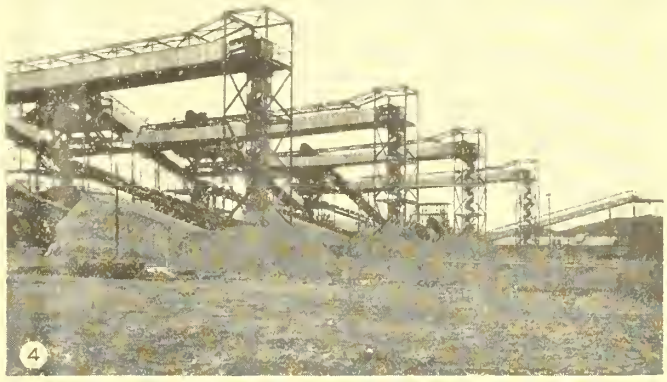
Five railroad tracks have been laid for efficient loading of sand and gravel from the plant. Between the classification towers and the sand stock piles, there are three tracks—one for gravel loading, the next for sand loading, and the third, adjacent to the sand piles, for the operation of a railroad crane. On the west side of the sand piles are two tracks, the first for the railroad crane and the other for sand loading. The sand is loaded into cars by the crane, equipped with a clam shell bucket.

A concrete tunnel, 11 feet in height and 9 feet wide inside, is constructed beneath all gravel stock piles, and has contained therein a 24 or 30 inch conveyor belt which leads to screens in the lower part of the classification towers. The gates installed in the roof of the tunnel are opened from inside, allowing the gravel to drop into a hopper from which it is fed to the loading conveyor belt.

The belt dumps the gravel into a vibrating reclassifying screen, which passes all gravel of a size less than that supposed to be in the stock pile, dropping this smaller material onto a lateral conveyor which returns it to the scalping station. The material remaining on the screen flows from its lower end to a hopper and a 48-inch shuttle conveyor and thence to bottom-dump railroad cars. The gravel is kept continuously wet by sprinklers installed at the top of the stock pile and is washed by water jets as it is dumped from the reclassifying screen onto the loading conveyor.

SCREENING PLANT—DETAILS

The capacity of the plant with its present installations is more than 500 tons per hour. Four 50-ton cars can be loaded out every 16 minutes. Present construction allows for storage in stock piles of 1,700 tons of cobbles, 1,500 tons of each size of gravel, and 22,000 tons of sand. By increasing the speed of the conveyor belts and making slight alterations, principally by extension of the transverse conveyors and the tunnels beneath the stock piles, the plant can be increased to a capacity of 1,000 tons per hour.



1, Loading concrete aggregates at Arizona gravel deposit. Piles of material at right of picture are discarded strippings. 2, Screening plant from southeast. View taken before plant was placed in operation. Note shuttle conveyor and platform for sand stock piles immediately beyond railroad crane; scalping station to right of four classification towers; bin and rock crusher at right of plant; and concrete tunnels beneath gravel stock pile towers. 3, Unloading gravel at screening plant. Note supply conveyor leading to scalping station and at left the conveyor ways between classification towers and stock pile towers. 4, Screening plant from southeast. Stock pile tower, gravel ladder, and loading conveyor tunnel in foreground. Cobble bin and crusher at extreme right

Photograph by B. D. Glaha

The plant is run by electrical power, requiring more than 50 induction motors for all operations. The supply conveyor and the conveyor to the first classification tower are run by 60-horsepower motors, the others by 10 and 20 horsepower, and most of the screens by 5-horsepower motors. The supply conveyor is 220 feet long, the lateral conveyors are 1,160 feet in total length, the transverse conveyors 710 feet, and the loading and shuttle conveyors 670 feet. The plant contains a 5-foot diameter, 20-foot long scalping screen, and 13 vibrating screens, 11 of which are 10 by 4 feet in size and 2 are 12 by 4 feet.

The plant is controlled from a central switching station located in the top of the scalping tower. Thirty-four sets of push-button switches electrically control all units of the plant, and one switch can stop all operations. At this same station the nine gates in the bottom of the supply bins are regulated by rheostat control, thus governing the supply of aggregates to the primary conveyor and the output of the entire plant. The conveyors are all operated at a constant speed regulated by the gearing from the driving motors. The speed of the lateral conveyors vary from 150 to 350 feet per minute, the transverse conveyors from 150 to 225 feet, and the loading conveyors from 225 to 300 feet.

Water for washing purposes in the plant is pumped from the Colorado River by stages through 2 miles of 12-inch pipe line against a static head of 415 feet to a sedimentation tank located on the hill southeast of the plant. The character of the silt in the river water is such that 98 per cent of it can be removed by a detention period in the tank of three hours. Water from the river contains an average of 6,000 parts per million of silt, and water sent to the screening plant is required to contain not in excess of 500 parts per million. The presedimentation tank, constructed of reinforced concrete, is 150 feet in diameter and 15 feet in height. It has a capacity of 800,000 gallons of water and is equipped with a Dorr traction clarifier. Sludge is removed by gravity.

Construction of the screening plant was started in November, 1931, and it was first operated on January 9, 1932, when S. O. Harper, assistant chief engineer of the Bureau of Reclamation, closed the switch to commence the initial operation. More than 385 tons of structural steel were used in the construction, and the cost of the plant amounted to approximately $450,000.

Notes for Contractors

Boulder Canyon project.—Bids under specifications No. 533 were opened at Denver, Colo., on May 2, 1932, for furnishing two 50 by 50 foot bulkhead gates, together with structural steel gate frames, guides, roller tracks, seats, seals, supports, and appurtenant parts; two 50 by 35 foot Stoney gates, together with structural steel gate frames, guides, chairs, and appurtenant parts; two hydraulic hoists for the bulkhead gates; and two worm gear type hoists operated by electric motors for the Stoney gates; for the outlet works at Hoover Dam. All material is to be installed by the Government.

Bids under specifications No. 534 will be opened at Denver, Colo., on June 15, 1932, for furnishing plate-steel outlet pipes for Hoover Dam, power plant and appurtenant works. The work involves the fabrication, erection, and painting of approximately 100,000,000 pounds of plate-steel pipes and appurtenances in outlet conduits and penstocks. Alternative bids will be considered on three plans—one with 30-foot diameter and 25-foot diameter plate-steel header pipes, with 13-foot diameter penstocks and 102-inch and 91-inch diameter needle valve conduits; one with twenty-eight 13-foot diameter pipes, 7 in each of the main concrete-lined tunnels, 16 of which will be penstocks and 12 needle valve conduits; and the other plan with sixteen 17 foot 6 inch diameter pipes, 4 in each of the main concrete lined tunnels, 8 of which will be penstocks and 8 needle-valve conduits. The work involves steel plate thicknesses varying from $\frac{7}{8}$ to $2\frac{13}{16}$ inches. The price of the specifications to other than prospective bidders is $3.50.

Bids under specifications No. 566–D were opened at Boulder City, Nev., on April 18, 1932, for the construction of an 8-room school house at Boulder City.

Sixteen bids were received on March 25, 1932, for the construction of thirty 3-room temporary residences at Boulder City, Nev., for the use of Government employees. The contract was awarded to the low bidder, DeCamp-Hudson Co. (Ltd.), of Los Angeles, Calif., at a total price of $9,053. 10.

Contract under specifications No.559–D for furnishing and installing a cooling system in the administration building at Boulder City was awarded on March 11, 1932, to the low bidder, the Frigidaire Corporation, of Dayton, Ohio, at a total price of $4,833.87.

Contract under specifications No.557–D for the construction of three community garages at Boulder City for the use of Government employees was awarded to V. C. Brunzell, of Gardena, Calif., at a total price of $3,218.

Grand Valley project.—Bids under specifications No. 567–D for the construction of the Grand Valley power plant and appurtenant structures, and under specifications No. 568–D for furnishing and erecting two plate-steel penstocks for the power plant, were opened on April 28, 1932.

Yakima project, Cle Elum Dam.—Bids under specifications No. 565–D were opened at Ronald, Wash., on April 7, 1932, for the construction of a road above the flow line of the Cle Elum Reservoir to replace a portion of a road to be submerged by the reservoir when completed. Thirteen bids were received, the low bid being that of Barnard-Curtis Co., of Minneapolis, Minn., with a total of $19,988.

Specifications have been issued for the purchase of cylinder gates and hoists for the Cle Elum Dam.

Yakima project—Kittitas division.—Bids under specifications No. 531 were opened on March 30, 1932, at Ellensburg, Wash., for the construction of Wippel pumping plant and appurtenant structures and Wippel pump lateral, station 21+15 to station 35+49. Twelve bids were received, the low bidder being L. Colucciо & Co., of Seattle, Wash., whose total bid was $13,713.

Yakima project—Kennewick division.—Bids under specifications No. 563–D were opened on March 3, 1932, for furnishing structural steel and cast iron gates for the Prosser power canal and Prosser power plant, and contract was awarded to the Commercial Iron Works, of Portland, Oreg., at a total price of $2,105.

Progress at Cle Elum, Owyhee, and Thief Valley

Winston Bros. Co., contractors for the Cle Elum Dam on the Yakima project, Washington, are ahead of schedule with their contract, although they had 24 rainy days during the month of March, with a total precipitation of three times the average. Fortunately, the work in progress was almost entirely under ground and consisted principally of tunnel lining. The contract was 31 per cent completed on April 1.

At the Thief Valley Dam on the Baker project, Oregon, the grouting was completed on April 1, and concreting was 92 per cent complete.

Concreting at the Owyhee Dam in Oregon was resumed by the General Construction Co. on March 2. At the present rate of progress all concrete will be placed by June 1 of this year.

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, under authority of the Secretary of the Interior.

Copies of the Reclamation Era will be sent, without direct charge, to any water user on the reclamation projects or divisions of projects, which are being operated by the Bureau of Reclamation. Special terms may be made with water users on projects or divisions of projects no longer operated by the Bureau. To others the price is 75 cents a year, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation. Postage stamps will not be accepted.

Material for publication in the Reclamation Era should be addressed to Commissioner, Bureau of Reclamation, Department of the Interior, Washington, D. C., and should be mailed in time to reach this office not later than the 14th of the month in order to insure publication in the succeeding month's issue of the Era.

SALLIE A. B. COE, *Editor*

MAY, 1932

Stick to Your Bush

VERY few settlers on reclamation projects are from the plains of New England. Not many of the homesteaders, if any, have picked huckleberries. It is very easy for an inexperienced young person to make the mistake of moving from a good berry bush to one that looks better, but in reality is practically the same. When moving from one bush to another considerable time is lost and consequently fewer berries are harvested. The old slogan "stick to your bush" is very appropriate not only for berry picking but for irrigation farming.

Many irrigation farmers make the mistake of changing from a well-planned crop-rotating schedule to growing a certain crop because of reports and advice given by persons in high positions who pretend to know what crops pay the largest returns.

It is recognized by all competent authorities that the farmers on Federal reclamation projects are producing crops that compete to only an insignificant degree, if at all, with the rest of the farmers of the country. Obviously, therefore, they should not be guided by advice about the acreage planted to a particular crop in some other locality. Considerable emphasis has been placed upon statements to the effect that the overproduction of wheat is due to the additional crop raised by the farmers on reclamation projects. The absurdity of this is self-evident. As a matter of fact, very few, if any, of our projects produce enough wheat and corn for home consumption. No one disputes that temporarily there is an overproduction of some crops. This may be laid to any of several causes, such as the increasing use of modern machinery or to a combination of causes. At any rate, to place on the reclamation project settlers the responsibility for the overproduction of such crops as wheat, corn, and cotton is comparable to asserting that the flood waters of the lower Mississippi River could be controlled by means of a small flood control dam at the source of one small contributing stream in the Rocky Mountains several thousand miles away from the flooded area.

Only a few years ago the farmers on one of the reclamation projects, alarmed by reports of an increased acreage of potatoes in the large producing sections, reduced their customary acreage of this crop. An unfavorable growing and harvesting season in the humid and dry sections followed, and there was a short potato crop. The few farmers on that project who stuck to their "bush" and did not change their plan of crop rotation were like the berry picker who did not roam from bush to bush. They harvested the usual crop and the value was vastly more than what their neighbors realized who deviated or took a chance.

Likewise, the farmers on reclamation projects are advised that now is an opportune time to raise legume crops and build up the soil, as well as to give the land a rest. If the farmers consider such a program as having merit, it is suggested that they keep within sight of the "bush," a sound and proven system of farming.

Other pronounced proofs of how it pays not to change the acreage materially from year to year were well illustrated during the year 1931 in the case of the onion and cabbage producers on our projects. Although these same farmers possibly did not make more than operating expenses in 1930, by staying with the crop they knew how to raise at the least cost, and by not changing or following the advice of prognosticators they received good wages for their labor in 1931.

It may not be out of place to call attention to the folly of scrapping the old farm equipment, including automobiles and trucks, and the wisdom of holding on to them a few years longer while others experiment with new devices. By this it is not intended to do an injustice to the manufacturers of modern farm machinery and automobiles or to the various high-powered salesmen, nor to criticize those engaged in trying to find some improvements to the present machines wherein the cost of growing crops may be reduced. It has been truthfully said by Alexander Pope:

Be not the first by whom the new is tried,
Nor yet the last to lay the old aside.

MACHINERY SUPPLANTS MEN

To one in a position to know it is obvious that the responsibility for overproduction of wheat, corn, and cotton can by no stretch of the imagination be properly charged to the few home builders on the reclamation projects, but is due rather to such factors as power equipment and machinery which have not only contributed to the overproduction of crops, but have been responsible for the unemployment of a large number of men formerly laborers on the farms. Feed for upkeep of work stock and mules and horses used a few years ago in producing crops have now been replaced by gasoline and tractors. Two men with a combine do the work that a few years ago required several men with teams. Had the many farmers who moved to the city stuck with their old "bush" a few years longer, and had others changed their system of farming a little more gradually, there would to-day be more people with "a place to roost" or "a place to hang their hats"; that is, a home. There has been too much of a desire to use the farm land as a factory or a plant to produce crops to accumulate a fortune instead of developing it as a mode of living. Had there been less of the mad rush for wealth and more for home building, our social and economic conditions would not be so unstable at this time.

Portions of farming sections have been considered the place to become rich and to permit the farmer to select a home with a more attractive winter climate. The farm to-day is not a place to be exploited only for the accumulation of wealth, but rather a place for the farmer to at least make a living and where he can live after his retirement. This will always be true. In other words, it is a good "bush" not to leave. In 1929 and 1930 farmers on some of the Federal reclamation projects made excellent profits by growing beans. The prices and favorable weather during these years contributed largely to this end. Some farmers who could not resist trying to become rich by specializing in a type of farming which seemed to offer more and easier profits, sold their cows, purchased some modern machinery and planted their entire farms to beans. The dairy cow was looked upon as a nuisance and in the way. However, these same people now realize they should have stayed with the cows, or in terms of this article, they should have "stuck to the bush."—*L. H. M.*

Boulder Canyon Project Notes

NEWS-REEL cameramen representing Paramount, Hearst Metrotone, and Fox companies and newspaper photographers from the Associated Press, Wide World, International News Photo, Hearst Co., and Acme News Pictures, visited the project on March 28 and 29. Moving and still pictures were taken from the air and ground of construction activities in Boulder City and Black Canyon.

Employment records were established during April when 4,200 persons were at work on the project, divided as follows: Government, 250; Six Companies and subcontractors, 3,400; other contractors on Government construction, 350; private building construction, Boulder City, 200.

With Frank Moran as manager and Jack Ryan as coach, Boulder City will be represented by a baseball club this coming season. A diamond has been leveled and rolled for the use of the club. It is also proposed to have a twilight league with several local teams including Reclamation, Six Companies, Boulder City Co., American Legion, and Bryan's Trucksters.

The Federal-State employment bureau in Las Vegas, with Leonard T. Blood in charge, received 36,000 letters of application for employment during the 15-month period ending in March and 20,000 personal applications in the the same period. During the first two months of this year 6,000 persons applied for work at the bureau, an average of about 100 per day.

The Nevada-California Power Co. is building a dormitory for the use of its employees. S. E. Henderson has 20 small residences under construction for rental purposes.

Distribution of the Six Companies' employees by percentages between various project operations is approximately as follows: Tunnels, 50; river operations, 10; concrete mixing plant, 3; spillways, 6; mechanical department, 11; electrical department, 2; railroad, 5; gravel plant, 3; Boulder City construction, 5; engineering offices, warehouse, etc., 5. The peak of employment was reached in April, when the principal contractor had 3,400 employees. Of this number, 34 per cent were ex-service men.

Expenditures to March 1 by the Government on the construction of Boulder City were as follows: Water system, $440,793; sewer system, $73,550; streets, grading, paving, etc., $258,394; electric distribution system, $38,905; landscaping, $18,075; administration building, $61,917; municipal building, $45,914; dormitory, $34,062; residences, $166,182; garage, $7,681; total $1,145,473. The Government will eventually spend about $2,000,000.

Boulder City now has three churches, a community church headed by Rev. Thomas Stevenson and which is representative of 20 Protestant denominations; a Catholic church with Father Hogan in charge; and an Episcopal church with Rev. Arthur S. Keane as pastor.

A municipal band has been organized in Boulder City, which will be directed by O. J. Littler, senior engineering draftsman of the Bureau of Reclamation. Seventeen musicians, all of whom have had from 2 to 15 years' experience in bands and orchestras, will compose the initial organization.

The Las Vegas laboratory has been vacated and all equipment moved to the field laboratory near the concrete mixing plant at the dam site.

The U. S. 66-Grand Canyon-Hoover Dam Highway Association met in Kingman, Ariz., March 20–21. Delegates were entertained by the chamber of commerce and Rotary Club of that city.

The first-aid station maintained by the Six Companies has been moved from its location near the river camp dormitories to a site between the low-level concrete-mixing plant and the railroad tunnel entrance.

Boulder City is to have a first-class hotel, a permit having been granted to W. F. Gray and Virginia L. Gray. The hotel, to be known as Boulder Inn, will be a 2-story fireproof structure with 100 rooms.

On March 16 the first concrete was poured for the lining of the 50-foot diameter diversion tunnels starting what will probably be a year's continuous run for the low-level concrete-mixing plant. The concrete was poured in the invert portion of tunnel No. 3 (Arizona) near the intake portal. This work is to be done in three installments—first the invert or bottom portion, then the sidewalls, and last the roof or ceiling.

A recent canvass by City Manager Ely showed that there were 115 heads of families, with dependents totaling 233, who are seeking houses in Boulder City.

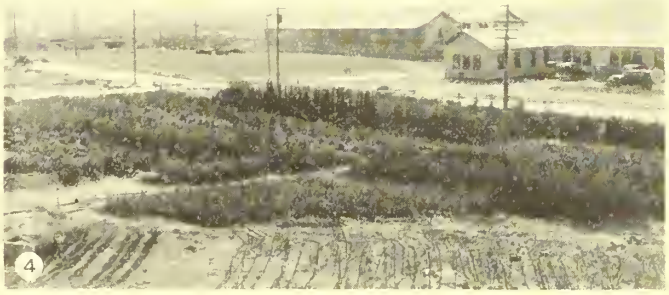
Business enterprises now in operation in Boulder City include 2 wholesale gasoline and oil stations, a builders' supply yard, tourist camp, 2 restaurants, jewelry store, barber shop, photograph studio and supplies, garage, shoe repair shop, electrical appliances stores, gasoline and oil service station, dental office, chiropractor's office, and 2 beauty shops.

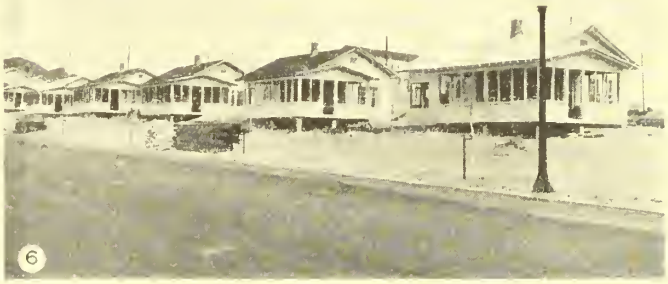
The filtration plant is operating satisfactorily and water is available to all completed Government houses. Sewer service to all homes of Government employees has also been completed. Construction of electrical and street lighting systems was finished in April.

Operations of the Six Companies working force now under way include excavation of the 15 by 56 foot invert section of the diversion tunnels; lining diversion tunnels with concrete; excavation of Arizona and Nevada spillways; driving 7 by 14 foot pioneer bores in Arizona and Nevada inclined spillway tunnels; excavation of tunnels to intake towers and at tower sites.

An application for a permit to operate an air service at Boulder City has been received by City Manager Ely. The applicants plan an investment of approximately $100,000 if the permit is granted. There is an excellent site for a flying field about 1 mile from the town.

A tract of land in the southerly portion of Boulder City has been leased to S. E. Henderson, of Portland, Oreg., a building contractor and lumber dealer, who proposes to erect a number of houses for rental to other than Six Companies' employees. Mr. Henderson plans to have 20 houses available in May, and will build others if there is a demand for them.

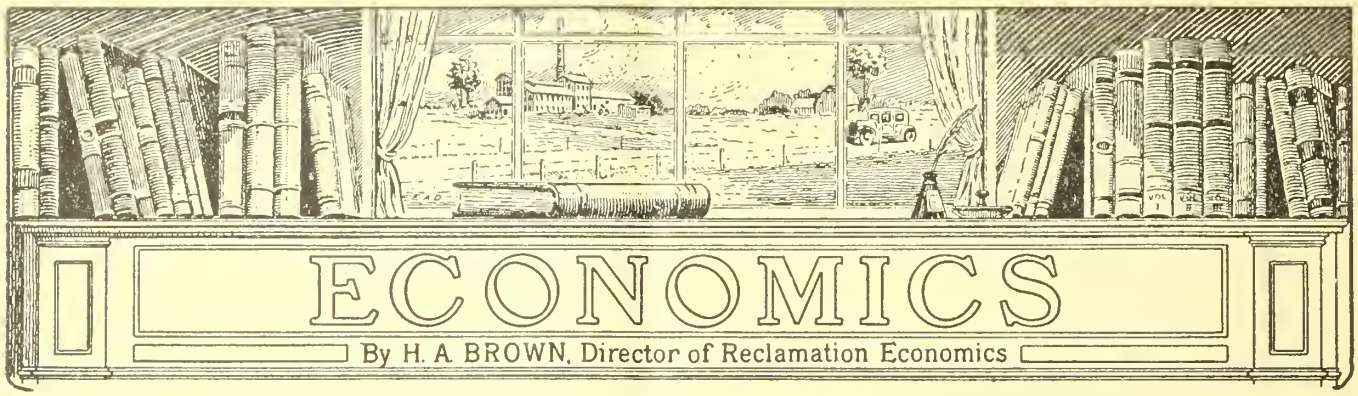




BOULDER CITY, BOULDER CANYON PROJECT

1, Planting and landscaping around Government dormitory. 2, Federal garage. 3, Planting and landscaping around Administration Building. 4, Nursery stock in heeling-in grounds, awaiting transplanting to permanent location. 5, Looking southeast across Boulder City business section and Escalante Plaza, showing planting and landscaping development. Municipal Building in center. 6, Government residences, 3 and 4 room, being erected on Utah Street. 7, Looking across Nevada Highway eastward through Arizona Street, showing theater building in course of construction to right. 8, Government residences, 6-room. View shows grading operations preparatory to landscaping. 9, Topsoil blanketing operations around Administration Building, preparatory to planting. One foot of top soil was deposited for lawn areas, 2 feet for shrubbery plots. 10, Commercial development at intersection of Nevada Highway and Avenue B

Photograph by B. D. Glaha



Cooperative Marketing on the Yuma Project, Arizona-California

The Yuma Farmers' Cooperative Association

By R. M. Priest, Superintendent, Yuma Project

THIS association, through the untiring efforts of a small group of local cotton growers, was organized under the Arizona "cooperative marketing act" during 1925 with a capital stock of $250,000, composed of 25,000 shares of common stock at a par value of $10 per share.

Primarily the purpose of the association was the ginning of short staple cotton and marketing of cotton seed. However, its articles of incorporation and by-laws permit it to engage in any and every activity in connection with the marketing and selling of the agricultural products of its members, the marketing of the by-products thereof, and the financing of the above activities as may seem to its members expedient or necessary.

The membership of the organization is composed of farmers on the Yuma project and the North and South Gila Valleys. One share of common stock is required for membership, but no one member can hold or control more than 5 per cent of the capital stock of the association. A member must be a farmer in order to vote his stock, otherwise he may only vote his membership. At present the association has 155 members representing some 9,000 acres of cotton land, which comprises about 40 per cent of the area devoted to cotton on the project, in addition to which there are about 15 members from the North and South Gila Valleys, representing some 1,500 acres of cotton.

Prior to the organization of this association all funds advanced farmers for the growing of cotton were obtained from cotton companies or local banks, which, for the most part, were controlled by the large cotton companies, which in turn controlled the market price for seed. As a result seed prices declined to a minimum of $14 per ton, barely paying ginning costs.

During 1925, at the insistence of the association organizers, the local banks agreed to waive all title to cottonseed secured by crop mortgages held by these institutions for a period of one year. In turn, the farmers who signed as members agreed to take stock in the association in lieu of cash for any profits they realized from the sale of cottonseed above the ginning costs, during the first few years of the organization's operations. In addition, 5 per cent of the gross earnings of the association are withheld as a reserve.

With the profits thus realized by the association, construction of five cotton gins was started. It was necessary to borrow an additional $20,000 to complete the gins and meet current operating expenses. This was repaid by the profits realized by the association from the first 60 days' operation of the season, for the first six years of operation.

EFFECT ON PRICES

Prices received by the members for cottonseed averaged approximately $25 to $27 per ton as compared with a price of $14 per ton paid prior to the organization of the association. This proved a benefit not only to members but to nonmembers as well inasmuch as the prices obtained by the association established and maintained local seed prices for all cotton growers. However, prices received during the present season, due to economic conditions, have averaged only $10 per ton.

The increase in prices received for cottonseed was made possible through a 5-year contract entered into by the association with the Pacific Cotton Seed Products Co. (Inc.), which operates large cottonseed oil mills at San Diego, Calif. This company, through the necessity of cutting down overhead costs of its oil mills by increasing the volume of output, agreed to purchase all seed offered by the association and further agreed to grant the association stock in the Pacific Cotton Seed Products Co. during the life of the contract up to $120,000, in exchange for profits realized by the company in the milling of association's seed, the stock settlement to be made at the expiration of the contract, which was in 1931.

The prices to be paid for the cotton seed under the terms of the contract are as follows:

"For prime dry cotton seed a price of three times in dollars per ton the price in cents per pound for prime crude cottonseed oil as quoted on the Dallas Cotton Exchange. All price changes to be based upon fluctuations of not less than one-half cent per pound in said price of oil. By way of illustration: If the price of oil shall be ten cents per pound the price to be paid for said seed shall be thirty dollars per ton."

Another direct benefit to local cotton growers, made possible through the activities of the association, was the installation of improved ginning and cleaning machinery. Prior to this the ginning equipment locally was felt to be poor and injured the staple to the extent that quotations locally by buyers were made as high as 100 points below the current market.

With the organization of the association considerable rivalry was evident between the older gins on the project and the association gins. This was augmented by clauses inserted in finance contracts with cotton growers whereby these growers when obtaining financing for the growing of cotton were compelled to have their cotton ginned at gins designated by the finance corporations, although the marketing of the seed of the association members was left to the association. This situation was overcome by the association in its seed contract with the Pacific Cotton Seed Products Co. This company controls the California Cotton Credit Corporation, a

finance corporation which obtains its funds from the intermediate credit bank at an interest rate of 4½ per cent. In the association seed contract the Pacific Cotton Seed Products Co., through the California Cotton Credit Corporation, agreed to remove the aforementioned clause from the growers' contracts, thereby permitting the grower to gin his cotton at any gin he chose, although association members through their membership agreements are required, to gin at association gins.

The association plans to organize, if possible, a local finance corporation and obtain the necessary funds to finance cotton grown by association members from the Federal intermediate credit bank. Funds for this purpose can be obtained through that agency at an interest rate of 4½ per cent and a call rate not to exceed 2 per cent. It is hoped by the association to have this money available for the financing of the 1932 cotton crop.

ASSETS LARGELY INCREASED

That the association has been successful is evidenced by the fact that in 1925 it started with no funds, and for the past four years it has paid an annual dividend of 8 per cent on all outstanding capital stock. Although the capital stock is still sold members at the par value of $10 per share, the book value of this stock is $14.17. The association owns buildings and equipment valued at $140,000 upon which a mortgage of $25,000 is outstanding.

An estimate has been made by association officials that additional revenue to the amount of $1,000,000 has been realized by local cotton growers because of the increased price paid for cottonseed since the inception of the association.

The 5 per cent of the gross earnings retained for a reserve is used when necessary for operating expenses. In addition, the association is allowed a 10 per cent depreciation on buildings and equipment. All profits realized by the gins above operating costs are returned to the members. An annual financial statement issued by the association to all its members bearing date of May 31, 1931, lists total assets of $146,112.63, and an operating statement for the year 1930–31 shows a gross income during that season of $64,016.37.

Beginning with the season of 1930–31 the association was instrumental in obtaining better cotton marketing conditions for growers than were offered by local buyers. The local association was able, through connections with the Southwestern Irrigated Cotton Growers Association, a cooperative agency located at El Paso, Tex., and a member of the American Cotton Cooperative Association, to have local cotton growers market their crop through these agencies and receive a cash advance of 90 per cent of the market upon delivery of their cotton at El Paso. The remaining 10 per cent was withheld until the cotton was sold by the American Cotton Cooperative Association. Upon the cotton being sold the farmer was paid the remainder of his equity, less insurance, warehouse, and association charges. However, if the market dropped below the advance paid him the association assumed the loss.

Locally, the grower was offered an 80 per cent advance of the market upon date of delivery and sold subject to call. If the market dropped below the amount of his advance he was compelled to supply a cash margin in order to hold his equity of 20 per cent less costs, otherwise he lost this equity. Although very little cotton was sold subject to call this season, a better grading was obtained by association members who marketed through the Southwest Irrigated Cotton Growers Association, the cotton thus sold being given a Government grading.

Western Development Must Not be Throttled

Whoever holds that we should have no more farm land because the farms already are producing too much is forced inevitably to the necessity of trying to demonstrate that maintenance of the parasitical element of the population which manifestly can not be supported is a good thing for society in general here in this country.

It is elementary, and it ought to be known to everyone intelligent enough to dig a clam, that the United States of America can not be injured by increasing its production of primary wealth; even a simpler person than a clam digger should know that, on the whole, it is better to to build up surpluses of wheat and cotton than of men who, if they live at all, must live off other men.

The idea is erroneous that making the land habitable and putting it to use of some sort is merely a matter of producing too much of certain farm crops. It is a way also of providing homes, of increasing consumption directly, of relieving a situation of unemployment which is breaking the back of what we are pleased to call on every successive Fourth of July the greatest Nation that has existed in all the history of the world.

Land reclaimed from the deserts of the West contributes nothing to any surplus farm output; but even that is not all. Development of the natural resources of the West in any and all ways is the only right solution of the national problem that has been created by the unbalanced and unnatural development of mechanized industry in the East. We need not think of western development in terms of more farms only. More farms would be incident to even greater achievements and the whole Nation would be helped.—*Yakima Daily Republic.*

KLAMATH project farmers are showing a decided interest in truck gardening, particularly onions, lettuce, celery, and cabbage. During a recent month the county agent's office was called on for over 200 pamphlets on the raising of these vegetables.

Photograph by J. E. Stimson

Irrigating potatoes, Minidoka project, Idaho

I have been asked on a number of occasions to write an article on food and the important place it takes in every-day life. Research on the subject has developed the facts in this article.

Keep Fit by Proper Diet and Exercise

THIS subject should be of interest to everyone who wants to present a good appearance, feel well, and increase the expectation of long life.

We all have among our acquaintances and friends people who are too thin or too stout. Those of normal weight and appearance demand our admiration. That is the goal of everyone, but, we meditate, there should be something done about the ones who are over or under weight.

Assuming that one is healthy, an underweight condition might be due to malnutrition, but is, according to the medical profession, mostly due to the faulty assimilation of the food that we eat or ill-proportioned diet that we select and the quantity that we eat. The first requires medical attention and the combination of the two latter requires education.

Our bodies build up on the food that we eat, and when we realize that our organism and vitality are dependent on our daily diets, just so soon will we give more thought to our food.

Proper quality and quantity of food plus sufficient exercise ordinarily mean good health, efficiency, and joy of living.

A healthful diet may be inexpensive and simple, but to plan intelligently one should know some of the fundamental principles of food chemistry and body reactions.

The human body may be likened to a machine. You can not get out of it what is not put into it. Fuel is necessary, also repair material. In the body, certain foods fill each of these needs.

We classify foods under five heads: (1) Carbohydrates, (2) fats, (3) proteins, (4) minerals, (5) vitamins.

We shall consider each briefly:

(1) *Carbohydrates.*—These include the starches and sugars, which are broken down in the digestive tract and absorbed into the blood stream. This is the sugar of the blood and furnishes the greater part of the fuel for the body. It is oxidized, yielding heat and energy.

(2) *Fats.*—Fats are a concentrated fuel and may be likened to coal. Like coal, they burn in a fire already started by other materials, which, in the case of the body, is glucose sugar, the sugar of the blood.

(3) *Proteins.*—Protein is the muscle-building food, and, while 58 per cent may be used as fuel, its true function in the body is that of repair material. Each day a certain amount of tissue is broken down and its place must be filled by new material. It is important to note that this amount is the same whether the individual is engaged in hard work or is resting in bed. In other words, increase in labor performed does not necessitate an increase in the consumption of protein. What is needed is more fuel.

The chief sources of protein are meat, eggs, milk, cheese, beans, peas, lentils, and nuts.

(4) *Minerals.*—Seventeen primary elements enter into the composition of the human body. All of these are essential to life and health. We shall discuss only three, as an adequate amount of the others is usually obtained without special thought.

Iron.—Iron is found in the hemoglobin, the red part of the blood. Its work is to carry the oxygen from the lungs to the tissues, where oxidation (combustion) takes place, yielding heat and energy. It is apparent that, without a sufficient quantity of iron, the body will not be able to properly utilize the other foods which are eaten. Anemia is a condition in which there is a lowered amount of iron in the blood and in consequence a lowered vitality and resistance to disease. Foods rich in iron include egg yolk, lentils, wheat bran, outer coats of other grains, beans, peas, and spinach.

Calcium.—Calcium, or lime, enters largely into the composition of the teeth and bones. It is also one of the most important alkalies of the blood and has been shown to be essential to the contraction of the heart muscle and to the coagulation of the blood. The chief calcium-containing foods are milk, turnips, egg yolk, nuts, beans, chard, etc.

Phosphorus.—Phosphorus is found in every cell in the body, and enters especially into the formation of the brain and nervous system. No phosphorus, no thought. A phosphorus compound is the natural chemical stimulus to bowel action and so prevents constipation. Phosphorus is also a factor in immunity to disease. Some phosphorus-rich foods are wheat bran and germ, egg yolk, beans and other legumes, nuts, milk, etc.

(5) *Vitamins.*—Vitamins are mysterious elements, known by their specific action in promoting growth, maintaining vitality, and preventing certain diseases. Five have been discovered. We shall discuss only two.

Fat soluble A.—This vitamin has to do with growth and vitality and also with muscle tone. A rat fed on a diet lacking this mysterious element will develop paralysis within six weeks. It is found in butter fat, egg yolk, cocoanuts, green leaves, etc.

Water soluble B.—The absence of this vitamin in the diet results in a lack of coordination between nerves and muscles, ending in paralysis. Rats fed on a diet lacking this vitamin developed paralysis within 10 weeks. Some of the foods containing this vitamin are bran, outer coats of all cereals, legumes, vegetables, and milk.

Balancing the diet.—A proper selection of foods will include a sufficient amount of each of these elements. In regard to the first three classes, the proper percentage of each in the diet, as given by the best authorities, is:

	Per cent of total calories
Carbohydrate	65
Fat	25
Protein	10

In applying this practically, we find that the average American dietary to-day has double the amount of protein necessary. As a consequence, an extra load is thrown upon the liver and kidneys which must handle the extra amount of waste material. These products tax the system and, consequently, the endurance of the individual is decreased markedly.

Sinee meat is essentially a protein food, the man who eats a large quantity of meat is sure to get an excessive amount of protein, and it is well to remember that the daily need for protein is not increased by manual labor. In other words, a laboring man needs no more meat than one of sedentary occupation. A decrease in the average meat consumption is, therefore, one of the important points in the balaneing of the diet. Both physical and mental stamina are promoted by decreasing the amounts of protein in the food.

A diet consisting of meat, white bread, potatoes, coffee, cake, and pie is quite defieient in the mineral elements. No amount of one element can make up for a defieiency of another. Raw and cooked vegetables, fruit, and milk should be included in the daily menu. This is essential as much for laboring men as for others.

CHEMICAL REACTIONS

Another important point, often overlooked, is the acid-alkaline balance. The blood is slightly alkaline in reaction. During exercise, acids are produced which depress the tissues, making us tired. During rest and sleep the acids are neutralized by the alkalies of the blood and the museles are restored to a normal state of freshness and tone. This shows the importance of having sufficient alkalies in the blood, thereby favoring a quick recovery from fatigue.

When foods are burned in the body, they leave an ash, either acid or alkaline in reaction. Meat, eggs, and grains leave an acid ash, while vegetables, fruits, and milk leave an alkaline ash.

These facts bring to us another important reason for decreasing the meat consumption and increasing the amount of vegetables, fruit, and milk in the diet. Since acid is fatigue-producing, a diet which is largely on the acid side (meat, eggs, and grains) will favor early fatigue, while a diet which includes a liberal amount of the alkaline foods (vegetables, fruits, and milk) will, without doubt, increase endurance and efficiency.

An acid-forming diet is known to produce high-blood pressure, arteriosclerosis, Bright's disease, apoplexy, and other blood-vessel diseases. This is extremely interesting and important, as statistics show that one out of every five deaths in the United States to-day is caused by blood-vessel diseases. And these diseases are on the increase. We are now realizing that diet is perhaps the most important point in their prevention. The acid-forming diet is, without doubt, responsible to a great degree for the alarming increase in these diseases.

It is now recognized that a proper balance between acid and alkaline producers in food is a fundamental in dietetics and must not be ignored or overlooked.

Spring Salads

SALADS at this time of the year appeal most when the ingredients are chiefly crisp, uncooked vegetables, bright with red slices of tomato, or whole radishes, set off by glistening bits of green pepper or watercress, which contrast well with the paler shades of lettuce, endive, sliced cucumbers, or celery. Winter salads must often be made partly of canned vegetables and fruit, and with them the tendency is to serve a rich mayonnaise dressing. There is a feeling of delightful freshness and daintiness about spring salads, with their gay colors, crisp texture, and the zest of a plain French dressing.

No rules for combining these salads can be given. Put together a little of this, a little of that—whatever you can get. There are numerous kinds of salad foundations available in city markets, such as escarole, romaine, or chicory, in addition to lettuce. Use some of these from time to time with watercress for its peppery tang, chopped celery for its flavor and crisp texture, and now and then a few very thin slices of cucumber. Those who like onion may include it in the form of large shaved rings, or as whole spring onions with 2 or 3 inches of stem; or, lacking onion, rub the salad bowl with a clove of garlic—just to give a "soupcon" or suspicion of garlic flavor. Sorrel and other wild greens usually eaten raw may be put in the salad.

Hoover Dam windshield paster

Tomatoes are generally scalded a minute and peeled before slicing for salad. Radishes are often cut in such a way that the red skin turns back in points, suggesting petals. If you can't get fresh tomatoes or radishes, use a slice or two of pickled beet or some canned pimento for red color—but don't use both reds in the same salad! Grated raw carrot brightens up a green salad and adds to the supply of vitamins for which the dish is especially valuable. Rutabaga turnip may be used in the same way.

Here is a good French dressing. Use the following proportions and make any amount you need:

One-half teaspoon of salt, a few grains of cayenne, paprika if desired, 2 tablespoons of vinegar, 6 tablespoons of oil. Add vinegar sparingly and beat the ingredients together until they are well blended. If you have a cruet or other bottle with a tight stopper you can keep French dressing on hand all the time, simply shaking the bottle vigorously when ready to use it. Many people like a tablespoon of chopped pickle added to French dressing for a salad of this type. If you use it, add it just at serving time.

A Good Combination

When vegetables constitute a large portion of a meal or when one is serving the type of dinner sometimes called a "vegetable plate," attention must be given to variety and contrast both in flavor and texture. There should be at least one hearty kind—that is, one that contains a rather higher proportion of protein and starch—either in the vegetable itself or in the other foods combined with it. Milk, cheese, and eggs are often used in sauces on vegetables and add to the proportion of protein. There should be also something crisp, something soft, something mild-flavored, something acid, and at least one pronounced flavor to give zest to the entire combination. There should be enough richness in the seasoning of the vegetables or the way they are cooked to make them substantial enough for the main course at dinner. This can be obtained by the use of butter or cream or by frying one vegetable. Much-needed minerals and vitamins are supplied by most of the vegetables. Give some thought, too, to the colors that will predominate on the plate. An attractive appearance stimulates appetite.

Green pepper, stuffed with a rice and meat mixture, is substantial. Celery is crisp in texture and has a pronounced flavor. Fried eggplant adds richness as well as another distinctive flavor, and its browned crumbs add to the color as well as to the "crunchiness" of the vegetables. String beans will be liked as a contrast to the other flavors, and there is a bit of pickle to furnish the necessary acid which rounds off the dinner.

Reclamation Organization Activities and Project Visitors

Commissioner Mead left Washington April 10 for the Denver office of the bureau, where administrative matters were considered jointly by him and the chief engineer and his staff, particularly those questions relating to the operation of the moratorium act of April 1, 1932. The legal and accounting phases were dealt with and P. W. Dent, Assistant Commissioner and chief counsel, and W. F. Kubach, chief accountant, accompanied Doctor Mead for this purpose.

During the absence of Commissioner Mead and Assistant Commissioner Dent, Miss M. A. Schmurr, assistant to the commissioner, was acting commissioner.

En route to Denver, Doctor Mead stopped at Cheyenne to meet with the acting governor and other State officials to discuss Wyoming water problems.

J. L. Savage, chief designing engineer, and L. N. McClellan, chief electrical engineer, have returned to Denver from Los Angeles, where they were in attendance on a conference with the contractors for power on designs for the Hoover power plant and machinery. Mr. McClellan stopped off at Boulder City to discuss the question of revision of rates for sale of electricity and water with Walker R. Young, construction engineer, and Mr. Savage visited the Kittitas division of the Yakima project before his return to Denver.

Porter J. Preston, engineer in charge of Colorado River investigations, passed through Boulder City from Denver en route to his temporary headquarters in Yuma, Ariz.

E. B. Debler, hydraulic engineer, J. R. Riter, assistant engineer, and H. W Bashore, senior engineer, held a recent conference in Cheyenne with John A. Whiting, State engineer, and C. F. Gleason, superintendent of power, on North Platte River compact and North Platte project matters.

L. H. Mitchell, assistant director of reclamation economics, left the Washington office on April 3 for an inspection of the Federal irrigation projects in the States of Nebraska, South Dakota, Montana, and Wyoming. Mr. Mitchell expected to give personal attention to economic problems on these projects and hold numerous conferences with State and project officials.

B. W. Steele, senior engineer, and Arthur Ruettgers, engineer, made a recent inspection of the work at Hoover Dam and various laboratories at the southern California cement mills, going later to Berkeley to attend the meeting of committee No. 108 of the American Concrete Institute, and to the board meeting on April 11–13 in Boulder City.

George A. Beyer, chief photographer in the Washington office, left for the West on April 21. His first stop was on the Yuma project, following which he will visit the Boulder Canyon, Orland, Klamath, Yakima, Vale, Owyhee, Boise, Minidoka, and Salt Lake Basin projects, returning to Washington probably the latter part of June.

F. L. Lathrop, representing the California State Fish and Game Commission, was recently on the Klamath project collecting data on the project water supply and uses.

The following representatives of the International Water Commission convened on the Yuma project: L. M. Lawson, commissioner, American section; Armando Santa Cruz, jr., commissioner, Mexican section; Louis C. Hill and J. B. Lippincott, consulting engineers, Los Angeles; R. M. Priest, engineer, Yuma, Ariz.; J. L. Favela, engineer, San Diego, Calif.; S. F. Crecelius, engineer, American section; Andrew Ortiz and J. C. Bustamente, engineers, Mexican section; M. B. Moore, secretary, American section; and H. J. S. Devries, district counsel, El Paso, Tex.

Charles B. Stafford, executive manager of the Wyoming Department of Commerce and Industry, and W. J. Burke, district counsel, were recent visitors on the Riverton project.

Norval Enger, associate engineer, and Lawrence J. Morand, inspector, on the Kittitas division of the Yakima project, have been transferred to the Boulder Canyon project.

Leo J. Foster, formerly superintendent of the Uncompahgre project and later serving temporarily in the Denver office, has been assigned to the position of engineer in charge of the Humboldt River investigations, Nevada, with headquarters at Winnemucca.

Harry W. Bashore, senior engineer, who has been in charge of Columbia Basin investigations, has been transferred to Sacramento to carry on further investigations of Central California water resources in cooperation with the State. Mr. Bashore will continue the work which was carried on in 1930 under the supervision of Charles A. Bissell.

Frank F. Smith, construction engineer, formerly in charge of construction of the Echo Dam, Salt Lake Basin project, and temporarily assigned in January to the Denver office for continued work in connection with the dam, has been transferred to Idaho Falls, Idaho, where he will hold the position of engineer in charge of the Upper Snake River storage investigations.

Photograph by A. A. Whitmore

Main Canal, Kittitas Division, Yakima project, Washington

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary, **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department.
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Deut, Assistant Commissioner
George O. Sauford, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng., J. L. Savage, Chief Designing Eng.; E. B. Dehler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Ageut; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz.	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles
Boulder Canyon	Boulder City, Nev.	Walker R. Young	Constr. engr.	E. R. Mills	Charles F. Weinkauf.	do H. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif.	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Owyhee, Oreg.	F. A. Banks	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont.	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex.	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Baker, Thief Val. Dam	Owyhee, Oreg.	F. A. Banks	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Umatilla, McKay Dam	Pendleton, Oreg.	C. L. Tice	Reserv. supt.		Denver office	do	Do.
Vale	Vale, Oreg.	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg.	F. A. Banks	Constr. engr.	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash.	John S. Moore	do	R. K. Cunuingham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash.	R. J. Newell	Constr. engr.	C. B. Funk		do	Do.
Yakima, Kittitas Div.	Ellensburg, Wash.	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo.	I. B. Hosig	Acting supt.	W. F. Sha	Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo.	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A.	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont.	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont.	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigatiou district	Zurich, Mont.	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Coutrol	Sidney, Mont.	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Flora K. Schroeder.	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gebauer	President	Mabel J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev.	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg.	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Laugell Valley	Langell Valley irrig. district	Bonanza, Oreg.	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A.	Ogden, Utah.			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo.	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Custom House	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg.	E. O. Larson	State of Utah.
Humboldt River, Nev.	Winnemucca, Nev.	Leo J. Foster	State of California.
Colorado River Basin investigations	Denver, Colo., Custom House	P. J. Preston	Colo., Wyo., Utah, and New Mex.
Central California Water Resources	Sacramento, Calif.	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*

University of Nebraska

WHALEN DIVERSION DAM, NORTH PLATTE PROJECT, NEBRASKA-WYOMING

U. S. GOVERNMENT PRINTING OFFICE: 1932

I 27.5

THE RECLAMATION ERA

VOL. 23, NO. 6 JUNE, 1932

A. A. Whitmore, Photographer

KITTITAS MAIN CANAL, YAKIMA PROJECT, WASHINGTON, CARRYING 600-SECOND FEET OF WATER

Clemson University Library

SOIL ROBBERS

OF ALL OUR RESOURCES that of soil fertility is the most important. If one thing above another should be protected and developed by the State it is the soil—the very breast of mother earth from which we must draw our nourishment or perish.

No man should have the right to impoverish his soil.

No man should have the right to skin his land, butcher it up, and sell the hide, hoof, bone, and tallow, too.

Such a man is not a farmer, but in very truth a robber of the soil and should be brought to strict account.

Dr. FREDERICK G. KRAUSS,
Director, Agricultural Extension Service,
University of Hawaii.

From BETTER FARM EQUIPMENT AND METHODS, February, 1932

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 6 JUNE, 1932

Résumé of Work Accomplished During Calendar Year 1931 and Proposed for Calendar Year 1932

By R. F. Walter, Chief Engineer

FORMER articles on this subject, the last appearing in the July, 1930, issue of the New Reclamation Era, were prepared to cover the fiscal year which ends June 30, but since construction work, especially on the northern projects, is usually planned for the construction season which conforms more nearly to the calendar year, this article is being prepared to cover calendar rather than fiscal years. However, in referring to appropriations it is necessary to specify fiscal years, since appropriations are made by fiscal years, with the exception of those for the Boulder Canyon project which are available until expended.

NEW PROJECTS OR FEATURES AUTHORIZED

During the calendar year 1931 construction of the Thief Valley Dam on the Baker project in Oregon was authorized. This is the first construction work authorized on that project, although surveys and investigations were undertaken a number of years ago. This reservoir is being provided for the purpose of supplying a supplemental water supply for lands heretofore irrigated by an inadequate stream flow, and no other features are contemplated. No other entirely new projects were adopted during 1931, but Hoover Dam on the Boulder Canyon project and Cle Elum Dam on the Yakima project were authorized for immediate construction. A power plant on the Grand Valley project, near Palisade, Colo., was also authorized for construction.

NEW PROJECTS OR FEATURES PROPOSED DURING 1932

At this writing it is doubtful whether any new projects or additional features will be authorized during 1932. However, it is possible that an initial appropriation may be secured, and if repayment contracts are executed and other necessary preliminaries completed in time, construction may be begun on the $34,000,000 All American Canal, which is one of the major features in connection with the Boulder Canyon project development authorized under the Boulder Canyon project act of December 21, 1928. There is also a possibility that construction of the proposed Hyrum Reservoir on the second unit of the Salt Lake Basin project in Utah may be authorized upon execution of a contract guaranteeing repayment of the cost of construction by the water users for whom it is to provide a supplemental water supply. An appropriation of $300,000 is available in fiscal year 1932 for commencement of this work in case it is authorized.

APPROPRIATIONS AVAILABLE

Congress appropriated for the fiscal year 1932, which ends June 30, 1932, for construction and operation and maintenance of the various projects, by direct appropriation from the reclamation fund, $6,971,000, and by reappropriation of unexpended balances of prior years' appropriations approximately $4,607,000, and also authorized the expenditure of $330,000 of commercial power revenues. An appropriation of $100,000 was also provided from the general Treasury for operation and maintenance of the Colorado River Levee system of the Yuma project, Arizona-California. Funds to be advanced by irrigation districts and others for operation and maintenance of various projects were estimated to amount to approximately $549,000, thus making available a grand total of $12,557,000, not including the appropriations for the Boulder Canyon project. The total appropriated for the Boulder Canyon project, including the appropriation made in the Interior Department appropriation act for the fiscal year ending June 30, 1932, is $25,660,000.

For the fiscal year 1933, which ends June 30, 1933, Congress has made from the reclamation fund a direct appropriation of $2,414,500, a reappropriation of an estimated unexpended balance of $1,887,000 from prior years' appropriations, and an authorization to expend $320,000 of commercial power revenues. In addition, $100,000 has been reappropriated from the unexpended balance of prior years' appropriations from the General Treasury for operation and maintenance of the Colorado River

Public Land Opening Riverton Project Wyoming

The Secretary of the Interior has announced the opening to entry on June 1 of 43 public land farm units on the Pavillion and Pilot divisions of the Riverton project, Wyoming.

For a period of 90 days from the date of opening ex-service men are eligible to apply for units. At the expiration of that period the remaining units will be open to the general public. Each applicant, including ex-service men, must have a capital of at least $2,000 in cash for units in excess of 30 acres, $1,000 for 20 to 30 acre units, and $500 for units less than 20 acres in size, or the equivalent in farming implements, livestock, etc., deemed by the local examining board to be as useful to the settler as cash. He must also have had at least two years' farming experience, preferably on irrigated land, his industry and character must be vouched for, and he must be in good health.

Requests for literature, including farm application blanks, should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C., or the Superintendent, Bureau of Reclamation, Riverton, Wyo.

Levee system. Funds to be advanced for operation and maintenance of various projects are estimated at $630,000, making a grand total of $5,351,500. An additional appropriation of $6,000,000 has also been made for the Boulder Canyon project, which brings the total appropriated for that project up to $31,660,000.

DAMS COMPLETED

Two large storage dams were completed during 1931—Deadwood Dam on the Boise project and Echo Dam on the Salt Lake Basin project. The Deadwood Dam is located on the Deadwood River, a tributary of the Payette, approximately 50 miles north of Boise, Idaho. It was completed in April, 1931, at a cost of $1,359,395. It is of the concrete arch type and forms a reservoir having a capacity of 160,000 acre-feet. It will provide storage water for the Payette division of the Boise project and supplement the flow of the Payette River during the low-water season, thus assuring a full supply for the Black Canyon power plant which furnishes energy to pumping projects in the Snake River Valley and for construction purposes on the Owyhee project in Oregon and Idaho.

The Echo Dam, which was completed in November, 1931, is located on the Weber River near Coalville, Utah, approximately 40 miles southeast of Ogden. It is of the earth-embankment type, forming a reservoir of 74,000 acre-feet capacity, and provides a supplemental water supply for approximately 60,000 acres of land heretofore irrigated with an inadequate stream supply. Construction of this dam and reservoir involved the relocation of a considerable stretch of the Union Pacific Railroad and the Lincoln Highway and the total cost of the dam, including this relocation work, right of way, and related features, was approximately $2,480,000.

DAMS UNDER CONSTRUCTION

Four storage dams are now under construction—Hoover, Owyhee, Cle Elum, and Thief Valley.

Hoover Dam.—Contract for construction of the Hoover Dam and power plant, which is located on the Colorado River near Las Vegas, Nev., was awarded to Six Companies (Inc.), of San Francisco, Calif., in March, 1931, and the contractor began work immediately. An organization of 2,500 men was soon assembled, housing and hospital facilities provided, and plant and equipment installed and placed in operation. About 20 miles of construction railroad connecting the Government line from Boulder City to the dam site with the gravel deposits and other parts of the job was built by the contractor, as well as several miles of construction highway. The first actual construction for the dam was the excavation through solid rock of the four 50-foot diameter diversion tunnels, having a combined length of over 3 miles. Good progress has been made, and except for removal of the 15-foot invert section and trimming, the excavation of these four tunnels was practically completed by April 1, 1932, and concrete lining begun. Work was also in progress on the Arizona and Nevada spillways and the two 50-foot diameter inclined spillway tunnels which connect with the two outer diversion tunnels. A modern gravel washing and screening plant with a capacity of 2,500 cubic yards per 8-hour shift has been completed and placed in operation, as has the low level concrete mixing plant in the canyon, which has a capacity of 280 cubic yards per hour.

In addition to the work under the Six Companies' contract, a branch railroad 22.9 miles long was completed by the Union Pacific Railroad from its main line near Las Vegas, Nev., to Boulder City, and a Government line 10.5 miles long from Boulder City to the dam site was completed by the Lewis Construction Co. under contract with the United States. A 22-foot oiled macadam highway from Boulder City to the dam site was completed by the General Construction Co. under contract with the United States. A transmission line 222 miles long, with a capacity of 15,000 kilowatts, was constructed by the Southern Sierras Power Co. from Victorville, Calif., to Hoover Dam to supply power for construction purposes. At Boulder City the desert has been transformed into a modern habitation of 3,500 people. Construction has been completed on the Government administration building, municipal building, dormitory, garage, and 70 residences for Government employees, and additional housing facilities are being provided. A modern water system and sanitary sewer system have been installed, and the paving of all streets and construction of curbs, sidewalks, and parks have been practically completed. Six Companies has erected an office building, hospital, 10 dormitories, mess house, club house, ice plant, garage, laundry, machine shop, commissary store, and numerous other buildings, in addition to over 600 residences for married employees. At the end of March, 1932, approximately 3,400 employees were engaged at the Hoover Dam and Boulder City, of whom 3,200 were employed by the various contractors and 200 by the Government.

During the spring of 1932 it is planned to complete all housing and other municipal improvements at Boulder City so that before the hot summer season arrives living conditions for all employees on the project will be as good or better than in any town of its size in the Southwest. Six Companies will push the excavation and concrete lining of the diversion tunnels with a view to diverting the river in the fall of 1932 and completing the cofferdams before the spring floods of 1933. Work on the spillways will continue during 1932 and it is planned also to perform all underground work possible for the outlet works. The completed Hoover Dam will be 730 feet in height above foundation rock, 1,180 feet long at the crest, 650 feet wide up and down stream at the base, and 45 feet wide at the top. It will store approximately 30,500,000 acre-feet of water. The total cost, including power plant, is estimated at $109,000,000. Date for completion of the Six Companies contract is April 28, 1938.

Owyhee Dam.—Work on the Owyhee Dam on the Owyhee project in eastern Oregon, which was briefly described in my last article, continued during 1931, under contract with the General Construction Co. Owing to extreme cold weather concrete operations were suspended during January, February, and December, 1931, and during January and February, 1932, but otherwise good progress was made and it is expected the dam will be completed by July 1, 1932. This dam, 405 feet high, will be the highest yet constructed, a distinction which it will be obliged to yield, however, to the 730-foot Hoover Dam upon completion of the latter.

Cle Elum Dam.—Construction of the Cle Elum Dam on the Yakima project was authorized in the spring of 1931. It is located on the Cle Elum River near the outlet of Lake Cle Elum, 8 miles northwest of Cle Elum, Wash. It is of the earth embankment type, approximately 750 feet long and 135 feet high above the stream bed. It will store 420,000 acre-feet of water for use on the various divisions of the Yakima project. Contract for construction of the dam was awarded to the Winston Bros. Co., of Minneapolis, Minn., on August 15, 1931. A separate contract for clearing the reservoir site of timber and brush was awarded the Lahar Construction Co., of Booneville, Mo., on October 1, 1931. Both contractors began work promptly and are making good progress. The total estimated cost of the dam and reservoir is $2,730,000. An appropriation of $1,393,000 is available in fiscal year 1932 and $500,000 has been appropriated for fiscal year 1933.

Thief Valley Dam.—Contract for construction of the Thief Valley Dam on Lower Powder River, 20 miles north of Baker, Oreg., was awarded to the W. H. Puckett Co., of Boise, Idaho, on September 3, 1931, and work began immediately. The dam is of the buttressed type with reinforced-concrete face slabs, 380 feet long at the crest, of which 270 feet is occupied by an overflow spillway, and the maximum height is about 66 feet above

bedrock. It will store approximately 15,000 acre-feet of water. It was found necessary to go deeper for suitable foundation rock than had been anticipated, but otherwise good progress has been made, and it is now expected the dam will be completed some time in June or July, 1932. The total estimated cost, including right of way, is $240,000.

CANAL AND LATERAL CONSTRUCTION

During 1931 construction of canals was in progress on the Minidoka-Gooding, Owyhee, Salt Lake Basin, Vale, and Yakima-Kittitas projects, certain existing canals were being enlarged on the Klamath, Minidoka-South Side, and Sun River projects, and laterals were being constructed on the Klamath, Shoshone, Sun River, Vale, and Yakima-Kittitas projects.

Klamath project.—On this project enlargement of the diversion canal, which carries excess water from Lost River into Klamath River, was completed at a total cost of $156,000. Late in the year the work of enlarging the first 8 miles of the J Canal was begun and control works were being installed in the diversion canal so that it can be utilized for conveying Klamath River water to the Tule Lake division for irrigation as well as for carrying off excess waters. This enlargement and control work is estimated to cost $81,000, for which $41,000 is available in fiscal year 1932 and $40,000 has been reappropriated for fiscal year 1933. During the calendar year 1931 approximately $30,000 was expended in construction of laterals for the Tule Lake division, which is being rapidly settled. Little lateral construction is planned for 1932, except in the present Tule Lake sump area, where some laterals will be constructed to utilize waste water in irrigating leased lands within the sump. An appropriation of $15,000 is available for this purpose in the fiscal year 1932. Owing to continued dry seasons the storage in Clear Lake Reservoir was greatly depleted, and in order to provide water for the Horsefly and Langell Valley irrigation districts during the season of 1931 it was necessary to construct a channel 5.4 miles long, 7 feet deep, and 20 feet wide at the bottom from the dam to the bed of the old lake. This work was begun in March and completed in July, 1931. The greater portion was performed by Government drag lines and the remainder under contract and also by drag line. The cost, including two timber-control structures, was $29,690. A total of 204,780 cubic yards of material was moved.

Minidoka project.—A program of canal and pumping system enlargement is being carried out on the South Side division of the Minidoka project with profits from power operations. During calendar year 1931, $53,000 was expended on the pumping system and $37,000 on the canal system. In 1932 a substation estimated to cost $24,000 will be built and enlargement of the canal system will continue. On the Gooding division of this project the Milner-Gooding Canal was completed to Big Wood River during 1931. Contract for the last 8 miles was awarded to Haas, Doughty & Jones, of San Francisco, on October 2, 1931, and this final section should be completed in May, 1932. Preliminary surveys for location of the lateral system were begun in 1931 and are continuing. It is planned to contract for construction of a portion of the lateral system in 1932. An appropriation of $250,000 is available in the fiscal year 1932 and $100,000 has been appropriated and approximately $100,000 has been reappropriated for the fiscal year 1933.

Owyhee project.—During 1931 work continued on the two tunnels, respectively, 16 feet 7 inches in diameter and 3½ miles long and 9 feet 3 inches in diameter and 4 miles long on the main canals of this project. This work is being done by three different contractors and all have made good progress except in the lower end of the 9 foot 3 inch tunnel where extremely unstable ground was encountered necessitating the use of steel liner plates and grouting the tunnel bore before excavating. Work on these tunnels will continue during 1932 and they should be completed in 1933. In January, 1932, contracts were let with J. A. Terteling & Sons, of Spokane, and the General Construction Co., of Seattle, for construction of the first 4½ miles of the north branch canal. Work was begun in March and the date for completion is May, 1933. Surveys for location of the lateral system are being made. An appropriation of $500,000 and a reappropriation of $1,000,000 for continuing construction on this project during fiscal year 1933 has been made.

Salt Lake Basin project.—The Weber-Provo diversion canal on the first division of the Salt Lake Basin project, construction of which began in March, 1930, was completed in 1931 at a cost of $365,000. This canal is approximately 9 miles long and has a capacity of 210 second-feet. It conveys water from the Weber River to the Provo River. No other work is contemplated on this division.

Shoshone project.—Approximately $20,000 was expended during 1931 in extending the lateral system of the Willwood division of the Shoshone project. This is a new division opened to settlers within the last few years. Little additional construction is planned for 1932.

Sun River project.—Enlargement of the Greenfields main canal and the Pishkun Reservoir was completed in the spring of 1931. Minor extensions to the Greenfields lateral system were also completed in 1931 and this division has been turned over to the irrigation district for operation.

Vale project.—The Bully Creek and Fairman Coulee siphons on the main canal, each 101 inches in diameter and of riveted plate steel, 6,220 and 1,010 feet long, respectively, were completed in June, 1931. The main canal was completed during 1931 to the Bully Creek east bench. Contracts were let for the construction of the Bully Creek east bench lateral system in March, 1931, and at the end of the year this work was 90 per cent complete and should be entirely completed by June, 1932. No further extension of the canal and lateral systems is contemplated until additional storage is provided.

Yakima Kittitas-project.—During 1931 the north branch canal of the Kittitas division of the Yakima project was practically completed, approximately $400,000 having been expended on this canal during the year. The main and south branch canals and laterals were completed prior to 1931. Construction of laterals under the north branch canal was continued during 1931, the cost for the year being about $200,000. Contract awarded in September, 1931, will complete all lateral construction now contemplated, the date for completion of this contract being in June, 1932. Contracts for construction of the Wippel pumping plant were awarded in April, 1932. The estimated cost of this pumping plant is $90,000, and it should be completed in 1933. All construction work on the Kittitas division is expected to be completed in 1933 and the works turned over to the irrigation district.

DRAINAGE CONSTRUCTION

During 1931 the drainage construction program on the Belle Fourche project was practically completed at a total cost of approximately $725,000. Drainage programs on the Lower Yellowstone project and the Garland division of the Shoshone project which had been in progress for several years were also completed during 1931. A modest program of drainage was carried out on the Willwood division of the Shoshone project, about $13,000 being expended in 1931, and some additional work will probably be done in 1932. On the Sun River project an appropriation of $25,000 is available for drainage construction on the Greenfields division in the fiscal year 1932 and an additional $25,000 has been reappropriated for the fiscal year 1933. Specifications for this work have been issued and contract will be awarded in June, 1932. On the south side division of the Minidoka project some drainage is being done with funds made available from power revenues. During 1931 this program was restricted somewhat in order to use available funds for canal and pumping system enlargement, and during 1932

also it is probable that only a small amount of drainage work will be done. The $300,000 drainage program on the main division of the Klamath project was continued and was about 60 per cent completed at the end of 1931. It will be continued during 1932. An appropriation of $100,000 is available in the fiscal year 1932 and $75,000 has been appropriated for the fiscal year 1933 to complete the program. Drainage to the extent of about $6,000 was performed in the Tule Lake division of the Klamath project in 1931 and work begun on the drainage pumping plant No. 5 which will pump drainage water into Tule Lake sump. This pumping plant is estimated to cost $13,000 and will be completed in 1932. No other drainage work is planned in the Tule Lake division during 1932. Additional drainage has been authorized in the Elephant Butte division of the Rio Grande project and approximately $25,000 was expended in 1931. This work will continue on a moderate scale during 1932.

POWER AND PUMPING PLANTS

Yakima Highlands power and pumping development.—The necessary preliminaries in connection with this development on the Kennewick division of the Yakima project in Washington were sufficiently completed so that actual construction was begun in May, 1931. The work first undertaken was the construction of a new low lift discharge pipe line for the pumping plant, consisting of 6,214 feet of 34-inch wood stave pipe and 364 feet of 34-inch reinforced concrete pipe. This pipe line was completed in October, 1931, at a cost of approximately $41,000. Work is now in progress on remodeling and installing new units in the pumping plant, in erecting a new 30-inch wood stave pipe for the high lift lateral and enlarging the distribution system. A contract was awarded to the General Construction Co. of Seattle on January 7, 1932, for repairs to the Prosser Dam and construction of the Prosser power plant and power canal. Work was begun under this contract in February and the date for completion is July 5, 1932. The total cost of all work on this development is estimated at $640,000, and is expected to be fully completed during 1932.

Grand Valley power plant.—A contract has been entered into with the Public Service Co. of Colorado whereby the company agrees to advance $215,000 for construction of a 3,000-kilowatt power plant on the Grand Valley project near Palisade, Colo. The company will operate the plant for a period of 25 years and will pay an annual rental of $15,000. Contract for construction of the plant will be awarded in May and it is hoped to have it in operation in September, 1932.

Dry Lake pumping plant No. 2.—In order to increase the water supply for the Langell Valley irrigation district on the Klamath project, a pumping plant of 15.4 second-feet capacity, known as the Dry Lake pumping plant No. 2, was constructed to pump water from the West Canal into upper Dry Lake lateral, a lift of 43.4 feet. This plant was built by contract during May and June, 1931, at a cost of $8,367.

Third unit at Shoshone power plant.—To supply the growing demand for power, a third unit has been installed in the Shoshone power plant, Shoshone project. This unit is of 4,000-kilowatt capacity, the former two units being 800 kilowatts each. Work was begun by Government forces in November, 1930, and the unit was ready for operation in July, 1931. The total cost was approximately $179,000.

CLEARING JACKSON LAKE RESERVOIR

For a number of years a large amount of drift and dead timber along the shore line of Jackson Lake Reservoir, which is located on upper Snake River near Grand Teton National Park, Wyo., has presented an unsightly appearance. An appropriation of $50,000 was made in fiscal year 1932 for use of the Bureau of Reclamation and a like amount for the National Park Service in cleaning up this accumulation. It was decided to transfer the National Park Service appropriation to the Bureau of Reclamation and have the latter supervise the entire job. Two contracts were let in August, 1931. One contract was completed in November, but work on the other, approximately 50 per cent completed, was closed down until spring on account of weather conditions.

OPERATION AND MAINTENANCE

During 1931, 16 projects were operated and maintained by the Bureau of Reclamation. Of these, 6 were financed entirely by money appropriated from the reclamation fund, 5 entirely by funds advanced, and 5 partly by appropriation and partly by advanced funds. On these 16 projects 618,250 acres were irrigated and 1,634,887 acre-feet of water delivered at an average cost of $2.39 per acre irrigated and $0.91 per acre-foot of water delivered. Certain reserved works, principally storage reservoirs, only were operated and maintained by the bureau on four projects mainly with funds advanced.

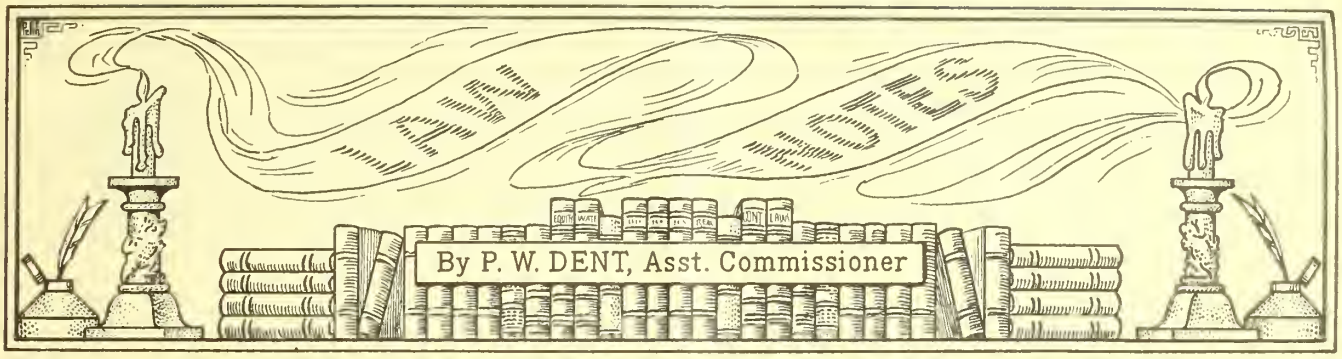
The Echo Dam and Reservoir and the Weber-Provo diversion canal of the Salt Lake Basin project were turned over during 1931, upon completion of construction, to the water users' association for operation and maintenance, and at the end of the year 2 of the 16 projects operated by the bureau were turned over to irrigation districts and water users' associations for operation thereafter. These latter two were the Lower Yellowstone and Uncompahgre projects. Some 21 projects or separate divisions of projects have now been turned over to irrigation districts or water users' associations for operation and maintenance. Two others, the Yakima-Kittitas and the Belle Fourche, will probably be turned over to the district organizations for operation at the beginning of 1933 and at the close of 1933, respectively.

SECONDARY INVESTIGATIONS

During the calendar year 1931 approximately $117,000 was expended on various secondary and cooperative investigations, partly from appropriated funds and partly from contributed funds, the principal features and approximate amounts expended being: Columbia Basin project, $30,000; North Platte River in Wyoming, $20,000; Rathdrum Prairie project in Idaho, $18,000; Salt Lake Basin, Utah, $14,000; All American Canal, Calif., $13,000; Heart Mountain, Wyo., $7,000; water resources, Sacramento Valley, Calif., $8,000.

In the calendar year 1932 investigations now in progress or likely to be undertaken and the approximate costs are as follows: San Joaquin project, California, $15,000; Upper Snake River storage, Idaho, $15,000; Boise project storage, Idaho, $1,000; Rathdrum Prairie, Idaho, $5,000; Tongue River storage, Montana, $1,000; Musselshell storage, Montana, $1,000; Humboldt River storage, Nevada, $10,000; Salt Lake Basin-Ogden River and Cache Valley divisions, Utah, $5,000; Gooseberry storage, Utah, $3,000; Roza division, Yakima project, Washington, $4,000; total estimated cost $60,000. Other investigations not yet authorized are being considered and may be undertaken during the year. If these are all undertaken an additional expenditure of approximately $20,000 will be required. Ample appropriation is available in fiscal year 1932 and reappropriation of the unexpended balance, which is expected to be sufficient for fiscal year 1933, has been made.

A decided back-to-the-farm movement is noted on the Sunnyside division of the Yakima project, and it is anticipated that the area irrigated and farmed will be larger than for a number of years. It is observed that wherever there is a habitable dwelling on a piece of land it is being occupied and preparations are under way for farming the tract, which in many cases has been idle for several years.



Klamath County v. Colonial Realty Company

By B. E. Stoutemyer, District Counsel

IN THE foregoing case, decided by the Supreme Court of Oregon February 16, 1932 [Pac. Rep. vol. 7 (2d) page 976], the facts may be summarized as follows: July 6, 1918, the Klamath Irrigation District made a contract with the United States under the Warren Act to pay the construction cost of the portion of the Klamath project within the boundaries of the district. Some time later the defendant, Colonial Realty Co. became the owner of 742 acres of irrigable land within the district. For the year 1921, and thereafter, the defendant failed to pay the irrigation district assessments levied upon its land. In 1925 the plaintiff, Klamath County, received from the sheriff delinquency certificates covering the amount of the taxes unpaid up to that time.

In an action by the plaintiff against the defendant for the amount of these taxes the defendant alleged that under the Warren Act it would be illegal for the district to supply the defendant with water for irrigating more than 160 acres of its land, but it did not deny that sufficient water to irrigate all of its land was received. The trial court found in favor of the plaintiff and the defendant appealed to the supreme court, where the decision of the lower court was modified so as to eliminate penalties and interest, and otherwise affirmed.

In its decision, written by Judge Campbell, the court says:

"Defendant admits that it owns 160 acres of land that is irrigable under the project and for which it received water, but makes no tender in payment for such service.

"It is first claimed by the defendant: 'The Klamath Irrigation District is prohibited by law from delivering water to this appellant in an amount exceeding that necessary to irrigate 160 acres of land and this appellant is prohibited by law from receiving and using the water in excess of an amount sufficient to irrigate 160 acres of land for which the taxes herein [are] attempted to be foreclosed.'

"(1) This question is not presented under the pleadings in this case. The defendant makes no claim that it did not get the water on its land. It is claiming that it received water illegally and therefore should not be required to pay for it. What is known as the Warren Act (February 21, 1911, c. 141, 36 U. S. Stat. 925) (43 U. S. C. A. §§523–525), was enacted for the purpose of declaring the policy of the Reclamation Bureau of the United States not to undertake to construct irrigation works unless the land in the project subject to irrigation, should be held in no greater quantities by each owner than 160 acres. It is equally the policy of the Government to compel the owners of land to pay for the cost of construction of irrigation works as well as of maintenance where the land is subject to irrigation from such works. There is nothing in the Warren Act that prevents a landowner under a completed project from selling his land, or that prevents one person from owning more than 160 acres on such completed project. The Government might refuse to furnish water for more than 160 acres to any one owner, but if it did furnish water which was accepted and received by such holder, then the holder would be compelled to pay for the service. If such owner should refuse to pay, it can not be heard to complain if delinquent certificate should be issued and foreclosed against the land.

* * * * *

"(3) The defendant claims that its lands are not benefited because it owns more than 160 acres. It bought these lands according to its own admission, for the purpose of selling the same. As arid lands, defendant's holdings have very little value, but as lands with water ready to be used for irrigation, undoubtedly the value is greatly enhanced. The reservoirs, canals, and ditches being already constructed, the lands would be benefited by the amount the price would be increased over their value as arid lands. It is admitted by defendant that as soon as it would sell 160 acres or any lesser amount to another individual or corporation, the lands thus sold would be entitled to the water service for irrigation purposes. The defendant can not be permitted to hold 742 acres for speculation and receive all the benefits of having reservoirs, canals and ditches constructed and maintained without cost to it until it disposes of its holdings in parcels of 160 acres or less. In re Goshen Irrigation District, 42 Wyo. 229, 293 P. 373; Nampa & Meridian Irrigation District *v.* Petri, 28 Idaho, 227, 153 P. 425."

COMMENT

In this opinion the court makes no reference to the case of Enterprise Irrigation District *v.* Enterprise Land & Investment Co., 300 Pac. 507, in which the same court a few months earlier, under a slightly different state of facts, reached a different conclusion.

By the decision in Klamath County *v.* Colonial Realty Co. the Oregon court now appears to be in harmony in this matter with the courts of the other arid States and with its own earlier decisions. In re Goshen Irrigation District, 42 Wyo. 229, 293 Pac. 373; Nampa and Meridian Irrigation District *v.* Petrie, 28 Ida. 227, 153 Pac. 425; in re Harper Irrigation District, 108 Ore. 598, 216 Pac. 1020; Weber *v.* Jordan Valley Irrigation District, 109 Ore. 426, 220 Pac. 146; Northern Pacific Ry Co. *v.* John Day Irrigation District, 106 Ore. 140, 211 Pac. 781; Fallbrook Irrigation District *v.* Bradley, 164 U. S. 112, 41 L. Ed. 369; Knowles *v.* New Sweden Irrigation District, 16 Idaho 217, 101 Pac. 81; Oregon Short Line *v.* Pioneer Irrigation District, 16 Idaho 578, 102 Pac. 904; Harney Valley Irrigation District *v.* Weittenhiller, 101 Ore. 1, 198 Pac. 1093; Paulson *v.* City of Portland, 16 Ore. 450, 19 Pac. 450; Welch *v.* Clatsop County, 24 Ore. 452, 33 Pac. 934; in re King Hill Irrigation District, 37 Ida. 89, 221 Pac. 839.

Recently Enacted Legislation

Vacation of Withdrawals of Public Lands

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That where public lands of the United States have been withdrawn for possible use for construction purposes under the Federal reclamation laws, and are known or believed to be valuable for minerals and would, if not so withdrawn, be subject to location and patent under the general mining laws, the Secretary of the Interior, when in his opinion the rights of the United States will not be prejudiced thereby, may, in his discretion, open the land to location, entry, and patent under the general mining laws, reserving such ways, rights, and easements over or to such lands as may be prescribed by him and as may be deemed necessary or appropriate, including the right to take and remove from such lands construction materials for use in the construction of irrigation works, and/or the said Secretary may require the execution of a contract by the intending locator or entryman as a condition precedent to the vesting of any rights in him, when in the opinion of the Secretary same may be necessary for the protection of the irrigation interests. Such reservations or contract rights may be in favor of the United States or irrigation concerns cooperating or contracting with the United States and operating in the vicinity of such lands. The Secretary may prescribe the form of such contract which shall be executed and acknowledged and recorded in the county records and United States local land office by any locator or entryman of such land before any rights in their favor attach thereto, and the locator or entryman executing such contract shall undertake such indemnifying covenants and shall grant such rights over such lands as in the opinion of the Secretary may be necessary for the protection of Federal or private irrigation in the vicinity. Notice of such reservation or of the necessity of executing such prescribed contract shall be filed in the General Land Office and in the appropriate local land office, and notations thereof shall be made upon the appropriate tract books, and any location or entry thereafter made upon or for such lands, and any patent therefor shall be subject to the terms of such contract and/or to such reserved ways, rights, or easements and such entry or patent shall contain a reference thereto.

SEC. 2. The Secretary of the Interior may prescribe such rules and regulations as may be necessary to enable him to enforce the provisions of this act. (Public No. 104, 72d Cong.)

Approved, April 23, 1932.

Six farms of 404 acres on the Rio Grande project have been subdivided this year into tracts of one-half to 1 acre.

Photo by George A. Beyer

Reclamation Exhibit at National Education Association, first floor, Interior Department, February 20-25, 1932

Cost of Workmen's Compensation Insurance

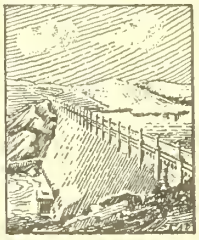
Six companies (Inc.) entered into a contract for the construction of Hoover Dam, Boulder Canyon project. The contractor was ordered to perform extra work under an article of the contract providing "The extra work and material shall be paid for at actual necessary cost as determined by the contracting officer, plus fifteen per cent for superintendence, general expense and profit. The actual necessary cost * * * will in no case include any allowance for office expenses, general superintendence or other general expenses." By another article of the contract it was provided that the decision of the head of the department upon questions of fact should be final and conclusive. The contractor incurred expense for workmen's compensation insurance on the work so performed, and made a claim for this expense as an item of the cost of the extra work. The department decided adversely to the contractor's claim, and upon appeal to the Comptroller General, the claim was disallowed, by decision dated March 28, 1932, the cost of the insurance being held to be a general expense. The Comptroller General pointed out that the decision of the department was final under United States *v.* Mason & Hangar Company, 260 U. S. 323, and Ley & Company *v.* United States, 273 U. S. 386.

H. J. Kaiser, New Head of General Contractors

Henry J. Kaiser, who was inducted into office as president of the Associated General Contractors at the spring meeting of the executive board in Washington on May 2 and 3, succeeds by virtue of his office as vice president at large the late William A. Starrett, elected president at the annual convention in January. Mr. Kaiser is a road builder and general contractor of long standing on the Pacific coast and is vice president of Six Companies (Inc.), which has the contract for the Hoover Dam. One of his large operations just previous to his Hoover Dam work was the construction of one of the longest sections of the Central Highway of Cuba. Taking his new office at the height of his business activity, Mr. Kaiser brings a wealth of energy and a close contact with construction problems that will be of great value to the association of which he is now the head.—*Engineering News-Record.*

The contract under which the Owyhee Dam, Owyhee project, Oregon-Idaho, is being constructed, was 95 per cent complete on May 1.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Steel for Hoover Dam

A steel job, exceptional in magnitude, calling for approximately 100,000,000 pounds of steel, is scheduled for opening of bids at the Denver office of the Bureau of Reclamation on June 15. Bids are invited on furnishing, erecting, and painting plate-steel outlet pipes in concrete-lined tunnels at the Hoover Dam site. Alternative bids are called for under three plans of two schedules each, as follows: Schedules 1 and 2, four headers varying from 30 feet in diameter to 25 feet in diameter, each header having four 13-foot diameter penstocks, and a valve manifold and conduits at its lower end; Schedules 3 and 4, 28 outlet pipes each 13 feet in diameter, 7 of which will be installed in each of four tunnels. Four of the pipes in each tunnel will be penstocks, and the other three pipes will be needle-valve conduits with manifolds at the ends; Schedules 5 and 6, 16 outlet pipes each 17 feet 6 inches in diameter, 4 of which will be installed in each of four tunnels. The pipes will be of plate steel having arc-welded longitudinal joints and either pinned or arc-welded girth joints. Plate thicknesses vary from seven-eighths inch to 2 13/16 inches. The work must be completed by the contractor within 1,975 days (5 years, 148 days). The Government will furnish a site for a field fabricating plant about 1 mile from the dam on the Boulder City-Hoover Dam Railway, and will transport fabricated pipe sections and appurtenances from the plant either to tunnel and adit entrances, or place them within 1 foot of final position in the tunnels. A cableway having a lowering capacity of 135 tons and a lifting capacity of 80 tons will be installed by the Government for lowering pipe sections from the canyon rim on the Nevada side to platforms at adit entrance. While it may be possible to ship 13-foot diameter pipe, the larger sizes must be rolled at the field plant. Invitations to bid have been sent to over 100 steel companies.

On the Rio Grande project 100 acres of pecans have been planted in the Tornillo district in El Paso County, making nearly 200 acres planted to this crop this year.

Notes for Contractors

Boulder Canyon project.—Bids under specifications No. 533 were opened at Denver, Colo., on May 2, 1932, for furnishing two 50 by 50 foot bulkhead gates, together with structural steel gate frames, guides, roller tracks, seats, seals, supports, and appurtenant parts; two 50 by 35 foot Stoney gates, together with structural steel gate frames, guides, chairs, and appurtenant parts; two hydraulic hoists for the bulkhead gates; and two worm-gear type hoists operated by electric motors for the Stoney gates for the outlet works at Hoover Dam. The estimated total weight of the gates and hoists was 7,000,000 pounds. Forty bids were received. The low bids, f. o. b. cars at factory shipping point, were as follows: Schedule 3, Hardie-Tynes Manufacturing Co., Birmingham, Ala., $60,395; and Schedule 4, Reading Iron Co., Reading, Pa., $32,500. All bids under Schedules 1 and 2 were rejected and the original bidders requested to submit new bids to be opened June 1.

Specifications No. 569–D were issued on April 20, 1932, covering the construction of a 34-room temporary dormitory for Government employees at Boulder City, Nev., and bids were opened on May 12, 1932.

Bids under specifications No. 566–D were opened on April 18, 1932, for the construction of an 8-room permanent school building at Boulder City, Nev. Eight bids were received, and contract was awarded to the low bidder, I. M. Bay, at Junction, Utah, whose bid was $12,441.

Grand Valley project.—Bids under specifications No. 567–D were opened on April 28, 1932, for the construction of the Grand Valley power plant. Eight bids were received, the low bid being that of Henry Shore, of Grand Junction, Colo., whose total bid was $19,478.65.

Bids under specifications No. 568–D were opened on April 28, 1932, for furnishing and erecting plate steel penstocks for the Grand Valley power plant. Eight bids were received, the low bid being that of the Pittsburgh-Des Moines Steel Co., of Des Moines, Iowa, the total amount of the bid being $7,875, based on shipment of materials on commercial bills of lading at the expense of the contractor.

Sun River project.—Specifications No. 536 have been issued covering the construction of approximately 12 miles of open drains on the Greenfields division, Sun River project, Montana. Bids will be opened on June 20, 1932. The principal items of work and the estimated quantities involved are as follows: 340,000 cubic yards of drain excavation; 400 cubic yards of excavation for structures; 12,000 cubic yards of back fill about structures; 115 cubic yards of concrete; placing 7,000 pounds of reinforcement bars; and laying 3,176 linear feet of corrugated metal pipe.

Yakima project—Cle Elum dam.—Bids under specifications No. 535 will be opened at the office of the Bureau of Reclamation, Denver, Colo., on June 16, 1932, for furnishing one cylinder gate 20 feet 2¼ inches in outside diameter; one cylinder gate 19 feet 10 inches in outside diameter, together with gate guides and seals and a tandem cylinder gate hoist, together with motor, control apparatus, and gate stems, for Cle Elum dam, Yakima project, Washington.

Colorado River Air Surveys

Arrangements have been made with the Air Corps of the War Department to make an aerial survey of the Needles and Parker Valleys on the Colorado River, to be used by reclamation engineers in studying changing river conditions due to the construction of the Hoover and Imperial (All-American Canal diversion) Dams. Personnel from March Field, Riverside, Calif., will do the work, which is to be completed before the June floods of this year. The net area to be photographed is 71 miles by 5 miles. It is also proposed to select 14 to 20 key points between Hoover Dam and the Imperial Dam site, and have cross sections of the river taken by bureau engineers. By a comparison with future cross sections at these points the changes in the river channel can be studied.

Boulder Canyon Project Notes

Boulder City will have a modern school building which will be ready for occupancy at the beginning of the fall term next September. Work has been started on a 1-story building, 57 by 180 feet, located in block 15 at the corner of Utah and Colorado Streets. The basement and foundation walls will be of concrete, the outside walls of solid brick, and the roof of tile on a timber frame. There will be eight class rooms, a library, and special rooms for the principal and teachers. The contract must be completed in 100 days.

On May 14 excavation of the 15-foot invert sections of the four diversion tunnels was 94 per cent completed, and trimming operations were also 92 per cent completed. Linear feet of tunnel lining poured to May 14 amounted to 2,758 feet of invert, 609 feet of sidewalls.

Current operations of the Six Companies include, in addition to work in the four diversion tunnels, excavation for the Arizona and Nevada spillways and for the Nevada intake towers.

Permittees who have established business enterprises in Boulder City have organized the Boulder City Commercial Association for the advancement of commercial, industrial, civil, and general interests.

On April 26, the Federal court at Carson City, Nev., granted an injunction restraining the State of Nevada from enforcing its mining law within the Boulder Canyon project Federal reservation. The injunction was sought by the Six Companies (Inc.), contractors for the Hoover Dam, to prevent the State from interfering with the use of gasoline trucks in tunnel work.

The Interior Department appropriation bill for the fiscal year 1932–33 contains an item of $6,000,000 for continuation of construction of Hoover Dam and incidental works, of which amount not to exceed $70,000 shall be available for the erection, operation, and maintenance of a school building in Boulder City, purchase of furnishings, and payment of teachers' salaries.

According to S. C. Durkee, State highway engineer of Nevada, bids will be opened at Carson City on June 15 for completing the surface of the Las Vegas-Boulder City highway. A heavy-duty bituminous surfacing will be laid over the entire roadway.

Construction of Legion Hall, which is to house the American Legion post of Boulder City, was started on May 9. The dedicatory exercises on that date were attended by about 500.

(Notes continued on p. 113)

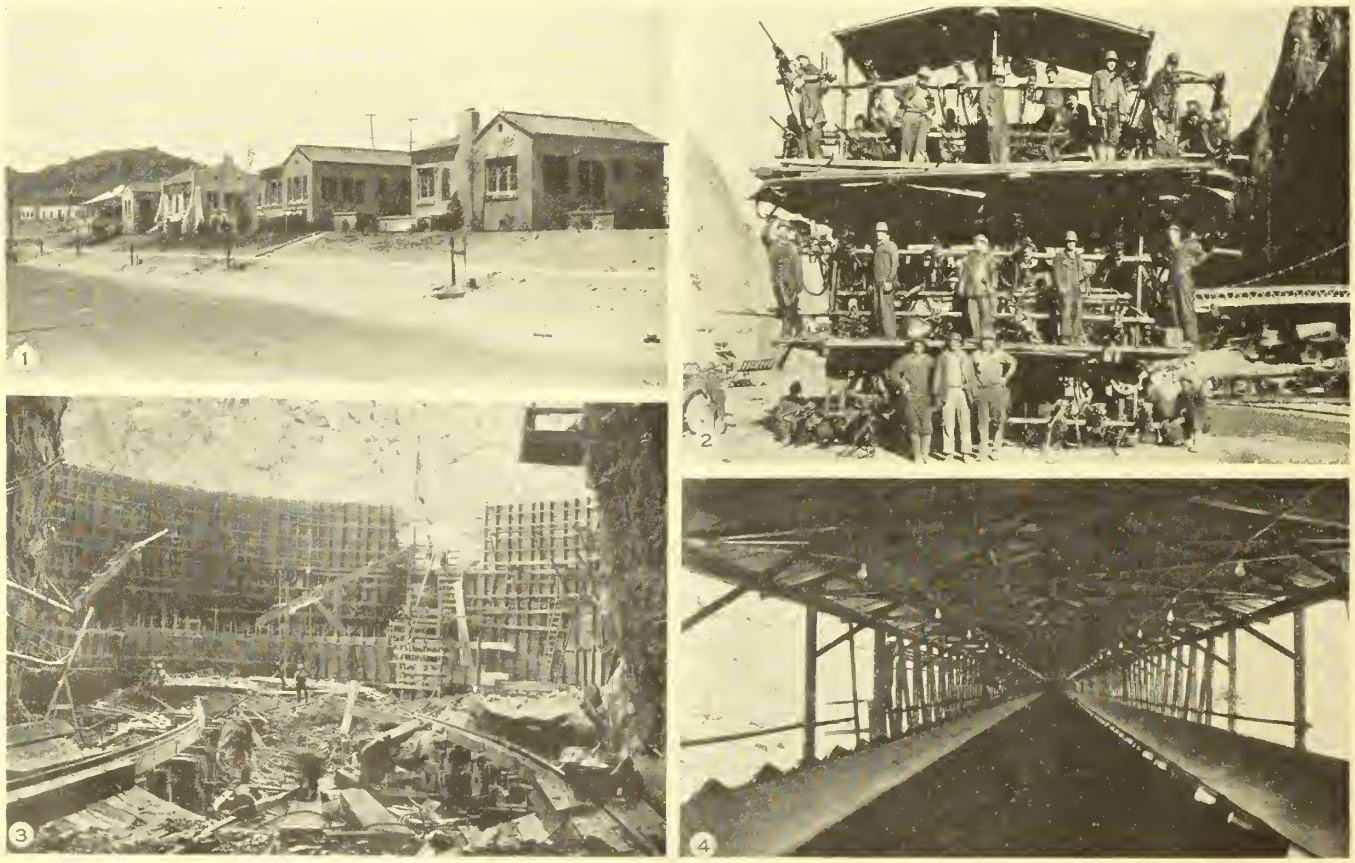


Photo by B. D. Glaha

BOULDER CANYON PROJECT PROGRESS VIEWS

1. Government residences at Boulder City, showing development of lawns and landscaping; 2, truck mounted drill rig used by Six Companies in upper portion of diversion tunnels. Rig is shown in position in which it approaches heading; 3, forms for trash-rack structure in place at inlet portal of diversion tunnel No. 3. Port through which tunnel concrete pouring operations will be carried on is shown; 4, looking down into aggregate conveyor at Six Companies' low level concrete mixing plant.

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, under authority of the Secretary of the Interior.

Copies of the Reclamation Era will be sent, without direct charge, to any water user on the reclamation projects or divisions of projects, which are being operated by the Bureau of Reclamation. Special terms may be made with water users on projects or divisions of projects no longer operated by the bureau. To others the price is 75 cents a year, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation. Postage stamps will not be accepted.

Material for publication in the Reclamation Era should be addressed to Commissioner, Bureau of Reclamation, Department of the Interior, Washington, D. C., and should be mailed in time to reach this office not later than the 14th of the month in order to insure publication in the succeeding month's issue of the Era.

SALLIE A. B. COE, *Editor*

JUNE, 1932

A Paying Investment

THOSE familiar with the Federal reclamation policy realize that this is about the only Federal activity that by law is placed on a paying basis, because of the requirement that the construction cost of the irrigation projects shall be returned to the Federal Treasury through the annual repayments of the water users. The foundation of Federal reclamation is the revolving fund, which revolves by reason of these required repayments, and is used over and over again for the construction work authorized by Congress from year to year.

The fund has not always revolved at the same rate of speed. Economic conditions have affected this rate, and from time to time its rate of revolution has been retarded. The recent depressed condition of agriculture greatly affected the finances of the water users, as a result of which their obligations to the Government were not met when due. Under the provisions of the relief act of April 1, 1932, the fund will revolve at an almost imperceptible speed for a year and a half, as the act authorized the deferment of construction repayments during this period. However, despite the handicaps imposed by reason of relief legislation adopted during the past years, and the adjustment of contracts providing for increasing the period of repayment, there had been returned to the fund to June 30, 1931, on the construction account more than $42,000,000.

The expenditure of the reclamation fund and its reexpenditure as the money is returned by the water users have transformed nearly 2,000,000 acres of otherwise desert land into irrigated gardens, supporting thousands of farmers and town dwellers and aiding in a very appreciable way the upbuilding of the West, without making any inroads on the financial stability of the farming sections of the Middle West and East.

Federal reclamation has unquestionably been a paying investment in newly created farm homes, in affording opportunities for country-minded men and women of small means to develop a home on irrigated land under economic conditions that offer a reasonable assurance of success. Federal reclamation promises neither wealth nor a certain annual return on the settlers' investment, but it does open the door to a mode of living that has a strong appeal to thousands of hardy souls who are not afraid of work and who can think of life on a farm and its numerous advantages in terms of living rather than of dollars.

GOVERNMENT'S INVESTMENT IN RECLAMATION PROFITABLE

But this is only half the story of Federal reclamation as a paying investment. From the standpoint of the Federal and State governments it has more than justified itself as a financial success. This may appear paradoxical when it is considered that the funds spent by the Government for the construction of these irrigation projects are returned by the water users over long periods of years without interest. Surely neither the Federal nor the State Government has realized anything on such a deal. But let us look at it from another viewpoint, as expressed recently by Mr. Louis C. Hill, of Los Angeles, consulting engineer of the bureau. Mr. Hill believes that it could readily be shown that the investment of the Federal Government in these irrigation projects brings the United States a very direct return provided the original capital is ultimately repaid to the Treasury by the water users.

As an example Mr. Hill calls attention to the Salt River project, Arizona, where the Government has expended for construction some $10,200,000 net, which is being repaid by the water users without interest. From the time the irrigation works were completed, there has been a steady increase in income taxes collected from the Salt River Valley, which, to a large extent at least, would not have been collected by the Federal Goverment if the project had not been constructed.

From his knowledge of conditions and of the amount of taxes raised, Mr. Hill estimates that the Federal Government was getting about 5 per cent on the total amount invested originally in the Salt River project, and as the principal was being steadily repaid and the income tax was not being lessened appreciably, the interest rate was, of course, steadily increasing. As only about $2,000,000 remains unpaid of the original debt, Mr. Hill believes it quite possible that 20 to 25 per cent is being paid the Government in the form of income taxes.

He very wisely concludes, therefore, that if he had $10,000,000 and could invest it so that the principal would come back to him and at the same time would continue indefinitely to pay him interest at 4 or 5 per cent on the full amount originally loaned, he would have no doubt that he had made a good investment.

Yet the Bureau of Reclamation is continually forced to combat the ill-digested views of Eastern and Middle Western critics who see only a menace in western irrigation by the Federal Government, and overlook entirely the benefits that have resulted to the Nation as a whole in thus bringing together the landless man and the manless land; in upbuilding the West through the development of its one great remaining resource—water; in opening up new and ever-increasing markets for eastern manufacturers; in the creation of taxable values amounting probably to at least a billion dollars; and in establishing a sound investment with an assured financial return on the money advanced by the Federal Government for this beneficial work.—*H. A. B.*

About 400 acres of cantaloupes are being planted on the Carlsbad project through special contract with an outside distributing firm, and more gardens are being planted than usual.

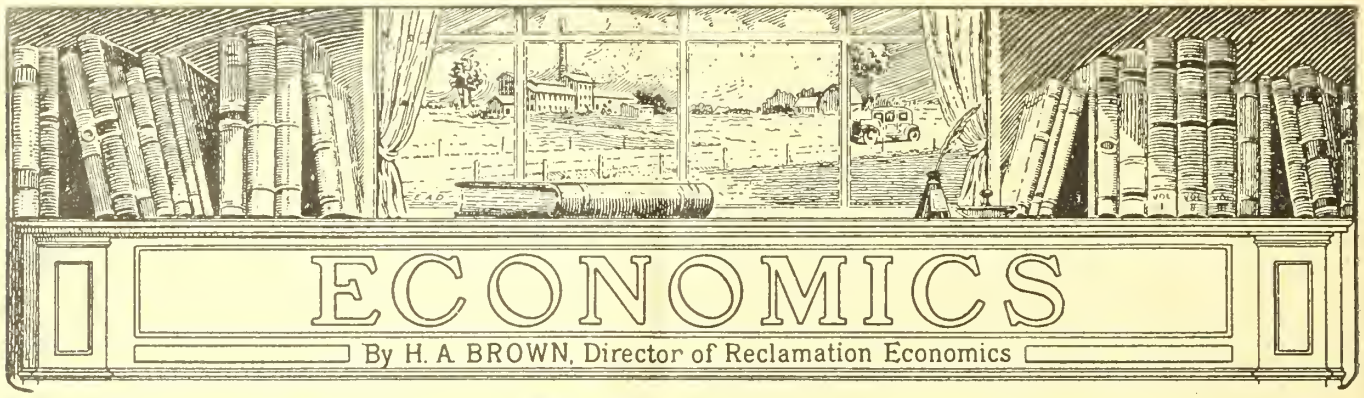
Boulder Canyon Notes

(Continued from p. 112)

A branch of the Latter-day Saints (Mormon Church) has been established in Boulder City, with Laurence Wortley as presiding elder.

Water and sewer systems, electrical distribution system, street improvements except in the southeast section of Boulder City are completed.

A census of school children has just been completed in Boulder City with the following results: Families with children, 404; number of ehildren, 839; below school age, 276; grade school age, 473; high school age, 90.



The Yuma Mesa Fruit Growers Association

By R. M. Priest, Superintendent Yuma Project

THIS cooperative association was formed during the fall of 1928 by citrus growers on the Yuma auxiliary project, with a capital stock consisting of $200,000—10,000 shares of preferred stock at a par value of $10 per share and 10,000 shares of common stock at a par value of $10 per share—for the purpose of packing and marketing citrus crop on Unit B lands. The groves are of varying ages, the first having been planted during 1923 and the remainder in the years following.

It became apparent to the growers that cooperative marketing would be the most satisfactory solution of their marketing problems, and that they should, if possible establish connections with the California Fruit Growers Exchange, a cooperative association with headquarters at Los Angeles which markets 77 per cent of all oranges and grapefruit and 93 per cent of all lemons grown on the Pacific coast and in Arizona.

The local association was formed during 1928 with the following plan of organization:

Membership limited only to citrus growers on Yuma auxiliary project and adjoining territory. Entrance fee for membership one share of common stock at par value of $10. Each member to purchase one share of common stock at a par value of $10 per share for each acre of land he enrolls in the association. Payment to the association for this stock is made by an assessment of 4 cents per field box of fruit of each member until that member's stock is paid in full. The funds derived from the sale of stock are to be used for the purchase of plant and equipment.

In addition to the above there is an association charge of 5 cents per packed box for the creating of a "reserve" fund sufficient to liquidate all debts and operating expenses, such as erection of buildings and purchase of packing equipment. When this fund is deemed by association officers to be of sufficient size to discharge all such obligations it is to be discontinued and at 3 cents per packed box "depreciation" charge substituted to create a fund which will be used to cover plant depreciation. Accumulations in this fund above actual depreciation costs will be credited to the individual growers who will be paid 6 per cent interest on the credits thus established. Refunds of these credits may be made to the individual growers in order of priority of purchase of the association's common stock.

BENEFITS OF CONSOLIDATION

During 1929 this association, with a membership of 35, representing 550 acres of citrus groves, together with the two local grapefruit syndicates having 350 acres of groves, and two cooperative marketing associations in Imperial Valley, Calif., formed the Desert Fruit Exchange, with headquarters at El Centro, Calif. This exchange thus became affiliated with the California Fruit Growers' Exchange, connection with this last-named exchange being made as follows:

Each local association and syndicate has one member who is appointed on the board of directors of the Desert Fruit Exchange, which in turn appoints one of its directors as a member of the board of directors of the California Fruit Growers' Exchange.

The benefits to be derived by the local association through its connections with the California Fruit Growers' Exchange are numerous. The latter exchange maintains sales agents in all the principal markets in the United States, as well as in several markets in Europe. The exchange employs inspectors who travel from one packing plant to the other inspecting the plants and methods and maintaining the grade of the pack. In addition to this a staff of service men is kept busy over the country assisting retailers in window displays and building up of sales. National advertising in all the leading periodicals and newspapers is carried on by the exchange, which levies for this purpose a charge from all its members of 10 cents per packed box on lemons and grapefruit and 5 cents on oranges. All fruit is marketed under the nationally known trade names of "Sunkist" for the first grade fruit and "Red Ball" for the second grade. In addition, the exchange owns timberlands and mills from which it furnishes member associations packing materials at cost. All operations of this exchange are carried on at a cost of from 3 to 3½ per cent of the gross sales, which annually run into millions of dollars.

A MODERN MARKETING SERVICE

The marketing service is modern with all district offices equipped with teletype machines for receiving daily market reports and transmitting all orders. The head office furnishes daily market reports to all association managers. For this marketing service and other benefits to be derived by member associations a charge is made by the exchange of 7 cents per packed box, in addition to which the Desert Citrus Exchange levies a charge of 5 cents per packed box as a general exchange and selling charge, together with a 3 cent per packed box export charge, which is used for the developing of foreign markets and to pay export charges.

The local association has entered into a contract with the Arlington Heights Packing Co. of Riverside, Calif., to pack the association's crop for the years 1931 to 1933, inclusive, for a price of 70 cents per packed box, which includes cost of containers and wrappers. The packing company has erected a shed at Yuma, Ariz., equipped with modern packing machinery, including washing, drying, waxing, and polishing equipment, to handle their contract. An additional contract was made with experienced packers of Imperial Valley to pick and

haul the fruit from the groves to the packing shed for 9 cents per field box.

The local association markets its crop in a seasonal pool due to the varying age of the groves. It has been the practice of the local association to make advances to the members during the marketing of the crop pending the outcome of the seasonal pools. This cash advance upon receipt of the fruit at the packing shed is 50 cents per field box on two-thirds of the crop. This is a cash advance with no deductions, all charges being deducted from the remainder to the credit of the growers when the final distribution of returns is made at the close of the marketing season.

During the season of 1930–31, 60,000 boxes of citrus fruit were packed at the local shed in addition to which some 23,000 boxes of cull fruit were handled. The market conditions during the present season of 1931–32 have been slow, and only 25 per cent of the crop had been marketed at the close of January, so it is not possible to estimate the volume of fruit that will be handled through the local shed this season, which will probably extend into the latter part of May.

Following is a general summary of all marketing charges made on a packed-box basis on grapefruit which constitutes the major part of the local crop:

California Fruit Growers' Exchange:	
Marketing charge	$0.07
Advertising charge	.10
Desert Fruit Exchange:	
Marketing charge	.05
Export charge	.03
Local association contract:	
Packing charge	.70
Picking and hauling charge	.12
"Reserve" fund charge	.05
Total charges per packed box	1.12

To this total charge, of course, must be added freight, the amount of which varies with the location of the market.

Vale-Owyhee Organization Makes Good Showing

In transmitting to the Washington and Denver offices of the Bureau of Reclamation supplies of the new edition of the booklet descriptive of the Vale and Owyhee projects, the Vale-Owyhee Government Projects Land Settlement Association has furnished us with the following interesting statement:

In the past three years this association has succeeded in obtaining 70 settlers, who have purchased 7,119 acres of land and have made investment in the Vale project as indicated in the accompanying table.

Land	$78,777.92
Fencing	11,520.75
Clearing	14,927.00
Buildings	21,874.00
Plowing	8,956.75
Leveling	12,794.00
Miscellaneous	76,880.25
Total	225,730.67

This statement speaks for itself. Further comment is unnecessary, but we can not refrain from adding "This live-wire organization is surely on the job, but the apparent successes thus far attained are only the beginning of great things for the Vale and Owyhee projects."

Burlington Representative Approves Tree Planting

Val Kuska, colonization agent of the Chicago, Burlington & Quincy Railroad Co., whose long association with project development matters has fully qualified him to express himself on the problems of our settlers, has written to L. H. Mitchell, assistant director of reclamation economics in the Washington office, commenting on Mr. Mitchell's article on homestead planning which appeared in the April issue of the Era. His letter is as follows:

"Have just read your article on homestead planning on Federal reclamation projects in the April issue of the Reclamation Era, and want to compliment you on the splendid presentation of the subject. I believe more effort should be devoted to tree planting in all the Western States and particularly on the reclamation projects where water is so easily available. It is my opinion that the majority of farm failures in the West are directly traceable to the lack of trees. In fact, every time I see a place without trees, I figure the fellow living there is about ready to move out.

"So I am especially glad to see you taking part in such a program, and hope you will be able to impress upon all project managers that tree planting probably contributes more to the success of settlers than any other one thing."

Weather and Water Supply

April was generally warm and dry on the projects until the 20th, when a storm of great intensity and proportions spread over the entire West, bringing abnormal rains everywhere except in the extreme southeast. The rains were followed by unseasonably cold weather, resulting in extensive damage. At the end of the month ground waters had regained much of the heavy losses of the past year and soil moisture was high. The outlook for irrigation water everywhere is good, with little danger of shortage anywhere. The greatest improvement has occurred in the Southwest, with Roosevelt Reservoir the highest in 10 years.

The Minidoka project reports 6,200 acres of sugar beets planted out of 6,566 acres contracted, with the expectation that the final acreage will equal or exceed the contracted acreage. The beets have started well and give promise of a good stand.

Subcommittees of the Land Use Planning Committee

The following officials of the Bureau of Reclamation from the Washington office, Denver, and the field have been designated by Dr. Mead as members of the specified subcommittees of the National Land Use Planning Committee, of which the Commissioner is a member:

I. *Adjustment in submarginal areas.*—Hugh A. Brown, director of reclamation economics.

II. *Adjustments and reorganization in better farming areas.*—L. H. Mitchell, assistant director of reclamation economics.

III. *Land inventories and land classification.*—Hugh A. Brown, director of reclamation economics; W. W. Johnston reclamation economist.

VI. *Agricultural credit.*—P. W. Dent, assistant commissioner.

VII. *Adjustment and reorganization in taxation in relation to land use.*—W. F. Kubach, chief accountant; B. E. Stoutemyer, district counsel.

X. *Reclamation, drainage, and irrigation policies.*—George O. Sanford, chief, engineering division; E. B. Debler, hydraulic engineer.

XI. *Control and direction of land settlement.*—Hugh A. Brown, director of reclamation economics; L. H. Mitchell, assistant director of reclamation economics.

XII. *Proposed committee on land value.*—George O. Sanford, chief, engineering division; W. W. Johnston, reclamation economist.

Work of Home Economics Clubs in Kittitas Valley

Wives of New Settlers Welcomed to Kittitas Project, Ellensburg, Wash.

By Mrs. Jess Newman, Wife of a Kittitas Project Farmer and Active Club Woman

HOME MAKING has become a hobby with the women of Kittitas Valley. There are several reasons for this; one of which is the fact that with the completion of the Kittitas project there is a security in home ownership and improvement never experienced before. The people of this area, being essentially farm loving, look no further for joy of living than their own homes and communities. However, there is not to be found a feeling of isolation nor of smug satisfaction, but of continued improvement in one's surroundings as circumstances permit. One of the State normal schools, located at Ellensburg, Wash., provides a cultural center for the county. No small factor in home interest is due to the work of the organized women's clubs which have gone about the matter of home improvement in a businesslike and enthusiastic manner. The State College of Washington, through its extension workers, provided by the Smith-Lever Act, has taken the leadership in these matters and given valuable help.

ORGANIZED CLUBS

Kittitas County, with its 890 farm homes, now has five active home economics clubs, one having been organized this spring. Altogether there is a working membership of over a hundred women. Every distinct rural community has its group of interested farm women, eager to learn and put into practice any idea that makes for better and happier homes. Most of these clubs belong to the County Federation of Women's Clubs which holds its annual meeting in May. At that time a luncheon is served followed by an afternoon of entertainment provided by all the clubs in the federation. The variety of the program brings to light much talent and creates much amusement. Likewise, the home economics clubs are organizing a county unit for business and social purposes. Meetings are to be held quarterly with a different club acting as hostess to all the other clubs at each session.

A survey of the work accomplished over a period of years shows how very comprehensive is its scope. Nearly every phase of home or community work has received or is now receiving attention of one or more of the groups. New settlers in the valley are eagerly welcomed because through them new ideas can be obtained.

Sewing and remodeling were among the first projects attempted as well as among the most useful. Tailoring of seams, proper finishes for various types of garments, making of tailored buttonholes and dress forms were some phases of sewing stressed. Millinery was literally the craze for several seasons, and even though all the hats turned out were not Paris models, yet this project among the women of Kittitas County as elsewhere had the effect of lowering, generally, the prices paid for hats. From the study of millinery and sewing the textiles and workmanship of ready-made garments could be better evaluated than before.

Nutrition has had its place in the homemaker's scheme. Valuable help has been given to the women in cooking and canning. Food values, combinations and all, are being studied by various groups. Oftentimes roll call at the regular meetings is responded to by such requests as Spring salad combinations, Favorite company dessert, or Suggestions for school lunches.

HOME MANAGEMENT

During recent years home economics clubs through the extension service have

Continued on p. 120)

Photo by Maurice Ricker
Yakima River between Yakima and Ellensburg, Wash., Northern Pacific Railway and State highway in distance.

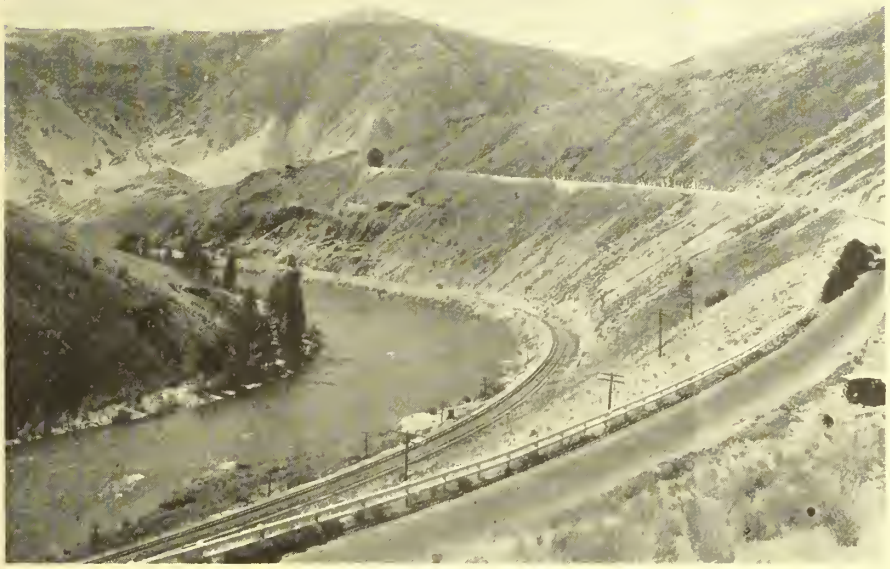


Photo by J. E. Stimson

Yakima River near Yakima, Wash.

THE Yakima River, winding its course through beautiful scenic country in the State of Washington, and furnishing water to the thirsty lands of the semiarid region of Washington, has inspired the following written appreciation by Mrs. Ella S. Tuttle, stenographer to the irrigation manager in the Sunnyside district office of the Yakima reclamation project:

The Labors of Yakima

Watering the Highlands

Yakima, the knightly river,
On his quest for wrong redressing,
Heard a call from out the desert,
Heard a sharp and bitter wail;

Not the cry of tufted pheasant,
With his oriental plumage,
In the miracle of sunset,
Glinting gorgeous blue and gold;

Not the strident voice of nighthawk,
Nor the howl of wastral coyote
Ever seeking living plunder
Through the wind-cooled, starry night,

But of parched and crisping leafage,
Thirsty land and thirsty herbage,
Pleading, from the burning uplands,
For the moisture of the plains;

Through the sunrise iridescent,
When the lowing of the cattle
And the bird songs in the valley
Augurate the coming day;

Pleading through the searing noontime,
Through the sifting, yellow dust-clouds,
Flung abroad, with bold vehemence,
From the east wind's heated arms;

Through the long, delightful evening,
When the west wind from the mountains,
Calms the dust and brings refreshment,
With a pleasant, snow-touched breath;

Suing still with grave insistence,
Through the moonlit balmy midnight
'Til the quiet, kindly river
Heard the plea, and understood;

Swayed and heaved his mighty shoulders,
Bent his sinews to the labor,
Sought and found the giant levers
That were placed within his grasp;

Rolled the waters up the hillsides,
Scattered them throughout the highlands,
Clothing dreary desolation
With a fresh, resplendent green.

Yakima, the sunny river,
Heard a song from out the uplands,
Thankful, joyous, many-throated,
Heard a blithe, triumphant song;

Not of oriole or robin,
Meadow lark, or wild canary,
Nor the sound of noisy blackbirds,
On the wing in dusky bands

But a glad exultant pacan,
Floating over fields of forage,
Dancing through the waving branches
Of the young and stately trees;

Sung by growing plant and leafage,
Nourished land and nourished herbage,
Sung in praises of the river,
Knight of desert and the plain.

The Labors of Yakima

Overcoming Drought and Alkali

Where plaints of the pine tree, in sad, minor strain,
Through thickets of cedar and fir softly quiver,
Where silvery aspen trees' sensitive leaves,
In the crisp, spicy fragrance, shimmer and shiver;
Engirded about by the craggy Cascades,
Each high, snowy peak an Eolian chorist,
The beautiful Yakima River was borne
From the heart of a lake in evergreen forest.

By deep, shady paths of the mountain's green slope,
Where flowering shrub the steep hillside embosses,
Cascading from rocks in a feathery spray,
Under branches low-hung with dark, trailing mosses,
His way to the sea reached the waterless plain,
Where Drought's searing hand swept the desert's gray features,
While over it all, in a wavering flight,
Raced the heat, like a host of thirst-driven creatures.

As Psyche, through masses of long, flowing hair,
Thrust fingers adrip from the sparkling fountain,
So Yakima, through the dry greasewood and sage,
Thrust his fingers all moist with dews on the mountain,
As, through the wide spaces of dry, arid plain,
He wended his way like a care-free young rover,
There leaving green meadows and full-uddered cows
Singing birds in the trees and bees in the clover.

Grim Alkali trailed her white skirts through the fields,
Despoiling the fruits and the rare vegetation,
But Yakima spied out the mischievous jade
And enjoined her to cease her rash depredations.
As, wanton and ruthless, she trampled the land,
Through orchard and garden he patiently sought her,
And over her feet, in the blistering sands,
Rich libations he poured of fair, cooling water.

Protesting and flouting, yet charmed and allured,
She followed him, seeking the clear waves, caresses,
While swiftly, through crevice and channel, he led
To the deepest and darkest earthen recesses.
From hilltop and lowland, from lush, verdant plain,
The freed, grateful land calls a jubilee rally,
To offer obeisance, a conqueror's due,
To the Yakima River, Prince of the Valley.

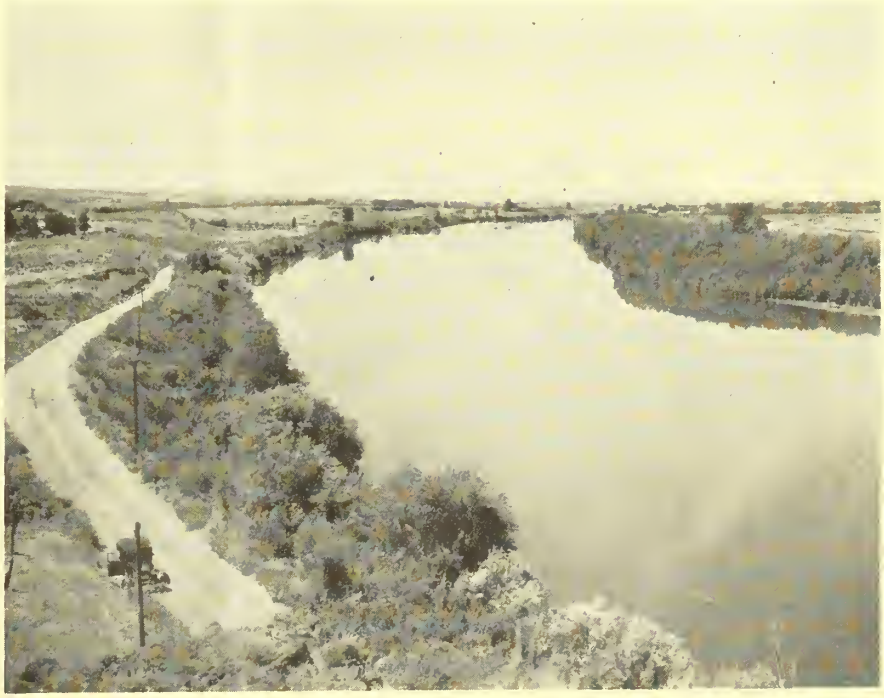


Photo by J. E. Stimson

Yakima River near Prosser, Wash.

ACCOUNTS AND FINANCE

By W. F. KUBACH, Chief Accountant

Appropriations for the Bureau of Reclamation for the Next Fiscal Year

An act making appropriations for the Department of the Interior for the fiscal year ending June 30, 1933, and for other purposes

(Act April 22, 1932, Pub. No. 95, 72d Cong., 1st sess.)

THE Interior Department appropriation act for the fiscal year 1933 was approved by the President on April 22, 1932. The general provisions of the act applicable to the Bureau of Reclamation as a whole are quoted below and the estimated amounts available for expenditure in the fiscal year are shown in the accompanying table:

For all expenditures authorized by the act of June 17, 1902 (32 Stat., p. 388), and acts amendatory thereof or supplementary thereto, known as the reclamation law, and all other acts under which expenditures from said fund are authorized, including not to exceed $170,000 for personal services and $16,000 for other expenses in the office of the chief engineer, $20,000 for telegraph, telephone, and other communication service, $5,000 for photographing and making photographic prints, $45,000 for personal services, and $10,000 for other expenses in the field legal offices; examination of estimates for appropriations in the field; refunds of overcollections and deposits for other purposes; not to exceed $15,000 for lithographing, engraving, printing, and binding; purchase of ice; purchase of rubber boots for official use by employees; maintenance and operation of horse-drawn and motor-propelled passenger-carrying vehicles; not to exceed $40,000 for purchase and exchange of horse-drawn and motor-propelled passenger-carrying vehicles; packing, crating, and transportation (including drayage) of personal effects of employees upon permanent change of station, under regulations to be prescribed by the Secretary of the Interior; payment of damages caused to the owners of lands or other private property of any kind by reason of the operations of the United States, its officers, or employees, in the survey, construction, operation, or maintenance of irrigation works, and which may be compromised by agreement between the claimant and the Secretary of the Interior, or such officers as he may designate; payment for official telephone service in the field hereafter incurred in case of official telephones installed in private houses when authorized under regulations established by the Secretary of the Interior; not to exceed $1,000 for expenses, except membership fees, of attendance, when authorized by the Secretary, upon meetings of technical and professional societies required in connection with official work of the bureau; payment of rewards, when specifically authorized by the Secretary of the Interior, for information leading to the apprehension and conviction of persons found guilty of the theft, damage, or destruction of public property: *Provided*, That no part of said appropriations may be used for maintenance of headquarters for the Bureau of Reclamation outside the District of Columbia except for an office for the chief engineer and staff and for certain field officers of the division of reclamation economics: *Provided further*, That the Secretary of the Interior in his administration of the Bureau of Reclamation is authorized to contract for medical attention and service for employees and to make necessary pay-roll deductions agreed to by the employees therefor: *Provided further*, That no part of any sum provided for in this act for operation and maintenance of any project or division of a project by the Bureau of Reclamation shall be used for the irrigation of any lands within the boundaries of an irrigation district which has contracted with the Bureau of

Photo by J. E. Stimson

Irrigating potatoes on Kittitas Division, Yakima project, Washington.

FUNDS AVAILABLE, FISCAL YEAR 1933—APPROPRIATIONS, UNEXPENDED BALANCES, FUNDS TO BE ADVANCED, AND POWER REVENUES

Direct appropriations	Unexpended balances continued available (estimated)	Power revenues appropriations	Funds to be advanced	Total available	Projects and other items	Construction: Examination and surveys	Construction: Storage system	Construction: Distribution system	Construction: Drainage system	Construction: Permanent improvements	Operation and maintenance: Direct appropriations	Operation and maintenance: Unexpended balances	Operation and maintenance: Funds advanced	Operation and maintenance: Power revenues	Miscellaneous
					RECLAMATION FUND										
$160,000				$160,000	Washington office										$160,000
					Administrative provisions and limitations:										
					Denver office—										
170,000				170,000	Personal services										170,000
16,000				16,000	Miscellaneous expenses										16,000
20,000				20,000	Telegraph and telephone, etc										20,000
5,000				5,000	Photographic and prints										5,000
					Field legal—										
45,000				45,000	Personal services										45,000
10,000				10,000	Miscellaneous expenses										10,000
15,000				15,000	Lithographing, engraving, etc										15,000
40,000				40,000	Purchase and exchange of automobiles										40,000
1,000				1,000	Attendance of meetings, etc										1,000
	$33,000			33,000	Examination and inspection of project							$33,000			
	54,000			54,000	Operation and maintenance of reserved works							54,000			
70,000		$25,000	$150,000	245,000	Yuma:										
					Irrigation system				$20,000		$50,000		$150,000		
					Commercial power system									$25,000	
35,000				35,000	Orland						35,000				
			45,000	45,000	Grand Valley								45,000		
35,000			20,000	55,000	Boise				15,000		20,000		20,000		
155,000	200,000	175,000	80,000	610,000	Minidoka:										
					Reserved works						55,000				
					Irrigation system								80,000		
					Gravity extension			$300,000							
					South division			125,000							
					Commercial power system									50,000	
100,000				100,000	Bitter root, betterment and repair work			100,000							
31,000	7,000		46,500	84,500	Milk River		$19,000	15,000			4,000		46,500		
	25,000			25,000	Sun River				25,000						
		80,000	45,000	125,000	North Platte:										
					Reserved works								45,000		
					Power system									80,000	
25,000	42,000		50,000	117,000	Carlsbad						25,000	42,000	50,000		
346,000	100,000			446,000	Rio Grande			10,000	131,000	$5,000	300,000				
500,000	594,000			1,094,000	Owyhee			1,094,000							
	25,000			25,000	Baker		25,000								
			4,000	4,000	Umatilla								4,000		
20,000				20,000	Vale						20,000				
120,000	40,000	[1] 5,000	73,000	238,000	Klamath			40,000	75,000		45,000		73,000		5,000
	75,000		75,000	150,000	Belle Fourche				75,000				75,000		
	299,000			299,000	Salt Lake Basin (second division)		299,000								
750,000				750,000	Yakima		500,000				250,000				
40,000	75,000		10,000	125,000	Yakima (Kittitas division)			75,000			40,000		10,000		
17,500		20,000		37,500	Riverton						17,500			20,000	
10,000	25,000	20,000	1,120	56,120	Shoshone				25,000		10,000		1,120	20,000	
	200,000		25,000	225,000	Secondary and economic investigations	$225,000									
	25,000			25,000	Giving information to settlers										25,000
2,414,500	1,819,000	325,000	624,620	5,183,120	Total reclamation fund	225,000	843,000	1,759,000	366,000	5,000	871,500	129,000	599,620	195,000	190,000
					GENERAL FUND										
	100,000			100,000	Colorado River front work and levee							100,000			
6,000,000				6,000,000	Boulder Canyon		6,000,000								
8,414,500	1,919,000	325,000	624,620	11,383,120	Grand total	225,000	6,843,000	1,759,000	366,000	5,000	871,500	229,000	599,620	195,000	190,000

[1] $5,000 from revenues of lease of land available for refund.

Reclamation and which is in arrears for more than 12 months in the payment of any charges due the United States, and no part of any sum provided for in this act for such purpose shall be used for the irrigation of any lands which have contracted with the Bureau of Reclamation and which are in arrears for more than 12 months in the payment of any charges due from said lands to the United States;

Examination and inspection of projects: For examination of accounts and inspection of the works of various projects and divisions of projects operated and maintained by irrigation districts or water users' associations, and bookkeeping, accounting, clerical, legal, and other expenses incurred in accordance with contract provisions for the repayment of such expenses by the districts or associations, the unexpended balance of the appropriation for this purpose for the fiscal year 1932 is continued available for the same purpose for the fiscal year 1933;

For operation and maintenance of the reserved works of a project or division of a project when irrigation districts, water users' associations, or Warren Act contractors have contracted to pay in advance but have failed to pay their proportionate share of the cost of such operation and maintenance, to be expended under regulations to be prescribed by the Secretary of the Interior, the unexpended balance of the appropriation for this purpose for the fiscal year 1932 is continued available for the same purpose for the fiscal year 1933;

The Shoshone project reports a recent shrub-gathering tour by 26 people on the North Fork of the Shoshone River. W. O. Edmondson accompanied the group and supervised the gathering of the native shrubs for the foundation plantings around the new Willwood community building, completed a short time ago. Together with the native shrubs, 600 trees have been ordered from the State experiment farm for wind-break purposes. With the foundation plantings and the shelter belt started, this will make one of the most attractive community buildings in the Northwest.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, returned to Washington on April 30 after an absence of several weeks during which he visited the Denver office, where he dealt with questions involved in the operation of the moratorium act and other administrative problems. Going from Denver to Los Angeles, Doctor Mead discussed preliminary action leading up to the building of the Parker Dam on the Colorado River, and thence to the Yuma project, Arizona, where he took up local problems.

Before returning to Washington the commissioner visited the Boulder Canyon project.

R. F. Walter, chief engineer, spent several days on the Boulder Canyon project, where he made a general inspection of the work in progress and attended to other official business at Boulder City.

Joseph Markham, superintendent of Jackson Lake Reservoir, Minidoka project, who was operated on at Jackson, Wyo., for an acute attack of appendicitis, died on May 15.

P. W. Dent, assistant commissioner, returned to Washington on April 29, after a visit to the Denver office and the Rio Grande and Carlsbad projects. At El Paso Mr. Dent discussed a proposed adjustment contract with the Hudspeth Irrigation district, and at Carlsbad he considered the contract for taking over the operation of the project and for a revised schedule of payments, allowing credits under the adjustment act of May 25, 1926.

L. M. Lawson, international water and boundary commissioner, with headquarters at El Paso, Tex., and former engineer of the Bureau of Reclamation, was in Washington the early part of May on business for his commission. During his stay in the city Mr. Lawson visited his many friends in the Washington office.

R. S. Lieurance, engineer in the Denver office, who spent three weeks at the Massachusetts Institute of Technology giving a course of lectures on the technical design of Hoover Dam, has returned to Denver, stopping en route in Washington, where he visited the Commissioner and others in the Washington office.

W. A. Bechtel, president; Henry J. Kaiser, chairman executive committee; and Felix Kahn, treasurer, of the Six Companies (Inc.), builders of Hoover Dam and appurtenant works, accompanied by their wives, were in Washington the second and third weeks in May on business connected with the Boulder Canyon project.

Haven Leigh, long a leader in agricultural affairs of the Minidoka project, died on April 24, after an illness of six months. For nine years Mr. Leigh had been a member of the board of directors of the Burley irrigation district, and for six years was its president. Mr. Leigh was noted for his success in dairying, and for two years in succession his herd of Holstein cows won the highest award in Idaho for butter-fat production.

L. N. McClellan, chief electrical engineer in the Denver office, spent a few days in Washington during the latter part of May to testify before the House Committee on Irrigation and Reclamation on power revenues on the Columbia Basin project.

Home Economics Clubs in Kittitas Valley

(Continued from p. 116)

centered attention on matters of home management. For one year the major project of all clubs was the study of kitchens. The specialist from the State College assembled a small group of women, one from each community, interested and instructed them in kitchen standards, and the use of the score chart. Two days were then spent with the leader in actually scoring kitchens. Later these women went back to their communities and interested their groups in kitchen improvement. The result is that the farm work in many homes has been improved in efficiency 50 per cent or more with very little cost. Those who have not been able to make all improvements possible at least know what is best for the worker in the matter of heights and arrangement of work units, lighting, most satisfactory floor finishes, improved equipment, and sanitation. Proper method of washing dishes and cleaning rooms provides more leisure for the farm woman. Those who are fortunate enough to build new homes will appreciate greatly these helps which home economics women can give.

The study of living rooms centered around such topics as the correct grouping of furniture for use and comfort, hanging of pictures, proper color combinations for certain exposures and types of wall finishes. Demonstrations on upholstering, making of slip covers, and refinishing of furniture gave suggestions that can be carried out in any room in the house.

Work in arts and crafts met with enthusiastic response because it provided a chance for creative endeavor. Reed work, such as the making of baskets, trays, and ferneries, has held the attention of women for some time. Lamp-shade making was likewise popular. Participants in all lines of work offered have been stimulated to their best endeavor because of opportunities to enter and exhibit their work at the Kittitas County Fair held annually in Ellensburg, Wash. In fact, almost the entire responsibility for entries at the fair and the making of booths is assumed by such groups as the farm bureaus and home economics clubs.

Educational phases of home economics work is likewise varied. Programs held monthly are made up of music, papers on worth-while topics, or talks by outside speakers and demonstrations. The Ellensburg Normal School, through its efficient home arts department, helps whenever possible in any work requested.

The Better Homes Tour, held for two successive seasons in the valley, has been especially beneficial because of cooperation among all the clubs and schools in the county. The educational value of this activity can not be estimated, for it tends to instill pride in the home, inside and outside, as nothing else has. No doubt the major project of home beautification which some clubs are taking up this year has been inspired by these tours.

The people of Kittitas County, including both rural and urban clubs, welcome whole-heartedly the newcomers to the valley. These clubs form a clearing house for new ideas and provide a well-rounded program for the busy housewife who feels the urge to do useful things with her hands, to create something beautiful and artistic and to improve herself mentally, all of which makes for happy, capable home makers. Leadership is being developed among rural women. Opportunity is given newcomers in the district to join the busy group nearest them, and to make them feel they have a definite place in their community, that they may be real neighbors with all others in this land of abundance and contentment. More information regarding the valley and land settlement opportunities may be obtained from the Ellensburg Chamber of Commerce, Ellensburg, Wash.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy**, Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peck	E. A. Peck	J. R. Alexander	Boulder City, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Bitter Root	Hamilton, Mont	G. J. Hagens	Irri. mgr			Wm. J. Burke	Billings, Mont.
Milk River [3]	Malta, Mont	H. H. Johnson	Superintendent	E. E. Chabot	E. E. Chabot	do	Do.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Baker, Thief Val. Dam	Owyhee, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	do	Do.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	L. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCornick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A.	Montrose, Colo	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho.	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont.	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg.	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A.	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Custom House	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of California.
Colorado River Basin investigations	Denver, Colo., Custom House	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor*

Irrigating potatoes

Breaking light sagebrush

A new home and garden

An oat field

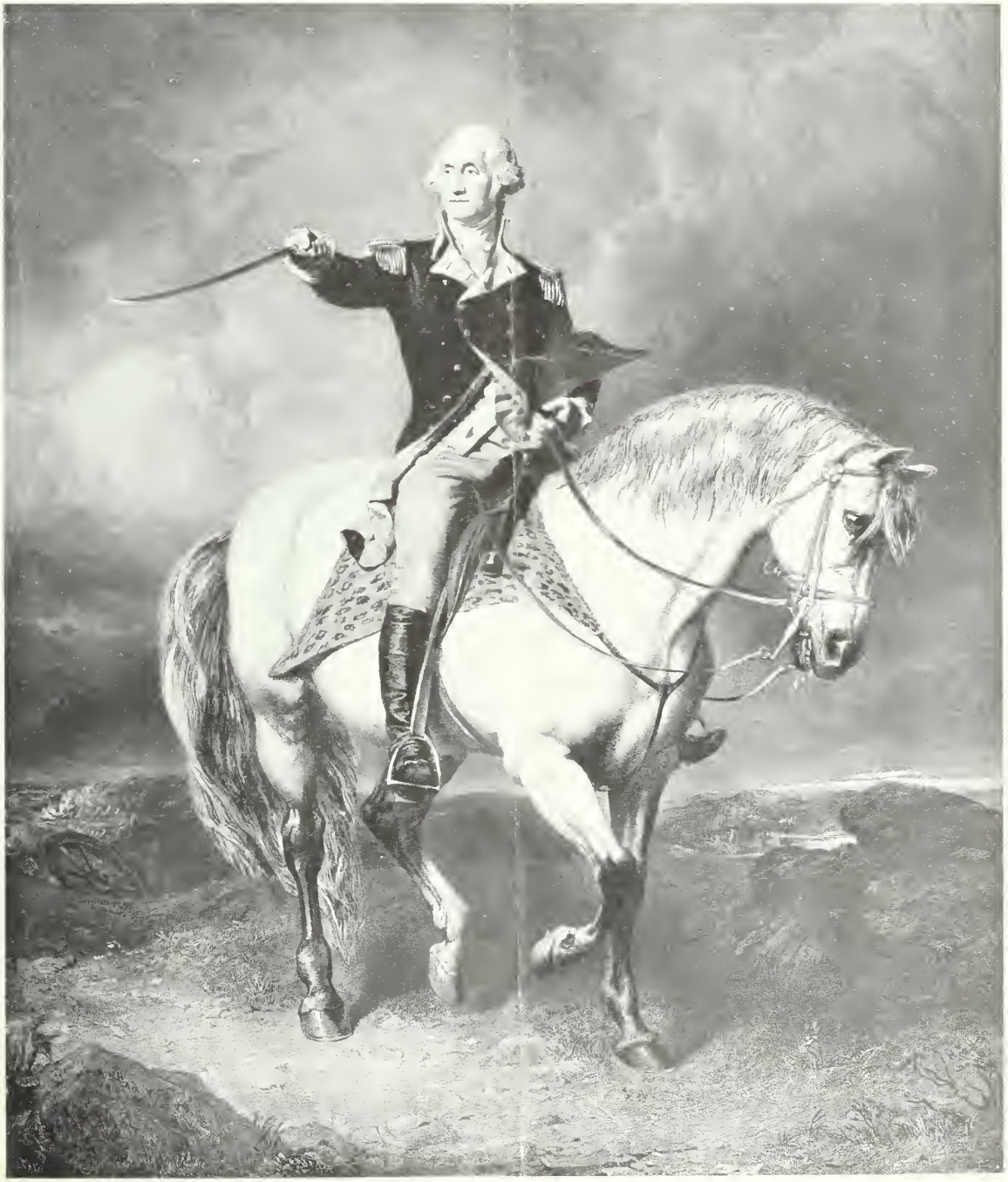
On June 1, 1932, the Bureau of Reclamation opened to entry 43 public land farm units on the Pilot and Pavillion Divisions of the Riverton project, Wyoming, where the water supply is ample, the soil excellent, and where a settler with the requisite cash, equipment, and experience has a good opportunity to succeed.

These views are typical of the project and its development.

Main Street of Riverton

THE
RECLAMATION ERA

VOL. 23, NO. 7 JULY, 1932



Painted by John Faed. Engraved by William Holl. Courtesy of United States George Washington Bicentennial Commission

"WASHINGTON AT TRENTON"

George Washington as a Farmer

"Nor was his enthusiasm for agriculture the evanescent enthusiasm of the man who in middle age buys a farm as a plaything and tries for the first time the costly experiment of cultivating the soil. He was born on a plantation, was brought up in the country and until manhood he had never even seen a town of five thousand people. . . . he was one of the first American experimental agriculturists, always alert for better methods, willing to take any amount of pains to find the best fertilizer, the best way to avoid plant diseases, the best methods of cultivation, and he once declared that he had little patience with those content to tread the ruts their fathers trod. If he were alive to-day, we may be sure that he would be an active worker in farmers' institutes, an eager visitor to agricultural colleges, a reader of scientific reports, and an enthusiastic promoter of anything tending to better American farming and farm life."

PAUL L. HAWORTH,

George Washington, Country Gentleman, pp. 3, 6 7.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 7 JULY, 1932

Social and Economic Value of Electrical Development in Federal Reclamation

Address of Dr. Elwood Mead, Commissioner of Reclamation, at the Annual Meeting of the American Society of Agricultural Engineers, at Columbus, Ohio, June 23, 1932 [1]

MY boyhood home on a farm was lighted by tallow candles. We grew sheep, killed them and used the tallow for illumination. Lighting with coal oil or petroleum, which followed, was a tremendous gain. I first came in contact with gas when I went to college. The beginnings of lighting with electricity came while I was in college. The interest in our physics class was greatly increased by illustrations of the incandescent street lights installed for the first time in Cleveland.

RECLAMATION LEADS WEST IN INTRODUCTION OF ELECTRICITY

In the western third of the United States the Reclamation Bureau has for the last quarter of a century been a leader in the introduction of electricity in farm homes and in the conduct of farming operations. It was one of the earliest users of hydroelectric power in the construction of irrigation works, making extensive use of the opportunities which existed on many mountain streams, to cheapen the cost of excavating canals by employing hydroelectric power to displace coal and gasoline, horses and mules.

When canals were completed and settlement followed, the new farmers found power lines stretching along the banks of canals which could be used as the main lines of a distribution system reaching to the individual farms. Instead of scrapping these and the power plant, local companies of farmers were organized to utilize these power lines to transmit electricity purchased at wholesale from the Reclamation Bureau, and retail it to their members. Where this was not done, companies were organized to install distribution systems and serve these developing farming communities, or established public utilities bought power at wholesale to retail to their customers.

HYDROELECTRIC DEVELOPMENT ON SALT RIVER PROJECT

One of the earliest and most noteworthy examples of hydroelectric development as an adjunct to irrigation is found on the Salt River project, Arizona, where the farmers under the canal organized a company, took over the Government's original power plant, and have expended over $12,000,000 building additional power plants, which now serve not only the project farmers but the important city of Phoenix, Ariz., mines and industrial enterprises. Here the power plants are owned by the owners of the irrigation system.

In 1930 the network of transmission lines on the project made electricity available for every one of the 7,000 farms upon the payment of a connection charge of $25. At that time 2,000 farms were being served and others were being connected at the rate of 50 a week. Power was being used for several hundred cooking ranges, and for water heaters, ensilage cutters, milking machines, cream separators, feed grinders, incubators, brooders, and a host of other farm appliances. Houses were being heated to some extent, but only in special cases where the cost was not a prime consideration.

MINIDOKA A TYPICAL ELECTRICAL PROJECT

A more typical power development is that on the Minidoka project in Idaho. One of the canals is above gravity. Water for irrigation has to be pumped into it. The power for this pumping is provided by the water passing the diversion dam in Snake River. It diverts water by gravity on one side of the river and furnishes power for lifting it into the canal on the other side. The amount of water in the river is far greater than that needed for irrigation, and this is being utilized to generate power not only for pumping but for industrial and domestic uses on farms. The original power works were made large enough to meet the ultimate requirements of pumping, but as the irrigators were few in number, and the amount of power available was largely in excess of the demand, it was first employed to heat farmers' homes and to cook the farmers' meals. Later, when the number of farmers increased and towns were established, the demand for power for pumping, the lighting of homes, and small industrial needs, like turning the cream separator, absorbed the whole of it, and the use of electricity for heating was abandoned.

FARM HOMES USE ELECTRICITY EXTENSIVELY

The large number and wide variety of electrical appliances in use afford a partial measure of the social and economic value of cheap power. Practically every farmer now has a motor belted to a jackshaft, which drives a pump, cream separator, grindstone, feed grinder, and numerous other labor-saving appliances. Nearly every farmer enjoys a large yard light on a pole, and with all these burning at night it is difficult to tell from a distance where town begins and country ends. The farm women in increasing numbers are outdoing their husbands in the use of electricity for flatirons, washing machines, hot plates, grills and toasters, vacuum cleaners, fans, percolators, sewing machines, heater pads, and curling irons.

This extensive use of cheap power has not only added to the convenience of the

[1] Presented by George O. Sanford, chief, Engineering Division, Washington office.

farm home, and lessened the cost of farming operations, but brings in a constantly increasing revenue, so that in the Burley Irrigation District on this project, power for pumping not only does not cost the irrigator anything, but in addition it more than pays his construction charges. The entire construction cost in this district is about $100,000 a year. This district's proportion of the net annual revenues from the Minidoka power plant is estimated at between $125,000 and $150,000, or considerably more than sufficient to meet the annual construction payment.

GROWING IMPORTANCE OF HYDROELECTRIC POWER

On 11 of the 29 Federal irrigation projects, there are 22 power plants now in operation, of which 14 were constructed by the Bureau of Reclamation. For the fiscal year 1930–31, the gross power sales from these plants were $3,500,000. The total output was 455,300,000 kilowatt-hours, of which 68 per cent was sold to consumers and 20 per cent utilized for irrigation and drainage requirements; the remaining 12 per cent was used for miscellaneous purposes and includes losses.

With the completion of the Grand Valley power plant in Colorado and the Prosser power plant in Washington, which are now under construction, there will be a total of 11 hydroelectric power plants aggregating 38,000 kilowatts, on 9 projects operated by the Bureau of Reclamation. The net revenues from the sale of power from these plants, after providing for the cost of operation and maintenance, will amount to about $600,000 per year.

The growing importance of hydroelectric power as a factor in Federal reclamation requires modification of the policies adopted at the outset. On the earlier projects electricity was thought of as only a means for pumping water for the irrigation of high lands or as a temporary agency for the cheaper construction of canals. There was no adequate realization of the financial possibilities of power development, and the capacities of the plants were accordingly limited to these elementary requirements. When the canals were built, the power plant that operated the dragline and the power line that carried the current to the dragline, were turned over to the irrigators, just as the half-wornout excavating machinery was turned over to them. What they did with it was their own affair; what revenue they got out of it was theirs.

As development progressed on a potentially power-favored project, there was usually an increasing demand for more power, not only for farm and domestic use, but to meet the needs of near-by towns which were eager to enter into contracts for the purchase of power for municipal and private purposes. On most projects it was wholly feasible to develop additional power by utilizing completely the available head at storage dams, in canal drops, and at other appropriate points. But when power plants began to be built for the express purpose of furnishing current to light homes and turn separators, and provide revenue to help pay for the irrigation works, the question of who owned these power plants and who was entitled to the revenue after the works were paid for, assumed a new aspect. The favored position held by the water users in the Burley Irrigation District is duplicated on the various divisons of the North Platte project in Nebraska and Wyoming, where the power development, although only in its early stages, permitted credits to be extended to the water users which in 1930 amounted to more than $156,000 compared with annual construction charges of approximately $275,000. The water users are urging the development of additional power, and if this is carried out their entire annual construction charges will be paid from the net power revenues.

The position of the Bureau of Reclamation has been that these works are the perpetual property of the Federal Government. Not a dollar of the money used to build these works has been furnished by the irrigators. In all cases the current has been sold at less than commercial rates, and the revenue from it has been applied to the payment for the power plant, reservoir, and canals, to supplement the payments made by the irrigators, until the works shall have been entirely paid for. On the other hand, irrigators are claiming that, after this has been done, these works which cost them nothing and from which they have been greatly benefited, shall become theirs, and that they can put in their pockets that revenue, as a perpetual dividend on an investment which the Government made.

ALLOCATION OF REVENUES FROM SALE OF POWER

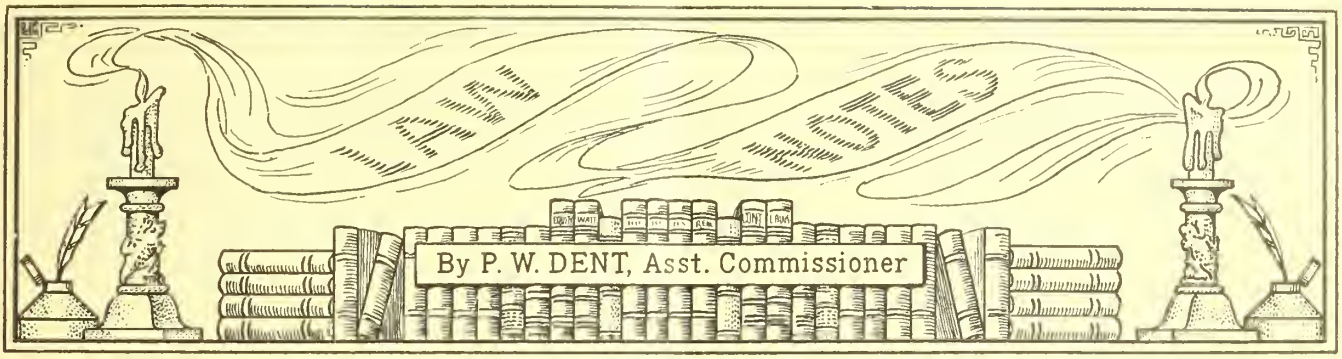
A decision rendered recently gave this power to the irrigators and, as pointed out, the profits from certain power plants are being used to pay their debts to the Government, although they never paid a dollar of the construction cost nor did they obligate themselves to pay all of it. However, in more recent appropriation acts, the terms of the appropriation provide that after the dam and the power plant shall have been paid for, then the net profits are to go into the reclamation fund. This new basis for the allocation of revenues from the sale of power has already been applied by Congress to a number of projects. If this policy is to be followed in all cases hereafter, revenue from power will soon furnish the largest part of the income for building additional works.

This radical change from the older conception of the development of power merely as an aid in construction to one in which its financial importance to the water users and the Government is more adequately appreciated is not inequitable to the water users on projects where an original power development or an expansion of the present development is possible. In this event the water users pay no part of the cost of the power plant, the dam, and the reservoir. This cost is paid for from the net power revenues. They have, however, received a very direct benefit from the cheaper construction made possible by reason of the power development. They also enjoy cheap power for use in the home and on the farm, and can look forward to the early expansion of local industry based on low power rates.

SALE OF POWER TO REPAY CONSTRUCTION COST

The power plant at Hoover Dam, now being built in the Colorado to regulate its flow, give an additional water supply for Los Angeles, and protect the Imperial Valley from floods, will in the 50 years after completion bring in a revenue of $373,500,000. This will pay the entire cost of the dam, the power plant and appurtenant works with 4 per cent interest, pay to the States of Arizona and Nevada $62,500,000 in lieu of taxes, and leave a surplus in the Boulder Dam fund of $67,000,000 in the first 50 years. Plans for utilizing the Columbia River by building a power plant as an adjunct to the Columbia Basin project are based similarly on a scheme of repaying the entire cost, with 4 per cent interest, from power revenues, and then using these power revenues to help build the irrigation works. What will be done with the power revenues after the works are paid for is still an open question, both on the Colorado River development, and in the legislation for the Columbia River. In one case the law, which has been passed, leaves that matter to be decided by Congress 50 years from now, and in the other case, the same provision is incorporated in the bill now before Congress.

On the 17th of this month the Bureau of Reclamation had its thirtieth birthday. During the period since the approval of the reclamation act the value of power as a substantial factor in the lives of the water users on the Federal irrigation projects and in the continuation of the reclamation policy has become increasingly apparent. The future holds promise of even greater social and economic benefits.



Decision in Case of City of Cle Elum v. Harper, et al

By B. E. Stoutemyer, District Counsel

MAYBE you think that after the field engineer has counted all of the sheep representing the day's troubles on the job he can drop off into a profound slumber. Not so. He frequently has additional sheep to count in the way of unofficial worries as witness the case of City of Cle Elum *v.* S. O. Harper, R. J. Newell, J. S. Moore, and Winston Brothers, arising on the Yakima project.

The action thus entitled was brought against the persons mentioned, not as officers of the United States Reclamation Bureau, but as individuals, to restrain them from proceeding to construct the Cle Elum Dam as an interference with the domestic water supply of the city. As commenced in the State court, it asked for purely injunctive relief. No injunction bond having been provided, while the jurisdiction of the case was suspended between the State and Federal courts upon a petition for removal and subsequent motion to remand, work on the dam had progressed beyond the power of relief by temporary injunction. Upon the case being remanded to the State Court, the city waived its prayer for temporary injunction to ask for relief by way of mandatory injunction or, as an alternate remedy, for damages.

At the trial which followed in the State court, numerous jurisdictional questions were raised. The court held that in so far as the action attempted to enjoin work being performed under the reclamation act or to quiet the city's title to waters of Cle Elum River as against the United States, it had no jurisdiction, but retained jurisdiction upon the following ground:

"As to the third phase of the case, we are of the opinion that we have jurisdiction to give a judgment for damages against the defendants, or any of them, as individual tort feasors if we find the evidence justifies it, but as above stated, it is certain this court can not in any view of the case, render a judgment for damages against the United States in lieu of equitable relief on the questions involved in the first phase of the case above mentioned, hence we may dismiss all consideration of the jurisdictional objections raised by the defendants in regard to that feature for any sort of a judgment for damages that the court could enter against the United States would be a nullity anyhow."

In explanation it may be said that the trial was resolved into an attempt to have a money judgment allowed the plaintiff by way of damages which the city hoped to use in payment of a new water system already under construction and which was not subject to interference by the construction of Cle Elum Dam. The new water system is an urgent necessity because of obsolescence of its present system including about 8 miles of wood-stave supply pipe which (to use the words of the court) "proved too expensive to operate and the city wants to be rid of it."

The court gave painstaking care to the arguments and briefs filed, and minutely analyzed the pleadings and the evidence. That he was duly sensitive to the latent purpose of the action is apparent from his conclusion that—

"The correspondence preceding the commencement of this action clearly shows that the city officers were endeavoring to get the Government to settle with the city and the settlement they were urging was a money settlement. That is, the city wanted the Government to contribute to the construction of another system and I am impelled to think that the allegations of the answer that such was the real object of this action was quite clearly proven. It is unfortunate that the city of Cle Elum finds itself in the present situation. But the courts must follow the law, and under the law and the evidence pertaining to this case I can not see that the city of Cle Elum is entitled to any relief except it be that it is entitled to a decree declaring that it has a water right to the extent of 3 cubic feet per second of time in the flood waters of the Cle Elum River, but as to what priority it has must be left to be determined in proceedings under the water code for the adjudication of the water rights in the Cle Elum River.

"I fail to see that any of the defendants have done anything rendering them liable either individually or collectively in damages to the plaintiff."

The trial gives rise to an interesting application of the rule that where a riparian owner complains of the pollution of a stream from sources above him, his own use of the stream as affecting pollution below fixed a standard for the measurement of his rights. This rule was announced by the United States Supreme Court in the case of Missouri *v.* Illinois (200 U. S. 522; 50 L. Ed. 579).

The application of the rule in the principal case was not helpful to the city, which dumps raw sewage into Cle Elum River while complaining of pollution by the camps of the construction engineer and contractor, both of which are of advanced design in respect to sanitation and use septic tanks for the treatment of camp sewage.

The court entered a decree denying plaintiff's application for injunction dismissing the action and gave the defendant officers judgment for costs against the city. It is understood the city intends to appeal. Later developments may also have some interest to readers of the Reclamation Era.

Confirmation of Bond Issue of Metropolitan Water District

June 2, 1932, the California Supreme Court affirmed the judgment of the Superior Court of Los Angeles County, validating the $220,000,000 bond issue of the Metropolitan Water District of Southern California for the construction of a water system for supplying the inhabitants of the district with water from the Colorado River. The water for this system will be obtained from the Government's Boulder Canyon project.

Twin Falls Canal Co. v. American Falls Reservoir District No. 2

By B. E. Stoutemyer, District Counsel

The report of the trial of Twin Falls Canal Co. *v.* American Falls Reservoir District No. 2 in the United States District Court for the District of Idaho, 49 Fed. (2d) 632, has been reviewed in the Reclamation Era (June, 1931, issue, p. 121). The Circuit Court of Appeals for the Ninth Circuit has now affirmed the decision of the lower court by opinion filed on May 23, 1932, in case No. 6613.

The action was brought by a Carey Act company whose predecessor in interest had constructed the Milner diversion dam in Snake River. Defendant is the irrigation district obligated to the Government to return the expenditures from the reclamation fund in the construction of the Gooding division of the Minidoka project, for which American Falls storage is diverted from Snake River in the slack water behind Milner Dam. The plaintiff-appellant asks for $59,000 as a contribution toward the cost of construction and operation of the dam.

The affirmance by the circuit court of appeals was grounded upon the following principles—

(*a*) The defendant district was in no sense the actor, and was improperly made a party defendant, since the project was constructed and is still being operated by the Federal Government;

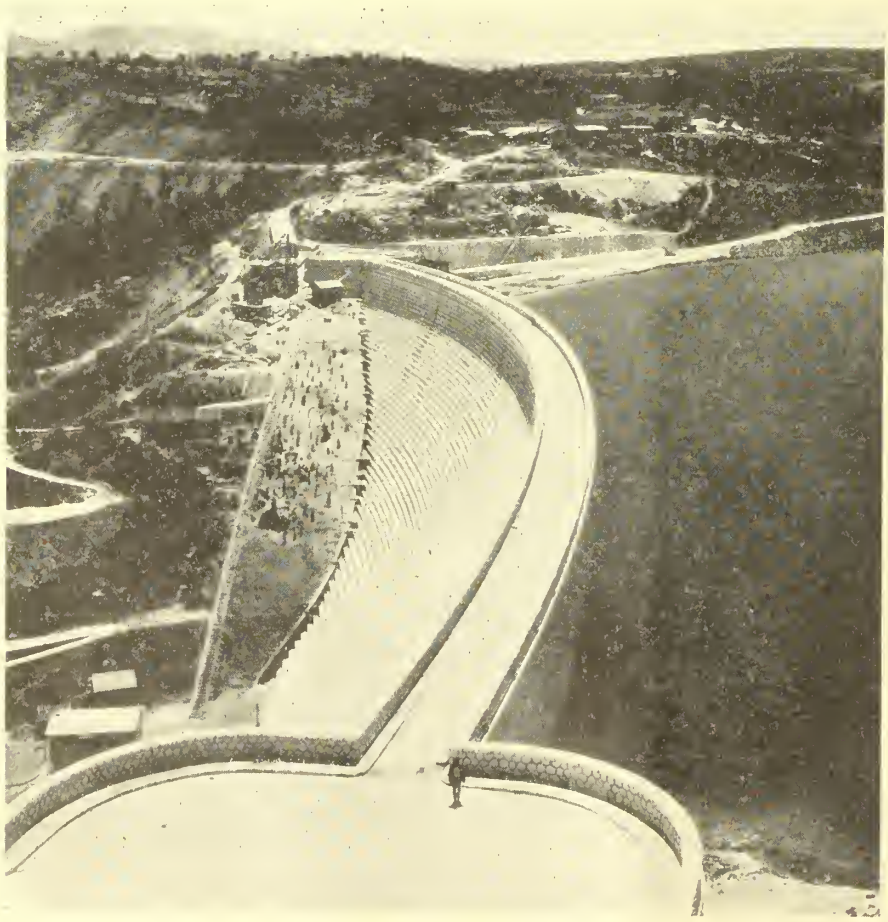
(*b*) A third person not a party to a contract is permitted to enforce the promisor's obligation only where such third person is the beneficiary solely interested in the promise;

(*c*) The construction of diversion works on public land across a natural stream vests, under the circumstances of this case, in the owner of the diversion dam, only an easement or limited right to use the stream bed and the overflowed public land for the purpose of diverting water into such owner's canal but without any monopoly of such stream bed or of the public land, and without any right to exclude others from free access thereto for the purpose of appropriating the unappropriated water;

(*d*) By construction of diversion works upon a natural stream in the slack waters of a diversion dam, the United States has not "taken" property of the holder of an easement over public lands for the construction and operation of such diversion dam and for the flowage of lands above the dam;

(*e*) The measure of damages, if the action had not failed for the reasons listed as (*a*), (*b*), (*c*), and (*d*), would have been the extent to which plaintiff's right or property was rendered less valuable for the uses to which it was devoted and not the benefit derived by the defendant from the existence of the dam, and as the plaintiff's property was not damaged there could be no recovery even if the action had not been defeated by the application of the principles listed above.

The decision merits the interest of the readers because rule (*a*) first announced by the State courts of Nebraska and Texas, respectively, in Livanis *v.* Northport Irrigation District (238 N. W. 757), and Malone *v.* El Paso County Water Improvement District No. 1 (20 S. W. (2d) 815), becomes a binding precedent for the Federal courts of the ninth circuit, comprising a major portion of the arid section of the United States. In addition the affirmance by the appellate court of the district court's decision upon the merits will be valuable as an authority in vexatious questions arising in eminent domain, suretyship, and water-right cases and in cases involving watercourses and claims against the United States.



Courtesy of Ulen & Co.

MARATHON DAM, ATHENS, GREECE

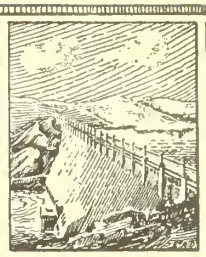
Built of concrete masonry, faced with mosaic marble. The only structure of its kind in the world

---

The Orman Lake Boat Club, an organization on the Belle Fourche project, having a lease and permit to operate on the reservoir, is expanding its recreational program and plans water sports for each week end including speed-boat races water polo, and aquaplane riding.

The Utah-Idaho Sugar Co. completed the beet loans for the Belle Fourche project this spring. About $100,000 in credit has been arranged which will take care of the labor and other incidental expenses in connection with the growing of about 10,000 acres of beets tributary to the factory. The initial loans are made as soon as the beets are ready for thinning.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Concrete for Hoover Dam

(Part II—Concrete Mixing)

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

GRAVEL and sand loaded into bottom-dump cars at the screening plant are transported over four miles of railroad to the contractor's concrete mixing plant in Black Canyon. This plant is situated on the Nevada side of the river at the base of the high wall of the canyon and less than a mile upstream from Hoover dam site.

Aggregates from the screening plant are dumped from the cars into separate compartments in the bunkers beneath the railroad tracks, and when required are separately transported an average distance of 450 feet by two 42-inch belt conveyors up a 16° incline to the tipple at the top of the concrete plant. Hoppers with movable spouts receive the material and drop it onto shuttle conveyors which transport it to the designated bin.

DESCRIPTION OF PLANT

The dimensions of the concrete plant are 78 feet by 118 feet in plan, 88 feet in height from truck-loading platform to top of storage bin, and 120 feet to top of tipple. A heavy concrete foundation supports the four 4-cubic yard Smith mixers and is extended westward beneath the structural steel framework of the plant. The top of the foundation for the mixers is at elevation 735, 15 feet above the truck-loading platform. Above the mixers is the control deck and above this the conveyor and batcher floor. The bottom of the 33-foot high storage bins is 9 feet above the batcher floor and the tipple rises about 30 feet above the bins.

The bins at the top of the plant are 6 in number, 3 of which are for gravel, 1 for cobbles, another for sand and the sixth for cement. All are 78 feet wide, and from front to back of the plant 30 feet of the total length of 118 feet is used for cement, 16 feet for 3 to 9 inch cobbles, 16 feet each for coarse, intermediate, and fine gravel, and 24 feet for sand. The bins are of steel frame construction with laminated timber sides and partitions. The walls are of 3 by 8 inch to 3 by 12 inch planks and the floor of 3 by 16 inch planks. The cement bin is covered and is waterproofed on the inside with tar and felt.

Bulk cement, transported by rail from the place of manufacture to Boulder Junction on the Los Angeles & Salt Lake Railroad south of Las Vegas, to Boulder City over the Union Pacific branch line, to the concrete plant, via the United States Construction Railroad and the contractor's line, is elevated to the bins through 6-inch steel pipe by air pressure, the unloading machine resembling a large vacuum cleaner.

Water for the plant is pumped from the Colorado River to a 50-foot diameter Dorr clarifier located on the canyon wall approximately one-quarter mile up-stream from the mixing plant. All silt above 500 parts per million is settled out in this tank, and the water flows by gravity to a 125,000-gallon storage tank situated in a side canyon above the mixing plant.

CONTROL OF AGGREGATE QUANTITIES

When the plant is placed in operation, the sand and different sizes of gravel from ¼ to 3 inches are each dropped through an automatically controlled gate into a batch hopper, termed a "batcher," located below each bin. Doors in the bottom of the batchers are opened in rotation by air-controlled electrically operated devices the hopper nearest the mixer opening last, and the aggregates are spread in thin layers on a 48-inch belt conveyor leading to a mixer hopper installed above and back of a mixer. When the 3 to 9 inch cobbles are used, they are allowed to pass through a door in the bottom of the cobble bin to an automatically controlled steel belt conveyor and to the cobble batcher. A chute connects this batcher directly with the mixer hopper.

For each mixer, cement runs from the cement bin through four chutes to an automatically controlled double screw conveyor cement feeder placed at the top of the cement batcher. The gate in the bottom of the cement batcher is just above a chute which leads to the throat of the mixed hopper. Water from the storage tank on the hill back of the plant flows to a water batcher through an automatic valve which shuts off the water when the batcher has received its designated weight. The outlet from the batcher leads to the mixer through a discharge valve which is manually controlled.

The automatic controls referred to in the above paragraphs are operated in all cases by the weight of the batcher and its load. The batcher is mounted on the end of a dial scale which connects by a series of levers and balancing weights to mercoid cut-off controls. At the scale, weights are added, dependent on the amount of material desired to be included in each batcher load.

The mercoid controls, installed on the weight end of the system, are electrical switches operated by change in position of a glass capsule containing a globule of mercury. The electrical circuit is broken at two projections inserted at one end of the capsule and the circuit may be closed by lowering the end of the capsule containing the projections, thus allowing the electrical current to flow through the mercury globule. One of the controls is termed the "main flow cut-off" and the other the "final balance cut-off". When the weight of aggregates in the batcher reaches about 95 per cent of the predetermined weight, the swing of the beam, on which the controls are mounted, causes the mercury globule in the main flow cut-off to move away from the two projections, thus breaking the electrical circuit and by means of electromagnetic coils, closing the gate in the bottom of the aggregate batcher by compressed air. The electrical current operating through the mercury globule in the final balance cut-off, by means of a small motor and air valve, alternately quickly opens and closes the gate to allow small amounts of material to dribble into the batcher until the predetermined weight is acquired, at which time the adjusted position of the cut-off beam breaks the contact in the final balance cut-off.

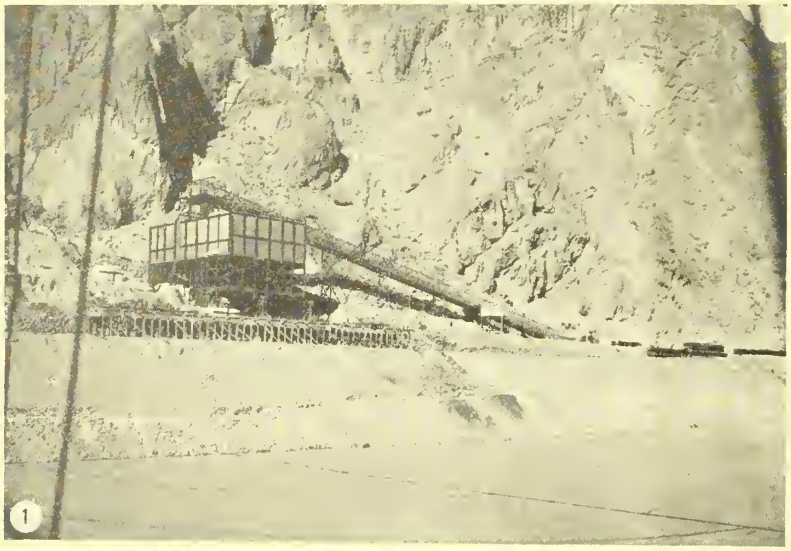
In the system of balance levers, there is a connection by rods to a recorder which registers on a 20-inch dial the visual record of the weighing. Connection is also made from the system to a graphic recording device consisting of a pen tracing on a time constant operated paper roll which is graduated in intervals of weight. The

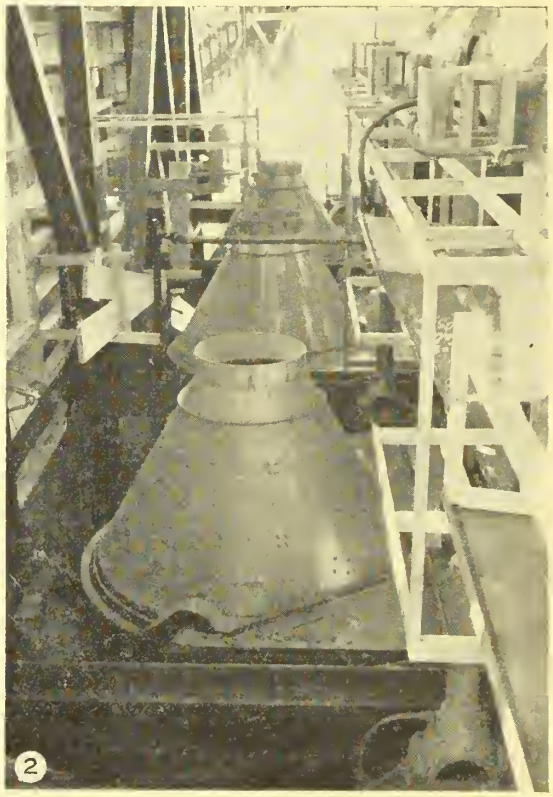
consistency of the concrete and the length of time it was mixed are also recorded on this roll by a hookup with a wattmeter which measures the power used in operating the mixer in question. As the power for rotating the mixer drum varies as the amount of water in this mix, this arrangement indicates the consistency and at the same time shows graphically the period of mixing after all materials were in the mixer. The chart gives a visual image of all operations of the plant and as well furnishes a permanent record of the weight of all materials that are placed in each batch of concrete. Similar visual and graphical recording instruments are employed for measuring the amount of water used, these devices also being operated by weight.

MIXING OPERATIONS

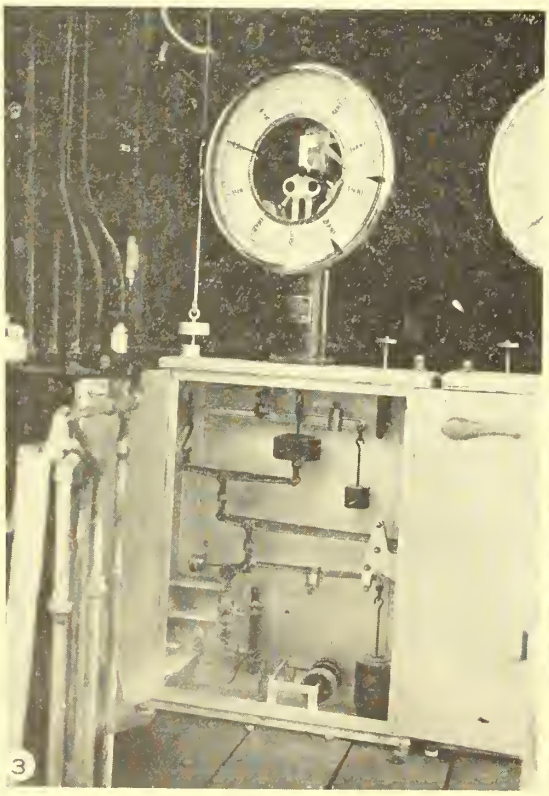
For actual mixing of the concrete, water from the water batcher is started into the revolving mixer. After approximately five seconds, the mixer hopper and the cement batcher gates are opened, allowing aggregates and cement to flow into the mixer drum; thus water, aggregates, and cement enter the mixer together. After all materials have entered, mixing is continued for a minimum period of 2½ minutes and the concrete is then dumped by tilting the mixer drum.

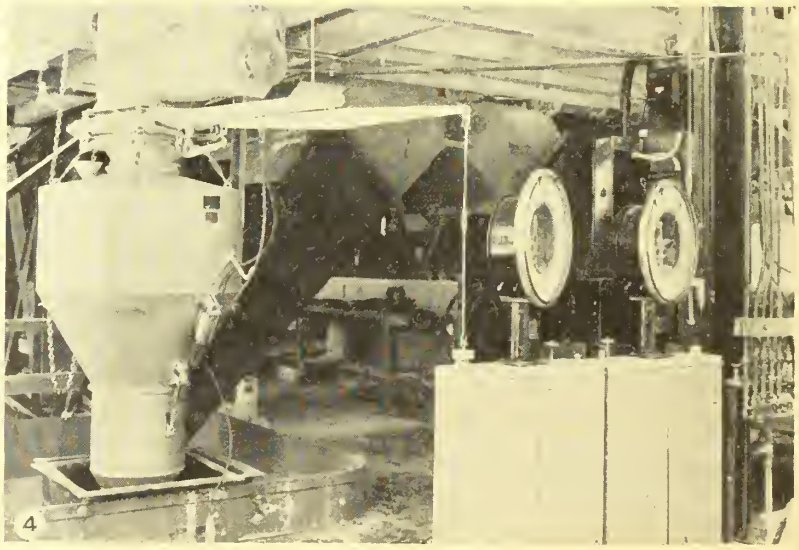
The concrete pours from the mixer plant through a chute into 4½-yard agitator drums mounted on trucks, or into 2-yard buckets carried by trucks. The agitator is in effect a mixer, which is rotated at intervals as the concrete is being transported





CONCRETE MIXING AT HOOVER DAM





1, Concrete mixing plant under construction. Aggregate bunkers are at extreme right. Inclined conveyor framing connects bunkers with tipple at top of plant; 2, mixer deck, showing three of the battery of four 4-cubic yard mixers; 3, scale for aggregate batcher showing dial-weighing system and location of cut-off controls. The two mercoid controls are located in the lower left corner of the panel box; 4, cement batcher and scale dials on control deck. Note motor-driven cement feeders above batcher and, below, the top of mixer hopper which incloses the mouth of the batcher, and aggregate chute in rear of batcher. The aggregate chute leads to aggregate hopper on conveyor floor above

in order to retain its consistency and uniform density. The buckets, two of which are transported by each truck, are of bottom-dump type. Rails, set in concrete to provide a smooth roadway for trucks, have been laid below the mixers for later transportation of concrete by railroad cars. At the present time all concrete for lining the diversion tunnels is transported by 10-ton trucks, and rail transportation will probably not be started until pouring has commenced for the dam and power-plant structures.

While one batch of concrete is mixed, another has been discharged into the mixer hopper and the cement and water batchers have been loaded. Thus under capacity operation, using all four mixers, 16 cubic yards of concrete can be manufactured by the plant in 3½ minutes. On this basis, the theoretical capacity of the plant over a 24-hour period would be 6,600 cubic yards.

PLANT EQUIPMENT

The concrete plant contains 1,493 feet of conveyors, four 4-cubic yard Smith mixers, two batchers each for water, cobbles, sand and each of the three grades of gravel, and four batchers for cement. Sixteen visual gages and two plant-operation recorders have been provided. Eight hundred tons of structural steel were used in construction, and the cost of the plant amounted to $351,000 of which sum $103,000 was paid for equipment. The principal power equipment consists of 75-horsepower motors for each mixer and 200-horsepower motors for each of the supply conveyors.

The capacity of the bunkers under the track is 1,500 cubic yards, or 300 cubic yards in each compartment. The two supply conveyors will together transport 1,500 tons of aggregates per hour. The storage bins have a total capacity of 5,400 cubic yards of aggregates and 14,800 barrels of cement.

The aggregate proportions in the concrete depend upon the type of construction for which the concrete will be poured and the amount of moisture present in the aggregates. As an illustration, one mix that has been used has a ratio of 2,000 parts of cement, 4,200 of dry sand and 9,400 of dry gravel by weight. The gravel in this particular case was composed of 32 per cent of ¼ to ¾ inch, 32 per cent of ¾ inch to 1½ inches, and 36 per cent of 1½ to 2¾ inches. Cobbles will be used when mass concrete is manufactured for the dam or similar structures.

It is contemplated that concrete for the dam will be transported from the present plant by railroad in 8-cubic-yard buckets. These buckets will be filled directly by the mixers and upon arrival at the dam site will be picked up by a 20-ton cableway and transported to position, and there dumped by trip line. It is anticipated that the dam will be poured to elevation 900 or 935 from the present plant, and that the plant will then be moved to a site on the canyon rim near the end of the United States construction railroad for pouring the remainder of the dam.

Notes for Contractors

Boulder Canyon project.—Under readvertisement of schedules 1 and 2, specifications No. 533 for furnishing bulkhead and Stoney gates for the Hoover Dam, bids were opened at Denver, Colo., on June 1. The low bidder was the Consolidated Steel Corporation of Los Angeles, Calif., with a combination bid of $233,200, f. o. b. cars, at factory shipping point. There were 12 companies that submitted bids.

Bids for furnishing plate-steel outlet pipes for the Hoover Dam power plant and appurtenant works (specifications No. 534) were opened at Denver on June 15. Four bids were received from the following manufacturers: A. O. Smith & Co., Milwaukee, Wis.; Chicago Bridge & Iron Co., Chicago, Ill.; Babcock & Wilcox Co., Barberton, Ohio; Western Pipe & Steel Co., San Francisco, Calif. The bids ranged from $9,270,800 for 13-foot diameter pipe, shipped on Government bill of lading, to $13,624,868 for 17½-foot diameter pipe shipped on commercial bill of lading. Babcock & Wilcox submitted low bid of $10,908,000 for furnishing 30-foot diameter pipe f. o. b. factory.

Bids were opened at Boulder City on May 12 (specifications No. 569–D) for building a 34-room dormitory for the use of Government employees, William M. Bickel and Co. of Las Vegas, Nev., submitted low bid of $2,927, and has been awarded the contract.

A preliminary draft of specifications for the turbines and governors to be installed in the power plant at the Hoover Dam has been mimeographed, and sent to manufacturers and other interested parties for comment.

Grand Valley project.—Bids under specifications No. 571–D were opened on June 8, 1932, for furnishing gate hoists for the Grand Valley power plant on the Grand Valley project, Colorado, and for the Prosser power plant on the Kennewick division of the Yakima project, Washington. Contracts were awarded as follows: Radial gate hoisting equipment for Prosser power canal headworks and two geared gate hoists for Grand Valley power plant forebay, under items 1 and 4, to John W. Beam of Denver, Colo., at a total price of $2,225; four geared gate hoists and appurtenances for the Prosser power canal wasteway and two geared gate hoists and appurtenances for the Grand Valley power plant ice chute, under items 2 and 5, to the Ottumwa Iron Works of Ottumwa, Iowa, at a total price of $1,215; and two worm gear gate hoists and appurtenances for the Prosser power plant forebay, under item 3, to the Aldrich Pump Co., of Allentown, Pa., at a total price of $1,895.

Yakima project, Kennewick division.—Bids were opened at Yakima on June 27, for constructing a 5-room residence at the Prosser power plant.

Colorado River Basin Investigations

The land classification of the Parker-Gila project has been completed, and 1,035,000 acres in the Gila River Valley have been classified, the work requiring a little less than six months. In the Denver office an estimate of cost has been made for a canal of 8,000 second-feet capacity located in the canyon between the upper and lower Parker dam site, the estimate being $22,597,000 for a canal 10.78 miles long, or about $2,000,000 a mile.

In Nevada, investigations are under way to determine the possibilities of pumping to small areas adjacent to the reservoir. An engineering party is now looking into possible irrigation projects along the Paria, Kanab, Escalante, and Fremont Rivers in Utah, and in the Virgin River Basin in Utah and Arizona. A third party is making its headquarters at Pinedale, Wyoming, and continuing work in the Green River Basin, which was started last season.

New Map Available

There has just come from the press a new map of the Grand Valley project, Colorado. This map is printed in four colors and shows canals, laterals, drains, roads, tunnels, siphons, etc. Divisions and irrigation districts are shown by differentiated patterns. Map No. 23888 A includes topography. Its size is 22 by 40½ inches, scale 1 mile to an inch, price 25 cents per copy. The small size, No. 23888, which is 10½ by 19½ inches on a scale of approximately 2 miles to an inch, sells for 10 cents per copy.

Under the Eagle's Wing

Some Phases of Life in Boulder City

By Mrs. D. L. Carmody (Wife of Engineer Carmody of the Boulder Canyon Project)

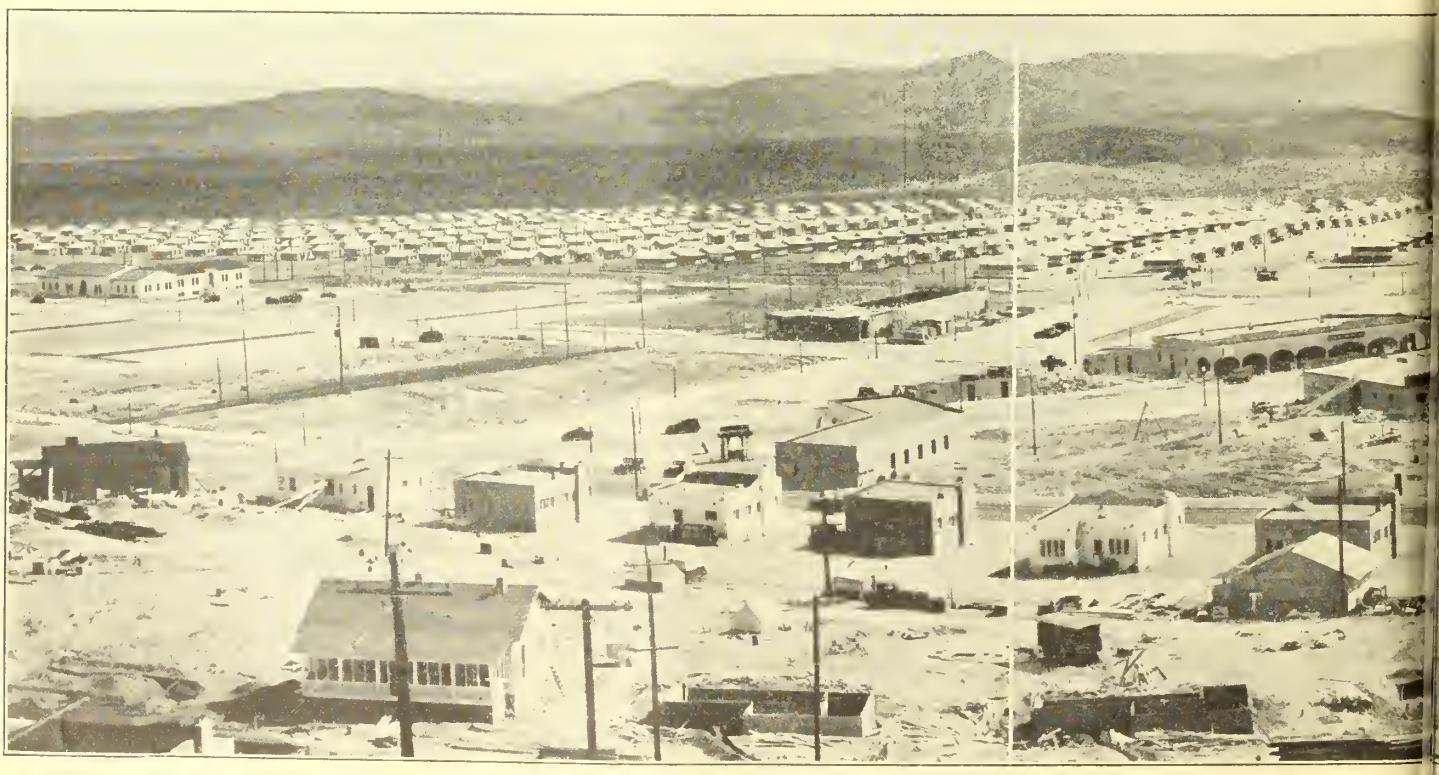
BOULDER CITY has almost reached maturity. It has passed from the status of a construction camp to the dignity of a city, with institutions, organizations, and many media for the carrying out of common purposes. Within a year it has become the model construction city of the United States and represents most of our national ideals as to what a city should be. It has no past replete with scandals and mistakes, no landmarks save the immutable mountain peaks which surround it so closely that they seem to crowd in and touch the edges; there is no real poverty here and no great riches, every roof-tree shelters at least one wage earner and a spirit of cheerfulness and democracy prevails.

Within the space of one year this bit of the desert has been completely transformed and now possesses all the qualifications of an extreme civilization, and this has been done in the twinkling of an eye. Even six months ago our houses were surrounded by impassable sand dunes so that neighborly visiting was out of the question. There were only a few avenues on which a car could travel and these were constantly blocked by paving activities. The air resounded day and night with the hoarse snorts and rumbles of giant tractors and monster motors of every variety and the soil was so harassed and stirred up that the slightest breeze dislodged it and after a night of high wind the fine sand poured in such quantities into our homes that we were forced to use a shovel to remove the débris.

Now we drive on beautiful wide avenues paved and oiled, which wind through the town joining the highways to the river and the dam site; there are cement sidewalks, handsome street lights, office and municipal buildings, a theater and stores, a newly finished church and others to be constructed, a school building in the near future, and all the arteries and nerves which go to form a city's organism.

LANDSCAPING OF BOULDER CITY

The men who have the good of Boulder City at heart are trying to make it a city beautiful, realizing that the eternal glare from the sand would be a severe strain



Boulde

upon our nerves and well might affect our health. Our lawns have been seeded, and flowering shrubs have been set out under the supervision of a landscape gardener. We are termendously grateful for all this and have promised ourselves to give the plants and grass all the water and care that they will surely need. Already the grass is showing up and spreading a carpet of green over the yellow sand; trees which have been placed at regular intervals along the sidewalks give promise of shade and birds which have been strangers to the desert are seen flitting and twittering in the young branches.

On the side of the town where the employees of the Six Companies have their homes there is much competition in landscaping the grounds as their manager has offered a monthly prize for the best-kept and most artistically decorated lawn. Vieing with each other they have gone to the desert, searching for inspiration and have gathered specimens of many strange plants. There are endless varieties of the cactus, also the yucca, called the Joshua tree; these with desert holly, greasewood, and purple sage combine to give a very attractive and unique appearance to the rock-bordered beds and walks.

So far, we of the Reclamation Service have rather avoided cactus as a domestic shrub, feeling that in its natural habitat it is marvelously lovely but that it would not harmonize with the more cultivated plants which have been given us, and its thorns render it rather dangerous to the youngsters.

Although the sides of the mountains seen from a distance are devoid of vegetation, they are really covered at this season with wild flowers of all colors. These do not transplant very successfully, and when they do take root in foreign soil they need quantities of water; this is hard to understand as they live up there in no soil and almost without any moisture at all.

One of our favorite diversions now is to drive out to some nearby canyon and gather beautiful bouquets. There are wild shasta daisies of a soft orchid hue, big white waxy mariposa lilies, and these look almost exactly like the expensive gardenias; there are masses of Nevada poppies bright yellow in color, scarlet plants called wild geraniums, myriads of little bushes covered with purple and yellow blooms, and loveliest of all, the cactus, now in full blossom nestling amid the cruelest of thorns and glowing against the olive green of their leaves like rare jewels and things of satin and silk, shading from deepest crimson to pale yellow and ivory white. Having no stems they are difficult to gather, the only way being to dig them up roots and all, then put them in a pot or bowl where they will stay fresh till the last bud has opened.

"BELIEVE IT OR NOT" (WITH APOLOGIES TO MR. RIPLEY)

Looking at a map of Nevada and having heard about the intense heat of the desert you probably would form the idea that the long summers here are well nigh unbearable and if you should go further and get your data from statistics you would feel assured that you had made no mistake. Records of winter temperature in Boulder City show that it seldom drops below the freezing point, indicating very mild winters, and that from June to September the mercury sometimes climbs as high as 122 above zero and that frequently during August, 118 above is the usual thing, lasting for weeks. But I hope that you do not depend upon statistics for your information. Statistics possess the veracity of a camera which gives you an image of your loved one done in cold grays and blacks and only in your imagination can you visualize the beautiful coloring of that dear face or bring back the magic of that smile. I know that there are times when two and two never make four any more than all mathematically stated facts always present us with vital truths as they really are. This is of course a revolutionary statement coming from the wife of a civil engineer as everyone knows that statistics are to an engineer what a compass and barometer are to a mariner, or measuring spoons and an oven thermometer are to a cook. But to support my attitude I assure you that we were colder last winter in Boulder City when the mercury only stood at 30 degrees above zero than any of us had been in more northern States when it was around 30 degrees below, and still dropping.

We all of us agree that heavy clothing and furnace fires are as much a necessity here as in higher altitudes though of course

ct, Nevada

we only need them for three or four months. It is true that the summers here are hot but they are not nearly as enervating as the warm days on the coast or in Los Angeles where at 96 degrees one is almost prostrated. Desert heat is not depressing; it is just hot and everyone knowing we are in for it makes a jest of it. It always cools off in the evenings and we have that to anticipate with pleasure.

BOULDER CITY HOMES ARE BUILT FOR COMFORT

Our homes, having double walls and an air space between the ceiling and the roof, are built to withstand the heat. They are equipped with all electrical convenience, stoves, refrigerators, hot-water heaters, etc., for the use of which we pay a nominal rental added to the rent of the house.

Most of the women of the Bureau of Reclamation have anticipated life in Boulder City as a crowning experience and I do not think they are disappointed. After homeless years of wandering and pausing for a brief time in every unreclaimed spot in the United States, these birds of passage have visioned in Boulder City the heavenly chance to become permanent residents, at least for a term of years and to beautify their homes. Many have indulged in new furnishings, and each woman has managed in some way to express her individuality so that in visiting the different families one seems to be visiting a succession of pictures, all of them different, all of them harmonious.

Several new stores have just opened here in addition to the Six Companies' commissary and although Las Vegas, an established town, is only 23 miles away, most of us do our shopping here where we can get everything we need at reasonable prices.

COMMUNITY ACTIVITIES

The population of Boulder City is rapidly increasing and the social opportunities are unlimited. There are already established a flourishing unit of the American Legion Auxiliary, several church societies, and many small card clubs, but as yet there has been no movement toward a woman's club or a book club, although we do have a circulating library. Still the life of the town is in its infancy and those improvements are sure to come. The men have interested themselves in different organizations and are very active in promoting helpful charities and entertainments.

LAW, ORDER, AND PROTECTION

Owing to the nature of the work on the dam the hours are continuous so that the men's days are divided into "shifts," the first being from 7.30 a. m. to 3.30 p. m., the second, called the "swing shift," from 3.30 p. m. till 11.30 p. m., and the last, appropriately known as the "graveyard shift," from 11.30 p. m. till 7.30 a. m. On this account some of the women are obliged to spend their evenings alone and in many such situations they have felt miserably unprotected, and some of the more timid ones have even suffered the dreadful agony of fear; the wind rattling the windows, a dog running past the door, a mouse behind the wainscote, all these sounds are magnified into something sinister and frightening.

Here in Boulder City there is no reason for such alarms to exist because just west of the city limits where the road narrows and the ground suddenly drops into a deep ravine and the mountains move up close—is the "gateway" to the reservation and this is the only entrance. Here the Government maintains an office and a sentry box where a ranger is stationed and here everyone desirous of entering Boulder City must stop and show his credentials, not only strangers but residents of the town itself. Visitors and sightseers must state their business and reasons for wishing to come in and failing to do so are turned back irrevocably. The "gateway" is conducted like the entrances to all of our National parks, and regulations are, of necessity, strictly enforced here as not only must the inhabitants of this remote little town on the desert be protected but the great dam must be forever safeguarded and eternally watched.

PROUD OF OUR AMERICA

Yesterday driving past the beautiful Administration Building I saw our flag proudly waving. It sent a glow through and through me and somehow I was so thrilled that tears filled my eyes for a moment. I think it is always that way when suddenly we see our flag in remote places. I experienced the same feeling that I used to have when a child and my father lifted me in his strong arms.

Out here we are so far away from the centers of government, with only the age-old mountains looming above us and far below us the ancient river gliding silently like a huge snake, that we feel a bit helpless; and amid these alien influences our flag rises and waves over us as a symbol of friendship and protection. It seemed to tell me that no matter what dangers and disappointments might beset us it is always protectively there watching over us and that we are forever shielded under the mighty eagle's wing.

Photograph by J. E. Stimson

Close-up of Almonds, Orland project, California

On the Vale project there are approximately 2,200 acres of land in crop on the Harper and Little Valley unit, 1,500 on the Bully Creek west bench, and 2,000 on the Bully Creek east bench, a total of 5,700 acres.

The Vale Owyhee Land Settlement Association reports 195 inquiries received and 13 calls from interested persons during a recent month. Two tracts of land, 40 and 20 acres, respectively, were sold to settlers.

Boulder Canyon Project Notes

The Boulder Canyon Project Federal Reservation suit, pending in the courts for several months, following issuance of a temporary injunction restraining Clark County, Nev., from collecting taxes from the Six Companies (Inc.), contractors for the Hoover Dam, will be heard in Carson City, September 1. The contractors have a bond for $6,000 posted, intended to cover a year's taxes in case the decision is in favor of the State.

Boulder City now has 900 buildings completed and an additional 100 under construction. Ninety per cent of these are residences. Of the completed buildings the Government owns 109, the Six Companies 682, and business permittees 109.

The 15-foot invert section and also trimming operations have been completed in all four diversion tunnels with the exception of a small amount of work at the outlet ends of tunnels 2, 3, and 4. On June 4, concrete lining had been poured in 3,866 feet of invert and 2,058 feet of sidewalls, respectively 24.3 per cent and 12.9 per cent of the total requirements for these two portions of the tunnel section.

Boulder City, with its present population of nearly 5,000, ranks as the third largest city in the State of Nevada. According to the 1930 census, Reno had 18,494; Las Vegas, 5,177; Sparks, 4,508; and Tonopah, 4,144.

The maximum of the Colorado River flood was apparently reached on May 26, when the flow through Black Canyon was 103,000 cubic feet per second. The pile trestle bridge across the river to the Arizona gravel pit was not damaged by the high water. A crew of men was kept busy at the trestle clearing away débris.

With summer temperatures in southern Nevada ranging from 105 to 120, Bureau of Reclamation office employees on the Boulder Canyon project will find the Administration Building cool and comfortable. The Frigidaire Corporation has been awarded a contract to install air-conditioning equipment, the units being the largest to be installed to date. These units will be placed in the offices of the construction, field, and office engineers, the chief clerk, district counsel, two drafting rooms, two clerks' rooms, stenographic room, and two others not yet assigned. The units will be out of the way and will not take up space needed for desks, filing cases, and other office equipment. Condensing units will be installed in the service section of the building, and the usual copper tubing lines will carry the refrigerant to and from the conditioners.

On June 10, delegates to the 14th annual convention of the American Legion, Department of Nevada, made an inspection of the project. An outstanding feature of the event was a trip by automobile through diversion tunnel No. 1 on the Nevada side, something never before attempted. There were 572 people in 144 automobiles making the tunnel trip which took about 30 minutes.

According to late estimates, 3,300 persons are employed on the project, divided as follows: Bureau of Reclamation, 245; Six Companies (Inc.), 2,530; subsidiaries and subcontractors of Six Companies, 210; other Government contractors, 140; business enterprises of permittees in Boulder City, 175.

One of the most interesting machines thus far put into operation on the project is the "arch jumbo," which was placed in operation in tunnel No. 4 on June 7. With a long tube shooting concrete back above an arch form at the top of the 56-foot tunnel, this jumbo and its crew are performing the difficult task of placing concrete at the top of the tube and hold it there until it sets. Working in two sections, the jumbo consists of a frame which holds up the arch-shaped form at the proper distance from the roof, and another frame with tube that extends back over the form and shoots the concrete into place.

Articles on Irrigation and Related Subjects

Gallison, Norman S.
- Construction of the Hoover Dam, illus., Compressed Air Magazine, May, 1932, v. 37, No. 5, p. 3803–3810.

Holmes, J. D.
- Cochiti diversion dam on Rio Grande, illus., Western Construction News and Highways Builder, May 25, 1932, v. 7, pp. 287–289.

Houk, Ivan E.
- Technical design studies for Hoover Dam with diagrams, Western Construction News and Highways Builder, April 10, 1932, v. 7, No. 7, p. 187–193.

Lake, Copeland
- Construction of the Hoover Dam, illus, Compressed Air Magazine, June, 1932, v. 37, pp. 3834–3839 (8th article in series) (Editorial Progress at Hoover Dam, p. 3816).

Mead, Elwood
- Doctor Mead tells romance of irrigation to reclaim arid lands of West, Southwest Builder and Contractor, April 29, 1932, v. 79, pp. 33–34.

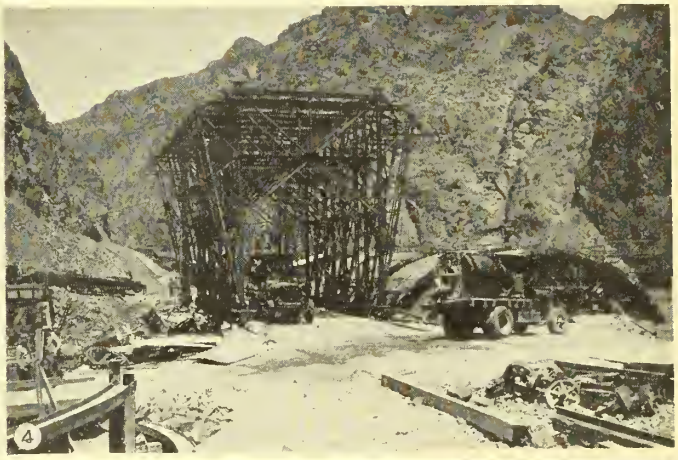
Mulholland, Jack
- The United States Reclamation Service, illus., Journal of Institution of Engineers, Australia, February, 1932, v. 4, No. 2, pp. 69–75.

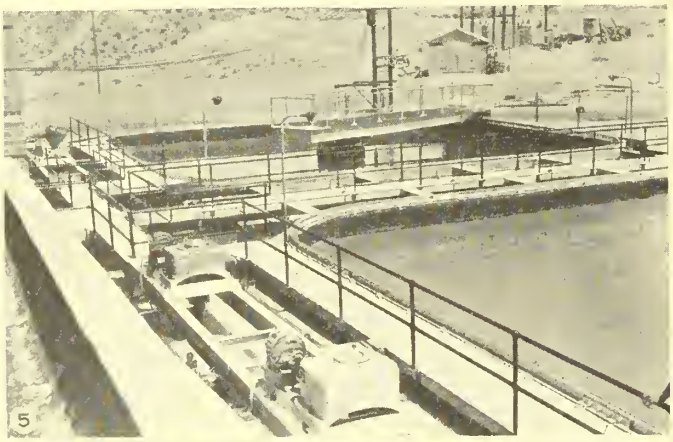
Nelson, W. R.
- Concrete work on Hoover Dam progressing. (May "Era") U. S. Daily, May 28, 1932, v. 7, No. 74, p. 5 (p. 599).

Quick, R. S.
- Preliminary Report on Surge Suppressor control in pump discharge lines (at Hoover Dam water supply), illus., Electrical West, May 15, 1932, v. 68, pp. 379–382.

Schmitt, F. E., Editor.
- A tale of construction marvels at Hoover Dam, illus., Engineering News-Record, April 21, 1932, v. 108, pp. 570–574, Editorial, p. 567.
- Automatic material batchers at Hoover Dam, illus., Engineering News-Record, April 14, 1932, v. 108, pp. 534–7.
- Refined aggregate production for Hoover Dam contract, illus., Engineering News-Record, June 2, 1932, v. 108, pp. 783–787.

Southwest Builder and Contractor.
- Gigantic steel forms will be used for concreting tunnels at dam, illus., Southwest Builder and Contractor, April 8, 1932, v. 79, No. 15, pp. 40–41.





BOULDER CANYON PROJECT MAKES STEADY PROGRESS

Photographs by B. D. Glaha

BOULDER CANYON PROJECT

1, Portion of field forces of Bureau of Reclamation employed on surveys and inspection at Hoover Dam. Field Engineer Ralph Lowry is kneeling seventh from left, front row; 2, looking into Black Canyon at Nevada diversion tunnel intake portals from top of canyon wall on Arizona side. Field at right is roadbed for elevation railroad (construction) which will pass over tunnel portals on trestle and enter tunnel at left. Note top arch concrete jumbo forms being assembled in front of portals; 3, general view of Six Companies' gravel screening and washing plant at Three-way Railroad junction. Note raw aggregate stock piles to left beyond plant; 4, fabricating steel frame carriages for top arch concrete forms near diversion tunnel intakes on Nevada side. Arch forms at right; 5, mixing tanks and clarifying basins at treating and filtration plant, Boulder City water supply; 6, side-wall concrete in place in diversion tunnel No. 2, near inlet. Photograph taken on fourteenth day after pouring when surface is no longer wetted; 7, chuting concrete from agitator truck on trestle into truck-conveyed bottom-dump buckets at tunnel invert whence it is hauled to forms; 8, cleaning invert excavation ahead of tunnel lining operations in diversion tunnel No. 2. Spoil is loaded by shovel into skip which is handled into

The Orland Orange Show

By E. A. Kirk, Secretary-Manager, Orland Chamber of Commerce

ORLAND oranges are tree-ripened for the Thanksgiving table. They have texture and color unsurpassed. They have flavor and sweetness fit for the queen. They are matured without artificial protection from low temperatures.

These may seem extravagant statements, but "the proof of the pudding is in the eating." Proof of these statements was the motive for the Orland Orange Show held here early in December of last year. The show, which was sponsored by the Orland Chamber of Commerce assisted by the Orland Orange Growers Association, was held in the chamber of commerce building. Practically every grower in the district contributed fruit for the general display, the fruit coming direct from the trees to the display tables. In addition to this, 31 growers entered into competition for a silver cup offered by the chamber of commerce for the best plate display of eight Washington navel oranges. The quality of the fruit was so high, the specimens exhibited so uniform, and the competition so close that it tried the ability of a number of expert orange judges to choose the winner, the cup finally being awarded to D. Woodward, an Orland project grower.

ORANGE SHOW MADE ANNUAL EVENT

In connection with the exhibit was an entertainment program featuring band music and dramatic plays, special trade features by the merchants, a community auction sale, and a series of round-table conferences on orange culture. So much interest was manifested in the display and in the orange industry that at the close of the show an urgent public request was made to the chamber of commerce to make the show an annual event. This was agreeable to the directors of the chamber of commerce and the dates of December 5–12 were selected for the holding of the second annual Orland Orange Show in 1932.

The early history of the project shows a few orange trees giving mute testimony to thermal conditions. The early settlers, however, took the testimony with considerable question. Small plantings were made on an experimental basis until 1921, when the records indicate the total acreage had reached 156 acres. The district had by that time proved itself suited to orange culture.

MOUNTAINS AFFORD PROTECTION FROM FROSTS

The mountain ranges to the east, north, and west afford protection from low temperatures. Official weather records show the Orland district freer from damaging frosts than any other citrus belt in California. The normal rainfall is about 18 inches, occurring for the most part between October and March.

The district is irrigated from the flood waters of Stony Creek impounded in East Park and Stony Gorge reservoirs, supplementing the early stream flow. Irrigation water is both abundant and cheap.

The soils are the alluvial deposits from Stony Creek consisting of clay, gravelly loams, and sediment loams. There is no hard pan. A gradual slope of about 15 feet to the mile toward the Sacramento River, 10 miles away, provides adequate natural surface drainage and the subsurface drainage is equally good, hence the district will never have to contend with alkali nor high-water level.

FRUIT RIPENS FOR EARLY MARKET

There are more than 400 acres of orange trees now growing in the project with approximately 500 additional acres on lands contiguous to the project area. The trees are hardy, bear well, and are remarkably free from insect pests. The fruit ripens early, the packing house being in operation prior to Thanksgiving time, thus putting the fruit on the early market. The Orland Orange Growers Association, a cooperative of local growers affiliated with the California Fruit Growers Association, shipped out about 55 carloads last fall while about 100 cars left the sheds of the James Mills Orchards Corporation adjoining the project.

(Continued on p. 135)

Orland orange exhibit

Aid to New Settlers in Kittitas Reclamation District, Yakima Project, Washington

By E. E. Mundy, Secretary, Chamber of Commerce, Ellensburg, Wash.

Service and guidance to new settlers is not discontinued or dropped as soon as the new families locate in the Kittitas reclamation district, according to the program adopted by the Kittitas Valley people at Ellensburg, Wash. As readers might well conclude, the word "Kitt-i-tas" is of Indian origin and means valley of peace and abundance. Prior to 1872 several tribes of Indians gathered annually in the valley for hunting, fishing, gathering of camas roots, and sports, but hostilities were never known in the valley.

The irrigation and agriculture of the valley has been steadily developed from the pioneer days of 1872. The first irrigation was done by diverting water from the numerous streams which flowed through the grass-covered lands. These streams were fed by the mountains to the north and west of the valley. Later, larger developments in irrigation occurred when farmers joined together and drew on the waters of the Yakima River which flows through the Kittitas Valley.

CONSTRUCTION OF PROJECT NEARING COMPLETION

The largest reclamation project in the district is the highline canal, which is being constructed by the United States Bureau of Reclamation. The construction of the project will be completed this year and irrigation water will then be available to 72,000 acres of fertile valley lands. In 1931 deliveries were made to about 36,000 acres and it is probable that water will be supplied to 50,000 acres this year.

Settlement of the land is progressing almost as rapidly as the construction. In addition to the families located on 30,000 acres at the time the project was begun, land has been purchased by almost 180 more families. Soils that grew nothing but sagebrush will be in a diversity of crops this year. The Kittitas Valley people estimate that there are opportunities for 100 families to locate in the reclamation district this year and that opportunities will exist during 1933 for an equal number of settlers. Further information regarding land settlement openings may be obtained from the Ellensburg Chamber of Commerce at Ellensburg, Wash.

NEW SETTLERS' CONFERENCE

Service to new settlers was demonstrated by the new settlers' conference which was held recently at Ellensburg. A large number of new settlers attended the agricultural meeting and discussed their problems with pioneer farmers, bankers, and specialists. The new settlers' conference had not been in session for a half hour until the following questions had been presented for discussion:

1. What assistance can be secured in financing our crops?
2. What are the best crops to plant?
3. What is the best method to use in irrigated new land?
4. How can we grow the highest quality alfalfa hay?
5. Where is a good source for purchasing seed?
6. What is the best pasture crop to plant?
7. What is the most economical and most satisfactory method of clearing new land?
8. What are the best trees to plant for shade?

Kittitas Valley produces a wide diversity of crops and yields are high per acre. Livestock and its products also play an important role in the production and marketing arrangements. Alfalfa hay, dairy products, potatoes, seeds, apples, pears, beef cattle, sheep, hogs, poultry, and cereal grains constitute the chief items of income.

It is believed that almost 10,000 acres are suited to apple and pear growing and to secure information regarding temperatures, especially the frost-free periods, a 5-year survey is being made by the United States Weather Bureau and Kittitas County cooperating.

ELLENSBURG CHAMBER OF COMMERCE

Group attending New Settlers' Conference at Ellensburg, Kittitas Division, Yakima project, Washington

Montana Irrigation Committee Studies Water Problems

Montanans (Inc.), a Montana State Chamber of Commerce, recently organized an irrigation committee which is planning a comprehensive study of and report on all pertinent features of storage and use of water in the State, the financing of irrigation projects, questions of law as to water rights, creation of irrigation districts, and proper utilization of water supplies.

The main committee has been divided into 13 subcommittees representing the various phases of the problems of irrigation development and water conservation in the State. Representatives of the Federal irrigation projects in Montana have been assigned to specified committees as follows:

Irrigation district laws.—H. H. Johnson, superintendent, Milk River project; W. J. Burke, district counsel.

Irrigation districts.—E. E. Lewis, superintendent, Huntley project; G. J. Hagens, manager, Bitter Root project.

Federal Reclamation.—A. W. Walker, superintendent, Sun River project, secretary; H. A. Parker, manager, Lower Yellowstone project.

Financing and refinancing.—H. H. Johnson, superintendent, Milk River project; H. M. Montgomery, secretary, Zurich Irrigation District, Milk River project.

Financing Operation and Maintenance Costs, Grand Valley Project, Colorado

By W. J. Chiesman, Superintendent

As early as last September I saw that it would be extremely doubtful if the Grand Valley Water Users' Association could raise the usual funds for operating the project during 1932 and from that time on I held the operation and maintenance cost at the lowest possible level. At the annual meeting of the water users held on January 11, 1932, there was a strong sentiment shown by the people for a reduction in operation and maintenance costs as they recognized that they were facing a probable failure of raising sufficient funds to operate the project. No criticism was raised as to the present management or cost and the only thought expressed was the apparent need for a reduction in the amount to be paid by each water user. The plan expressed at this meeting for accomplishing this retrenchment was for the water users to take over all lateral maintenance and perform the work. As a means of arriving at some definite plan along these lines a committee of 12 was appointed to meet with the board of directors. This committee soon realized that great inequalities were sure to arise, as in some cases there were only two users on a long lateral requiring a great deal of maintenance, while in other cases users would have no work whatever to do.

As a compromise I offered a plan wherein I would cut off all of the forces except the ditchriders and hire water users for all work needed, giving preference so far as practical to the users indebted to the association. In hiring these water users they agree verbally to sign their pay checks over to the association in payment of any unpaid water charge and if the individual is paid up, he is given advance credit.

This plan was put into effect this season and to date (May 27) it has been successful and so far as is known the water users are satisfied with its operation. At the end of April approximately $6,700 in collections had been made from this source and practically all of this amount covered water charges that would not have been collected in any other manner.

Furthermore, in my opinion, this method of operating brings the water user in closer contact with the project and increases to a great extent his interest in the project. In the past the average water user was of the opinion that it was up to the Government to do these various jobs and that it was of no concern to him if a drop washed out beside him. Now they are beginning to realize that it is their money that pays for these things and as a whole they are showing much more interest in project affairs than ever before.

With this in effect this project will be able to go through the year in an average manner and will be able to hold the necessary maintenance up to par which would have been impossible in any other manner.

On a Cash Basis at Last

A reader of the Chattanooga Times reports that he is at last on a cash basis, and tells how he got there.

"I bought a car instead of a farm, and it wore out; but the farm I figured on is still O. K. I invested in a radio instead of a cow and the radio gives static instead of milk.

"I am feeding five nice hounds instead of five pigs. I had our piano tuned instead of the well cleaned. I spent all my cash in 1928 and traded up my future wages on installments in 1930, so hard times caught me in a bad shape.

"If I had only spent my last $10 for flour and meat instead of gas and oil, I would have been O. K. I built a nice garage last year instead of covering my barn and loafed in the mountains two weeks instead of being in the pasture fixing it so my cow won't get out; but she is dry, and mortgaged to boot, for two blankets my wife bought from an agent instead of paying the preacher.

"I'm on a cash basis now, but I' ain't got no cash.'

"Write or phone if you hear any relief from the Government coming down my way."—*The New Agricultural Review.*

The planted acreage of sugar beets on the Milk River project considerably exceeds that of any previous year, and if the crop which is up is brought to maturity, a greatly increased tonnage will be harvested.

The American Legion has completed a 42 by 90 foot hall at Tulelake, Calif., Klamath project, at a cost of $6,000.

The Community Presbyterian Church at Tulelake, Calif., Klamath project, is nearing completion. The church will cost approximately $2,000.

A land-leveling demonstration was held at the L. G. Baldwin farm near Fairfield, Sun River project, on May 19. About 100 farmers were present and all appeared eager to learn. The Lion's Club of Choteau furnished an excellent luncheon at noon and constructive talks were made by L. H. Mitchell, assistant director of reclamation economics, who spoke on What Reclamation Means in Developing Homes; Dan Noble, agricultural development agent of the Milwaukee Railroad, who spoke on Developing Montana's Irrigation Resources; County Agent Robert Clarkson, who spoke on Irrigated Pastures; E. E. Isaac, extension horticulturist from Bozeman, who spoke on Beautifying the Farmstead; Sam Sloan, extension agronomist from Bozeman, who spoke on Crop Rotation; and D. P. Thurber, who spoke on Economy in the Use of Water.

The Chamber of Commerce at Carlsbad, N. Mex., has been active in securing action on the extension of the road south to Pecos, Tex., and surveys have been completed. The Park Service recently let contracts for a building program for about $40,000.

June 17 marked a milestone in the history of reclamation. On this date 30 years ago the Federal reclamation act was approved by President Roosevelt.

The Sons and Daughters of Norway held a big celebration at Fairfield, Sun River project, on May 17, commemorating the independence day of Norway. An excellent entertainment followed by dancing and luncheon was furnished at which some 800 persons were present.

The Kiwanis Club of Great Falls, Sun River project, put on an excellent program in Fairfield on May 28, for the purpose of raising money for a project booth at the North Montana Fair. An excellent attendance was present and more than $100 was realized.

Orland Orange Show

(Continued from p. 133)

The district has proven itself admirably adapted to orange culture. The acreage has been materially increased by recent plantings. Farmers are becoming orange conscious and it requires no great stretch of the imagination to visualize the Orland project of the future as one of the outstanding citrus districts of California.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, left Washington on July 1 for Yellowstone Park, to represent the Secretary of the Interior at the annual meeting of the American Society of Civil Engineers, July 6–9. As this copy goes to the printer it is planned that a number of the engineers will leave by the eastern entrance of Yellowstone Park and be escorted by Doctor Mead and our local officers over the Shoshone project.

Doctor Mead plans to make an inspection trip over a number of the projects by automobile. These will include Minidoka, Owyhee, Boise the office of the district counsel at Billings, Mont., and the Denver office.

The Owyhee dam has been completed and was dedicated with appropriate ceremonies on July 17. Secretary Wilbur and Commissioner Mead were present and delivered the principal address.

During the absence of the commissioner in the West, P. W. Dent was designated acting commissioner.

Miss Mae A. Schnurr, assistant to the commissioner, and George O. Sanford, chief of the Engineering Division of the Washington office, attended the annual meeting of the American Society of Agricultural Engineers at Ohio State University, Columbus, Ohio, June 20–23. Mr. Sanford presented Doctor Mead's paper entitled "Social and Economic Value of Electrical Development in Federal Reclamation."

H. H. Plumb, engineer in the Denver office who spent several days on the Yakima project assisting in the tests of electrical installation and control of the valves at the Yakima River pressure tunnel wasteway, later inspected the spillway gates at McKay dam, Umatilla project, and the new substation at the South Side pumping station No. 1 on the Minidoka project, returning to Denver by way of the Salt Lake Basin project where he inspected the wasteway gates at Echo Dam.

L. H. Mitchell, Assistant Director of Reclamation Economics, returned to Washington, on June 14, after an extended western trip. Mr. Mitchell was accompanied by his wife and daughters, who will make their future home in Washington. They left Wyoming on June 8 and traveled 2,200 miles by automobile in a little more than 5½ days.

Theodore Wyman, jr., captain, Corps of Engineers, United States Army, and William Gerig, head engineer of the Kansas City district, visited the Belle Fourche Dam for the purpose of acquainting themselves with details of this high earth structure.

W. H. Nalder, assistant designing in the Denver office, recently visited the Yakima project where he made an inspection of the construction work at Prosser and Kennewick.

Hollis Sanford, inspector, and Bert A. Hall, engineer, on the Owyhee project, have been transferred to Hoover Dam.

Ivan E. Houk, senior engineer in the Denver office, attended a recent meeting of the special committee on irrigation hydraulics of the American Society of Civil Engineers at San Francisco and Berkeley, Calif.

Roy B. Williams, construction engineer on the Kittitas division of the Yakima project, was transferred to the Boulder Canyon project effective on May 25.

Welfare Committee of the Department of the Interior

The original welfare committee of the Department of the Interior has recently been expanded to include representatives from each of the bureaus and from the Secretary's office and also to have charge of the proceeds received from the Welfare and Recreational Association of Public Buildings and Grounds as a result of the operation of the cafeteria and candy counter in the Interior Building. These funds, together with funds already in the hands of the original welfare committee, are loaned to needy employees of the department under strict regulations requiring the repayment of the loan without interest and in specified amounts and at periodic dates.

The Bureau of Reclamation is represented on the committee by Miss Sallie A. B. Coe, treasurer.

Burton P. Fleming, of Las Cruces, N. Mex., has been appointed dean of engineering at the New Mexico State College for 1932–33, succeeding James T. Rood, resigned. For the past 3½ years Mr. Fleming has been manager of the Elephant Butte Irrigation District. Before coming to Las Cruces he was head of the department of mechanical engineering at the Iowa University and was also consulting engineer for a number of years.

We understand that Mr. Fleming is now at Ames, Iowa, doing some post graduate work and that he will return to Las Cruces in August.

J. L. Savage, chief designing engineer, who spent a few days in cooperation with Engineer R. S. Lieurance at the Massachusetts Institute of Technology at Boston, went later, in company with C. M. Day, mechanical engineer, to New York and Jersey City to interview engineers of the Kellogg Co.; to Pittsburgh to confer with engineers of the Aluminum Co. of America; and to the plants of the Babcock & Wilcox Co. at Barberton, Ohio, and the A. O. Smith Co. at Milwaukee, Wis., to witness model tests of special connections for the plate-steel outlet pipes for Hoover Dam.

The Arizona Holding Co., successor to the Yuma Trust & Holding Co., applied for a national banking charter with the idea of opening a national bank at Yuma on July 1. This holding company is affiliated with the Citizens National Bank of Los Angeles.

On the Yuma auxiliary project 92,167 boxes of grapefruit, or 192 carloads, were marketed through the local packing shed during a recent month. In addition 4 carloads of oranges were trucked to Riverside, Calif., where they were packed and marketed from the Riverside shed.

Pastures and ranges on the Belle Fourche project are providing an abundance of feed, and practically all stock has been shifted to summer grounds. The water holes and general range conditions are better than for many years because of spring rains that have averaged about six inches.

O

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kuhach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District council	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Do.
						J. R. Alexander	Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Bitter Root	Hamilton, Mont	G. J. Hagens	Irri. mgr			Wm. J. Burke	Billings, Mont.
Milk River [3]	Malta, Mont	H. H. Johnson	Superintendent	E. E. Chabot	E. E. Chabot	do	Do.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	do	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. const. eng	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	I. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonehright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tont	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangeu	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	H. A. Parker	Project Manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington Wyo.
Northport division	Northport irrigation district	Northport, Nebr	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district	Baker, Oreg		Reser. supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West Division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry, W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of California.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*

Painted by Thomas P. Rossiter. Courtesy of United States George Washington Bicentennial Commission

"WASHINGTON AS A FARMER AT MOUNT VERNON"

U. S. GOVERNMENT PRINTING OFFICE 1932

7. 3

THE RECLAMATION ERA

VOL. 23, NO. 8 AUGUST, 1932

Clemson College Library

Photograph by F. C. Bohlson

OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO, DEDICATED JULY 17, 1932

THE FAMILY AND THE HOME

THE unit of American life is the family and the home. It vibrates through every hope of the future. It is the economic unit as well as the moral and spiritual unit. But it is more than this. It is the beginning of self-government. It is the throne of our highest ideals. It is the source of the spiritual energy of our people. For the perfecting of this unit of national life we must bend all of our material and scientific ingenuity. For the attainment of this end we must lend every energy of government.

—President Hoover.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 8 AUGUST, 1932

Permits and Leases at Boulder City

By Sims Ely, City Manager

BOULDER CITY, its homes, its business community, and the unique system of individual permits under which all business activities are conducted have all grown out of a humane idea, agreed upon by President Hoover, Secretary Wilbur, and Commissioner Mead when definite plans for the Boulder Canyon project began to take shape. It was known that the extremely hot summers on the Arizona-Nevada Desert at the altitude of the Hoover Dam, only 650 feet above sea level, with the added heat encountered between the canyon walls (last summer the men at the river worked at times in a temperature of 128° in the shade), made it humanely necessary that for the men employed on construction and for the families brought here the best living conditions practically attainable must be provided.

FIXING CAMP SITE

The construction camp, it was foreseen, must be situated on the highest accessible ground near the works. A site ideally situated for the camp was found on a sloping plateau, 7 miles from the site of the dam, and having an altitude of 2,500 feet, an area almost steadily swept by winds or breezes and offering, in the dry air of the desert, a place which is more pleasurable at a temperature of 110° than is Washington, D. C., at 90°. Bidders for the contract on the dam were therefore informed that the construction camp must be situated on this plateau, and that the workers must be transported, at the contractor's expense, between the camp and the works.

HOMES FOR WORKERS

Logical steps, in sequence, in developing the idea of providing every reasonable comfort for the workers and their families, attended and followed the letting of the contract for the dam. The best housing the world had ever seen in a construction camp was advised by the bureau, and worked out with the cordial cooperation of the contractor corporation, Six Companies (Inc.). Nine great dormitories, excellently heated in winter and artificially cooled in summer, equipped with electric lights, running water and shower baths, and affording separate rooms for some 2,500 men, were constructed, as well as some 700 modern cottages for workers having families. The most modern mess halls ever seen in any construction camp were provided; and the dormitory accommodations, with board at the mess halls, were furnished at a total cost to each dormitory occupant of $1.65 per day. All this construction was at the expense of the contractor. To enable the workers to buy all necessary supplies at moderate cost, the contractor was permitted to install, as a commissary, a very complete store of general merchandise. For the area of ground allocated for all these construction-camp activities of the contractor, Six Companies (Inc.) pays a monthly rental of $5,000.

OPERATION OF COMPETING STORES

It had been foreseen that the "company store," if it had no competition nearer than the town of Las Vegas, 23 miles away, would have things too much its own way in the matter of prices. To protect the workers from any possible exploitation by the contractor, it was planned to provide competition for the commissary by arranging for the operation of competing stores, in a permanent town, alongside the contractor's area. Thus it came about that Boulder City is in two sections, one comprising all the business activities of the contractor, the dormitories, and the workers' cottages, and so on, and the other consisting of the Government's office buildings, the business houses of merchants, and dwellings of Government employees and others, both sections of the town being provided, of course, with good streets and sidewalks, electric lights, a superb water and sewerage system, and, in fact, all the facilities to be found in the most modern towns.

LEASES OBTAINED BY PERMITS

And this is where the Boulder City system of "permits" which has attracted so much attention throughout the country comes in. It was clear that independent business houses would have little chance to prosper unless their numbers were closely restricted, for it was evident that the contractor's commissary would always have decided advantages, in volume of business, through its ability to arrange convenient credit accommodations and through its greater buying power. Retaining the title for all the ground within the reservation, the Government leases town lots in Boulder City for business and residence purposes for a period of 10 years at moderate rentals. In order to obtain a lease, a permit is necessary. The bureau had the great responsibility of deciding, largely by guesswork, as to the number of permits which should be issued for each type of business, it being recognized that in many types the duplication of certain lines to be found in different types would be unavoidable. Generally speaking, two permits for each type of business were deemed sufficient; for some lines, one permit was thought sufficient.

News that permits in limited numbers would be issued for business enterprises at Boulder City was widely circulated, and letters in great volume from aspirants for permits poured in from all sections of the country through the spring months of last year. To all inquirers a circular was sent, clearly setting forth the facts

concerning the hazards which business men and concerns establishing themselves in the town would necessarily encounter, particularly in the matter of the competition offered by the contractor's commissary. By June 30 of last year many hundreds of formal applications had been received, and for several months thereafter the work of allotting permits to the chosen applicants went forward.

By the terms of the permit contracts the permittees were required to proceed with obtaining leases and to follow with construction of the necessary buildings within 30 days after they had received notification that the street improvements and other town facilities were ready. These notices first went out on November 30 last. Because of the stringent financial conditions many permittees asked for extensions of time, and were accommodated with 30-day extensions. Two additional extensions for like periods were granted in many cases, but meanwhile construction of business houses on a considerable scale had begun by January of this year, and the business section as it now stands was completed in May.

There had been no improvement in business conditions outside, and during the winter and spring many permittees relinquished their permits. In some cases other applicants were allowed to take the places of these retiring permittees; in others the permits were allowed to lapse, because the fact was becoming more apparent that if the permittees who had already made final arrangements for proceeding with their enterprises, by obtaining leases and constructing buildings or renting space in buildings constructed by others, were to have the protection to which they seemed entitled, the allowable number of permits must be still further restricted by declining to grant further extensions to the permittees who were still inactive, those permits thereby becoming null and void. The outside public has continued to inquire about the possibility of getting permits, however, and there are still many callers who are rather insistent that they should "have a chance" to go into this or that line of business in the town.

If the bureau had not decided to limit still further, beyond the tentative plans of last summer, the number of business permits, the business section of Boulder City would to-day be at least one-third larger than it is. When the holder of a permit for one of the usual lines of business fails to exercise his permit, it is treated as satisfactory evidence that for the time being no other permit for that type of business should be granted, and that we should leave the field to those already established.

The wisdom of this policy is seen in the fact that after some permittees went to the extent of obtaining leases, paying, of course, the required rental for the first quarter, they then found it impossible to proceed. There are four leases of this type—one for a garage and service station, one for a service station, one for a small recreation hall, and one for a shoe-shining business. Because the rental money has been paid and no permittee already doing business can be injured through failure of a competitor to establish himself, we have treated these lessees leniently, hoping that they might build. But the time is at hand when we must notify them that the rental money is lost and their leases and permits must be canceled if they do not proceed. Another lease not exercised is that for a hotel, elsewhere discussed.

As matters stand, there has not only been no business failure but the town is not overbuilt; there is not an empty storeroom, and all establishments are doing fairly well. They, of course, are not doing so well as they would like, but all are probably doing better than they could do anywhere else just now, for here is one of the few unimpaired pay rolls of the country. Wages have not been reduced. The minimum wage, in harmony with the Government's policy laid down when the contract for the dam was let, is $4 per day, and the average is above $5. But the contractor's commissary presents a competition, in the form of low prices and its system of issuing coupons to workers charged against their wages and redeemable in merchandise only, which these concerns, particularly in some lines, find hard to meet. Also, competition comes from Las Vegas, where certain establishments (laundries and clothes-cleaning concerns, for instance) hold permits to solicit and do business in Boulder City. All these things have created some discouragement among permittees who have made large investments in buildings and equipment and stock of goods.

Some of the larger investors are anxious about the future. The vast construction program comprised in the Boulder Canyon project at the present rate of progress will be completed within six years. Looking forward to that time, and the uncertainties of the future after completion of the construction period, some of our permittees are in doubt about their ability to amortize their investments within the construction period.

BOULDER CANYON PROJECT ATTRACTS TOURISTS

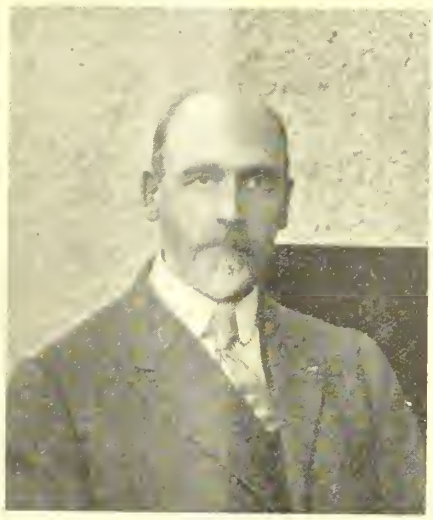
In discussing the future with these men, the writer has pointed out, for their encouragement, one apparent certainty and one possibility. The certainty is that travelers by train and by automobile will come here by thousands every year to see the Hoover Dam and the fascinatingly wonderful lake created by that dam. Even now the sight-seeing visitors passing through the reservation gate are in the thousands every month. Aside from the scenery, the boating attractions to be found in a hundred miles of still water, and the attractions for fishermen when the cold waters of the reservoir are stocked with game fish will certainly bring visitors to Boulder City in large numbers. Thus, it is pointed out, business enterprises that cater to the wants of the traveler should have excellent chances to prosper in Boulder City. The possibility referred to is found in the fact that the Government's investment and the contractor's investment in buildings and town facilities will have provided here the basic and larger part of the necessary plant for a veterans' hospital, capable of taking care of a hospital population of some thousands. And for some years there has been heard the claim that Nevada stands in need of such a hospital.

HOTEL AND APARTMENT HOUSE NEEDED IN BOULDER CITY

The town could fairly be described as complete, except for two important enterprises, still lacking. There is no hotel, and a hotel is badly needed. A well-appointed, modern hotel, operating at moderate prices, should command a large patronage from the traveling public and should be profitable. Last summer an application for a hotel permit was approved, but the granting of the permit was withheld until the applicant might show that he could be expected to finance the enterprise. The increasing difficulties in the financial field led to abandonment of that project in the winter, and it was not until the past spring that any one of the several aspirants for this valuable permit appeared to be able to find the money for construction if a permit were granted. In April a permit and a lease were granted for a promised hotel of 74 rooms. The lessees have just given us the unwelcome information that it is impossible to raise the required sum and that the enterprise must be abandoned. This, of course, means forfeiture of the rental thus far paid to the Government. Doubt that such a hotel as above indicated would pay has never been stated by anybody. We shall continue to look for some one who has both faith and money.

The other enterprise lacking is an apartment house. Here, however, it is less easy to advise investors to go ahead. Probably the investment in an apartment house should be amortized within the construction period, whereas a good hotel, having no competition during the construction period, should pay better and better as the years go by.

Frederick Haynes Newell, 1862–1932



Frederick Haynes Newell, the first executive head of the Reclamation Service and a nationally known consulting engineer, died suddenly on July 5 after a heart attack in his offices in the Shoreham Building, at Washington, D. C.

Mr. Newell, who was one of the founders of reclamation and the author of many engineering works, was born in Bradford, Pa., on March 5, 1862; graduated as engineer from the Massachusetts Institute of Technology in 1885; engaged first in mining in Colorado, then in miscellaneous engineering in Ohio, Pennsylvania, Virginia, and other States. In 1889 he joined the United States Geological Survey as assistant hydraulic engineer and was engaged in the irrigation branch of that service and in stream measurements and various investigations concerning the water supply of the arid regions from 1889 to 1895. In 1895 he organized the hydrographic branch of the Geological Survey and remained in charge until 1907. On March 9, 1907, the Reclamation Service became a separate bureau, and Mr. Newell was appointed director, which position he held until December 10, 1914, when his designation was changed to that of consulting engineer, and in the latter capacity he served the bureau until November 30, 1923.

While connected with the Bureau of Reclamation Mr. Newell was also a member of the Public Lands Commission and of the Inland Waterways Commission, which was later merged into the Conservation Commission. He was the author of numerous books and articles on irrigation.

Mr. Newell was buried at Needham, Mass., his ancestral home.

PERMITS AND LEASES

Omitting statistics that might prove tedious to read, the following information concerning permits and leases should be interesting:

The total number of active commercial leases at this time is 39, the latest being to the Southern Nevada Telephone Co., which for the past year had operated a long-distance service, and has just established a local exchange. Previously, Six Companies (Inc.) had been operating an exchange for its own use, and had accommodated many of our lessees by running wires to their establishments from its switchboard, thus giving them local and long-distance service.

Noncommercial leases include the Catholic and Episcopal churches, respectively, and the Masonic Lodge.

There are 15 individual residence leases, in addition to 2 leases to one permittee, covering residence sites whereon 17 duplex houses and 14 single cottages have been constructed. All of these are now occupied. No lease for a residence site is granted until the applicant has given satisfactory references.

There are 113 live permits for business and professional purposes. If a lessee constructs a building with more space than he needs for his own use, we of course permit him to rent store or office space to other permittees. The number of commercial leases in operation by no means indicates the number of business establishments that are operating. The more important business concerns include 1 general merchandise store (including groceries); 1 grocery store; 2 men's clothing stores; 1 ladies' ready-to-wear store; 2 drug stores; 4 restaurants; 1 vegetable and fruit store; 2 butcher shops; 1 pool hall; 1 electrical store; 1 music store; 2 tourist camps; 1 union bus terminal; 1 motion-picture theater (the largest in Nevada); 1 railroad (Union Pacific); 1 telegraph company (Western Union); 1 telephone company; 2 bus concerns (operating between Boulder City and Las Vegas); 1 taxi concern; 1 drayage business; 2 automobile and tire stores; 2 repair garages; 5 service stations; 1 storage garage; 1 automobile wrecking yard; 2 wholesale oil and gasoline establishments; 2 beauty shops; 3 equipped dental offices (6 dentists); 1 physician's office (operated in connection with the office of a Las Vegas hospital); 1 mortuary; 1 bakery; 2 laundries; 2 clothes cleaning and pressing establishments; 1 merchant tailor; 2 newspaper offices (Las Vegas dailies).

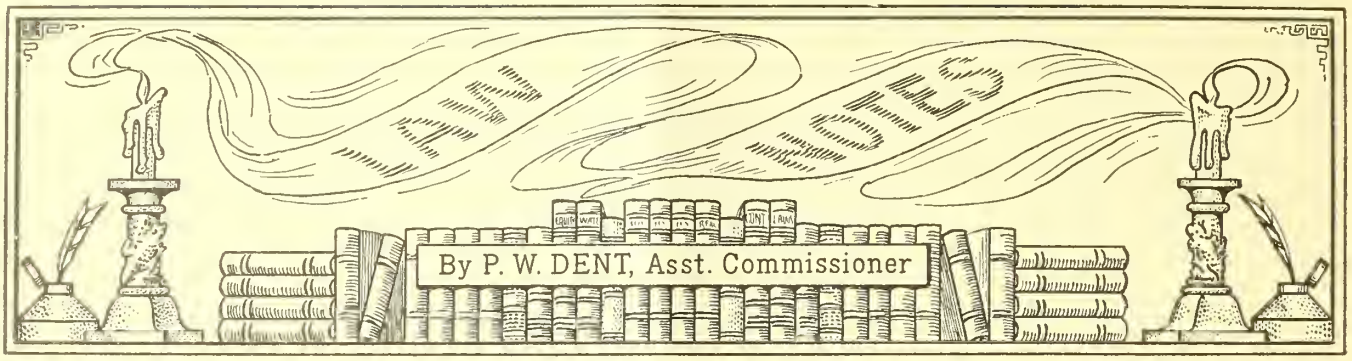
We have this far placed no limit on the number of insurance agents, lawyers, physicians, dentists, and other professional and office people to whom permits may be issued, and sundry inactive permits in these various lines are outstanding, our only requirement before the permittees can do business here being that they must establish offices. As yet the town has only one lawyer (of Las Vegas), who is here part of the time. Some people of humorous turn cite this fact as possibly helpingto explain our good record in law enforcement.

For the accommodation of its employees and the people of Boulder City in general, Six Companies (Inc.) operates a commodious and exceptionally modern hospital, with a staff of physicians and surgeons. Thus there is no demand for a hospital to be operated by a permittee.

The following States are represented by permits in the numbers shown: Nevada, 40; California, 26; Utah, 13; Colorado, 7; Arizona, 5; Texas, 5; Oregon, 4; Pennsylvania, 2; New Mexico, 2; Mississippi, 2; Florida, Idaho, Rhode Island, Montana, Tennessee, Nebraska, and Wisconsin, 1 each.

By way of accommodating the business community of Las Vegas and as one of the means of protecting the workers by assuring early competition for the commissary, sundry permits to business concerns in Las Vegas were granted last summer. The most important of these comprise dairies, laundries, and clothes cleaning and pressing establishments. This policy was necessary because when these permits were granted the creation of a business community in Boulder City was still a matter of distant months.

These Las Vegas permits generally contain a special clause to the effect that the permittee will pay such occuation fee or license as the Government may in due course demand. To date no fee has been charged. But now, we feel, the time has arrived to establish a schedule of occupation fees to be charged these nonresident permittes for the protection of permittees who have made substantial investments in Boulder City for operation of the same types of business as are represented by the Las Vegas permits. Much thought has been given to the question of the amounts to be charged, in fairness to all. A tentative schedule for consideration by the commissioner and the Secretary has been made up, to go into effect August 1, if approved. The proposed annual fees, to be paid quarterly in advance, are: For steam laundries, $600; for dry cleaning and pressing establishments, $600; for peddling fruits and vegetables to consumers, $400; for soliciting individual orders for clothing, $400; for peddling aluminum ware to consumers, $100. No fee whatever is to be charged for business transacted with Boulder City dealers.



Revenue Act of 1932

THE revenue act of 1932 affects to some extent the operations of the bureau. Applicable provisions of the act are shown below:

[Public—No. 154—72d Cong.]

An act to provide revenue, equalize taxation, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this act, divided into titles and sections * * * may be cited as the "revenue act of 1932." * * *

SEC. 616. *Tax on electrical energy.*—(*a*) There is hereby imposed a tax equivalent to 3 per centum of the amount paid on or after the fifteenth day of the enactment of this act, for electrical energy for domestic or commercial consumption furnished after such date and before July 1, 1934, to be paid by the person paying for such electrical energy and to be collected by the vendor.

(*b*) Each vendor receiving any payments specified in subsection (*a*) shall collect the amount of the tax imposed by such subsection from the person making such payments, and shall on or before the last day of each month make a return, under oath, for the preceding month, and pay the taxes so collected, to the collector of the district in which his principal place of business is located, or if he has no principal place of business in the United States, to the collector at Baltimore, Maryland. Such returns shall contain such information and be made in such manner as the commissioner with the approval of the Secretary may be regulation prescribe. The commissioner may extend the time for making returns and paying the taxes collected, under such rules and regulations as he shall prescribe with the approval of the Secrtary, but no such extension shall be for more than 90 days. The provisions of sections 771 to 774, inclusive, shall, in lieu of the provisions of sections 619 to 629, inclusive, be applicable in respect of the tax imposed by this section.

(*c*) No tax shall be imposed under this section upon any payment received for electrical energy furnished to the United States or to any State or Territory, or political subdivision thereof, or the District of Columbia. The right to exemption under this subsection shall be evidenced in such manner as the commissioner with the approval of the Secretary may by regulation prescribe.

SEC. 617. *Tax on gasoline.*—(*a*) There is hereby imposed on gasoline sold by the importer thereof or by a producer of gasoline, a tax of 1 cent a gallon, except that under regulations prescribed by the commissioner with the approval of the Secretary the tax shall not apply in the case of sales to a producer of gasoline.

(*b*) If a producer or importer uses (otherwise than in the production of gasoline) gasoline sold to him free of tax or produced or imported by him, such use shall for the purposes of this title be considered a sale.

(*c*) As used in this section—

(1) The term "producer" includes a refiner, compounder, or blender, and a dealer selling gasoline exclusively to producers of gasoline, as well as a producer.

(2) The term "gasoline" means gasoline, benzol, and any other liquid the chief use of which is as a fuel for the propulsion of motor vehicles, motor boats, or aeroplanes.

SEC. 701. *Imposition.*—(*a*) On and after the fifteenth day after the date of the enactment of this act, there shall be imposed—

(1) In the case of each telegraph, telephone, cable, or radio dispatch, message, or conversation, which originates on or after such date and before July 1, 1934, within the United States, a tax at the following rates:

(A) Telephone conversations for which the charge is 50 cents or more and less than $1, 10 cents; for which the charge is $1 or more and less than $2, 15 cents; for which the charge is $2 or more, 20 cents;

(B) telegraph dispatches and messages, 5 per centum of the amount charged therefor; and

(C) cable and radio dispatches and messages, 10 cents; but only one payment of such tax shall be required, notwithstanding the lines or stations of one or more persons are used for the transmission of such dispatch, message, or conversation; and

(2) a tax equivalent to 5 per centum of the amount paid on or after the fifteenth day after the date of the enactment of this act to any telegraph or telephone company for any leased wire or talking circuit special service furnished on or after such date and before July 1, 1934. This paragraph shall not apply to the amount paid for so much of such service as is utilized in the conduct, by a common carrier or telephone or telegraph company or radio broadcasting station or network, of its business as such.

(*b*) No tax shall be imposed under this section upon any payment received for services or facilities furnished to the United States or to any State or Territory, or political subdivision thereof, or the District of Co umbia, nor upon any payment received from any person for services or facilities utilized in the collection of news for the public press or in the dissemination of news through the public press, if the charge for such services or facilities is billed in writing to such person. The right to exemption under this subsection shall be evidenced in such manner as the commissioner with the approval of the Secretary may by regulation prescribe.

SEC. 702. *Returns and payment of tax.*—(*a*) The taxes imposed by section 701 shall be paid by the person paying for the services or facilities.

(*b*) Each person receiving any payments specified in section 701 shall collect the amount of the tax imposed by such section from the person making such payments,

and shall on or before the last day of each month make a return, under oath, for the preceding month, and pay the taxes so collected, to the collector of the district in which his principal place of business is located, or if he has no principal place of business in the United States, to the collector at Baltimore, Maryland. Such returns shall contain such information and be made in such manner as the commissioner with the approval of the Secretary may by regulation prescribe. The commissioner may extend the time for making returns and paying the taxes collected, under such rules and regulations as he shall prescribe with the approval of the Secretary, but no such extension shall be for more than 90 days.

SEC. 725. *Stamp tax on conveyances.*—Schedule A of Title VIII of the revenue act of 1926 is amended by adding at the end thereof a new subdivision to read as follows:

"8. Conveyances: Deed, instrument, or writing, delivered on or after the 15th day after the date of the enactment of the revenue act of 1932 and before July 1, 1934 (unless deposited in escrow before April 1, 1932), whereby any lands, tenements, or other realty sold shall be granted, assigned, transferred, or otherwise conveyed to, or vested in, the purchaser or purchasers, or any other person or persons, by his, her, or their direction, when the consideration or value of the interest or property conveyed, exclusive of the value of any lien or encumbrance remaining thereon at the time of sale, exceeds $100 and does not exceed $500, 50 cents; and for each additional $500 or fractional part thereof, 50 cents. This subdivision shall not apply to any instrument or writing given to secure a debt."

SEC. 1113. Effective date of act. Except as otherwise provided, this act shall take effect upon its enactment.

Approved, June 6, 1932, at 5 p. m.

Death of Ernest George Hopson

Ernest George Hopson, who has been engaged in engineering work in Oregon for 26 years, died in a hospital in Portland, Oreg., on July 4 at the age of 64 years. He was born in Reading, England. During his earlier years he had been engineer of the Manchester Ship Canal in Massachusetts and was later a member of the Metropolitan Water Board of the New York Water Supply. During his residence in the West he had served for a time as supervising engineer of the United States Reclamation Service.—*Engineering News-Record.*

John H. Pellen Retires from Active Service

John H. Pellen, in charge of the drafting section of the Washington office of the Bureau of Reclamation, retired recently at the age of 72. On December 4, 1895, Mr. Pellen was appointed to the Geological Survey as a lithographic map engraver and in 1897 was assigned to the division of illustrations. On March 15, 1904, he was transferred to the Reclamation Service as a topographic draftsman, and on May 7, 1909, was placed in charge of the drafting division with the title of chief draftsman. Having rendered loyal and efficient service to the Government for more than 36 years, Mr. Pellen was retired from the active rolls on June 30, 1932.

Photograph by Walter F. West

George O. Sanford, chief of engineering division (left); John H. Pellen (right)

In making the presentation of the Gladstone bag which was the parting gift of his bureau associates, George O. Sanford, chief of the engineering division, in the course of a few remarks, told Mr. Pellen that the initials J. H. P. on the bag stood not only for his full name but for what his associates wished for him, namely, joy, health, and prosperity. The accompanying photograph shows Mr. Sanford and Mr. Pellen at the time of the presentation.

During Mr. Pellen's official connection with the Bureau of Reclamation he supervised the drafting work with remarkable ability and was of especial assistance in the training of junior engineers, who later became proficient topographic draftsmen. In 1907 he was assigned to special work for the War Department in Cuba for a period of nine months.

Boulder City Hot, but Not Enervating

The heat at Boulder City, like the weather in other sections of the country, is always a subject of intense interest, and the question uppermost in the minds of most people is how human beings can live and work in such high temperatures. A brief description of conditions given in a personal letter presents an excellent idea of how it feels:

"The elevation of Boulder City is 2,500 feet above sea level. In the canyon where we work it is about 500 feet. It is very dry and very hot most of the time. At present, with what seems a cool breeze blowing through the house, it is 95° at 9 o'clock at night. In the canyon it is usually about 10° hotter. The breeze that blows up the canyon between those hot rock walls is like a blast from a furnace. The highest temperature I have noticed thus far is 112°. The amazing thing is that one feels fine. We have been very hot and sweat profusely, but the work goes on as lively as ever. It's the hottest heat I have ever felt, but it doesn't have the usual depressing effect. When people drive on a hot day they shut the car windows. The hot wind seems to burn. Your nose and ears begin to burn, just as they are affected by a cold wind. Add to this that we do not suffer and we feel better than ever and you have the truth about temperatures at Boulder City."

Bureau of Reclamation Has Card Index of Dams

The Bureau of Reclamation is the principal constructor of dams in this country, having built a total of 126 dams in 26 years of construction work. It has recently completed the 405-foot Owyhee Dam, the highest in the world, and has under construction the 730-foot Hoover Dam. A card index is maintained in the Washington office of all dams, both in this country and abroad, which is a source of information for other Government bureaus and the public.

Crops on the Minidoka project continue to do well. The first cutting of alfalfa is practically completed and much of it is in the stack. Beets and potatoes are growing rapidly and most of the wheat has headed out. It is reported that the potato acreage this year was reduced 10 or 15 per cent below that of last year.

ENGINEERING

GEORGE O. SANFORD, Chief, Engineering Division

Concrete for Hoover Dam

(Part III—Lining of Diversion Tunnels)

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

THE type of conveyance now used for transporting concrete from mixing plant to pouring site depends upon the means adopted for placing the concrete in its final location. Trucks loaded with two 2-yard bottom-dump steel buckets are employed when the concrete is conveyed from trucks to pouring site by gantry crane, and the agitator drum, mounted on truck, is used when it is possible to pour concrete directly into place or into a chute leading to a hopper, where it is transferred to the steel buckets.

The inlets of all diversion tunnels have been excavated to the portals and a concrete arch cofferdam built around each portal for protection from floods. A rock fill nearly to the top of the cofferdam has been made between these structures and the river, and as a result trucks can not be driven directly into the tunnels at these portals.

The present procedure for pouring the 3-foot lining in the diversion tunnels is to transport the concrete from the mixing plant to the inlet portals in 4-cubic-yard agitator drums. Upon arrival at the tunnel portal the concrete is dumped into a chute leading to a steel hopper, from which it is dumped into the steel buckets as desired. These buckets, two of which are loaded on each 10-ton truck, are then conveyed to the pouring site, where a 10-ton gantry crane lifts the buckets from the truck and moves them to the pouring position.

Lining diversion tunnels is performed in three operations—the invert section, comprising the lower 74° of the tunnel, is poured first; this is followed by pouring side walls, 88° on each side; followed in turn by pouring the remaining 110° in the roof or crown of the tunnel. All sections are poured for the same linear distance, so that a transverse construction joint is secured around the entire periphery of the tunnel. At present this section is 40 feet in length for all tunnels except in the portions of the two outer tunnels, which will later be used for spillway purposes, where the construction joints are placed 26⅔ feet apart.

PRELIMINARY OPERATIONS

Following the excavation of a tunnel to its full 56-foot average diameter, the first operation preliminary to lining is the pouring of a concrete gantry rail base on both sides of the tunnel. The top of this foundation is 3.1 feet in height above the finished tunnel invert, and its inside corner is accurately poured to line and grade at a distance of 15 feet 9½ inches from the center line of the tunnel, with the result that the corner is located 24 inches from the finished face of the concrete lining, the 24 inches being the specified minimum thickness of lining. On each of these bases, which have an average width of 2½ feet, is placed a 6 by 12 inch timber, to which is spiked a 90-pound rail. On these parallel rails is then mounted the 10-ton gantry crane, which is capable of traveling along the tunnel at the rate of 300 feet per minute. The transverse traveler of the crane, equipped with two hooks of 5 tons' capacity each and operated by a 10-horsepower electric motor, has a traveling speed of 125 feet per minute and a hoisting speed of 100 feet per minute.

Longitudinal steel side forms 2 feet high, made up in sections 10 feet long, are set in position on the concrete foundation and held rigidly in place by bolting the form to the gantry rail concrete foundation and to the timber rail base. Transverse steel forms 2 feet wide, approximately 32 feet long, and spaced 26⅔ or 40 feet apart, are bolted to the longitudinal forms and braced against the rock floor of the tunnel. The space between the form and the floor is filled with a 2-inch timber bulkhead. Both transverse and longitudinal forms are constructed of 10-gage steel plate, smooth inside, supported by 2-inch angle top flanges and 2 by 3 inch stiffeners. Keyways between abutting sections of concrete, 1½ by 10 inches in transverse forms and 6 by 12 inches in longitudinal forms, are provided by grooves of these shapes in the steel plates.

LINING THE INVERT

The shape of the invert is procured by a device consisting primarily of two steel screeds supported on car wheels which run on the inside bottom flanges of two I beams. The beams, shaped to the invert and separated by an approximate distance of 11 feet, are connected at each end by a steel framework and supported by pairs of car wheels which run upon the upper flanges of the longitudinal forms.

Each of the screeds has a horizontal upper deck mounted on the screed plate, which itself is shaped to the radius of curvature of the finished tunnel section, which is 50 feet in diameter. The screed plate is approximately 11 feet long and 4 feet wide. On the upper deck is mounted a hand winch operating two cables, each of which is fastened through single sheaves to the framework connecting the I beams, so that by winding the winch the screed is moved upward across the invert toward the side forms.

For concreting operations the winch on the screed is unwound, allowing the two screeds to meet at the center of the tunnel. The gantry crane picks up the two buckets of concrete from the truck and transports them to the pouring site. Concrete pouring through the bucket gate, which is opened or closed manually by a large removable handwheel, is dumped on the tunnel wall side of each screed and puddled into place beneath. When the space is filled the screeds are pulled toward the tunnel walls, leaving behind them the molded shape of the invert. This process is repeated until the screeds arrive at the side forms.

To move the screeds and their track framework lengthwise of the tunnel, screw jacks installed on the axles of the wheels, which run on the side form, raise the framework slightly, allowing it to be pushed manually to its next position, or, if the distance to be moved is of great length, the gantry crane picks up the framework bodily and moves it to the desired location.

The surface of the invert is finished by men working from a movable timber platform supported just above the concrete by curved I beams placed 5 feet apart. The I beams are connected at each end

by a steel framework which contains double flanged wheels running on the gantry-crane track.

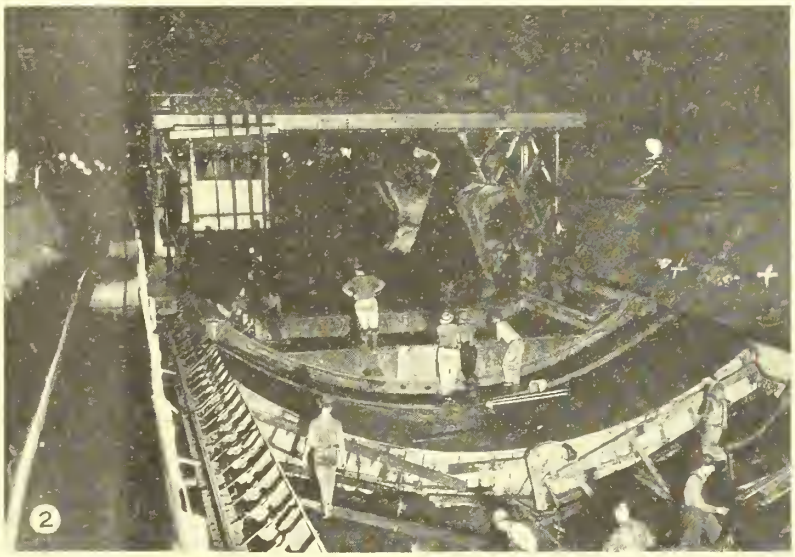
After the concrete in the invert has been finished, sand is dumped on it for a depth of approximately 3 feet on the center line of the tunnel, to act as a roadway for operation of trucks.

SIDE-WALL SECTIONS

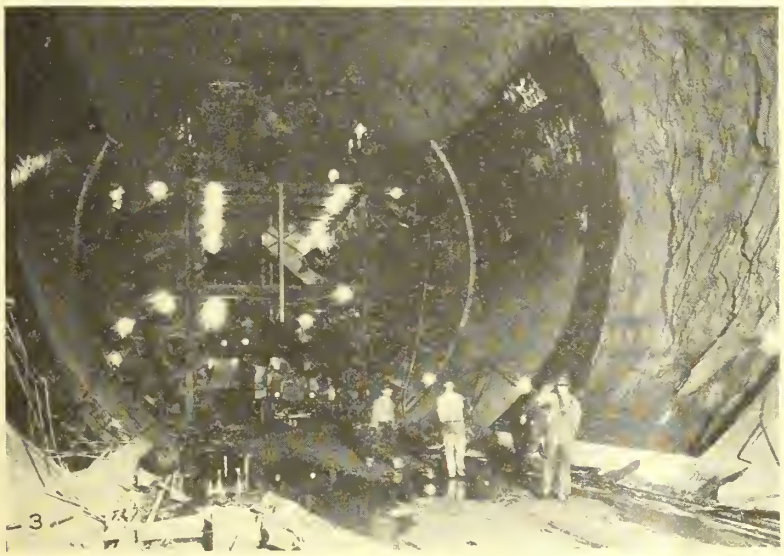
In preparation for pouring the side wall and crown sections, a concrete shelf 1½ feet wide is poured along each side of the finished invert as a foundation for 90-pound rails which are placed 11½ feet from the center line of the tunnel. These rails are the track for the side-wall jumbo, an 80-foot long and 50-foot high structural steel framework weighing 385 tons, which supports the ¼-inch steel skin plate for forming the walls.

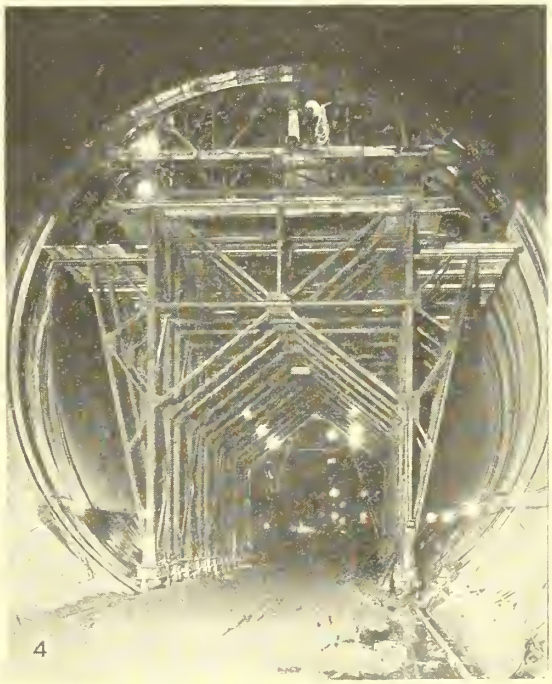
This jumbo is equipped with chutes, a traveling crane, and other mechanism for placing the concrete in designated position, and a series of screw jacks and ratchets used for distribution of hydrostatic pressure of green concrete and for the adjustment of position of the wall forms for pouring, or for moving the jumbo to a new position. Because of unequal lengths of walls on curves the jumbo is made up in five panels, three of 20 feet and two of 10 feet length. Each of these sections is equipped as a unit with supporting double-flanged wheels, rectangular chutes, and "coffin" chutes. Screw jacks and steamboat ratchets are mounted at the top of the section and bear against the rock crown to resist the upward pressure of green concrete. Other jacks are installed in the ends of the horizontal struts connecting the forms on each side of the tunnel and bear against the arch beams holding the steel form face. On curves, wooden gores are built between the steel sections.

A 5-ton bridge crane, equipped with two steel hooks and powered by a 10-horse-



CONCRETE AT HOOVER DAM





Photograph by B. D. Glaha

HOOVER DAM, BOULDER CANYON PROJECT

Transferring concrete from agitator truck through chutes to bottom-dump buckets for placement in diversion-tunnel lining; 2, pouring invert concrete in diversion tunnel No. 3; 3, pouring side-wall concrete in diversion tunnel No. 4 (here two forms are in use with alternate longitudinal pours being made); 4, steel frame carriage supporting form for 110° top-arch concrete in diversion-tunnel lining. Note jacks and wedges by means of which the form is placed in position and lined up.

power motor, runs on a pair of 50-pound steel rails carried on a longitudinal 10-inch H beam, which is in turn supported by the vertical struts on each panel. The bridge has a traveling speed of 300 feet per minute and the transverse traveler a hoisting speed of 100 feet and a traveling speed of 125 feet per minute.

The concrete chutes from the interior face of the jumbo to the faces of the forms are spaced from 4 to 6 feet vertically at the form face and are from 8 to 16 feet in length. Six of the chutes are of ordinary type, 12 inches deep and 30 inches average width, made of ¼-inch plate and 2-inch angles. The opening in the form face at the lower end of the chutes is closed when desired by a 12 by 24 inch steel door pushed into position, flush with the form face and bolted in place. The uppermost chute, termed the "coffin," is, in effect, a hopper 3 feet 3 inches deep at the end next the tunnel center line, 12 inches deep at the form face, and 4 feet wide. This chute is hinged at the form face, and concrete is dumped over the top of the form by raising the loading end by means of a cable connected through sheaves to a compressed-air winch located at the base of the jumbo. This "coffin" is made and operated in the manner designated to permit pouring the top 4 feet of wall, which otherwise could not be poured by gravity on account of its proximity to the roof of the tunnel.

POURING THE CONCRETE

Pouring operations consist of lifting the 2-cubic-yard bucket from the truck which has been driven to the section of the form designated for pouring, hoisting the bucket to the chute where the concrete is required, moving the bucket so that the hooks on the bucket gate are above a 3-inch round tripping iron bar over the chute; then by lowering the bucket slightly the tripping bar opens the bucket gate, pouring the concrete into the chute. When emptied the bucket is disengaged from the bar, lowered to the truck, and the other bucket is lifted, moved to the opposite side of the tunnel, and poured in a similar manner. An inspector and five to seven laborers are behind each form to puddle the concrete into place. A timber bulkhead, framed to provide a 1½ by 10 inch keyway similar to that in the invert concrete, is placed at the center or one-third point of the 80-foot length of forms, and each of these 40 or 26⅔ foot sections is poured to the top of the form before the adjacent section is started. As the top part of the section is completed, carpenters remove the lower part of the bulkhead, continuing this removal as concrete rises in the section. Obviously, concreting is started at the lower level of chutes, and the doors at the ends of these are closed before pouring is started through the chutes above. A longitudinal keyway, approximately 2 by 10 inches, is formed or cut in the top of the side-wall concrete, against which the crown concrete will abut.

At present 34 hours are required for pouring an 80-foot section of wall on each side of the tunnel. After the 80-foot section has been poured the forms are required to remain in place for 12 hours. When this period has elapsed the timber bulkhead, erected at that end of the form which does not abut on a previously poured wall section, is removed, the jacks and ratchets are loosened, and the form moved to a new position. Moving the jumbo is accomplished by means of a block and tackle attached to the rails ahead and rigged to air winches installed on the jumbo at its base. Each 80-foot section of side wall requires approximately 60 hours per cycle.

CROWN SECTIONS

A structural steel jumbo is used for pouring concrete in the crown section of the diversion tunnels. Essential parts of this jumbo are a concrete gun carriage, pipe carriage, traveler, and arch-form support. All these parts are supported on flanged wheels traveling on the 90-pound steel rails laid for the side-wall jumbo.

The gun carriage, approximately 45 feet long and 47 feet high, is equipped with a 2-drum electric hoist and two pneumatic concrete guns, with their receiving hoppers and concrete conveyers of 8-inch wrought iron and rubber hose. A 25-horsepower motor is used to move the carriage on its track. Its maximum speed is 100 feet per minute in a forward direction, or 20 feet per minute in reverse. The hoist for raising the buckets of concrete is powered by a 50-horsepower motor and has a lifting speed of 300 feet per minute.

The pipe carriage and traveler serve to support the 8-inch pipe through which the concrete is forced into the space above the crown forms. The pipe carriage in pouring position is connected to the gun jumbo, while the traveler may be moved to a position between the pipe carriage and the arch-form jumbo to support the conveyor pipe.

The arch form jumbo is made up in 10-foot and 20-foot panels, each panel of which is built of structural steel and equipped with jacks to place the face of the form in correct position for pouring, or to lower the form face away from the finished concrete. Trusses at 7-foot 4-inch maximum intervals, having lower chords 33 feet 4 inches long, support the center 88° of the crown section. The ¼ inch form face and its supporting beams for the lower 11° on each side of the center is connected at one end to the truss and supported at its opposite and exterior end by screw jacks bearing on the framework of the jumbo. Bulkheads are placed to secure transverse construction joints at 40 feet or 26⅔ feet, in manner similar to those for the invert and side-wall sections.

For pouring, the electric hoist installed on the gun carriage lifts the 2-yard buckets from the truck and dumps them into the gun hopper. The gun, by air pressure, forces the concrete through the 8-inch pipe to the center of the arch form. From here it flows to its final position through a 90° elbow and continuation of the conveyor pipe, or by a chute and baffle arrangement running down the arch form. Pouring is started at the end of the form farthest removed from the gun, and the conveyor pipe and its appurtenant placing device are pulled lengthwise on the forms as concreting progresses.

All concrete in the tunnels is sprinkled as soon as the forms are removed and is kept continuously wet for 14 days thereafter. Pipes with jet sprays are installed along the walls and a film of water is permitted to run uninterrupted over the concrete surface. This water is pumped from sumps dug near the ends of the tunnel portals, the water being comparatively clear, as the silt is removed by the filtering action of the loose excavated material.

The lining of diversion tunnels constitutes a prominent part of the concrete-pouring program for Hoover Dam and serves to give an impression of the magnitude of the work and the efficient methods the contractor is using to gain the desired results. Lining the inclined spillway tunnels, the spillway open cuts, the pressure tunnels, penstocks, and pouring concrete for the intake towers and the main structure, a 727-foot dam and its attendant power plant will present special problems, each of which will be solved in different manner.

The program of pouring concrete for Hoover Dam has started. When it is completed a concrete structure will be flung across the channel of the Colorado River, and the undertaking, described by President Hoover—"Here man builds his vision into stone, that generations to come may be blessed" [1]—will have been achieved.

[1] Inscription by President Hoover on the Washington Memorial Monument, erected on a pinnacle overlooking Hoover Dam site.

On the 67 farm units opened to entry under Public Order No. 28 on the Klamath project, 66 entrymen have filed water-right applications.

Notes for Contractors

Boulder Canyon project.—Bids under specifications No. 534 were opened on June 15, 1932, for furnishing and installing plate-steel outlet pipes for the Hoover power plant and appurtenant works. Bids were submitted by the following: Babcock & Wilcox Co., of New York and Denver, Colo.; A. O. Smith Corporation, of Milwaukee, Wis.; Chicago Bridge & Iron Works, of Chicago, Ill.; and the Western Pipe & Steel Co., of Los Angeles, Calif., The total bid prices of the low bidder, Babcock & Wilcox Co., for the 12 alternative items varied from $9,270,800 to $11,996,300. Contract was awarded to the Babcock & Wilcox Co. on its bid of $10,908,000 under schedule No. 1, item No. 1.

The Southern California Edison Co. has submitted to the Denver office a preliminary draft of specifications covering the generators, transformers, and oil-circuit breakers for the power plant.

Engineers of the Pelton Water Wheel Co. and the Allis-Chalmers Co. have discussed with the Denver office engineers specifications soon to be issued calling for bids on turbines, governors, and valves for six units of the power plant.

Under specifications No. 572–D, bids were opened at Denver on June 10 for furnishing five automatic temperature-difference recording and controlling units and supplies for adiabatic calorimeter rooms located in the bureau's concrete laboratory in Denver. The low bid of $4,514 was submitted by the Denver Fire Clay Co., of Denver.

Under invitation A–13622–A for furnishing approximately 1,500,000 pounds of reinforcing steel for the Cle Elum Dam the Sheffield Steel Corporation, of Kansas City, Mo., submitted low bid of $17,852.62. Nine bids were received.

The Central Iron & Steel Co., of Harrisburg, Pa., on July 11 shipped 786 steel plates weighing 833,930 pounds to the Consolidated Steel Corporation, of Los Angeles, to be used in constructing the bulkhead and Stoney gates called for under specifications No. 533.

Specifications are being prepared covering a 146-ton cableway for handling the large penstocks and power-plant machinery between the loading station at the canyon rim to the bottom of the canyon.

Rio Grande project.—Eighteen pump manufacturers submitted bids on June 16 for furnishing motor-driven centrifugal pumps and control apparatus (specifications 573–D) for the pumping plant to be located on the Federal detention farm near El Paso, Tex. Award of contract was made to the Worthington Pump & Machinery Co., of Denver, Colo., on its bid f. o. b. Harrison, N. J., of $2,164 for furnishing one 2-speed pump having capacity of 8 second-feet when operating under a total effective head of 32 feet, and 9 second-feet when operating under a total effective head of 67 feet, complete with motors and control equipment.

Sun River project.—Bids under specifications No. 536 were opened on June 20, 1932, for earthwork and structures for open drains on the Greenfields division. Twenty-one bids were received. Contract was awarded to the low bidder, W. H. Puckett Co., of Boise, Idaho, at a total price of $23,024, the principal item being 340,000 cubic yards of excavation for drains, for which the unit price bid was $0.0545 per cubic yard.

Yakima project, Storage division.—Bids were opened at Denver on June 16, under specifications No. 535, for furnishing and delivering f. o. b. cars at factory shipping point (item 1) one motor-operated tandem cylinder gate hoist with a capacity of 364,000 pounds for the bottom gate and 270,000 pounds for the top gate, with stems and other accessories; and (item No. 2) two cylinder gates with outside diameters of 20 feet 2¼ inches and 19 feet 10 inches, together with guides and seats, for installation in the outlet works at Cle Elum Dam. Thirty-eight concerns submitted bids, and the American Locomotive Co., of Schenectady, N. Y., was low bidder on both items, with a combination bid of $14,714 f. o. b. factory. The gates and hoist will be installed by the Government. Contract has not yet been awarded.

Pipe Contract Awarded

The Babcock & Wilcox Co., of Denver and New York City, on July 9 was awarded the contract for furnishing, erecting, and painting plate-steel outlet pipes for the Hoover Dam power plant and appurtenant works. Award was made on schedule 1, item 1, at the low bid of $10,908,000. The main headers to be installed in four concrete-lined tunnels will vary in diameter from 30 feet to 25 feet, with 13-foot-diameter pipes branching off to the power plant. Plates will have a maximum thickness of 2 3/16 inches, and the approximate weight of plate steel will be 92,000,000 pounds. This material will be shipped to Boulder City from Chicago and the fabricated sections from Barberton, Ohio, both on Government bills of lading. The contractor will build a field fabricating plant at Bechtel, about 1 mile from the dam site, on the Boulder City-Hoover Dam construction railroad.

The contract involves about 5,600 feet, or 1.1 miles, of 30-foot pipe, 380 feet of 25-foot pipe, 4,600 feet of 13-foot pipe, together with valve conduits 8 feet 6 inches and 7 feet 2 inches in size, manifolds, stiffener rings, etc. Pipe sections will be transported by the Government from the fabricating plant to the landing platforms at the entrances to tunnel adits. From there the contractor will transport the pipe into final position in the tunnels. The weight of the heaviest pipe section will be about 150 tons. A cableway will be installed by the Government, with which pipe sections will be lowered from the canyon rim down into the canyon. Not less than the first 40 feet of header immediately below the intake towers must be in place within 580 days, and all headers and penstocks must be completed within 1,975 days. The second low bid was also submitted by Babcock & Wilcox under schedule 2, item 3. Bids ranged from $9,270,800 to $13,624,868. Amounts for comparison of bids were determined by adding to the bids the freight and evaluations for loss in head, maintenance cost, and additional cost of appurtenant works.

On July 5 a hearing was held before Assistant Secretary Dixon because of a protest filed by the A. O. Smith Corporation, of Milwaukee, Wis., against award of contract, claiming infringement of patents. The Assistant Secretary decided to ignore the protest and approved award of contract to the Babcock & Wilcox Co. This is one of the most important contracts to be let in connection with construction of the dam, power plant, and related works. The specifications provided that the contractor furnish a performance bond of $2,500,000; but to further protect the Government against any possible loss resulting from suit for patent infringement, the bond will be increased to $6,000,000.

Of the 23 farm units opened to entry on October 15, 1931, on the gravity division of the Minidoka project, 15 have been filed on.

Boulder Canyon Project Notes

Boulder City is now provided with regular bus schedules to both Las Vegas, Nev., and Kingman, Ariz. There are nine trips daily to Las Vegas, and the trip requires 35 minutes. A bus leaves Kingman on Sunday, Tuesday, Thursday, and Saturday for Boulder City, returning each day, the 1-way trip taking 4 hours and 40 minutes.

The Colorado River rose to a peak of 72,700 second-feet at the dam site on June 26, the second high water of the May-June flood period, as on May 26 there were 103,000 second-feet flowing through the canyon. The average flow during the month of June was 60,188 second-feet, but the contractor's operations were not hindered by the high stage of the river.

The Babcock & Wilcox Co. will probably employ from 300 to 500 men on its pipe contract. This force will be employed at the Bechtel fabricating plant and also on work in the tunnels. It will mean a sizable addition to the population of Boulder City. The Six Companies (Inc.) plans to increase its working force in October by putting on 300 miners to drive the upper penstock tunnels.

All building construction by the Government in Boulder City is now practically completed, with the exception of the school building and 34-room dormitory which are now under construction.

On June 30, a year and four days after electrical energy was first supplied to the project by the Nevada-California Power Co., 20,706,000 kilowatt-hours of electricity had been consumed in project activities. The cost to the Government for this power amounted to $332,559, an average of 1.6 cents per kilowatt-hour of energy. The requirements during the month of June were 2,692,000 kilowatt-hours, at a cost of $32,358.

In order that the two 60-cycle units to be installed in the Hoover power plant to supply power to the Nevada-California Power Co. may go into service as soon as water is available for their operation, it has been decided to rearrange the penstocks so that the downstream penstock on the Arizona side will connect to the upper outlet pipe instead of the lower pipe as originally intended. To preserve the symmetrical arrangement of penstocks, those originally planned to connect to the upper outlet pipe will now be connected to the lower pipe, and vice versa. This change in penstock arrangement will make it possible to supply 60-cycle power to the contractor for construction purposes as soon as the initial installation is ready for operation in 1936. Probably some plan will be worked out whereby the surplus power may be sold to the Nevada-California Power Co.

Excavation of the open cuts for the Nevada and Arizona spillways is in progress, and on July 1 these operations were, respectively, 85 and 55 per cent completed. On June 29 work was resumed in the inclined tunnel to the Nevada spillway. Blasting operations for the Nevada intake towers are in progress, and drilling at the site of the Arizona towers was started on June 22.

Sixty-one contracts, representing 115 tracts of land in the reservoir site, had been executed by the landowners and the Government on July 1. Payments amounting to $242,352.25 had been paid to 45 owners for 82 tracts. The Government acquired 3,657.5 acres of land as a result of these transactions.

Approximately 3,070 persons are now employed on the project, divided as follows: Bureau of Reclamation, 240; Six Companies (Inc.), 2,380; subsidiaries and subcontractors of Six Companies, 220; other Government contractors, 80; business enterprises of permittees in Boulder City, 150.

Officers of Boulder City Lodge, No. 37, F. & A. M., were installed on the evening of July 1 in their new hall recently completed. The lodge is unique in being one of very few to meet on the ground floor of a building. The hall is located on a high hill just east of Boulder City.

Commencing July 5, the Six Companies (Inc.) is issuing thermos flasks to all men taking lunches, with no charge except in case of loss or repair. This service is necessary on account of the hot summer weather and will allow the men to have cold drinks with their lunches.

During the month of June 6,942 visitors entered the reservation, arriving in 2,601 automobiles. Of these 510 were traveling the route between Kingman, Ariz., and Las Vegas, Nev., via the Black Canyon Ferry. These figures show an average of 230 sightseers at the dam daily.

A gaging station has been established on the Colorado River about 1½ miles below the dam site.

On July 2 concrete lining of the diversion tunnels had been poured as follows: Invert, 6,846 linear feet, 43 per cent; sidewalks, 2,600 linear feet, 22.6 per cent; arch, 628 linear feet, 4 per cent. The trash rack foundation, inlet portal, and transition in tunnels Nos. 2 and 3 have been completed.

The contract recently awarded to the Babcock & Wilcox Co. for furnishing and erecting steel outlet pipes in the penstock tunnels will involve the fabrication of approximately 4,500 feet of 30-foot diameter pipe, 1,800 feet of 25-foot pipe, 5,400 feet of 13-foot pipe, and 1,900 feet of 8½-foot pipe.

Yuma Indoor Baseball League

The Yuma Indoor Baseball League started its second season with 12 teams enrolled. The league is divided into two divisions, with a game between two teams of each division four nights each week on an outdoor diamond at the high school athletic field which has been lighted for night play. These games are well attended by the community. Seating arrangements will accommodate 1,000 persons. The teams are sponsored by the various business, fraternal, and religious organizations of the town and valley. These games provide good amusement at a nominal fee of 10 cents admission for men and 5 cents for women. Last year these league games became very popular locally, and thus far this season are living up to their former popularity. The funds derived from the games are used to improve the high school athletic field.

Owyhee Dam Completed, Highest in World

The Bureau of Reclamation again holds the honor of having constructed the highest dam in the world, the 405-foot Owyhee Dam on the Owyhee River, in eastern Oregon. For 14 years the 349-foot Arrowrock Dam, built by the bureau to store water for irrigation of Boise project lands in Idaho, was the highest. In 1929 the 358-foot Pardee and 372-foot Pacoima, both in California, were completed, and in 1931 the city of Seattle, Wash., finished the Diablo Dam on the Skagit River, which is 389 feet above foundation rock.

Switzerland also entered the picture in 1924 with its 362-foot Schrach Dam, and went still higher in 1931 with the Spittallam Dam, 374 feet in height. France now has three high dams under construction—the 377-foot Sarrans, 394-foot Chambon, and the 446-foot Sautet, the last named a thin arch containing only 78,000 cubic yards of concrete, which will overtop the Owyhee by 41 feet.

The Owyhee Dam is 405 feet in height from foundation to crest, 835 feet long measured along the crest, 30 feet thick at the top, and 255 feet thick at the base. The structure is of the massive concrete arch-gravity type and contains about 540,000 cubic yards of concrete. It forms a reservoir 52 miles long, with an area of 13,000 acres, and capacity of 1,120,000 acre-feet, of which 715,000 acre-feet is live storage. The cost of the structure is approximately $6,000,000.

An unusual feature of this dam is the presence of a shattered zone or fault crossing the site near the center of the 300-foot canyon. Material in this zone through the entire width of the base of the dam was excavated to a maximum depth of 175 feet below the river bed and refilled with concrete. While the main structure has a maximum height of 405 feet, from the lowest concrete in the foundation cut-off to the crest is 520 feet. The dam contains a freight and passenger elevator with a lift of 271 feet.

On July 17 the dam was formally dedicated with appropriate ceremonies, the guest of honor being Secretary Wilbur.

Addresses were delivered by the Secretary and Commissioner Mead.

Imperial Irrigation District Signs Contract

The Cory contract was signed by Imperial Irrigation district directors and Dr. H. T. Cory at the July 19 session of the board, marking another step in the plan to permit trial of the Egyptian type of agriculture in Imperial Valley.

Doctor Cory, the engineer instrumental in stemming the floods of the Colorado River in early valley history, by terms of the contract may embark on his project upon 3,300 acres of valley land. Upon condition that work is under way within a stated period on the original acreage, he was given option to 13,200 acres in addition.

The engineer became familiar with the Egyptian system of working irrigated land while in Egypt representing the United States Government, and later, while engaged in a different project, found the same system used successfully in Spain.

He selected what is termed "the worst" land in the valley, that in which there is a high salt content. He said he wished to use the bad lands in order that the success of the system and certain machinery might be demonstrated.

It is expected development will begin some time this fall.—*Imperial Valley press.*

Dedication of Echo Dam, Salt Lake Basin Project, Utah

Echo Dam, constructed by the Bureau of Reclamation on the Salt Lake Basin project, Utah, was dedicated on July 13, 1932. Among those present at the ceremonies were Hon. George H. Dern, Governor of Utah; W. R. Wallace, chairman of the Utah State Water Storage Commission; President Heber J. Grant, of the Church of Latter-day Saints; Carl R. Gray, president of the Union Pacific system; F. F. Smith, construction engineer for the Bureau of Reclamation at the dam; E. O. Larson, in charge of the Salt Lake Basin investigations; and E. B. Debler, hydraulic engineer, of the Denver office.

Inquiries by mail and in person continue to come in to the Sun River project from prospective settlers. The four farm units opened for settlement on June 20 are more than covered by applications from ex-service men. The new settlers are busy getting settled, getting in their crops and getting acquainted with their land and conditions. Practically all are hopeful of the future. The idea of a home and a place to stay and make a living seems to be paramount among practically all settlers, new and old.

Articles on Irrigation and Related Subjects

Andrews, Ralph L.:
- Lining the diversion tunnels is a spectacular job at Hoover Dam. Illus. Union Pacific Magazine, July, 1932, v. 11, pp. 3-4, 15.

Mead, Elwood:
- Place of Federal reclamation in a Federal land policy. Proceedings of National Conference on Land Utilization, Chicago, Ill., November 19-21, 1931, pp. 17-23; report of 251 pages issued May, 1932.
- Use of revenues of Federal power plants discussed. (Paper read at meeting Am. Soc. Agrl. Engrs., Columbus, Ohio, June 23, 1932.) U. S. Daily, June 24, 1932, v. 7, p. 2 (p. 772).

Schmitt, F. E., editor:
- Driving 56-foot tunnels for Hoover Dam. Illus. Eng. News-Record, June 16, 1932, v. 108, pp. 853-857. Editorial, p. 845.
- Columbia Basin project reported feasible. Map and drawings. Eng. News-Record, June 30, 1932, v. 108, pp. 907-911.

Weymouth, F. E.:
- A great job looms in the Colorado River aqueduct. Illus. Eng. News-Record, June 16, 1932, v. 108, pp. 847-850. Editorial, p. 845-846.

Yates, J. Perry:
- Low-level concrete plant for Hoover Dam. Illus. Western Construction News and Highways Builder, June 10, 1932, v. 7, No. 11, pp. 317-323.

Morris Bien 1859-1932

Morris Bien, former chief counsel and Assistant Director of the Bureau of Reclamation, died on July 28 at his home in Takoma Park, Md.

Mr. Bien came to the Bureau of Reclamation on July 10, 1902, by transfer from the General Land Office, where he had been in charge of questions relating to rights of way over the public domain and irrigation. He was retired from the Government service on July 10, 1924.

Mr. Bien studied law both in George Washington University and the National University Law School, and after his retirement practiced law in Washington for a number of years. He was a charter member of the National Geographic Society and the University Club, and was a member of the Cosmos Club, the Washington Society of Engineers, and the American Association of Engineers, of which he had served as president.

Cooperatives on the Klamath Project, Oregon—California

By B. E. Hayden, Superintendent Klamath Project

COOPERATION pays. Haphazard buying and selling is poor business. Better financial and social conditions prevail where cooperative organizations have been instituted. There are five active cooperatives on the Klamath project.

MALIN CHEESE & PRODUCE CO.

The first cooperative organization formed on the Klamath project for the control and marketing of farm products was the Malin Cheese & Produce Co., incorporated in June, 1921, with a capital stock of $6,000. One hundred and twenty-five shares of stock were issued with a par value of $50 each. Forty-five charter members subscribed for all of the stock and advanced funds with which to build and equip the plant. Operation of the plant was begun November 8, 1921, and 1,258 pounds of milk were received the first day.

During the first three years no dividends were declared, but a direct benefit was realized by stockholders in plant improvement and in increased prices received for milk.

In 1924 the company was reorganized with a capital stock of $12,000, $10,700 of which was sold. Although the par value remained at $50 a share, the price received ranged from $62.50 to $75 a share. For 1924–25 the company declared annual dividends of 10 per cent. During 1930 and 1931, owing to extremely low prices received for cheese, no dividends were declared. It is the policy of the company, while prices are abnormally low, to declare no dividends but to balance accounts at the end of each month and distribute all profits to dairymen in the price paid for milk.

The capacity of the plant is 25,000 pounds of milk, yielding 2,600 pounds of cheese daily. Milk is supplied at present by 145 farmers milking from 1,200 to 1,500 cows. Prior to the organization of the company, purchasers of cream on the project made a differential of 2 cents per pound in the price paid for butterfat according to location. The price is now the same at all points and is less subject to fluctuation than when no farmers' organizations existed.

LANGELL VALLEY DAIRYMEN'S ASSOCIATION

The Langell Valley Dairymen's association is a small cooperative, organized in 1929 for the convenience of dairymen living in Langell Valley, a more or less isolated section of the Klamath project. The association organized with a capital stock of $6,000, represented by 120 shares of stock of $50 par value each. About $4,000 of the stock was subscribed by farmers and the remainder is held in the treasury. There are about 20 farmer members, who milk an average of 250 cows. The company has paid no dividends, but follows the plan of paying all profits in increased price of butterfat.

KLAMATH POULTRY PRODUCERS' COOPERATIVE ASSOCIATION

The Klamath Poultry Producers' Cooperative Association was organized on March 31, 1928, as a nonprofit concern without capital stock. The object was the establishment of better markets and better prices for poultry products. Mr. L. Alva Lewis has been manager of the association since its inception, and now is its president as well as manager.

The association became active on March 25, 1929, when the first eggs were received and sold. Until December, 1931, eggs only were handled. Since that date a complete line of poultry feeds are sold by the association.

The volume of business done by the association is shown by the gross sales, which were as follows:

1929	$32,000
1930	48,324
1931	56,422

The average price per dozen received for eggs during those years was 33, 26, and 19 cents, respectively, which was about 2 cents higher than offered at the local market.

Although the association was organized without capital, its finances are now in good condition, with about $2,000 in the treasury.

KLAMATH HAY GROWERS' ASSOCIATION

The Klamath Hay Growers' Association is a nonstock, nonprofit organization, whose principal business is to locate markets and send out quotations to stimulate the sale of hay. The county agent's office is used as a sort of clearing house and looks after the business of the association. During 1931 about 2,000 tons of hay were sold through the organization.

KLAMATH POTATO GROWERS' ASSOCIATION

The Klamath Potato Growers' Association is another loosely organized cooperative that depends mainly on the county agent for direction. The object of the association is to secure the proper grading of potatoes, arrange for cooperative buying of certified seed and sacks, to set uniform prices to be paid for labor at picking time, and to secure the best transportation rates to market.

In the fall of 1931 the association took up the matter of shipping rates to California points as compared to rates from Idaho points to California markets. In February, 1932, the association had a conference in the county agent's office with representatives of the Southern Pacific, Great Northern and Western Pacific, and

(Continued on p. 152)

Recent Improvements at Orland, California

By R. C. E. Weber, Project Superintendent

DURING the summer of 1931 and in the early portion of the year 1932 improvements on many farms on the Orland project were noted. A corresponding movement also occurred in connection with development in the town of Orland during the same period. Much of this work represented the expenditure of considerable sums of money, while other improvements, especially many on project farms, although less pretentious, meant additional investment in the way of labor and material by the owners, and, what is most important, indicated confidence on the part of farmers, as evidenced by their additional farm investments at a time when economic agricultural stress was most severe. The illustration on the back cover of this issue shows some of the recent improvements the Orland farmers have made. It is especially noteworthy that this expansion took place during a period of depression.

Probably the largest expenditure of money for improvements on any individual farm on the project area is represented in connection with new developments on a 20-acre tract located in the Lemon Home Colony on the north side of the project. Here the owner last spring concrete-lined over 2,000 linear feet of farm laterals, built numerous concrete structures, and constructed 900 linear feet of concrete pipe lines economically to facilitate irrigation of the land. New plantings on this property during the spring consisted of 3 acres, making a total of 13 acres of oranges on this farm at the present time; ultimately the entire 20 acres will be set to this variety of citrus.

In the Plaza section considerable spring activity in developing new lands, and rehabilitation of older areas, not irrigated for several years, occurred. A 40-acre unit is being leveled and prepared for alfalfa; and 20 acres on another farm, comprising 37 acres, together with a 32-acre ranch, were releveled and reseeded to alfalfa.

ORANGE AND ALMOND PLANTINGS

On the north side of the project, activities seemed to have centered on new plantings to trees, particularly oranges.

Photograph by G. K. Griffith

Dairy barn on Orland project

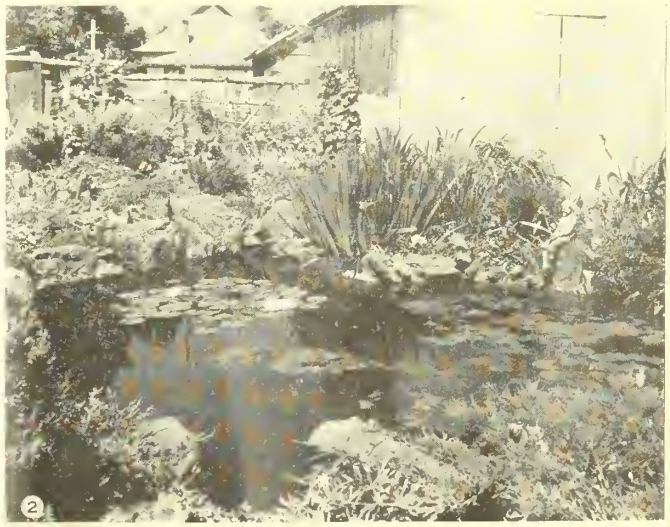
One farmer planted 6 acres of his 19-acre ranch (previously in alfalfa) to oranges, while 2 acres on the same place have been reseeded to alfalfa. In the spring of 1931 a professor of chemistry in the San Jose State Normal College acquired a 30-acre tract, located north of Stony Creek and fronting the State highway. During last summer about 10 acres of his holdings were set out in oranges, and this spring the remaining area was also planted, making the entire farm a solid planting of young orange trees. During the winter of 1931–32 a farmer, who has been on the project since its early operation by the Government, expanded the area of his holdings in almonds by an additional planting of 6 acres, making a total of 11 acres in this variety of trees on the 40-acre farm. The acreage now in almonds on this place had previously been devoted to the raising of alfalfa.

IMPROVEMENTS IN BUILDINGS

On 10 project farms, entirely new residences, or extensive alterations and additions to existing ones, have been constructed during the 12-month period. Five farmers have built new barns or have effected major improvements on older structures. The most extensive of this class of building is a large dairy barn, built in the fall of 1931 and representing an investment of about $3,000 on the part of the owner, who operates a milk-delivery route in connection with his herd of over 50 dairy cows.

In the town of Orland, five new residences, or extensive improvements to older homes, were built. During the summer of 1931 numerous rock gardens were constructed in connection with the lawns and yards of residences, both project and town.

Nor has new industrial development lagged behind that of farm and residence improvements. A new garage in Orland fronting the Pacific State Highway was built in the spring of 1932, marking the entry of another major oil company into the local field. One of the Orland lumber companies constructed a warehouse for cement storage and has about completed an extension thereto for providing additional storehouse space. A large packing plant for handling dried fruits was built early in 1932. This plant, located south of Orland with railroad side-track facilities, will be equipped in time for handling the current year's products, and its operation will afford considerable employment to local people.



Photograph by George A. Beyer

Rock gardens on farms of Ollis Grant (left) and J. H. Maxon (right)

The Desert Flora Near Boulder City

By Fern Wittwer and Ruth Oppedyk, of Las Vegas, Nev.

"MADE-TO-ORDER" Boulder City finds itself in a desert that is a gypsy sort of land, not at all like an irrigated housewifely domain. Natural attractions are near the red sandstone Valley of Fire, the ancient Pueblo Indians' Lost City, Gypsum Caves, the great Colorado River, and the Grand Canyon. Boulder City and its desert surroundings are further enhanced by unobtrusive yet exquisite flowers with their sturdy, shrubby neighbors.

Plants found in the Boulder City area do not embrace all species usually found in the desert group. Certain associations of desert plants grow in localities best suited to their needs. Although the better known cactus family is represented, it does not dominate in this area. Its illustrious member, saguaro, is not present. Aside from cacti, but in the same association, are joshuas. However, in the vicinity of the new Government city they are scarce. The fuzzy-leaved, scraggly, flaming flowered ocotillo is rarely found. The above succulent plants are not in evidence to the same extent as mesquite, creosotes, rabbitbrush, sagebrush, hollies, and the short-lived flowers.

A PERMANENT RESIDENT—THE CACTUS

Desert plants were in the Boulder City vicinity before the ancient Indians of the buried Lost City and have been perpetuated through natural selection and adaptation. The cactus' means of defense is known to all. Its spines protect it from hungry and thirsty animals. The tender leaves of the mesquites are guarded by their treacherous thorns. Even the Indians and pioneers were careful to avoid the spear-protected branches in gathering the beans from these bushy trees. The creosote bush has attractive, glossy, dark-green leaves, the appearance of which is most refreshing, yet this shrub is not molested by animals because of a sticky, resinous exudate with its unpleasant taste. The tender, juicy buttercups have a forbidding bitter, acrid flavor.

Native as the Indians are to the desert, they must yet make in their habitat some provisions which are artificial to nature's environment. Their means for procuring and storing water and food add to their difficulties, while the plants make and set aside their supply with ease. Obviously, because of their wide spacing and great source of energy from the sun, these plants have no difficulty in manufacturing their food. What they need more than light and food is moisture. There are several ways by which their rate of absorption or taking in water is increased and their rate of transpiration or "sweating-off" water is reduced. In shrubby perennial plants the leaf surface is thick, heavily covered, and relatively small. Mesquites, creosotes, desert willows, and desert holly have tough and hardened bark. The covering of succulent cacti is thick and spongy. The air spaces in this protective surface provide insulation to meet quick thermal changes and can thus conserve moisture. After a rain the wall of a barrel cactus can stretch like that of a toy balloon to accommodate its newly captured moisture. The hard stemmed plants have deeply penetrating root systems. A slight rain can cause great filling and stretching of the walls in succulents because they have an extensive system of roots very near the surface. These greedily capture every bit of surface moisture—surely they are economical in quenching the plant's constant thirst. As any living matter is largely made up of water, which is forever being lost, desert plants especially must obtain this water quickly and use it conservatively.

Typical source of supply for cactus gardens

THE DESERT IN THE SPRING

The small flowers, which appear in very early spring and add brilliant color accents to the vast dry areas, have their own means of survival. The many composites of the sunflower group have hairy-covered leaves and stems. These aid in moisture conservation, as well as making them less relished for food by the animals. The same is also true of the many phacelias, as well as the amsinckia with its curved stem of yellowish golden flowers. Gilias of the phlox family, evening primroses, and the desert poppies produce numerous seeds

Desert varieties transplanted around workmen's homes

which are hardy enough to withstand severe droughts until a season of the moisture required for growth occurs. Peculiar bottlestoppers are sometimes chewed for their juiciness by thirsty travelers. They are assured of propagation because of the production of innumerable seeds and of the profuse varieties. Joint fir or Brigham tea is protected by its small spriggy branches and scaly leaves, which are not only tough in composition but also of drab gray and yellowish green, thereby making it inconspicuous in the desert background. All the small flowering plants are certain of seed maturity. This is true since the colorful flowers are short-lived and therefore do not attract the attention of plant enemies. The characteristic hairiness and dull greenness of color help them to blend into the obscurity which befriends them.

A stranger to the desert might remark about its apparently barren aspect. But let him try counting the many different kinds of plants in a given area. The great numbers growing in their associations will surprise the person who believes the desert to be sparsely vegetated.

COLOR RUNS RIOT IN THE DESERT

The attractive features of the many desert plants give pleasure as satisfying as that enjoyed from the cultivated ones. When a traveler stops his car to exclaim at the rainbow of blossoms, the desert has a message, an offering of beauty as compensation for its cruelties of droughts and hardships. Desert flowers are insistent on showing their color schemes, whether in the gaudy red and green of the Indian paintbrush or the blendings of predominant hues. The main combination is one of orange yellows, whites, and lavender blues. Often repeated, this complementary scheme is saved from becoming monotonous by the softening gray greens of leaves and the bewildering variety of flowers. Orange yellows are found in amsinckias, composites as small sunflowers and wild carrots, buttercups, and desert poppies; white in primroses, yuccas, Joshuas, and many small flowers; lavender blues in the gilias, phacelias, chylisimias, and hydrophyllaceaes; when in blossom the desert willow clumps are a mass of soft pinkish white. Tiny deep-red berries tend to accent the white leathery leaves of desert holly, whose shrubby relatives appear as reddish-purple mounds. Feathery green mesquites and cat's-claws show delicate yellow catkins. The shiny dark-green creosote shrubs are freckled with fuzzy golden flowers. Cacti bloom in greenish white, yellow to orange, and pink through to red.

Generally all desert plants present a symmetrical form. The larger ones, willows, mesquites, cat's-claws, and creosotes, appear as round clumps; likewise the greasewoods, hollies, and even the smaller bristly shrubs, the white Fescue grasses, and the short-lived flowers. This pleasing rounded type of symmetry is followed by yuccas and barrel cacti. It is relieved by the sometimes gawky branching of joshuas and prickly pears. The wide spacings among the larger plants gives them freedom to form into their perfect shapes naturally, while myriads of small varieties fill in the open ground space.

In early spring the desert of the Boulder City locality appears most beautiful. The flashing green of young plants in March gives the appearance of many more shrubs than previously. The April blossoming sets it all alive with colorful glow. Gray-brown stillness follows, which corresponds with the surroundings, and continues during hot summer and early winter.

MATERIAL FOR LANDSCAPING

The sturdiness and beauty in form and color of some specimen shrubs of desert holly, creosote bush, mesquites, and purple sage suggest that, if given due cultural attention and fair trial, in time they might rival their cacti associates as favorites for landscaping purposes in home gardens. Their decorative qualities would give a more softening outline. Their shade and colors should afford more coolness. Because they seem fond of growing among rocks, the delicately colored, short-lived, small flowering plants apparently have the qualities for adding variety and interest to the rock walls and gardens in any desert town.

There is little doubt that Uncle Sam's carefully planned Boulder City will flourish. Nor was mother nature recklessly gambling when she gave her dry plants, with their provisions for adaptations, a chance to thrive. Adaptations to facilitate living in Boulder City will be artificial. But the plants in the area show that the scorching heat and parching dryness of the desert can be conquered. They will withstand forever. Some will meet their doom only when flooded by the great artificial lake to be made by Hoover Dam.

Boulder City children in cactus garden

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, returned to the Washington office on July 25, after a western trip taking him as far as Washington and Oregon. Doctor Mead plans to make another trip to other sections of the West the latter part of August.

E. B. Debler, hydraulic engineer, made a recent inspection of the Upper Snake River investigations and later joined Dr. Elwood Mead, Commissioner of Reclamation, at the meeting of the American Society of Civil Engineers in Yellowstone National Park.

F. A. Nickell, assistant geologist in the Denver office, spent some time on the Yuma project in connection with studies of the desilting problem on the Colorado River, and from Yuma went to Idaho Falls, where he assisted F. F. Smith, assistant engineer, on the geological investigation of reservoir sites in the Snake River Basin region.

Prof. Kaizo Noma, of Tokyo Imperial University, who has spent several months in the Washington office studying reclamation law and problems of the public domain, left recently for Japan. On his way to the west coast he planned to visit the Denver office.

A. R. B. Edgecombe, assistant executive engineer, Indian Service of Engineers, irrigation secretariat, Lucknow, United Provinces, India, holder of Commonwealth fellowship, under which he is studying at the University of California, called at the Denver office and obtained information concerning the work of the bureau.

Prof. Masahiro Kato, agricultural expert of the Government General of Chosen, and T. Karakawa, secretary of the Japanese Association of the Sacramento Valley, recently visited and inspected the Orland project works.

R. F. Walter, chief engineer, visited the Belle Fourche project for inspection purposes and to gain information on the economic and agricultural conditions.

Porter J. Preston, engineer in charge of the Colorado River Basin investigations, has been on extended leave from his office in Denver as the result of a surgical operation which was performed on June 7.

Frederick W. Haversack, assistant engineer, has been transferred from the Kittitas division of the Yakima project to the Denver office.

John R. Lawrence, James R. Granger, and William Killmore, inspectors, have been transferred from the Kittitas division of the Yakima project to the Boulder Canyon project.

Tevfik Fikret, of Turkey, and Sudhendle K. Gaha, of India, graduate students at the University of Iowa, recently called at the Denver office and obtained information on the irrigation works of the bureau.

J. L. Lytel, former superintendent of the Strawberry Valley and Yakima projects, who for the past several years has been engaged in subway construction as chief engineer of the Dwight P. Robinson Co. in Buenos Aires, South America, was a recent visitor in the Washington office.

Mr. Pond, senior engineer of the War Department, spent two days on the Klamath project collecting data for use in connection with a study of the possibility of diverting Klamath River water to the Pitt River.

Klamath Cooperatives

(Continued from p. 148)

Santa Fe Railroads, which resulted in the agreement of the Interstate Commerce Commission to a reduction of $12.60 a car from Klamath Falls to San Francisco. The result of this reduction will profit Klamath potato growers from $50,000 to $75,000 annually, partly in freight charges and partly in better market conditions. Potatoes are shipped under United States grades and under State law and inspection. The association is making an effort to get the potato area on the California side of the line put under the same inspection and rules. This should be done to protect the excellent reputation that Klamath potatoes now have.

Mrs. Margaret L. Erixon, stenographer in the Washington office of the Bureau of Reclamation since January 16, 1925, and previously connected with other departmental branches for a number of years, was retired on account of disability on May 31, 1932.

George A. Beyer, chief photographer, has returned to Washington after an official visit to a number of projects.

T. H. Reavis and L. F. Woodside, investigators for the General Accounting Office, visited the Minidoka project and made an audit of the fiscal accounts.

Frank D. Allen, janitor on the Orland project, was retired at the close of June 30, in accordance with the provisions of section 204 of the economy bill.

Henry C. Holcomb, gate tender on the Carlsbad project, was retired from active service on June 30.

Sir William Willcocks 1852–1932

Sir William Willcocks, late director general of reservoir studies in Egypt and consulting engineer to the Turkish Government in Mesopotamia, died in Cairo, Egypt, on July 28, 1932. Sir William received his education in India and graduated from Rorkee College, Rorkee, India. He was connected with Indian and Egyptian public works and was widely known as the projector and designer of the noted Egyptian Assuan Dam. In 1914 he made a tour of inspection of Federal reclamation projects in the United States and delivered several addresses, including one before the Engineers' Society of Western Pennsylvania, on How the Ancients Would Have Controlled the Mississippi River.

Among his many writings perhaps the most popular was From the Garden of Eden to the Crossing of the Jordan. Others included The Assuan Dam and the Gebel Aulia Reservoir; The Wady Rayon Reservoir and the Drainage of Egypt; and Sudd Region of the White Nile and the Harnessing of Its Waters.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng., J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydranlic Eng.; L. N. McClellan, Chief Electrieal Eng., C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief elerk	Fiscal agent	District council	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young.	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	do	Do.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Snperintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cnnningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. Const. Eng	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	I. B. Hosig	Acting supt		Denver office	do	Do

[1] Reserved works, Boise project, snpervised by Owyhee office.
[2] Jaekson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Gnernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

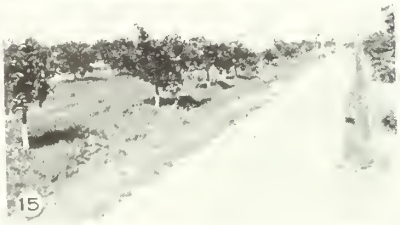
Completed projcets or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Projeet	Organization	Office	Operating offieial		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen.supt.and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junetion.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	G. J. Hagens	Irrigation manager	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Hnntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chiuook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields divisiou	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torriugton, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigaton district.	Baker, Oreg		Reser, Supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry, W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Offiee	In charge of—	Cooperative agency
All American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*



Photograph by George A. Beyer

NEW IMPROVEMENTS ON ORLAND PROJECT, CALIFORNIA (SEE ALSO PAGE 149)

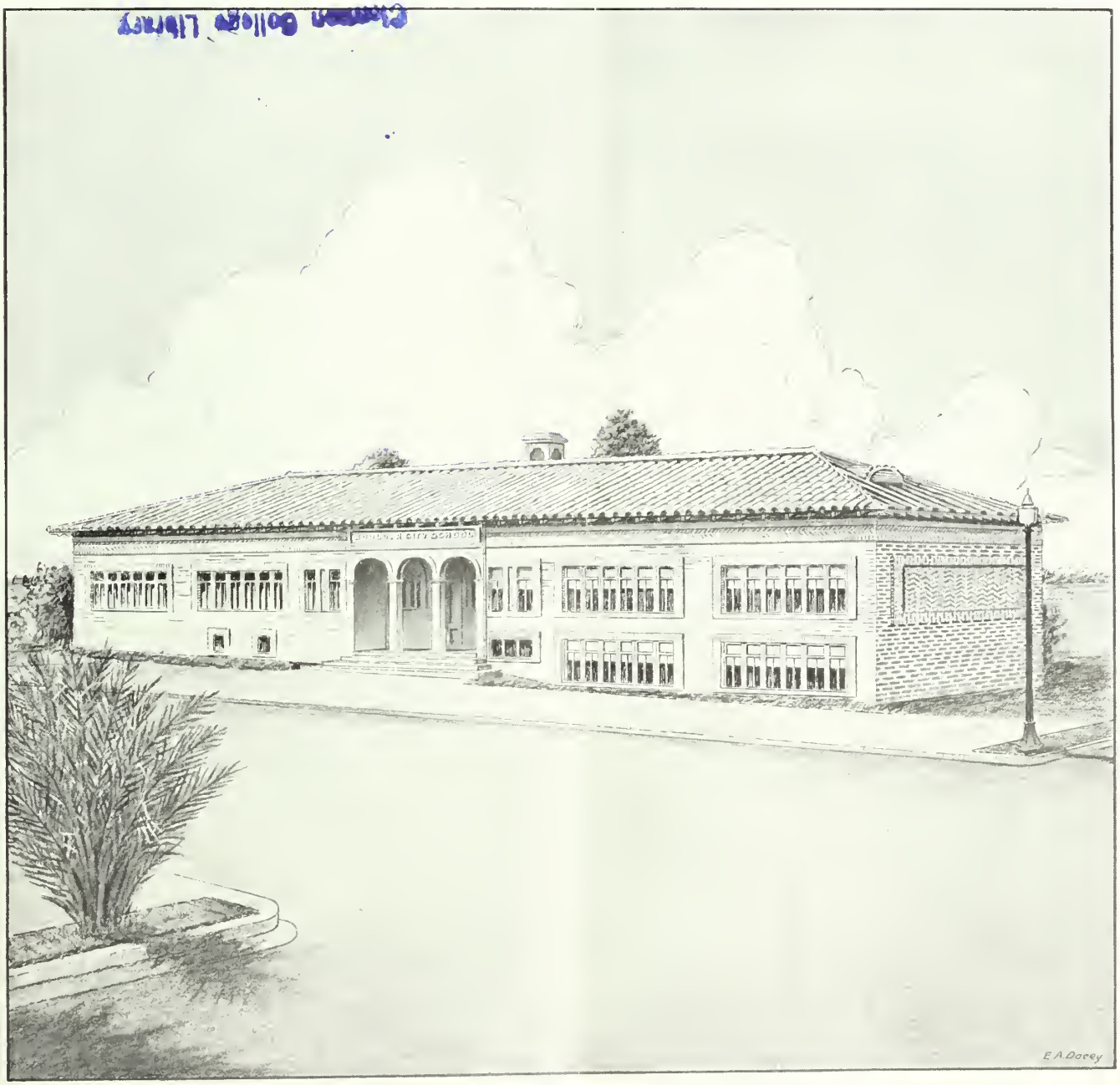
1, Olaf Groghan's new cottage and garden; 2, farm of M. Perez; 3, addition to warehouse, Macy Lumber Co.; 4, Anchorage Trading Co., new packing house; 5, addition to J. B. Hann's residence; 6, new residence of Henry Wolin; 7, addition to C. B. Martin's barn; 8, new residence on farm of J. D. Snodgrass; 9, new barn of Nels Foshaug; 10, Dr. S. Iglick's new residence; 11, new residence on Jennet Birch farm; 12, residence and yard improvement, W. A. Lane; 13, new residence of A. F. Kronsbein; 14, addition to dairy barn of G. Salvagno; 15, concrete-lined farm lateral on H. C. Symond's orange grove; 16, new service station; 17, new residence on Walter Baumaan farm; 18, new residence on Cockrell farm; 19, A. H. Green's new farm residence; 20, Signo Hendrickson's new farm home.

U. S. GOVERNMENT PRINTING OFFICE: 1932

UNIVERSITY OF CALIFORNIA

THE RECLAMATION ERA

VOL. 23, NO. 9 SEPTEMBER, 1932



BOULDER CITY SCHOOL AS IT WILL APPEAR UPON COMPLETION

EDUCATIONAL FACILITIES ON THE FEDERAL IRRIGATION PROJECTS

Among the first questions asked by an inquirer concerning opportunities for settlement on the Federal irrigation projects is "What facilities are there for the education of my children?" Few prospective settlers of the present day are willing to go where they will be compelled to deprive their children of the educational advantages to which they are entitled under our public school system. Fortunately no settlers are lost for this reason, as the availability of public school facilities is one of the first matters to which attention is given in a newly developed Federal irrigated area.

The schools serving the children on farms and in towns on the Federal irrigation projects number nearly 700, or about one school per thousand total population. As a rule, the schools are located in the project towns and the children from the surrounding farming area are picked up each morning by school busses, transported to school, and returned to their homes in the evening.

These school buildings are in general unusually attractive architecturally, and this is especially true of the high-school buildings, many of which will compare favorably with the most up-to-date city high schools, not only in construction but in apparatus and equipment.

During the past year special attention has been directed to the spectacular work now being carried on at the site of Hoover Dam on the Colorado River, where in a few years the huge 730-foot dam will link the States of Nevada and Arizona. The concentration at Boulder City of the families of the workmen on the dam, of Government employees, and of concessionaires created an educational problem for the 423 children of elementary school age and the 90 potential high-school pupils. The matter was presented to Congress, and authorization has been given and contract awarded for the erection of a school building in Boulder City which will be completed in time for occupancy this fall. Ten rooms will care for the needs of the pupils in the elementary grades and three for the pupils ready to enter high school.

Every effort is being made by the Bureau of Reclamation in cooperation with The Six Companies, the contractors for the construction of Hoover Dam, to provide suitable facilities and competent teachers for the education of the children of Boulder City.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 9 SEPTEMBER, 1932

Owyhee Dam Dedication Address

By F. A. Banks, Construction Engineer

THERE comes a time in the life of most communities when the door of opportunity seems to open and reveal a future bright with progress and with the hope for better things that go with it. Such a time is this, and it gives me great pleasure to participate with you in the commemoration of the event.

In some instances such an occasion arises unexpectedly owing to the sudden discovery of hidden wealth, and the brief space of prosperity is followed by inflation, exploitation, and possibly desolation; in others it is the result of man's successful attempts at the more gradual development of natural resources that brings with it more permanent results in the way of prosperous farming communities and cities throbbing with industry.

Gold has been discovered in seeking a rock to throw at a mule; oil, in a search for drinking water; but the location, financing, and development of an irrigation project is the result of vision and courage followed by years of effort and sometimes seeming failure before the vision is converted into a reality.

It has been many years since plans were first made for the construction of this project. There are probably many here who have been born and have reared their families since its inception; but all through these years there has been that unbroken thread of interest in the project that has served to bring it closer and closer to realization until now we find ourselves in the midst of its construction.

The Owyhee Dam, the dedication of which you have just witnessed, has been constructed for the United States Bureau of Reclamation by the General Construction Co., of Seattle, Wash. Its length is 1,000 feet measured along the roadway and 810 feet at the high-water line. The height of the roadway is 530 feet above the lowest foundation and 417 feet above the rock of the river bed. It forms a reservoir 52 miles long with a maximum depth of 310 feet and a total capacity of 1,123,000 acre-feet, of which 740,000 acre-feet is usable storage. Its "glory hole" spillway has a capacity of 30,000 second-feet at high-water level and 40,000 second-feet at the level of the roadway. The thickness of the dam is 30 feet at the roadway and 250 feet at the river bottom. Its cost when complete, exclusive of the railroad, reservoir right of way, etc., will be about $6,000,000.

SELECTION OF DAM SITE

Perhaps you would like to hear something of the procedure that was followed in the selection of this dam site and the construction of this dam.

This site was first selected as a diversion dam site by the Arnold Co. of Chicago in 1909, at which time it was proposed to carry the canal down on the west side of the river and provide storage at the Duncan Ferry site near Jordan Valley. During the preliminary investigation by the Bureau of Reclamation it was found to be more feasible to construct the Owyhee Dam as a combination diversion and storage dam.

In order to provide our designing engineer in Denver with the data for properly designing a structure of this kind, it was necessary to make surveys, diamond drill borings, and geologic examinations, the results of which would clearly define the shape of the canyon and the material of which it was composed, not only upon the surface but for distances up to 400 feet below the surface.

The building of a structure of this size involves the use of an enormous amount of concrete aggregates and the location of a suitable supply is an important factor in the cost of the work. A most excellent pit was located at Dunaway, Oreg., 5 miles south of Nyssa, and a construction railroad was built from this pit to the dam site, a distance of 24.3 miles, at a cost of about $650,000. This is the road over which many of you traveled this morning, and, like the dam, it was built by the General Construction Co.

With the design data at hand, the source of gravel determined upon, and the construction of the railroad well under way, plans and specifications were issued and the contractors were invited to submit their bids on the construction of the dam with all materials such as cement, steel, gates, etc., furnished by the United States. The General Construction Co., of Seattle, Wash., was the successful bidder and, on July 14, 1928, 4 years ago almost to a day, construction work was started. The completion date was fixed as March 3, 1933; but, as you can see, it will be completed far in advance of that date.

RIVER CHANNEL DIVERTED

When a dam is to be placed in the channel of a river that sometimes flows as much as 23,000 second-feet, it is quite evident that some substantial preparations must be made to take care of the river during the exposure of the foundation, especially in this instance where the borings indicated that the foundation for a substantial portion of the dam would have to be laid at a depth of 200 feet below the river. To effect this, a concrete-lined tunnel 22.6 feet in diameter and 1,000 feet long was driven through the opposite cliff and substantial cofferdams constructed across the canyon near each end of the tunnel. With the river diverted through the tunnel, all loose rock was scaled off the cliffs and the excavation for the foundation commenced. The major part of this excavation was done with large drag-line excavators, some of the material being disposed of in the cofferdams and the balance hauled away from the immediate site of the work. By

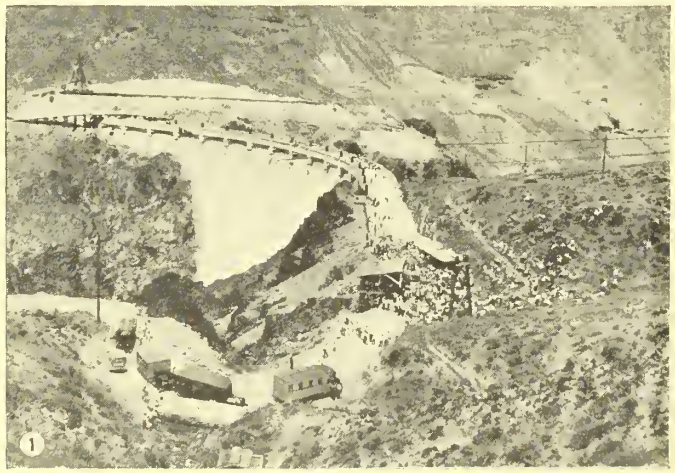
the time the foundation excavation was well under way the erection of the cableway was completed and it played an important part in the most hazardous undertaking of excavating a portion of the foundation, to a depth of 200 feet below the river. Some idea of the magnitude of this work may be appreciated from the fact that this excavation had to be made and refilled with concrete to a depth below the river of two-thirds of the height of the dam above the river. The fact that this was successfully accomplished is a tribute to the skill and resourcefulness of the contractor.

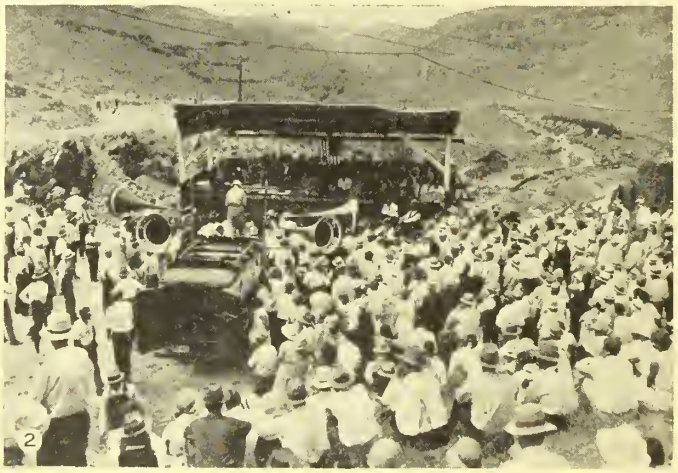
PLACING OF CONCRETE

The erection of a screening and washing plant and concrete plant to deliver 1,000 cubic yards of concrete per shift was so timed that the placing of concrete followed immediately upon the preparation of the foundation to receive it and proceeded as rapidly as was permitted under the specifications. The production reached a maximum of over 55,000 cubic yards in one month. Some idea of the magnitude of the job and its unseen features may be obtained from the fact that the dam was 50 per cent completed, on a cost basis, when the concrete reached the present level of the river. Gravel of excellent quality was obtained from the Government pit at Dunaway, hauled 25 miles to the screening plant, there washed and screened into sand, cobbles, and three sizes of gravel. Over a million dollars worth of cement was purchased from the lime plant of the Oregon Portland Cement Co. Regular tests were made by the Bureau of Standards and in our own laboratory and I might state that the cement was found to be both uniform and excellent in its quality. I might also add that the officials of the company were very successful in their efforts to render the best possible shipping service and that the railroad officials made it a special point to see that all shipments were promptly delivered. Incidentally, our freight bill amounted to something over $300,000. The concrete was mixed in two 4-cubic-yard mixers, dumped into cars, transported to the dam and conveyed into the dam in an 8-cubic-yard bucket by the Lidgerwood cableway. This cableway is the largest of its kind ever made. The main cable is 3 inches in diameter and has a span of 1,300 feet and a load capacity of 25 tons. The tail tower is fixed, while the head tower has a travel of about 500 feet, thus permitting the placing of concrete in all portions of the dam. This cableway is operated by remote control from the cabin suspended in the middle of the canyon.

"GLORY HOLE" SPILLWAY

One of the unique features of the dam is the "glory hole" spillway located just upstream from the dam on the opposite side of the river, with its aluminum painted ring gate. Similar spillways have been constructed before and the hydraulic properties of this structure have been tested by models built to scale. The ring gate, however, is something new, being an adaptation of the familiar type of drum gate. The operation is something like this: The ring gate is 60 feet in diameter and 15 feet high, with 12 feet of travel. It is located in a concrete float chamber. As the reservoir fills during flood, water enters through control gates





OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO

1, Crowd assembling at the dam for dedicatory ceremony; 2, Secretary of the Interior Wilbur delivers address; 3, view of downstream face of dam; 4, curved gallery to elevator

into the float chamber and the gate floats up with the top about 2 feet above water. When the maximum height of travel is reached the gate stops while the water keeps on rising and finally pours over the ring, falls through the "glory hole" and is discharged out of the spillway tunnel below the dam. As the water rises above the top of the gate and above normal high water, the gate automatically recedes a sufficient amount to permit the flood to pass without raising the water surface higher than normal; 30,000 second-feet may thus be passed. With an additional rise of 5 feet, bringing the water surface of the reservoir to the level of the roadway, the spillway will handle 40,000 second-feet. With the passing of the flood and the decrease in the flow the gate automatically rises to prevent loss in storage.

ELEVATOR AFFORDS EASY INSPECTION OF GALLERIES

After these ceremonies the 4,200 feet of galleries will be thrown open for inspection. Entering at the turret house, the first horizontal gallery leads to the elevator running to the bottom of the dam. This elevator is the first ever installed in a dam and will be operated express from top to bottom for your convenience up to the limit of its capacity. The next lower gallery contains two 5 by 6 gates controlling the power outlets that have been installed in connection with a future proposed power plant. The next gallery leads to platforms on the downstream face of the dam. The next contains the irrigation outlets consisting of three 4 by 4 slide gates in the gate chamber within the dam and three 48-inch differential needle valves. These are for the purpose of furnishing water to the Owyhee ditch. The next gallery, just a little above river level contains three 4 by 5 sluice gates with an equal number of emergency gates. From this gallery side galleries lead to platforms on the downstream face while a main gallery leads through the abutment to the exit, where a car will be waiting to take you back to camp.

In closing, I wish to express my appreciation of the cooperation of Mr. McEachern and his organization. Our association in this undertaking has been most pleasant and I shall look forward with pleasure to new work upon which we may be associated.

I feel at this time that this community owes a very deep debt of gratitude to such men as Mr. Van Petten, Mr. Lowell, Doctor Sarazin, Mr. Hunt, Mr. Goshert, Mr. Morgan, and the many others who have devoted so much of their time and effort in behalf of this project. It must be a source of great gratification to them to be here and witness the completion of this dam, the basic structure of this project. Let us look forward to the completion of the balance of the project, where there may be well-tilled farms, comfortable homes, and a happy, prosperous people. That, after all, is the true object of reclamation.

The Yuma project shipped 169 carloads of melons to market during a recent month.

The Yuma Indoor Baseball League games, which are played at night on a lighted field at the high-school grounds, have attracted record crowds this season. Several games with Imperial Valley and Southern California teams have been enjoyed by large crowds. The proceeds from these games, after all expenses are deducted, are used for the purchase of equipment for the high-school athletic field. The receipts at the close of July exceeded $1,000. The league games will continue until school opens in September. This is the second successful season enjoyed locally and has furnished cheap entertainment for the community, as well as providing a wholesome pastime for 200 young men and women players. Two girls' teams are enrolled in the league.

Mrs. Carrie B. Allen Retires from Active Service

After a service of a little over 15 years, most of which has been in the Washington office of the Bureau of Reclamation, Mrs. Carrie B. Allen, senior scientific illustrator, was retired on July 31 in accordance with the provisions of section 204 of the recently enacted economy bill.

During her service with the bureau Mrs. Allen has painted literally hundreds of enlarged photographs and transparencies and thousands of lantern slides. Rooms in the Washington, Denver, and project offices are enriched by Mrs. Allen's talent as an artist. Scores of her paintings adorn the walls of the Capitol and of the Senate and House Office Buildings, as well as the administrative offices of the colonization and development agencies of the transcontinental railroads, chambers of commerce, and various other organizations.

Although Mrs. Allen had never visited any of the Federal irrigation projects, it was a common occurrence for field representatives of the bureau and others from the irrigated areas to comment on the fidelity with which she reproduced the color effects of that section of the country. Her work invariably excited the admiration of all who knew the West.

Boulder City Boasts a Band

By B. D. Glaha, Engineering Draftsman, Boulder City

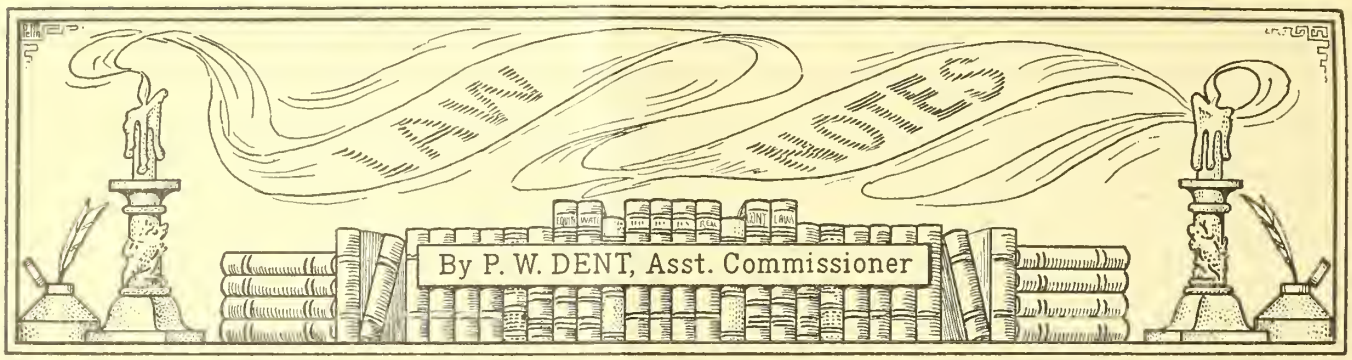
In the development of the social life of a community the cultural and recreational phases are of but little less importance than those aspects having to do with the physical well-being of the inhabitants. In line with this thought the officials in Boulder City lent every aid when the municipal band idea came into being shortly after the Bureau of Reclamation formally occupied the brand new city in March of this year.

A cursory survey of the field disclosed an unusual amount of musical talent among the employees of the Bureau of Reclamation and Six Companies (Inc.), the Hoover Dam contractors. By reason of a varied experience gained while at school and professionally, the work of whipping these possibilities into shape fell naturally to Otto J. Littler, an employee of the bureau in the office engineer's division. With the unstinted assistance of Larry Rousch, a Six Companies employee, and Homer Looze, of the bureau, Littler, as leader and director, was able to present the new band in its initial concert on Mothers' Day, May 8, at Boulder City. The band has been sponsored from the first by the local post of the American Legion, under whose colors it "stopped the parade" when the Legionnaires of Nevada recently convened in Las Vegas. The band has also played to enthusiastic listeners at the prize ring shows staged by the Legion in Boulder City.

At present the organization is made up of a well-balanced instrumentation of about 30 pieces while every new employee is sounded out as a possible recruit. Boulder City also boasts two peppy dance bands, and the organization of a little symphony orchestra is being considered.

On the Vale project 150 inquiries were received by the Vale-Owyhee Land Settlement Association and 14 interested persons called at the office. Several persons also called at the Reclamation office to inquire regarding public land farm units.

A 67-acre farm on the Lower Yellowstone project was sold recently for $1,700.



Recent Congressional Legislation of Interest to the Bureau

Division of Yellowstone Waters

[Public—No. 178—72d Congress]

AN ACT Granting the consent of Congress to the States of Montana and Wyoming to negotiate and enter into a compact or agreement for division of the waters of the Yellowstone River

That consent of Congress is hereby given to the States of Montana and Wyoming to negotiate and enter into a compact or agreement not later than January 1, 1936, providing for an equitable division and apportionment between the States of the water supply of the Yellowstone River and of the streams tributary thereto, upon condition that one suitable person, who shall be appointed by the President of the United States, shall participate in said negotiations as the representative of the United States and shall make report to Congress of the proceedings and of any compact or agreement entered into: *Provided*, That any such compact or agreement shall not be binding or obligatory upon either 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.

Approved, June 14, 1932.

Klamath Land Classification

[Public—No. 191—72d Congress]

AN ACT To amend section 14 of an act entitled "An act to adjust water-right charges, to grant certain other relief on the Federal irrigation projects, and for other purposes," approved May 25, 1926 (44 Stat. 636), as amended (46 Stat. 249)

That an act entitled "An act to adjust water-right charges, to grant certain other relief on the Federal irrigation projects, and for other purposes," approved May 25, 1926 (44 Stat. 636), as amended by the act of April 23, 1930 (46 Stat. 249), be, and the same is hereby, further amended by adding after the subparagraph (a) in section 14 the following new subparagraph:

"(a–1) The Secretary of the Interior is hereby authorized to reclassify all lands within the Klamath irrigation district and to place in the temporarily unproductive class such lands as he determines are properly subject to this classification."

Approved, June 23, 1932.

Columbia River Compact

[Public—No. 211—72d Congress]

AN ACT To extend the life of "An act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes"

That the time within which the States of Washington, Idaho, Oregon, and Montana may enter into a compact or agreement respecting the disposition and apportionment of the waters of the Columbia River and its tributaries as authorized by the act approved March 4, 1925 (43 Stat. L. 1268), and the amendatory acts of April 13, 1926 (44 Stat. L. 247), and March 3, 1927 (44 Stat. L. 1403), is hereby extended to January 1, 1935: *Provided*, That the State of Wyoming shall be made a party to such compact or agreement.

Approved, June 29, 1932.

Division of Snake River Waters[1]

[Public Resolution—No. 36—72d Congress]

JOINT RESOLUTION To permit a compact or agreement between the States of Idaho and Wyoming respecting the disposition and apportionment of the waters of the Snake River and its tributaries, and for other purposes

Whereas the Snake River and its tributaries are interstate streams flowing through the States of Idaho and Wyoming; and

Whereas the above-named States are vitally interested in the possible development of the Snake River and its tributaries for irrigation, power, domestic, and navigation uses; and

Whereas the plans for future reclamation development must take into consideration the needs of the States and the water-right problems of interstate streams, and an agreement must be reached by the States concerned regarding the economic apportionment of waters of said interstate streams; and

Whereas it is desirable that a compact for the economic apportionment of the waters of the Snake River and its tributaries for irrigation, power, domestic, and navigation purposes be entered into by and between the said States of Idaho and Wyoming, and that the interests of the United States be considered in the drawing of said compact, by authorized representatives of each of said States and of the United States: Now, therefore, be it

Resolved 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 Idaho and Wyoming to negotiate and enter into a compact or agreement not later than January 1, 1934, providing for an equitable division and apportionment between said States of the water supply of the Snake River and of the streams tributary thereto, upon conditions that a suitable person shall be appointed by the President of the United States, from the Department of the Interior, who shall participate in said negotiations as the representative of the United States and shall make report to Congress of the proceedings and of any compact or agreement entered into: *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: *And provided further*, That the rights of other nonparticipating interested States shall not be jeopardized by such compact.

SEC. 2. The right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, July 8, 1932.

[1] President Hoover has announced the appointment of R. F. Walter, chief engineer of the Bureau of Reclamation, as the representative of the Department of the Interior to participate with representatives of the States of Idaho and Wyoming in the conferences to take place under the provisions of this resolution.

Los Angeles Aqueduct

[Public—No. 188—72d Congress]

AN ACT Granting to the Metropolitan Water District of Southern California certain public and reserved lands of the United States in the counties of Los Angeles, Riverside, and San Bernardino, in the State of California

That, subject to the reservation, until their disposition is hereafter expressly directed by law, of all minerals except earth, stone, sand, gravel, and other materials of like character, there is hereby granted to the Metropolitan Water District of Southern California, a public corporation of the State of California, all lands belonging to the United States, situate in the counties of Los Angeles, Riverside, and San Bernardino, in the State of California, including trust or restricted Indian allotments in any Indian reservation or lands reserved for any purpose in connection with the Indian Service, which have not been conveyed to any allottee with full power of alienation, which may be necessary, as found by the Secretary of the Interior, for any or all of the following purposes: Rights of way; buildings and structures; construction and maintenance camps; dumping grounds; flowage; diverting or storage dams; pumping plants; power plants; canals, ditches, pipes, and pipe lines; flumes, tunnels, and conduits for conveying water for domestic, irrigation, power, and other useful purposes; poles, towers, and lines for the conveyance and distribution of electrical energy; poles and lines for telephone and telegraph purposes; roads, trails, bridges, tramways, railroads, and other means of locomotion, transmission, or communication; for obtaining stone, earth, gravel, and other materials of like character; or any other necessary purposes of said district, together with the right to take for its own use, free of cost, from any public lands, within such limits as the Secretary of the Interior may determine, stone, earth, gravel, sand, and other materials of like character necessary or useful in the construction, operation, and maintenance of aqueducts, reservoirs, dams, pumping plants, electric plants, and transmission, telephone, and telegraph lines, roads, trails, bridges, tramways, railroads, and other means of locomotion, transmission, and communication, or any other necessary purposes of said district. This grant shall be effective upon (1) the filing by said grantee at any time after the passage of this act, with the register of the United States local land office in the district where said lands are situated, of a map or maps showing the boundaries, locations, and extent of said lands and of said rights of way for the purposes hereinabove set forth; (2) the approval of such map or maps by the Secretary of the Interior, with such reservations or modifications as he may deem appropriate; (3) the payment of $1.25 per acre for all Government lands conveyed under this act other than for the right of way for the aqueduct, and (4) for all lands conveyed in Indian reservations or in Indian allotments which have not been conveyed to the allottee with full power of alienation, the district shall pay for the benefit of the Indians such just compensation as may be determined by the Secretary of the Interior: *Provided*, That said lands for rights of way shall be along such locations and of such width, not to exceed two hundred and fifty feet, as in the judgment of the Secretary of the Interior may be required for the purposes of this act: *And provided further*, That said lands for any of said purposes other than for rights of way for the aqueduct may be of such width or extent as may be determined by the Secretary of the Interior as necessary for such purposes.

SEC. 2. Whenever the lands or the rights of way are the same as are designated on any map heretofore filed by said district or by the city of Los Angeles in connection with any application for a right of way under any statute of the United States, which said application is still pending, or has been granted, and is unrevoked and has been transferred to and is now owned by said district, then upon the approval by the Secretary of the Interior of any such later map with such modifications and under such conditions as he may deem appropriate the rights hereby granted shall, as to such lands or rights of way, become effective as of the date of the filing of said earlier map or maps with the register of the United States local land office.

SEC. 3. If any of the lands to which the said district seeks to acquire title under sections 1 and 2 of this act are in a national forest, the said map or maps shall be subject to the approval of the Secretary of Agriculture so far as national-forest lands are affected; and upon such approval and the subsequent approval by the Secretary of the Interior, title to said lands shall vest in the grantee upon the date of such subsequent approval.

(Continued on p.159)

Hugh Arbuthnot Brown, 1877–1932

Dr. Hugh A. Brown, a native of Ann Arbor, Mich., and for nearly three years director of reclamation economics in the Bureau of Reclamation, died suddenly on August 13 at the Argyle Country Club near Washington, where he was rounding out the final tennis match of the season. Death was due to a cerebral hemorrhage.

Doctor Brown had been connected with the Department of the Interior since March 5, 1907, first as private secretary to Secretary of the Interior James R. Garfield. In the spring of 1909 he was temporarily employed by the Reclamation Service and a few months later was transferred to the Department of Commerce and assigned to the position of private secretary to Director of the Census E. Dana Durand. In 1912 Doctor Brown was retransferred to the Reclamation Service, where he was continuously employed until the date of his death.

With his first assignment as senior clerk in 1912 Doctor Brown has risen rapidly from one grade to another, until on December 7, 1929, he succeeded George C. Kreutzer, Director of Reclamation Economics, deceased, having previously served as Mr. Kreutzer's assistant for several years. For this position he was eminently fitted by virtue of his long experience in economic matters and his early academic and collegiate courses.

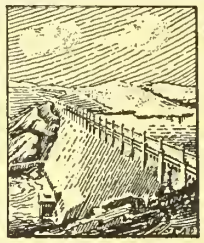
In March, 1930, Doctor Brown was detailed to the President's Committee on the Conservation and Administration of the Public Domain, which for more than a year he served in the capacity of executive secretary, with James R. Garfield, chairman.

Doctor Brown was a graduate of Princeton University in 1898 and later of George Washington University, where he received his degree of M. D. On August 28, 1909, he married Miss Beulah Luxon, of Washington, D. C., who survives him.

Dr. Brown's unusual ability as a writer, his pleasing personality, and his thorough familiarity with the work in which he was engaged, were the outstanding features of the valuable services which he rendered to the Bureau of Reclamation and the Department of the Interior.

ENGINEERING

GEORGE O. SANFORD, Chief, Engineering Division



Excavation of Diversion Tunnels for Hoover Dam

By W. R. Nelson, Assistant Engineer, Boulder Canyon project

FOUR diversion tunnels, each 56 feet in diameter, having an average length of 4,000 feet, and a combined capacity sufficiently large to carry the entire flood flow of the Colorado River, have recently been excavated as an integral part of the construction of Hoover Dam.

Two of these bores have been driven through the walls of Black Canyon around the dam site on the Arizona side of the river and the other two through the walls on the Nevada side. After lining with concrete to an inside diameter of 50 feet and making connections to other structures, these tunnels will be used for diversion of water around the site of the dam and power plant during the construction period, and upon their completion will form component parts of the spillway and power house features.

Preceding the driving of the tunnels and in conjunction with the usual preparatory work of building roads to the tunnel portals, installing compressor stations and moving construction equipment into position, the walls of the canyon were stripped of loose rock above all tunnel portals. For this latter work, men were lowered by ropes from the tops of the sheer cliffs and barred or blasted loose all rocks that might become dislodged and fall into the canyon below.

ADITS AND PILOT BORES

Underground work was commenced during May, 1931, in two 10 by 12 foot adits which were driven, one on each side of the river, into the abutments of the dam to intersect the diversion tunnels. When the adits penetrated to the intersections, at distances varying between the limits of 363 to 826 feet from the adit portals, pilot bores as top headings 12 by 12 feet in section were started in both upstream and downstream directions. After the diversion-tunnel portals had been excavated to their approximate position, 12 by 12 foot top headings were also started from these locations. During September, 1931, operations were in progress at 14 headings, in which month 3,300 linear feet of pilot tunnel were excavated, removing 20,000 cubic yards of rock. Altogether, 14,637 linear feet of 12 by 12 foot tunnels were driven, excavating 84,815 cubic yards of rock and using approximately 765,000 pounds of 40 percent powder, an average of about 9 pounds of powder for each cubic yard of excavation. Tunnel procedure and equipment were similar to those in modern usage, 50-horsepower Conway mucking machines, 8-ton storage-battery locomotives, compressed-air drifter drills, and 2-cubic yard mine cars comprising the principal equipment.

Headings, consisting of the top 41 feet to the full 56-foot diameter, were started from diversion-tunnel portals during October, 1931, and by January, 1932, were progressing from the inlets and outlets of all tunnels. The procedure for these excavations differed radically from ordinary tunnel methods, the principal difference being in the size of equipment that was used efficiently in these large bores.

DRILLING JUMBO

After a vertical face was secured at the portals, the wings on both sides of the pilot tunnel were blasted outward to the 56-foot diameter section and to a depth along the tunnel of at least 25 feet. A "drilling jumbo," consisting primarily of a steel frame and two decks supporting five horizontal bars on which were mounted as many as 30 drifter drills, the whole carried on a 10-ton truck, was backed into position against the tunnel face at one side of the heading. After blocking the truck to retain its position, air and water lines were connected, drills inserted, and drilling commenced.

A total of 48 holes were drilled to depths as great as 20 feet and the jumbo was then moved to the opposite side of the tunnel, where the operations were repeated. Only two set-ups of the jumbo were required for drilling the face. Holes were spaced as shown on the accompanying diagram, with the two higher rows drilled upward toward the floor of the top headings and wing sections. Loading was done as the holes were drilled, in all cases allowing at least one drilled hole to remain between the loading and drilling operations. Dynamite of 40 per cent strength was used, requiring approximately 1,800 pounds for each round. After drilling and loading were completed, all men and machinery were moved to a safe distance and the round was fired electrically in 15 delays, the number by each hole on the accompanying diagram indicating the sequence of the firing. The face was advanced an average of 16 feet at each round, breaking approximately 1,000 cubic yards of rock, or an average of 1.8 pounds of powder per cubic yard. To maintain the top heading in advance of the main heading, the wing sections on both sides of the pilot tunnel were blasted simultaneously with the 56-foot face.

After the smoke and fumes had been cleared by blowers, of capacities between 34,000 to 120,000 cubic feet per minute, installed near the adit entrances to pilot tunnels, a 30-horse-power caterpillar tractor equipped with a bulldozer emerged from the pilot tunnel and pushed the broken rock from the top heading onto the bench below. After a "60 cat." bulldozer had cleaned up the bottom, an electrically operated 3½ cubic yard power shovel moved to the face, followed by a fleet of 7 to 10 cubic yard trucks to commence mucking operations. After all rock was removed, Government engineers outlined the tunnel periphery on the face of the heading and the drilling jumbo reentered to continue the cycle of operations.

Tunnels of the 41 by 56 feet section were excavated for a combined length of 6,848 feet during the month of January, 1932, removing 454,335 cubic yards of rock. A record was established for one day when, in three shifts on January 20, 256 linear feet were excavated, breaking 17,000 cubic yards.

After the 41 by 56 feet headings were holed through, the remaining 15 feet in the invert section of the tunnel was removed in a manner similar to that for the section above. For this operation, the top deck of the drilling jumbo was taken off and bars shaped to the invert were added on both sides of the drill car-

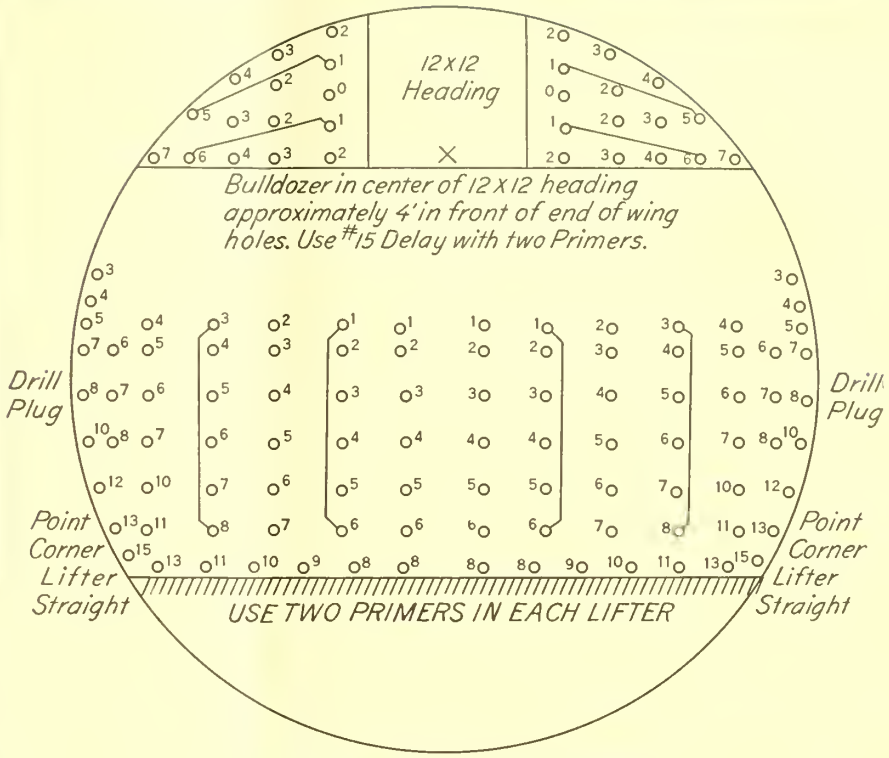
riage. The entire invert heading was drilled from one set-up of the jumbo, 25 holes being drilled to depths of 20 feet. Approximately 750 pounds of 40 per cent dynamite were used for each round, breaking 320 cubic yards of rock.

TRIMMING OPERATIONS

Reaming the tunnels to the specified cross section was accomplished from a "trimming jumbo" for the 41 by 56 inch section and by gantry crane, truck, skip, and power shovel in the invert. The trimming jumbo consisted essentially of two parallel steel trusses, each shaped to the periphery of approximately a 35-foot section of a 50-foot diameter circle, which were placed about 9 feet apart and connected by a steel framework. The structure was mounted on car wheels and propelled on parallel rails located for line and grade with respect to the tunnel by Government engineers. A triangular plate, having at its center of gravity a small ring or other contrivance for fastening a steel tape, was affixed to the jumbo by three cables, each equipped with turnbuckles and so arranged that the plate was held near the center line of the tunnel. When the jumbo was set up, Government engineers adjusted the plate so that the ring was accurately placed at the tunnel center line, and workers, operating from the timber platforms, took measurements with a steel tape from the ring to the tunnel roof and walls to determine which projections should be removed. These they barred down or blasted loose.

Trimming the invert was done immediately in advance of tunnel-lining operations. Skips were loaded by hand or power shovel and were transported to the dumping ground directly by truck or, where necessary, first by a gantry crane, installed for concreting operations, and thence by truck.

The ingenuity and skill that the principal contractor for building the Hoover Dam and power plant displayed in driving these tunnels are worthy of commendation. Starting the work on May 14, 1931, it was carried forward through a summer when the temperatures in the canyon reached 128° in the shade. During August, operations were halted for one week by labor troubles and in February for 10 days by an unexpected rise of the Colorado River. Despite all obstacles, the work progressed rapidly, and the last section of tunnel was holed through on May 23, 1932, a year and nine days from the starting date. In the 12-month period 1,500,000 cubic yards of rock were removed, all of which, by reason of the contract specifications, were required to be dumped out of reach of the Colorado River at all stages of its water height. This latter requisite necessitated removal of excavated material a distance as much as 1 mile from the tunnel portals.



DRILLING AND LOADING DIAGRAM for 41'X56' Section of Diversion Tunnels.

San Gabriel No. 1 (Rockfill) Dam to be Constructed

On August 1 the Los Angeles County flood-control district opened bids for constructing the San Gabriel No. 1 Dam, which will be the highest and largest rockfill dam in the world, 380 feet above foundation rock and containing 5,562,000 cubic yards of rock. Other items of work are 76,750 cubic yards of concrete, 1,921,000 cubic yards of excavation, and 2,167,000 square feet of either gunite facing or 6-inch concrete slabs. The low bid and only bid of $11,270,043.55 (gunite facing), $11,215,868.55 (poured facing) was submitted by Constructors (Inc.), comprising the following: Bechtel-Kaiser-Warren Co., Oakland, Calif.; Utah Construction Co., Ogden, Utah; J. F. Shea Co. (Inc.), Portland, Oreg.; Morrison-Knudson Co., Boise, Idaho; Bent Bros. (Inc.), Los Angeles, Calif.; Winston Bros. Co., Minneapolis, Minn.; L. E. Dixon Co., Los Angeles, Calif.; and Hall-Johnson Co., Alhambra, Calif. Some of these contractors are now working for the Bureau of Reclamation and building the Hoover and Cle Elum Dams.

Los Angeles Aqueduct

(Continued from p. 157)

SEC. 4. Said grants are to be made subject to the rights of all claimants or persons who shall have filed or made valid claims, locations, or entries on or to said lands, or any part thereof prior to the effective date of any conflicting grant hereunder, unless prior to such effective date proper relinquishments or quitclaims have been procured and caused to be filed in the proper land office.

SEC. 5. On the cessation of use of the land granted for the purposes of the grant the estate of the grantee or of its assigns shall terminate and revest in the United States.

Approved, June 18,1932.

The western wing of the Cord Transcontinental Handicap Air Derby left Los Angeles for Cleveland, Ohio, on August 21, stopping overnight at Yuma, and the next day for lunch at Phoenix, Ariz., meeting the eastern wing coming from New York City at a point in Oklahoma, from whence both wings made a race as a unit composed of 50 planes to Cleveland. The choice of Yuma as the first control point for the western wing will give that city and its airport desirable publicity and assist in making the local field a more popular one for air travelers.

Boulder Canyon Project Notes

Boulder City is an electric community with 93 per cent of the homes having electric refrigeration. The Government's administration and municipal building has a cooling system as well as the Six Companies' office building, dormitories, and guest house.

On July 10, Las Vegas and vicinity, including Boulder City, was visited by a terrific cloudburst, which caused considerable damage to the highway and also washed out the Six Companies' railroad trestle in the Las Vegas wash.

During the week ending July 16, the concrete-mixing plant made record runs of 1,060 cubic yards per shift, 2,650 cubic yards in 24 hours, and 17,116 cubic yards for the week.

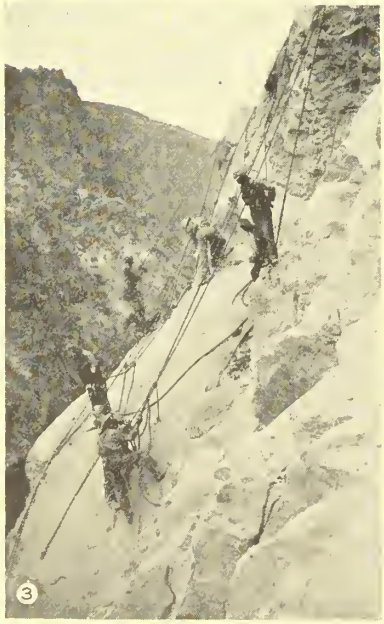
Babcock & Wilcox were notified on August 1 to proceed with their contract for furnishing and erecting the plate-steel outlet pipes. Temporary offices have been established in the Boulder City theater building, with H. L. Tucker, construction superintendent, in charge. A 100-man dormitory and 25 houses will be erected in Boulder City at once.

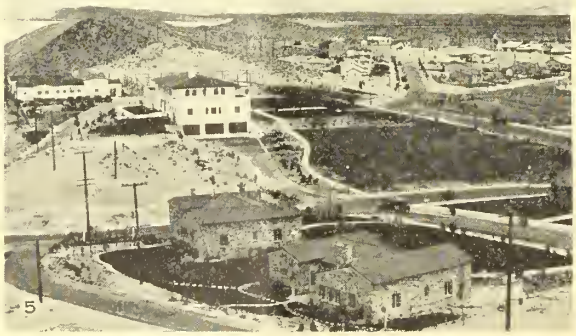
The average number of employees on the project is approximately 3,100, of whom 250 are Bureau of Reclamation employees. The monthly pay roll is about $420,000.

Progress in lining with 3 feet of concrete the four 56-foot diameter diversion tunnels, to August 17, was as follows: Invert, 73 per cent; side walls, 49 per cent; and arch 21 per cent.

The $6,000,000 performance bond furnished by the Babcock & Wilcox Co. in connection with its pipe contract was divided among the following companies: American Surety Co., $750,000; the Aetna Casualty & Surety Co., $750,000; United States Fidelity & Guaranty Co., $600,000; Fidelity & Deposit Co. of Maryland, $600,000; National Surety Co., $600,000; Hartford Accident & Indemnity Co., $500,000; Massachusetts Bonding & Insurance Co., $450,000; Maryland Casualty Co., $400,000; Fidelity & Casualty Co. of New York, $400,000; Globe Indemnity Co., $250,000; Royal Indemnity Co., $250,000; New Amsterdam Casualty Co., $250,000; Continental Casualty Co., $200,000. This is the largest bond ever written for a Bureau of Reclamation construction job.

A laboratory has been established in the Municipal Building, Boulder City, for the purpose of investigating the effects of high temperatures on the human organism. This work is being carried on by the Harvard University School of Medicine, under the direction of Dr. D. B. Dill. Diet, causes of heat prostration, alleviating measures, clothing, and working efficiency under high temperatures are among the subjects being studied.





Photograph by B. D. Glaha

BOULDER CANYON PROJECT

1, Moving picture theater; 2, major units of Boulder City water supply. View from west showing 2,000,000-gallon storage tank on hill, 100,000 gallon receiving tank with aerator at foot of hill and treating and filtration plant at right; 3, high scalers at work on Arizona intake towers, location some 550 feet above level of Colorado River; 4, school building under construction by Government; 5, administration building area, showing development of landscaping; 6, looking upstream into Black Canyon from Triangulation Point, Fortification Hill in background. Note tunnel lining forms near inlet portals of Nevada diversion tunnels

During the month of July, 150 tourists a day visited the dam site. Permits were issued for 1,500 automobiles and the total number of visitors was 4,538.

The Six Companies will employ a novel method of draining water from the dam site by a system of tunnels below the foundation of the dam. Shafts on each side of the canyon, connecting with tunnels across the canyon, will be used to pump water to the surface and outside the cofferdams. These tunnels and shafts will be filled with concrete when their usefulness is ended.

Walker R. Young, construction engineer, has announced the appointment of a health and sanitation board on the Boulder Canyon Federal Reservation, to consist of the following members: Sims Ely, city manager of Boulder City, chairman; D. M. Forester, sanitary engineer; and Dr. Wales Haas, in charge of Six Companies' Hospital.

At the end of July payments amounting to $318,973.90 had been paid to 58 owners for 107 tracts of land in the reservoir site. The Government acquired 4,682.36 acres of land, 490.99 shares of irrigation preferred stock, and 1,663.77 shares of common stock in these transactions.

The clerk of Clark County, Nev., has established an office in Boulder City to allow residents to register for the forthcoming election. The county assessor recently completed an assessment of all property belonging to individuals and business firms on the Federal reservation.

Benches are being excavated for runways of the movable cableways at the dam site, in which operation the top of Lookout Point on the rim of Black Canyon on the Nevada side was blasted into the canyon, on August 10.

Inquiries by mail and in person continue to be received on the Sun River project from prospective settlers. Two new farm units were definitely allotted recently. The new settlers are continuing to improve their places as opportunity affords, although irrigation and the crops have taken most of their time.

All irrigated crops are in excellent condition on the Klamath project and indications are that yields of all crops will be average or better.

Notes for Contractors

Boulder Canyon project.—The Carnegie Steel Co. of Pittsburgh, Pa., was low bidder among five steel firms submitting bids for furnishing 580,000 pounds of steel sheet piling in 40, 45, and 50 foot lengths, under advertisement No. 3495–A, opening July 26. There were five bidders, and the Carnegie bid was $16,114 f. o. b., Boulder City, Nev.

In the Denver office conferences have been held with all the principal turbine manufacturers in regard to preliminary specifications for the hydraulic turbines and governors for the Hoover power plant. Comments and suggestions were also received from the Southern California Edison Co., the Southern Sierras Power Co., the Metropolitan Water District, and the city of Los Angeles. Final plans and specifications are now being prepared prior to advertising for this equipment.

Current work in the Denver office comprises designs of cylinder gates, hoists, and throat castings for the intake towers; bulldozer type emergency gates for the spillway outlets; bulkhead gates for the intake towers; and a 150-ton cableway for handling outlet-pipe sections and power-plant machinery.

Owyhee project.—Preparation of final designs for the intake and control structure for tunnel No. 1, and the division structure at the outlet of tunnel No. 1 are under way in the Denver office. Designs of 4 feet 9 inches by 12 feet high-pressure gates for the intake and control structures have been commenced.

International Boundary Commission.—The Denver office has completed designs and estimates for the proposed Caballo Dam on the Rio Grande, below the Elephant Butte Dam. Alternate schemes provide for a dam to store from 100,000 to 350,000 acre-feet. L. M. Lawson is commissioner, with headquarters at El Paso, Tex.

Panama Canal.—Detail drawings for the 100 by 18 foot drum gates for the Madden Dam have been completed by the Denver office. Specifications are being prepared for needle valves, drum gates, and control and slide gate hangers.

Articles on Irrigation and Related Subjects

Cle Elum Dam:

Cle Elum Earth-fill Dam and Outlet Works. (Long illustrated article.) Western Construction News and Highways Builder, July 25, 1932, vol. 7, No. 14, pp. 410–419.

Martin, Leo J.:

A Gigantic Battle to Subdue a River. (Construction of Hoover Dam.) N. Y. Sunday Times, July 31, 1932, feature section, pp. 4–5.

Mead, Elwood:

Value of Electric Development in Federal Reclamation. U. S. Daily, July 21, 1932, v. 7, p. 8 (p. 954).

Schmitt, F. E., editor:

Hoover Dam Penstocks Set Record Size; Plans. Eng. News-Record, July 21, 1932, v. 109, pp. 79–80. Editorial, p. 86.

Model Tests Verify Design of Madden Dam Spillway. Illus. Eng. News-Record, July 14, 1932, v. 109, pp. 42–44.

Young, Walker R.

Hoover Dam: Purposes, Plans, and Progress of Construction. Illus. Scientific American, Sept., 1932, 88th year, pp. 134–138.

Excellent progress has been made in the construction of the new potash refinery near Loving, on the Carlsbad project.

Construction Results to June 30, 1932

With the completion of the Owyhee Dam in Oregon, the bureau has constructed 140 dams on its irrigation projets, which involved the placing of 23,202,000 cubic yards of concrete, earth, and rock. There have been built 13,682 miles of canals, which if placed end to end would extend over halfway around the world. Up to June 30, the bureau has excavated 142 tunnels with a total length of 243,050 feet, or 46 miles. Structures completed to date comprise 167,985 canal structures, 12,377 bridges, 16,119 culverts, and 5,590 flumes. Pipe amounting to 4,711,610 feet, or 900 miles in length, has been laid. Excavation, all classes, has reached the huge total of 311,466,000 cubic yards, which material would form an embankment 50 feet wide, 10 feet high extending from New York to San Francisco. In building dams and structures, there have been placed 5,116,000 cubic yards of concrete, which required 5,862,000 barrels of cement. Other construction results to the end of the last fiscal year were: Roads, 1,477 miles; railroad, 120 miles; telephone lines, 4,044 miles; transmission lines, 3,308 miles.

A new weekly newspaper, the Mountain Eagle, is being published at Las Cruces, New Mexico, Rio Grande project.

Farm Development by Mr. and Mrs. J. C. Krause, Shoshone Project, Powell, Wyoming

By I. B. Hosig, Acting Superintendent

The two pictures on the back cover page present vividly an achievement in home building such as the founders of the reclamation law prevised. The charm of the achievement is doubly enhanced when one knows that it is the doing of a single couple, Mr. and Mrs. John C. Krause, of Powell, Wyo., and it is complete when one knows this delightful couple and their family.

Mr. and Mrs. Krause, as bride and groom and with only a brown trunk and their ambitions, came to the Shoshone project in February, 1909, when it was but little more than an idea in the middle of 2,000 square miles of sagebrush and cactus, and selected 80 acres of that sagebrush and cactus as the beginning of their estate and castle. The labors and privations of the early days are dimly hinted at in the picture of the first shack. During the first years crops were scant, and prices for that little which was produced were poor. When work was available Mr. Krause helped out the family income by working with his team for the Government on building additional ditches and on operation and maintenance work. But farm development was the central theme.

The farm program he had learned in the irrigated area of northeastern Colorado was always in mind. Details may have been altered to fit the new circumstances, but the cardinal policies always remained the same. They were and are: Building up the farm with livestock and a household economy sustained as far as possible directly on the products of the farm. In the pursuit of these policies intelligent application and creditable completion of all undertakings were shown. The picture of the home to-day fairly bristles with this conception of work.

Success was inevitable. In 1915 the first shack was incorporated in a 6-room bungalow. In 1916–1918 80 acres of additional land were acquired. The price in the light of subsequent events may have been somewhat high, but the purchase was not repented nor the bargain's execution relented. In 1925 the finishing touches were put on the home, making it eight rooms. The shallow well of early days was replaced by a drilled well 116 feet deep. Electricity was brought to the farm. The water is now pumped into a pressure system by that power and the home is strictly modern.

The family now includes a group of four children who give not only promise but also fruit of the indefatigable family temperament. Viola, the oldest, is a sophomore at the University of Wyoming. In five years of 4-H club work she has represented the county at the State fair at Douglas twice and the State at the national meeting at Chicago once. This year she is a leader of a class of 14 girls. John, jr., 15 years old, has been at Douglas twice also, and, while weighing only 185 pounds and being only 6 feet 2 inches high, gets considerable farm work done. The other boy and girl are younger.

Mr. Krause's farm program consists of raising 30 to 50 acres of sugar beets and moderate acreages of beans and potatoes for cash crops. He milks 6 to 12 cows and has a farm band of 100 to 200 sheep. Lamb feeding cleans up the beet tops, beet pulp, hay and straw that the normal farm stock does not get, as well as forages of this nature that he can buy of neighbors. Mrs. Krause holds up her end of the farm management and the family live nearly 100 per cent off the farm and garden. Besides fruits and vegetables, meats are canned or carried over fresh for considerable periods in the electric refrigerator. Milk is given extra care and goes to town as sweet cream at prices double the ordinary run. The chickens must lay; the turkeys must grow. Not bad for the Iowa bride and the Colorado groom of 1909, is it? Read the picture again.

Huntley Project Observes Twenty-fifth Anniversary

Residents of the Huntley project and surrounding counties recently gathered at Osborn, Mont., to observe the twenty-fifth anniversary of their enterprise. The history of the project is typical of Federal reclamation developments in various parts of the West.

The Huntley project was one of the first opened for settlement under the provisions of the original reclamation act and the special act of April 27, 1904. On May 8, 1904, Arthur P. Davis, assistant chief reclamation engineer and later for many years head of the Reclamation Service, arrived in Billings to start a survey of the territory. Water was turned into the canals on June 26, 1907, and 25 years ago, July 22, the first unit of the project was thrown open for settlement.

Since the opening of the first unit many settlers have come and some have gone on in search of greener pastures. The period for payment of construction charges was extended in 1914 from 10 to 20 years from the date of entry, and in 1927 was further extended to 40 years.

There have been ups and downs, as in any new undertaking, but through it all those who have stayed by their guns have,

(Continued on p. 163)

Advantages of Farm Over City Life

Farmers are "better off" than they have been in a generation, Dr. C. H. Lane, Chief of Agricultural Education Service of the Federal Board for Vocational Education, stated orally July 22. "Farm boys are just discovering how fortunate they are as farm boys, despite the increase in taxes and the drop in farm prices to new low levels," Doctor Lane said. "The men who have stuck to the farm are in a better condition, financially and otherwise, than millions who have followed the lure of centers of population when employment was plentiful and wages were high." Continuing, Doctor Lane supplied the following additional information:

It is safe to say that boys who are members of the Future Farmers of America agricultural organization realize their advantages over city boys. They have at least a security of a living, while city boys face in many cases a dilemma. If the farmer uses his land and his wits in accordance with vocational agricultural training, he not only will have a job but also will subsist by that job.

Turning to hundreds of thousands of young men in the urban centers, many with college degrees, their future is precarious and filled with hazards in these uncertain times. At least the farm boy can provide for bread and is doing it. He has work and can enjoy that security of permanent employment so necessary for personal tranquillity, morale, and stability.

Work on the farm is hard, but the so-called drudgery of the farm has been changed so that in these times it is not as hard and as nerve wracking as industrial work in the cities. In the cities where industrial and occupational work of a varied character exists in contrast, hours are by comparison long, exactions more severe, and permanency of employment insecure.

The urban industrial employee is subjected to economic hazards, arbitrary dismissal, technical displacement, sudden reductions in salary without regard for his planned budget and standards of living already settled for a definite period, and disturbed morale owing to fear of impending financial calamities.

Farmers complain of their taxes. Yet the city man is likewise taxed. Farmert complain of scarcity of ready cash. Yes the city man reduced in income likewise has this complaint, because he buys to live on what a farmer raises to live on, and the city man in reduced circumstances must calculate from day to day and week to week on just how he can manage properly in handing over his wages for necessities which are available to him only by purchase.

Through the medium of the Future Farmers of America, farm boys are learning advantages about them inaccessible to the city boy. Aside from instilling in them practical farm training through vocational education, this organization has created in them a greater realization of the dignity and worth of honest toil.

Agriculture offers opportunities for the essentials of living and for deeper contentments of life which few other vocations afford. In a State like Maryland, where recently was held the first encampment of the members of the Future Farmers of America, represented by six local chapters, agriculture offers to competent farm youth an opportunity for attainment and satisfaction hardly to be found among the luckiest adventurers of the cities in the East.

For a long period in American history farm troubles have pressed upon statesmen for solution. In recent years more has been done to assist farmers financially and educationally than ever before. As a group they have been signaled out for special aid, special education, and special guidance. In taking advantage of their opportunities, farmers should emerge well provided for and contented.—*United States Daily.*

Irrigation Districts

Irrigation districts are regarded as quasi municipal corporations. The revenues of these districts are handled on very much the same plan as those of municipalities, through the collection of tolls, rents, charges, and by the taxation machinery provided by the laws under which organized. They are political subdivisions of the States. This machinery is sometimes special and entirely apart from the taxing machinery of other political subdivisions, while in some cases the taxing machinery of the county is utilized. The method is entirely dependent upon the special State laws applicable. The charges collected through the medium of the taxing machinery are usually referred to as special assessments measured in accordance with the benefits apportioned to each tract of land. In this respect special levies and assessments are different from taxation generally, the usual requirement of which is uniformity under some method provided by the Constitution.

Trade in Dried Olives on Orland Project

The dried olives which were shipped from Orland during June were processed by the Anchorage Trading Co., a local concern. Olives in this form are a relatively new product on the Orland project, the demand originating from the Greek and Italian trade in large centers of population in the East. A recent tariff of 4 cents per pound on the imported product made it financially feasible to dry process local olives.

About 125 tons of the 1931 crop were dried and marketed by the Anchorage Trading Co. These were shipped to the San Francisco Bay region and there reloaded for water transportation to New York. Local shipments were consigned mostly by motor truck.

The olives were dried by what is termed the Greek process and are designated by the trade name of Greek cured olives. The process is relatively simple, consisting of drying dead ripe olives in salt.

Disposal of olives in the dried form made it possible to more profitably market the smaller sizes, which normally are utilized for oil purposes. Prices received were somewhat more than those for oil olives, but less than the price paid for curing olives. In addition to the higher price for olives used for drying, considerable employment to local labor was afforded, the Anchorage Trading Co., estimating that six weeks' work for 85 or 90 people was necessary to handle the tonnage of last year's crop which the company dried.

The general manager of the Utah-Idaho Sugar Co. visited the Belle Fourche project and was well pleased with the condition of the crop in that section. Favorable weather for the balance of the season would mean a beet harvest of 100,000 tons tributary to the factory.

Price's Desert Gold Dairy expects to start construction of a milk plant in El Paso, Rio Grande project, early next year. The cost of the plant is estimated at $150,000.

Huntley Observes 25th Anniversary

(Continued from p. 162)

for the most part, established comfortable homes upon productive land and developed progressive communities in which to rear their families.

The project goes into its second quarter century with many rough spots ironed out and the experimental phases largely completed.—*Billings Gazette.*

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, spent the month of August in the Washington office. Doctor Mead has tentatively planned to make a trip west in October.

A recent itinerary of R. F. Walter, chief engineer, included the Belle Fourche project; Idaho Falls, in connection with the Upper Snake River investigations; the Big Lost River irrigation project, in company with the Commissioner; Spokane where he and Doctor Mead met and held a conference with the Secretary of the Interior; Ellensburg, Yakima project; and the Owyhee project, where he attended the dedicatory exercises at Owyhee dam; and Boulder City, Nev.

P. W. Dent, assistant commissioner and chief counsel, left Washington on August 21 for a short trip to the West. He spent a day or so in the Denver office of the bureau and then proceeded to Boulder City, Nev., joining the Senate Committee on Irrigation and Reclamation, which was making a tour of inspection of the Hoover Dam and the San Joaquin and Sacramento Valleys. Mr. Dent was with the committee on its trip over the Boulder Canyon project and also accompanied the committee to Portland, Oreg., where hearings were held pursuant to Senate resolution of the past session of Congress regarding transportation and hydroelectric development of the Columbia and Snake Rivers. At Portland, Mr. Dent also discussed with District Counsel Stoutemyer matters relating to the Yakima and other projects.

L. H. Mitchell, Assistant Director of Reclamation Economics, left Washington on August 20 to visit a number of the western projects and gather information regarding economic conditions. His itinerary will cover the Grand Valley, Uncompahgre, Strawberry Valley, Orland, Klamath, and Newlands projects. Mr. Mitchell is expected to return to Washington about September 20.

At the annual meeting of the Federal Irrigation Congress held in Boise, Idaho, on September 1, questions relating to the Federal reclamation projects and their needs were considered. The Bureau of Reclamation was represented by F. A. Banks, Construction Engineer at Ontario, Oreg.

J. L. Savage, chief designing engineer, made a recent general inspection of the Kittitas division and Cle Elum Dam, on the Yakima project, and the Boise and Owyhee projects, and later attended the board meeting at Boulder City.

F. A. Nickell, assistant geologist, has returned to Denver from Idaho Falls, where he has been making a geological investigation of reservoir and dam sites in the Upper Snake River Valley.

Elmer A. Jacob, associate engineer in the Denver office, has been granted a furlough without pay to permit him to take up the duties of city engineer for the City of Provo, Utah.

Reclamation

By Alice Lee Eddy, Kittitas, Wash.

Well, yes, I guess it is a bit forbidding—
You'd call it lonely, desolate, and drear—
But we have lit the fire upon our hearthstone,
Our family altars we have set up here.
Here we will build a home with toil and laughter,
Here we will build a home with tears and song;
What matter if it is a small beginning?
We're *building*, so the years will not seem long.
That row of stocks along there where you're standing?
The windbreak—graceful golden willow hedge.
This bare space that we're keeping wet and muddy?
The lawn, with rows of flowers around the edge.
That broken, tumbled slope of rocks and gravel?
That's going to be a pasture very soon.
The cows we haven't yet will surely like it
And stand knee-deep in the lush grass of June.
A small, crude house and thirsty, new-cleared sageland
Is all that you, the passerby, can see,
But we look with the eyes of dreams and striving
And see it as the home it's going to be.

E. B. Debler, hydraulic engineer, spent some days on the Upper Snake River investigations and attended the meeting of the American Society of Civil Engineers in Yellowstone Park. From this meeting, in company with the commissioner and the chief engineer, he inspected the irrigable area and dam sites being considered in connection with the Upper Snake River investigations. He then inspected the Big Lost River Valley and the Gooding division of the Minidoka project, after which he attended the dedication of Echo Dam, reviewed the Salt Lake Basin investigations, and, in company with the commissioner, went to Ordway, Colo., to inspect the Crowley County project.

Porter J. Preston, senior engineer, who has been absent from his official station on account of illness, has returned to Salt Lake City to resume work on the investigations under section 15 of the Boulder Canyon project act.

Julius Szilagi, chief engineer of the Hungarian Agricultural Ministry, made a recent visit to the Belle Fourche project for the purpose of gaining information on American irrigation details.

John S. Moore, superintendent of the Yakima project, attended the midsummer meeting of the Washington Natural Resources Association held in Yakima, and made a brief talk on water supplies and irrigation in the Yakima Valley.

H. F. McPhail, senior engineer, spent a recent month on a tour of inspection of several large hydro-electric power plants in the Northwest and gathering information in connection with the designs for Hoover Dam.

The following junior engineers have been transferred from the Denver office to the Boulder Canyon project: Harvey W. Hillyard, John E. Soehrens, William T. Moody, Gordon W. Manly, James D. Church, and Graydon C. Wright.

H. J. S. Devries, district counsel at El Paso, has returned to his post from the Carlsbad project which he visited in connection with the formation of the Carlsbad Irrigation District.

Yakima County, Wash., has awarded a contract to J. B. Covello, of Seattle, for the paving of an additional 2.1 miles of the Summitview road on the Tieton division. When this job is completed the paving will extend from Yakima to the top of the Weikel grade. This portion of the paving is to be 20 feet wide and will cost approximately $60,000.

A large number of inquiries have been received recently regarding settlement on the Riverton project, and seven prospective settlers have been shown over the project.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent, C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz.	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr.	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Owyhee, Oreg.	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash.	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash.	A. A. Whitmore	Act. Const. Eng	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo.	I. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Owyhee office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A.	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val., W. U. A.	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	G. J. Hageus	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont.	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont.	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont.	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gebauer.	President	Mabel J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev.	D. S. Stuver	Project manager.	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district	Baker, Oreg.		Reser. supt.	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg.	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg.	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River, W. U. A.	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo.	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Garland, Wyo.	Herman F. Krueger	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of	Cooperative agency
All American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg.	E. O. Larson	State of Utah.
Humboldt River, Nev.	Winnemucca, Nev.	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*

Original Homestead Shack
J. C. Krause, Shoshone Project, Wyo.

The Home Today

(SEE PAGE 162)

U. S. GOVERNMENT PRINTING OFFICE: 1932

THE RECLAMATION ERA

VOL. 23, NO. 10

OCTOBER, 1932

CLEMSON COLLEGE LIBRARY,
GOVERNMENT PUBLICATIONS

Photo by Ray-Bell Films, Inc.)

LOWER YELLOWSTONE PROJECT, MONTANA-NORTH DAKOTA

FARM BUILDINGS AND CATTLE OF C. A. MORRELL, 3 MILES NORTHEAST OF FAIRVIEW, MONT.

Western Reclamation Aids Eastern Development

THE people of the West are not looking to competition with the farm products of the East. The products of the 7,000,000 acres of the western land now under irrigation do not lower the price of the eastern farm crops. The things which California sends to the Atlantic seaboard are luxuries. She could not possibly ship her wheat over the long haul across the country and compete with the wheat that passes through the New York market. She sends instead oranges, lemons, fine raisins, fancy prunes, fruits, and so forth. The market which California finds for those products in New York State is a distinct gain to the New York farmer. These products of irrigation are purchased by the wealthier class, and the money goes back to California from whence it immediately comes back to New York again to be expended for the staple articles which California buys from the East—farming implements, cotton and woolen fabrics, and all the manufactured goods which are made in New York factories. Those factories furnish a market for the products of the New York farmer.

It is an incontrovertible fact that the prosperity of the West causes a reflex agricultural prosperity in the agriculture of the East. Suppose the 600,000,000 acres of arid land west of the one hundredth meridian and the industries which have arisen in connection therewith should be suddenly wiped from the face of the earth. What would be the result? Disaster would follow in many an eastern community because thousands of farms and factories depend upon the orders of their western customers. Those factories employ hands, and those hands, when employed, live well and spend well. They create a demand for great amounts of farm products. To bring the illustration still further, does anyone contend that the Atlantic States would be benefited if the whole country west of the Alleghenies were effaced from the map? The cases are parallel. One part of the country is the complement of the other, and the prosperity of one section will not retard but will help all the others.

Excerpts from The Public Papers of Francis Newlands.

CARNEGIE INSTITUTE LIBRARY

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 10 October, 1932

Income of the Federal Reclamation Bureau[1]

By Dr. Elwood Mead, United States Commissioner of Reclamation

THE prosperity of the arid region is interwoven with the growth and prosperity of irrigated agriculture. The stores and shops of the arid States must have a background of irrigated farms. They furnish a better food supply, cheaper living, and local markets. The irrigated farm does not add to the crop surplus of the country. Western cities are growing faster than irrigated agriculture. Irrigated farms do not send East as much as western cities import.

Notwithstanding these facts, the progress of irrigation is seriously menanced. Development by private enterprise has ceased. Irrigated agriculture can not afford to pay the heavy interest charges which go with private development. There is no longer a market for irrigation bonds. The costlier works of the present and future must be built by the government, either Federal or State.

IN ALL OTHER COUNTRIES RECLAMATION IS A GOVERNMENT UNDERTAKING

In reaching this conclusion, the United States has followed the path of other governments. In every country in the world irrigation development is to-day being carried on either by the government directly or by the aid of government subsidies. In this country its continuation is menaced by opposition based on the theory that there is enough agricultural development; that irrigated farms contribute to the surplus, and that the Government should cease giving any aid. The result is that every effort to secure appropriations has to surmount this obstacle.

THE NEED FOR FEDERAL AID

While this situation confronts us the fact remains that there never was a time when the activities of the Reclamation Bureau were as helpful as to-day, or the need for them as great. This grows out of conditions which are the result of limitations on early development by private enterprise. It was difficult to raise money, especially for projects that had a high acre cost. The strain was, therefore, to reduce first costs. To do that many canals were built too small, many were built with wooden structures which are now having to be replaced. On a majority the building of reservoirs could not be considered, because reservoirs are costly and the money could not be raised. Now, with a greater population, with more acres under irrigation, with an advancing civilization, the people under these older projects need more water. They need to have interest payments on their bonded indebtedness reduced. They need reconstruction of works so that the necessary water supply can be carried and danger of interruption of water delivery and loss of crops lessened. They need reservoirs to conserve the flood waters, because the natural, unregulated flow of streams will no longer suffice.

THE WEST NEEDS CONSTRUCTION PROGRAM

The West needs a program for securing these things. The Bureau of Reclamation knows what ought to be done, but it is prevented from doing it by lack of funds. Owing to the moratorium of 1931 and the partial moratorium of 1932, the annual income for 1932 has shrunk to $3,000,000. We need three times this sum to carry on at a satisfactory rate. If the Reclamation Bureau is to fulfill its function, if it is to be an efficient agent in western development, it must be provided with more money.

WHAT THE ARID STATES OUGHT TO DO

The question is, what can be done? The answer must come from the arid States. Hostile public opinion can be overcome by organized, earnest effort of the arid region. Mistaken apprehension of harm needs to be removed by argument, persuasion, and presentation of facts. Thus far the National Government has done everything, influenced of course in this by western representatives in Congress. It has furnished the money, recommended the appropriations, defended the results. The Western States have been the beneficiaries. The time has come when this will not answer. The opposition to irrigation is too widespread. The humid sections of the country must be convinced that reclamation is a business enterprise, and that the salvaging of imperiled communities does not involve the rest of the country in risk of having to pay the debt.

We can not do this if the agitation for moratoriums on Federal projects is continued. The situation of farmers everywhere is deplorable. Something needs to be done, but conditions on Federal projects are no worse than on farms elsewhere; on the contrary, they are better. The statements made in hearings before Congress last winter in the drive for a moratorium did great harm to Federal reclamation. Another such drive this winter, with the present attitude of Congress and eastern farmers, may arouse resentment and might spoil all hope of aid. It might change the attitude of the Reconstruction Finance Corporation, which now is friendly and sympathetic. It wants to help these struggling western projects but has grave doubts as to whether irrigation projects are self-liquidating; whether money loaned to them will be repaid.

The most unpleasant task of all reclamation officers is the collection of water payments. What those payments are to be should be determined by Congress, acting without political pressure, and having regard only to the economic needs

(Continued on p. 168)

[1] Submitted at meeting of Oregon Reclamation Congress, Bend, Oreg., Oct. 6 and 7, 1932.

140103—32

"Lookout Point" Removed to Make Way for a Cableway Structure

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

An eruption of rock and smoke billowing upward and outward; the subsequent rumbling roar and earth shock; a cloud of dust, smoke, and ashes 100 feet in thickness rolled ponderously down the Nevada wall of Black Canyon across the river and up the opposite side to fill the canyon to its brim with a murky vapor.

"Lookout Point," the eminence that provided an opportunity for many celebrities to view the operations below at Hoover Dam site, had been found an obstacle in the path of orderly progress and now lay in shattered fragments in the canyon below.

Six Companies (Inc.), principal contractor for building Hoover Dam, drilled 700 holes with compressed-air jack hammers to depths as great as 20 feet for displacement of the point. Each hole was loaded with nearly one-fourth box of dynamite and an electric blasting cap. Wires connecting all detonators led to a single circuit and an open switch located in the near-by channel of the Nevada spillway.

At 11.30 a. m., August 10, whistles shrilled their warning; an ominous expectant hush settled over the black cliffs and confined drifting stream. Ten minutes passed; then 8,000 pounds of powder flashed as one, 2,000 cubic yards of rock were torn from their fastenings and hurled into space, leaving behind a rough bench approximately 80 feet long and 50 feet wide.

Within an hour jack-hammer men returned to string their steel and rubber air lines, chose the drill hole locations and released their jumping clattering drills to make ready for further lowering of the bench.

Blasting operations will be stopped at an elevation 80 feet below the former position of "Lookout Point" where a shelf 50 feet wide and 1,280 feet long will be secured. Two heavy tracks will be laid on the shelf to support a 75-foot tower acting as a movable end structure of a steel-stranded cableway spanning the canyon to connect with a 45-foot tower on the Arizona wall.

By means of these structural steel towers, operating on the rails laid parallel to the canyon wall, the sheave trains traveling on the 3-inch steel cable spanning the canyon and the blocks suspended from the sheaves, a 20-ton load of concrete or other materials can be lifted from transportation vehicles and moved to any spot within the three-dimensional block beneath the plane bounded by track lengths on the benches and the elevation of the spanning cables.

Within the next two years, visitors to Hoover Dam site will see trainloads of concrete stop below the cableway. Blocks will swoop down to an 8-yard bucket of concrete, grasp it in its talon-like hooks, mount into the sky, travel outward and downward to finally deposit its load at the pouring site designated by an operator from his vantage point in the movable tower near the former position of "Lookout Point."

Income of Reclamation

(Continued from p. 167)

of western development. The influence of the lobby ought not to be felt in a matter which so vitally concerns the future progress of the western third of the country. But to make this effective there must be a live public opinion throughout the West which recognizes the present and future importance of this matter.

Believing that Federal reclamation has been one of the most beneficent activities in the West; that the value of its contribution to western development will be better understood half a century hence than now; that money advanced to it to salvage projects in distress will go farther and do more good than if furnished in any other way, I have struggled to maintain the reputation of the bureau as a business enterprise, in the interests of those living on existing projects, as well as those in sore need of Federal aid. I believe next winter is going to be a critical and decisive period in the history of Federal reclamation, and that the deliberations of this matter at Bend may exert a far-reaching influence. I deeply regret not being able to be present and share with you in the discussion of this vital question.

The sugar industry on the Belle Fourche project is giving employment on farms and in factories to hundreds of families and has effected much agricultural improvement.

Colorado River Basin Surveys

These investigations are being made under section 15 of the Boulder Canyon project act. The land classification maps of the Gila River Valley in Arizona have been completed in the Salt Lake City office. In Nevada a reconnaissance of irrigation possibilities around the shores of Boulder Canyon reservoir and by means of further utilization of the waters of Virgin River and Muddy Creek and its tributaries has also been completed. Below the Hoover Dam site and along the Colorado River, irrigable lands were found in four general localities, the Hutton Ranch, Tristate Mining Camp, Mohave Indian Reservation, and Vegas Wash, with a total gross area of about 16,000 acres. A report on these investigations is now being prepared.

Investigations in the southern part of Utah on tributaries of the Colorado River have been carried out in the vicinity of Kanab Creek, Virgin River and Santa Clara Creek, and near Kanab, Utah. An area of 210,000 acres, three-fourths lying in Arizona, was studied. Three reservoir sites, one on each of the streams, were surveyed. In the Green River basin in Wyoming, four topographic parties and three land classification parties have been working on areas located in the Bonneville tract; in the valleys of the New Fork, East Fork, Green River, La Barge, Fontanelle, and Big Sandy Creeks. Topography was obtained on 400,000 acres, reconnaissance land classification on 464,000 acres and detailed land classification on 288,000 acres. Headquarters have now been established at Green River, Wyo., and work is under way on areas further to the south. In the Denver office work is being planned for the winter of 1932–33 to include investigations in the San Juan River basin in Colorado, New Mexico, and Utah.

List of Engineering Articles No. 7 Now Available

The latest edition of List of Engineering Articles (No. 7), a 52-page pamphlet complete with index, has just been received from the printer. Individual copies will be furnished upon request addressed to the Commissioner, Bureau of Reclamation, Washington, D. C.

Weather conditions on the Milk River project have been excellent for the growth and maturity of crops. Cultivated crops, especially sugar beets, have made an excellent growth and an average yield equal to that of 1930 is in prospect, although from a much greater area. Very good yields were reported from the grain harvest, both from the project and adjacent dry lands.

Colorado River Resents Being Harnessed

By B. D. Glaha, Senior Engineering Draftsman and Photographer Boulder Canyon Project

THE taming of the Colorado!

A nicely turned phrase and one to stir the imagination. Since the inception of work on Hoover Dam in Black Canyon we have seen these words so many times in print that the idea of a mighty river passively submitting to taming without a struggle has been easily gained. But is one to suppose that the river that has gouged its way through Grand Canyon, battered its course through Marble Gorge, Boulder Canyon, Black Canyon, and many miles of equally tortuous passes along its length, is going to allow itself to be harnessed and civilized without resistance?

Periodically the Colorado River realizes its strength and shakes off the shackles of control. Old Man River rouses himself from his sluggish summer siesta, looks about and marvels at the impudence of the puny beings taking such audacious liberties with his personal freedom. Then he reaches into the headwaters of the Green and brings down a flood from the glaciers of the Wind River Mountains, gathers in a cloud-burst from off the Little Colorado, brings down a heavy summer storm from the San Juan, and sends the combined result downstream to prove to his tamers that he still has a trick or two to take.

He played just such a trick during the last week in August when 58,000 cubic feet per second bolted its way through Black Canyon, flooded the lower ends of the four 50-foot diversion tunnels, suspended all regular operations in the lower canyon and wrought havoc with protective dikes and barriers. Concrete cofferdams that had been constructed against the expected spring run-off had been removed, leaving the diversion tunnel portals barred only by earth and rock dikes. The normal channel of the river had been temporarily constricted by rock stripped from the intake tower locations. The water surface rose to an abnormal elevation for the quantity of water passing. Old Man River pried his fingers through the crevices of the barriers. First a trickle, then a gushing stream, and within a few minutes the lower reaches of the tunnels were being flooded. Roadways and dikes along the river's edge melted away like snow banks before a spring freshet. High-pressure pumps were hurriedly installed in the tunnels, and power shovels and muck trucks concentrated at key points in the canyon.

The flood was held at bay and its peak passed within 24 hours, but, as we watched its passing, the question presented itself, Now just what might happen if Old Man River decided some time to settle down in earnest to the business of being rampageous instead of contenting himself with a child's prank of a mere 58,000 second-feet flow?

Tamed, Old Man River most assuredly will be, but his captors will be obliged to watch his moods carefully and guard against the times when he displays his great strength, for if vigilance is relaxed the results of many months' labor may be nullified in a day's span.

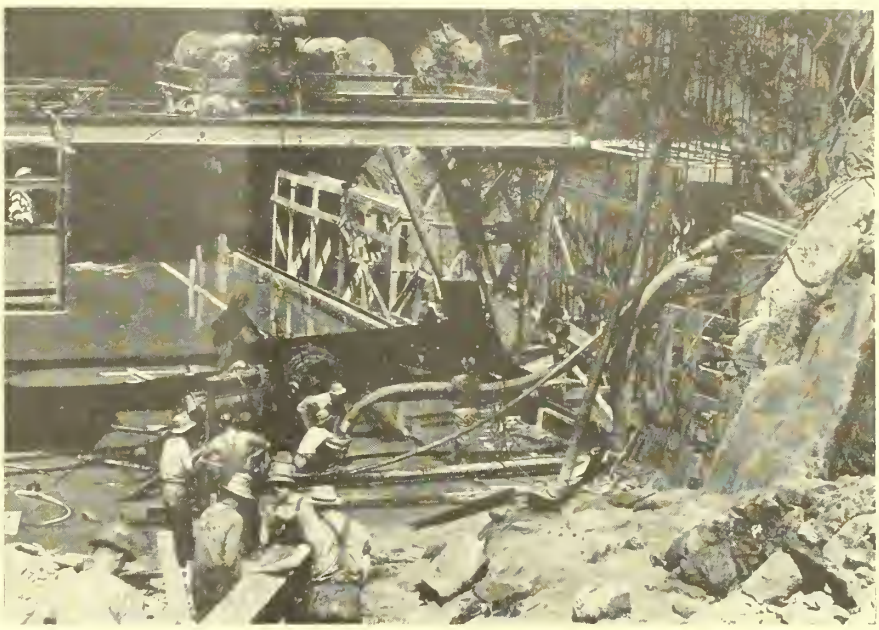


Photo by B. D. Glaha

BOULDER CANYON PROJECT

Installing 12-inch high pressure pumps in outlet portal of diversion tunnel No. 2 during flash flood of August 31. Note water breaking through earth and rock dike at right.

Colorado River Boards to Meet

Arrangements have been made for a visit to Boulder City and for joint meetings in Denver of the Hoover Dam Consulting Board, with the Concrete Research Board and the Colorado River Board during the latter part of October and the early part of November. The following dates have been fixed for these meetings:

Colorado River Board, Boulder City, November 10 to 13, inclusive; Denver, November 15.

Hoover Dam Consulting Board, Boulder City, Nev., October 16 and 17.

Hoover Dam Consulting Board and Concrete Research Board (joint meeting), Denver, October 19 to November 5, inclusive.

The purpose of these conferences is to review the progress of design and the research program, and especially to consider tentative specifications for the cement for Hoover dam.

The personnel of the three boards is as follows:

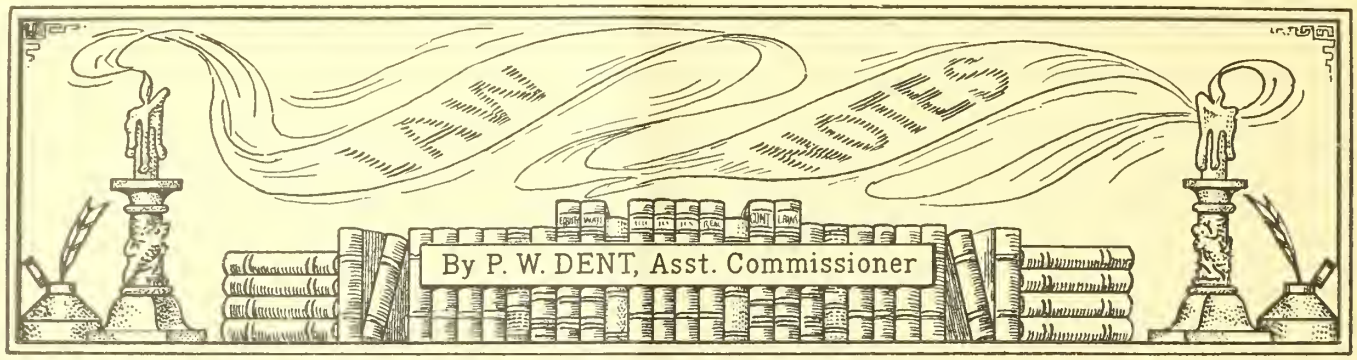
Hoover Dam Consulting Board.—D. C. Henny, W. F. Durand, L. C. Hill.

Concrete Research Board.—P. H. Bates, F. R. McMillan, R. E. Davis, W. K. Hatt, H. J. Gilkey.

Colorado River Board.—Maj. Gen. W. L. Sibert, Robert Ridgway, C. P. Berkey, D. W. Mead, W. J. Mead.

A tour of inspection over the irrigated farms of the valley from Chinook to Nashua, Milk River project, conducted by the extension agents and sugar company officials, was well attended, particular attention being given to the progress which has been made by the new settlers during the past two years.

The Minidoka project reports potatoes in excellent condition, with the prospect of a heavy yield and an unusual proportion of No. 1 grade.



The Economy Act

[*Public—No. 212—72d Congress*]

AN ACT Making appropriations for the legislative branch of the Government for the fiscal year ending June 30, 1933, and for other purposes.

* * * * * * *

PART II

TITLE I.—FURLOUGH OF FEDERAL EMPLOYEES

FURLOUGH PROVISIONS

SEC. 101. During the fiscal year ending June 30, 1933—

(a) The days of work of a per diem officer or employee receiving compensation at a rate which is equivalent to more than $1,000 per annum shall not exceed five in any one week, and the compensation for five days shall be ten-elevenths of that payable for a week's work of five and one-half days: *Provided*, That nothing herein contained shall be construed as modifying the method of fixing the daily rate of compensation of per diem officers or employees as now authorized by law: *Provided further*, That where the nature of the duties of a per diem officer or employee render it advisable, the provisions of subsection (b) may be applied in lieu of the provisions of this subsection.

(b) Each officer or employee receiving compensation on an annual basis at the rate of more than $1,000 per annum shall be furloughed without compensation for one calendar month, or for such periods as shall in the aggregate be equivalent to one calender month, for which latter purpose twenty-four working days (counting Saturday as one-half day) shall be considered as the equivalent of one calendar month: *Provided*, That where the nature of the duties of any such officer or employee render it advisable, the provisions of subsection (a) may be applied in lieu of the provisions of this subsection: *Provided further*, That no officer or employee shall, without his consent, be furloughed under this subsection for more than five days in any one calendar month: *Provided further*, That the rate of compensation of any employee furloughed under the provisions of this Act shall not be reduced by reason of the action of any wage board during the fiscal year 1933.

(c) If the application of the provisions of subsections (a) and (b) to any officer or employee would reduce his rate of compensation to less than $1,000 per annum, such provisions shall be applied to him only to the extent necessary to reduce his rate of compensation to $1,000 per annum.

SEC. 102. No officer or employee shall be exempted from the provisions of subsections (a) and (b) of section 101, except in those cases where the public service requires that the position be continuously filled and a suitable substitute can not be provided, and then only when authorized or approved in writing by the President of the United States. The Director of the Bureau of the Budget shall report to Congress on the first Monday in December in 1932 and 1933 the exemptions made under this section divided according to salary, grade, and class.

SEC. 103. All rights now conferred or authorized to be conferred by law upon any officer or employee to receive annual leave of absence with pay are hereby suspended during the fiscal year ending June 30, 1933.

DEFINITIONS

SEC. 104. When used in this title—

(a) The terms "officer" and "employee" mean any person rendering services in or under any branch or service of the United States Government or the government of the District of Columbia, but do not include (1) officers whose compensation may not, under the Constitution, be diminished during their continuance in office; (2) Senators, Representatives in Congress, Delegates, and resident commissioners; (3) officers and employees on the rolls of the Senate and House of Representatives; (4) carriers in the Rural Mail Delivery Service; (5) officers and members of the police department of the District of Columbia, of the fire department of the District of Columbia, of the United States park police in the District of Columbia, and of the White House police; (6) teachers in the public schools of the District of Columbia; (7) public officials and employees whose compensation is derived from assessments on banks and/or is not paid from the Federal Treasury; (8) the enlisted personnel of the Army, Navy, Coast Guard, and Marine Corps; (9) postmasters and postal employees of post offices of the first, second, and third classes whose salary or allowances are based on gross postal receipts, and postmasters of the fourth class; (10) any person in respect of any office, position, or employment the amount of compensation of which is expressly fixed by international agreement; and (11) any person in respect of any office, position, or employment the compensation of which is paid under the terms of any contract in effect on the date of the enactment of this Act, if such compensation may not lawfully be reduced.

(b) The term "compensation" means any salary, pay, wage allowance (except allowances for subsistence, quarters, heat, light, and travel), or other emolument paid for services rendered in any civilian or noncivilian office, position, or employment; * * * and does not include payments out of any retirements, disability, or relief fund made up wholly or in part of contributions of employees.

(c) In the case of any office, position, or employment, the compensation for which is calculated on a piecework, hourly, or per diem basis, the rate of compensation per annum shall be held to be the total amount which would be payable for the regular working hours and on the basis of three hundred and seven working days, or the number of working days on the basis of which such compensation is calculated, whichever is the greater.

COMPENSATION REDUCTIONS

SEC. 105. During the fiscal year ending June 30, 1933—

* * * * *

(d) In the case of the following persons the rate of compensation is reduced as follows: If more than $1,000 per annum but less than $10,000 per annum, 8⅓ per centum; if $10,000 per annum or more, but less than $12,000 per annum, 10 per centum; if $12,000 per annum or more, but less than $15,000 per annum, 12 per centum; if $15,000 per annum or more, but less than $20,000 per annum, 15 per centum; if $20,000 per annum or more, 20 per centum:

(1) Persons exempted, under section 102, from the provisions of subsections (a) and (b) of section 101; * * *

(6) Officers and employees (as defined in section 104 (a) occupying positions the nature of the duties and periods of work of which make it impracticable to apply the provisions of subsections (a) and (b) of section 101; * * *

(e) Subsections (c) and (d) of this section shall not operate (1) so as to reduce any rate of compensation to less than $1,000 per annum.

* * * * *

APPROPRIATIONS IMPOUNDED

SEC. 110. The appropriations or portions of appropriations unexpended by reason of the operation of this title shall not be used for any purpose, but shall be impounded and returned to the Treasury.

LIMITATION ON JURISDICTION OF COURTS

SEC. 111. No court of the United States shall have jurisdiction of any suit against the United States or (unless brought by the United States) against any officer, agency, or instrumentality of the United States arising out of the application of any provision of this title, unless such suit involves the Constitution of the United States.

* * * * *

Approved, June 30, 1932, 11.30 A. M.

A contract has been let to the Dennis Construction Co. of San Diego, Calif., for the realignment and paving of about 10 miles of United States highway No. 80 from the end of the present pavement at the western edge of the reservation division to the sand hills, approximately 17 miles west of Yuma in California. This stretch of highway at present is composed of oiled macadam and when paved will complete the all-paved highway from Yuma west to San Diego and Los Angeles. Work on this contract, which will probably start shortly, should provide employment for a number of men.

Federal Court Upholds California's Apportionment of Colorado River Waters

In Greeson *v.* Imperial Irrigation District, Circuit Court of Appeals, Ninth Circuit, decided June 6, 1932, 59 Fed. 2nd, 529, it was held by the court that the defendant district might lawfully enter into a contract with other districts and municipalities apportioning California's share, under the Colorado River compact, of the waters of the Colorado River. The suit for an injunction was brought by landowners of the district alleging that the defandant district's share of the water rights before the making of the contract, was larger than the share to be acquired by the district under the contract, and therefore that the contract was without consideration. The court found this contention without merit, holding that the contract was a reasonable compromise of a disputed matter.

A New Book on Irrigation

A new book on irrigation, entitled "Irrigation Principles and Practices," by Orson W. Israelsen, Ph. D., professor of irrigation and drainage, Utah State Agricultural College, has just been published by John Wiley & Sons (Inc.), in the Wiley Agricultural Engineering Series. It is a comprehensive work of 422 pages, divided into 24 chapters dealing with the source, conveyance, measurement, and pumping of irrigation water, irrigation methods, including farm implements and structures, properties of soils and relation, storage and movement of water in soil, alkali, transpiration and evaporation; the consumptive use of water and its relation to crops, and methods of irrigating various crops. Chapters are also included on the social and administrative aspects of irrigation and other problems with a chapter on irrigation in humid climates. Numerous illustrations, diagrams, and charts add to the completeness of the work. A list of references is given at the end of each chapter and the appendix contains a series of problems and questions which should prove of interest to the student of irrigation. An index adds to its value as a library reference book. The book may be purchased direct from the publishers at $5 net.

Harvesting and threshing of grain has been in progress on the Riverton project, with yields reported generally good. An excellent second cutting of alfalfa was put up.

Revised Book on Land Drainage

The increased demand for information on reclaiming land by drainage has caused the authors of Land Drainage, Messrs. W. L. Powers, Ph. D., soil scientist, Oregon Agricultural College and Experiment Station, Corvallis, Oreg., and T. A. H. Teeter, B. S., associate professor of engineering, University of Minnesota, to revise and enlarge their book which is included in the Wiley Agricultural Engineering Series published by John Wiley & Sons (Inc.). The book consists of 353 pages with numerous illustrations and is divided into four parts, discussing field drainage, district drainage, special drainage problems, and drainage surveying and practice. An appendix includes laboratory exercises on farm drainage, tables for use in Kutter's formula, and the figures for the latest United States census report on drainage for 1930. A series of questions and references at the end of each chapter add to its value as a text book, and for library reference purposes.

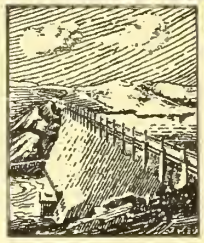
Sun River Settlers Carry Awards from State Fair

The North Montana Fair, which was recently held at Great Falls, was a decided success in spite of the extremely bad weather on the opening day. About 130,000 persons paid admission to the grounds. The exhibits of stock, poultry, grains, vegetables, and culinary art were all outstanding. The Sun River project made an excellent showing, with the Fairfield Bench community taking first place in artistic arrangement of its booth and in community attendance. A banner was also awarded for each of these features. Fifty-one individual prizes were carried off by the residents of this community.

The community booth which was sponsored by the East Greenfields bench and the Fairfield community clubs jointly, was awarded fifth place in number and quality of products exhibited. This feature carried with it a cash prize of $20.

As anticipated at the beginning of the current irrigation season, there has been an ample water supply for all of the projects of the Bureau of Reclamation, and with the approaching close of the season there is considerable holdover storage in prospect for next year. For reservoirs with concurrent data available the total storage content on August 31, 1932, was 3,980,000 acre feet, compared with 1,310,000 acre feet for the same date in 1931.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Surveying in Black Canyon

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

INSPECTION of a topographical map of Black Canyon where Hoover Dam is being built reveals many features that are quite unexpected and decidedly unusual in a map of this type. Tracing a contour along the canyon wall, it may merge abruptly with 10 or 20 others and then cross, with a dotted line, a dozen or two of its associates before returning to view as a line of single elevation along a less precipitous part of the canyon.

The sheer walls, overhanging cliffs, and deep water-worn caverns that produce this condition present obstacles to ordinary types of surveying that are not only difficult to surmount but hazardous in the extreme. In addition, a vast amount of time is required to procure exact topographical data on account of the inordinate number of transit shots or observations that are necessary, and by reason of the precipitous canyon walls and large expanse of surface that is covered by a relatively small horizontal area.

As an example of this situation, 4,000 transit shots were taken for a horizontal area of 330 feet by 660 feet on a section of the canyon wall, which is shown on the topographical map. The 660-foot measurement is parallel to the river, and the distance of 330 feet in a horizontal direction away from the river covered a difference in elevation of 600 feet.

Ordinary surveying methods, with triangulation forming the basis for horizontal control and elevations from United States Geological Survey bench marks for vertical control, were used in the early investigations and for all engineering data concerning Black Canyon preceding the year 1930. In conjunction with the examinations by the Bureau of Reclamation of Boulder and Black Canyons during 1920–1923 the topographical survey conducted by the United States Geological Survey of the Colorado River upstream from Boulder Canyon was continued downstream through Black Canyon and a triangulation system established at the latter canyon. At this time more detailed topography was taken at Black Canyon for locating the proposed dam in the most favorable site and for aiding in the design of the dam and its appurtenant works.

After Congress had passed the Boulder Canyon project act, thus assuring construction of the dam, and the Colorado River board had approved the site in Black Canyon, surveys in the canyon were renewed. Many new triangulation points were set; permanent bench marks were established; the town site for the construction camp at Boulder City was laid out; location and quantity surveys were made for United States construction railway, Boulder City-Hoover Dam Highway, transmission line from Nevada-California substation to the dam site, a telephone line from Boulder City to the dam site, and other construction features.

PHOTOTOPOGRAPHICAL SURVEYS

The area of 50 square miles over which construction activities would extend was much too large to be adequately covered by ordinary surveying methods within a limited period, and other measures and methods were required in order not to delay commencement of construction. Contracts were awarded for ground and aerial phototopographical surveys of areas adjacent to the dam site, and for making an aerial photographic controlled mosaic map of the entire area in the vicinity of the dam site, which would be covered by project activities. A contour interval of 5 feet was required and a horizontal scale of 400 feet to the inch for aerial surveys and 50 feet to the inch for ground phototopography.

Brock and Weymouth Co. of Philadelphia was awarded the contract for the aerial survey, and the Aerotopograph Corporation of America, Washington, D. C., for the ground phototopography. Both companies started work in July, 1930, and completed the field work in August. The aerial mosaic was completed and forwarded to the project office on November 29, the ground phototopography on December 2, and the aerial topographic map on January 22, 1931. The mosaic covered an area of more than 96 square miles, the aerial topography about 18.5 square miles, and the ground phototopography 7,400,000 square feet, projected on a vertical plane.

A Fairchild monoplane and Brock aerial plate magazine mapping camera were the principal equipment used for the aerial survey. All aerial photographs were required by specifications governing the contract to overlap at least 50 per cent in the direction of the line of flight and at least 20 per cent between parallel flights. Ground control was procured by marking points of known location, and generally of unknown elevation, with 12 by 12 feet white sheets or by painting 12 by 12 feet squares with whitewash on the ground surface. The contractor built a triangulation system by measuring a base line 7,138.57 feet in length and extending this by a system of triangles and quadrilaterals to include Bureau of Reclamation triangulation stations, significant points in connection with the aerial survey, and finally tying the network to the "Gyp-River Mountain" line of the triangulation system of the Metropolitan Water District of Southern California, which is in turn tied into the Texas-California arm of primary triangulation of the United State Coast and Geodetic Survey.

The underlying principles of both ground and aerial photographic surveys are essentially the same, differing chiefly in the position of the camera when pictures are taken. For aerial views the plate of the camera should be in a horizontal position and all pictures taken from a definite height above the ground, dependent upon the focal length of the camera and the required scale for the map. This height is maintained by the plane's barometer, which is checked for elevation on the flying field at the beginning and end of each flight. Photographs for ground surveys should preferably be taken with the plate of the camera in a position parallel to the ground surface, which may be nearly vertical when there are large differences in elevation in the landscape being surveyed.

MAKING THE MAPS

The topographical map from the aerial survey was prepared by stereoscopic

scrutiny and by means of equipment similar to the "aerocartograph" and coordinatograph, a description of which may be found in an article, Photographic Surveys of Hoover Dam Site in "Civil Engineering" for April, 1931.

Prints from 171 negatives, covering an area of more than 90 square miles, were assembled on a network of accurate control, established by triangulation, field traverse and graphic triangulation of the photographs, to form the completed mosaic. These prints had been rephotographed from the originals, after the originals had been adjusted in the reproducing machine to correct for tilt of the camera, different heights of the plane above the ground and other factors.

In Black Canyon where the steeply sloping walls, numerous caverns, and overhanging cliffs preclude the use of aerial photography, the survey was conducted by means of ground photography, using a photo-theodolite. Greater detail was also required in this section, where the dam was to be located, and, as stated previously in this article, the maps from this survey were required to be made on a scale of one inch equaling 50 feet.

The photo theodolite is built in the same fashion as a transit, practically the only difference being that a camera is mounted in place of the telescope. The plate holder of the camera can be removed and an eyepiece with cross hairs inserted in its place. The camera lens then becomes the objective lens of the transit, or the theodolite, and the optical axis becomes the line of colimation. The details of this survey are described in the article mentioned in a previous paragraph.

From the enlargement of the aerial mosaic to a wall map 8 by 20 feet in size, the relationship of various project features could be discerned at a glance. The topographic maps aided in locating structures and furnishing approximate estimates of the amount of yardage that would be removed in excavations for the dam, power plant, and other features in Black Canyon and adjacent areas.

Owing to the unemployment situation, the contract for construction of Hoover Dam was awarded in March, 1931—six months ahead of the time originally planned. Six Companies (Inc.), of San Francisco, to whom the contract was awarded, commenced work from many places and the requirements for surveying rapidly increased. Under the demands for locations of numerous features, rapid but accurate work was required to be accomplished under extreme stress.

SURVEYORS ENCOUNTER DIFFICULTIES

The work was severely fatiguing, as well as exceedingly hazardous. Ladders were built to reach some locations, but others were found inaccessible except by lowering men by ropes. To ascend or descend the canyon walls by ordinary means usually required long hikes over trails that were few and far between.

The winds of the springtime, causing discomfort and danger by carrying sharp sand particles and dislodging pebbles and rocks along the canyon walls, were succeeded by the severe high temperatures of the summer. During July the mean temperature in the shade was 107.4°. On two days the maximum temperature was 128°, and for two-thirds of the month the thermometer at some time during the day registered above 120°. In the sun, thermometers broke at 140°, rocks and metal burned the hands, and the canyon walls reflecting the sun's rays created an inferno in the canyon below. All accurate measurements required temperature corrections for chaining, surveying instruments had to be shaded, and heat waves made reading of record or point impossible for any except short distances. Surveying was started at 2 o'clock a. m. and stopped at 11 o'clock a. m. The men worked with practically no clothing, only shoes, trousers, and helmets.

Photo by B. D. Glaha

Surveyor in Black Canyon has hazardous task

Reflecting the loyalty of the men to their organization and indicating the careful manner in which the work was performed, it is of interest to note that none of the men quit work on account of its arduous character, none were discharged, and none were killed or seriously injured.

The contractor, starting at a few locations, soon extended these to a dozen as tunneling got under way, then to twice this number as the tunnels were widened to the full 56-foot diameter. With the starting of excavations for spillways, intake towers, trash-rack structures, connecting tunnels, and adits, the number was further increased until in March, 1932, the contractor was proceeding with 15 distinctly different operations in Black Canyon at 36 locations. Thirteen Government survey parties, totalling 48 men, and two parties of the Six Companies (Inc.), were required for location and quantity surveys. Some of their duties were to locate all structures and give line and grade for subsequent operations, cross section all sites for structures, measure quantities of material removed in their excavation, and to outline the tunnel section with white paint after each blast in driving diversion tunnels. Considerable ingenuity was exercised in obtaining some of these measurements, particularly for the completed 56-foot diameter tunnel section, the outlining for excavation for canyon wall structures and the measurement of excavation removed.

CANYON WALL SURVEYS

As the preceding surveys were not sufficiently accurate and complete for all purposes, a survey was instituted in December, 1931, of the walls of Black Canyon in the area of the dam site. The map prepared from the readings obtained is plotted on a scale of 20 feet to the inch and with 10-foot intervals between contours.

For this canyon wall survey two transits were located at points of known locations and elevations on a wall of the canyon and oriented by backsighting on each other. The rodman, termed in this instance a "rigger," descended from the opposite canyon rim in a vertical line to the river's edge, stopping at points required for accurately delineating the canyon wall surface. Horizontal and vertical angles were read at both transits for each designated point. Over most of the area surveyed, the rigger was lowered by ropes in order to reach otherwise inaccessible places. A 15-foot pole with flag attached at one end was used to reach the back of caves or below overhanging cliffs, but in many instances it was necessary for the rigger to swing himself inward as a pendulum in order to secure readings under high overhanging cliffs.

The survey crew for these operations consisted of 11 men. An assistant engineer acted as crew chief and was assisted by 2 transitmen, 2 recorders, 2 riggers, 2 ropemen for lowering the riggers, 1 man stationed in the canyon below to warn workmen of rocks that would be dislodged by the operations above, and 1 signalman who was stationed between the

(Continued on p. 177)

Boulder Canyon Project Notes

The Six Companies recently awarded contracts for five 20-ton cableways. These cableways will be used to raise excavated material from the canyon, place concrete in the dam, and handle equipment and materials. Two cableways with moving towers running on tracks benched on both the Nevada and Arizona sides, with spans of 2,580 feet each, will serve the spillway area. The dam site will be covered by two cableways of similar type, but with spans of 1,380 feet each. The fifth cableway will be of the radial type, with a 1,365-foot span, and will cover the lower portals of the spillway and penstock tunnels. The Six Companies will handle benching and track-laying. Six contracts have been awarded as follows: 3-inch locked coil wire track cable to the Columbia Steel Co., San Francisco, Calif. (to be manufactured by the American Steel and Wire Co.); triple-tandem-drum hoist mechanism on towers, including traveling carriages with six cable track wheels to the Lidgerwood Manufacturing Co., Elizabeth, N. J.; operating ropes seven-eighths inch to 1½ inches diameter to the Pacific Wire Rope Co., Los Angeles, Calif.; cable towers and fittings, including structural steel towers 60 to 100 feet in height to the Consolidated Steel Corporation, Los Angeles, Calif.; electrical and control equipment, including 125-horsepower travel motors for moving towers, and 500-horsepower hoist motors for operating winches to the Westinghouse Electric and Manufacturing Co., San Francisco; pneumatic equipment to the Ingersoll-Rand Co., San Francisco.

The Las Vegas board of education announces that students from Boulder City attending the Las Vegas high school will not be required to pay tuition. This stand was taken in view of the State's position that the Federal reservation was never properly created, and that the area is still a part of Nevada, and in the Las Vegas school district. The board's ruling is effective only until the tax suit, now pending in the courts, is settled.

During the week of August 28–September 3, the project was visited by Senators John Thomas of Idaho, Robert D. Carey and John B. Kendrick of Wyoming, Tasker L. Oddie of Nevada, Clarence C. Dill of Washington, Robert B. Howell of Nebraska, and Henry F. Ashurst of Arizona, members of the Senate committee on Irrigation and Reclamation. They were accompanied by Congressman Samuel S. Arentz of Nevada, Assistant Commissioner Porter W. Dent, and Chief Engineer R. F. Walter.

"Lookout Point" is no more. As described elsewhere in this number of the Era, this well-known observation point where thousands have viewed operations in the canyon below, has been blasted away to prepare for cableway operations.

On September 10, percentages of completion of concrete lining in the diversion tunnels were as follows: Invert, 81 per cent; sidewall, 65 per cent; and arch, 37 per cent.

The flash flood of the Colorado River with a peak of 58,000 cubic feet per second on September 1 seeped through embankments into all tunnel outlet portals causing work at these places to stop, the waters rising very rapidly in spite of pumping. Concreting operations were also shut down for all shifts of September 1 and 2 because of the high water.

The number of employees on the project reached a new high peak of 4,065 on August 31, divided as follows: Six Companies (Inc.), 3,345; Boulder City Co., 129; Anderson, 121; Bureau of Reclamation, 220; miscellaneous Government contracts, 50; business enterprises, 200.

During the month of August 7,637 visitors entered the reservation, arriving in 3,045 automobiles. Of this number, 515 were traveling the route between Kingman, Ariz., and Las Vegas, Nev., via the Black Canyon ferry.

A survey of police activities in Boulder City during the past year shows that no major crimes have been committed; there have been no serious injuries or deaths from assault and only one completed robbery or burglary. In 51 prohibition cases, 48 convictions were secured. During the year 1,056 undesirables were removed from the reservation.

To accommodate an increase in the number of workers which can not be taken care of in Boulder City, Six Companies (Inc.) has reopened the dormitories and mess hall at the river camp in Black Canyon.

John A. Fulton, director of the Mackay School of Mines, University of Nevada, has called attention to the importance of a paper read before the July meeting of the Los Angeles section of the American Institute of Mining and Electrical Engineers under the title: "Possibility of Electrochemical Industries at Hoover Dam." A quotation from the paper is as follows: "If the cheap power at Hoover Dam can be made available to the electrochemical and electrometallurgical industries near the dam, there would appear to be no doubt whatever that these industries will create great plants employing thousands of workers, and when well established the industries will continue to operate for generations to come. The power will always be available, and basic mineral substances exist in such quantities as to be practically inexhaustible."

During the last two weeks in August and early September, there was a large influx of workmen to the project. According to records of the Federal-State Employment Office in Las Vegas, new men registered at the rate of 150 per day.

A total of 1,746 residents of Boulder City registered for the primary elections on September 6, and two polling places were established by Clark County officials.

During the month of August, the maximum temperature at Boulder City was 109°, minimum 67° and mean 88.8°. Maximum temperatures were 100° or above on 18 days. There was no precipitation during the month, and the sky was clear for 26 days.

Indoor baseball games played at night on a lighted field at the Yuma Union high-school grounds, Yuma project, continue to be popular. An 11-star team, composed of players from the various teams in the league, have defeated several southern California teams as well as a picked team from Phoenix, Ariz. These all-star games when played locally are heavily attended and a large group of the fans go with the team for out-of-town games in Imperial Valley.

Irrigation is fundamentally a practice of supplementing that part of the natural precipitation which is available for crop production.—*Orson W. Israelsen, Ph. D.*

Notes for Contractors

Boulder Canyon project.—Bids were opened at Denver on September 26 for furnishing, installing, and painting at the Hoover Dam, one electrically-operated 2-speed cableway, capacity 150 tons, span approximately 1,200 feet. The cableway will be used for transporting 30-foot diameter steel pipe sections, power-plant machinery, gates and valves from a loading platform at elevation 1,262 down into the river canyon to platforms at elevations 799 and 670. The hoisting equipment will be operated and controlled by direct-current electrical apparatus with five control stations. The cableway must be ready for test and operation within 135 days from date of receipt by the contractor of notice to proceed.

On August 29 bids under invitation A-3020-A were opened at Denver, Colo., for furnishing 400,000 barrels of Portland cement. Invitations were sent to 57 prospective bidders and six bids were received. The lowest regular bid received was $1.24 per barrel, f. o. b. mills, which was the joint bid of four southern California companies, the Riverside, Monolith, Southwestern, and California. The Companies proposed to blend the cement at Oro Grande, Calif. All bids have been rejected and new bids were received on September 26.

The Riverside Cement Company of Los Angeles, Calif., has been awarded the contract under invitation for bids A-3031-C for furnishing 50,000 barrels of Portland cement in cloth sacks. The bid was $1.55 per barrel f. o. b. mill, Crestmore, Calif.

Specifications No. 540 are being printed and advertisements will be issued some time in October asking for bids to furnish turbines for 6 of the 17 units of the Hoover Dam power plant. The specifications call for four 115,000-horsepower turbines, and two 55,000-horsepower turbines, together with butterfly valves and governors for each installation. The larger turbines exceed in size any heretofore manufactured.

Madden Dam.—The Denver office is writing specifications covering the purchase of drum gates and drum-gate control apparatus, 84-inch needle valves and sluice gate hangers.

Owyhee project.—Specifications No. 538 have been issued calling for the furnishing of eight 4-foot 9-inch by 12-foot high-pressure hydraulically-operated sluice gates and operating mechanisms for the control works at the intake of tunnel No. 1. Bids will be opened at Denver on October 20.

The work of constructing these control works, which will include excavation, placing of concrete, and installation of gates, will soon be advertised, the specifications being numbered 539.

Articles on Irrigation and Related Subjects

Darwin, A. Gilbert:
- Aggregates supply for Hoover Dam, illus., Western Construction News and Highways Builder, August 25, 1932, v. 7, p. 467–473. (Editorial p. 466.)

Debler, E. B.:
- Duty of water in terms of canal capacity, illus., Civil Engineering, September, 1932, v. 2, No. 9, pp. 546–548.

Gallison, Norman S.:
- Construction equipment for Hoover Dam, illus., Civil Engineering, September, 1932, v. 2, No. 9, pp. 573–577.

Gardiner, W. H.:
- Construction methods on the Cle Elum Dam, illus., Civil Engineering, September, 1932, v. 2, pp. 568–572.

Houk, Ivan E.:
- Uplift pressure measured at Gibson Dam, illus., Eng. News-Record, August 18, 1932, v. 109, pp. 196–198. (Editorial, p. 204.)
- Uplift pressure in masonry dams, illus., Civil Engineering, September, 1932, v. 2, No. 9, pp. 578–580.

Ingersoll-Rand Company, 11 Broadway, New York:
- The story of Hoover Dam, illus., series of articles running in Compressed Air Magazine printed as separate volumes, in 1932, v. 1, 32 pp., v. 2, 40 pp.

Israelson, Orson W.:
- Irrigation principles and practices, illus., volume of 422 pages, issued by John Wiley & Sons (Inc.), New York, 1932.

Justin, Joel D.:
- Earth dam projects, 345 pp. 1932. John Wiley & Sons (Inc.). Contains data regarding: Belle Fourche, Avalon, Cold Springs, Conconully, Cle Elum, Deer Flat, Echo, Jackson Lake, Lahontan, Minidoka, McKay, and Sherbourne Lakes Dams.

Mead, Elwood:
- Reclamation aims said to be saving of existing farms. United States Daily, August 23, 1932, v. 7, No. 146, pp. 1 and 3 (1171 and 1173).
- Reservoir projects as contribution to national wealth. United States Daily, August 26, 1932, v. 7, No. 149, p. 8 (p. 1202).
- Irrigated areas declared in need of financial aid, United States Daily, August 31, 1932, v. 7, No. 153, pp. 1 and 2 (pp. 1227 and 1228).
- Developing industrial empire on utilization of water, United States Daily, September 6, 1932, v. 7, No. 157, p. 8 (p. 1266).
- Reclamation needed for West's prosperity. The Constructor, September, 1932, v. 14, No. 9, p. 20.

Nelson, W. R.:
- Concrete for Hoover Dam, Pt. 2, Mixing Plant. The Architect and Engineer, August, 1932, v. 110, No. 2, pp. 57–59.
- How aggregates will be obtained for Boulder Dam concrete (From May "Era"), Eng. and Cont'g, August, 1932, v. 71, No. 8, pp. 199–200.

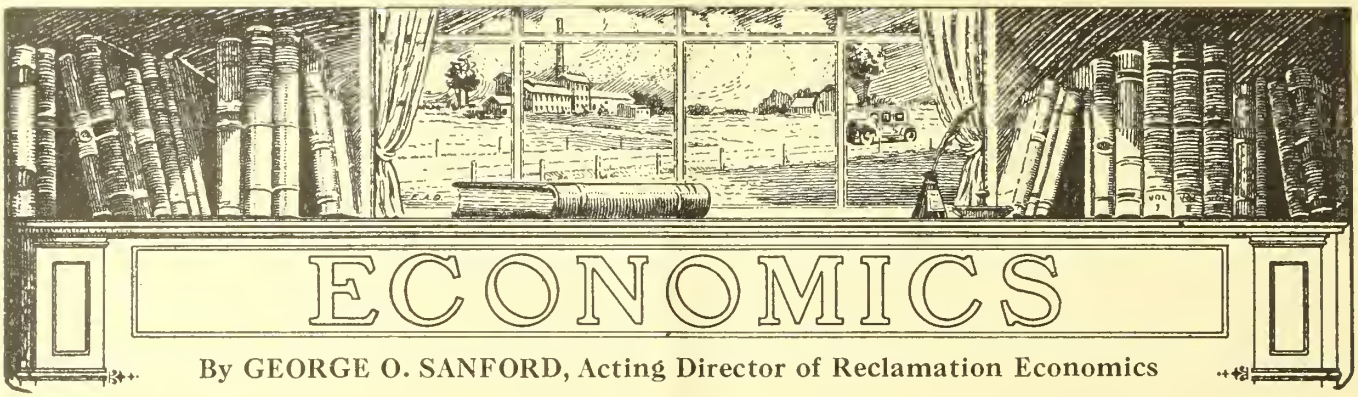
Robins, Col. Thos. M.:
- Improvement of the Columbia River (Grand Coulee site), illus., Civil Engineering, September, 1932, v. 2, No. 9, pp. 563–567.

Stabler, Herman:
- Rise and fall of the Public Domain. illus., Civil Engineering, September, 1932, v. 2, No. 9, pp. 541–545.

Tomlin, Robert K., Editor:
- Hoover Dam number, *Construction Methods*. Series of long illustrated articles by W. A. Bechtel, J. I. Ballard, Henry J. Kaiser, and others, Construction Methods, August, 1932, v. 14, No. 8, pp. 15–49.

Western Construction News:
- Driving and lining Hoover Dam tunnels, illus., Western Construction News and Highways Builder, August 10, 1932, v. 7, No. 15, pp. 439–443.

The western wing of the Cord Transcontinental Handicap Air Derby, composed of some fifty-odd planes, landed at Fly Field on the Yuma Mesa on the afternoon of August 21. Yuma was the first control point for the western wing, the planes and pilots stopping overnight and taking off for Tucson and El Paso the next morning. Accommodations were provided the flyers at Yuma and lap prizes awarded to the winners of the first lap which started at Los Angeles.



By GEORGE O. SANFORD, Acting Director of Reclamation Economics

Agricultural Settlement Work in Germany

THE world-wide depression has brought all civilized nations face to face with problems of unemployment, land settlement, and the production and distribution of agricultural products. In the United States, there has been more or less discussion of a back-to-the-land movement as a partial solution of our economic ills, and there is considerable doubt whether such a movement will materially help in bringing about a greater stabilization in economic conditions and increased prosperity in the country. What is being accomplished along settlement lines in other countries is of considerable interest at this time as it will give some indication of what probably can be accomplished here if similar work is undertaken on a comprehensive scale. It is believed that the following description of settlement work in Germany, taken from a report prepared by Mr. E. Veithardt, of the consulate general's office in Berlin will help in reaching a decision regarding a possible future policy in the United States.

INCREASED INTEREST IN AGRICULTURAL SETTLEMENT

The agricultural settlement movement in Germany which dates back to 1887, has been given a new impetus by the depression and decrease in the price of farm land, so much so that the number of new settlements doubled between 1928 and 1931. From 1887 to 1918 the number of settlements created was 45,000 and since that time the number has been increased by 48,375. In addition 86,000 small settlements have been enlarged by giving the farmers more land. Farm laborers to the number of 29,000 have been given a house and small lot. In the 45 years of its existence the movement therefore has resulted in the creation of 122,375 individual farms averaging about 25 acres each.

By the term agricultural settlement is meant a small farm owned and operated by an independent farmer who makes his living exclusively from the soil.

The purpose of the agricultural settlement movement is fourfold, namely, to relieve the labor market, to check the farm-to-city movement, to break up large estates into small farms, and to foster the growth of a stable class of small and independent landowners.

The settlement movement has developed in three directions, the first of which was the purchase by the State, by other public or semipublic organizations, of large bankrupt or semibankrupt estates. The latter were cut up into small tracts which were turned over to settlers. The second took the form of providing farm laborers with a house and a small lot, and the third, the enlargement of such lots into self-supporting farms by the addition of more land.

BREAKING UP OF LARGE ESTATES

Origin of movement.—The idea of agricultural settlements and their utilization for workers who are unable to find work either in factories or on large farms is by no means new in Germany. The movement, which in pre-war times was known as "interior colonization" began as far back as 1887, at which time the Provinces of West Prussia and Posen were colonized in this manner. By legislation passed in 1890 and 1891 this practice was extended to the whole of Germany. The procedure followed at that time corresponded in principle to that of the present agricultural settlement movement, which is based on the Federal settlements law of 1919. The latter provided that land for settlements should preferably be taken from large estates which have gone bankrupt or are otherwise not in a position to continue operations and are divided into small farms for farmers' sons or former farm hands, or into lots which are placed at the disposal of manual workers. It has been estimated that after being subdivided the number of people to which an estate offers a means of livelihood is doubled.

Pre-war development.—During the first 33 years of this development, that is, from 1887 to 1915, approximately 45,000 individual farms were created in this manner, the occupants of which had for the greater part originated from the families of independent farmers. Only about 15 per cent, or 6,400 farms, were given to former farm laborers or their sons.

Postwar development.—After the World War the movement was taken up again and a certain procedure was introduced whereby public funds were set aside for financing purposes. The greater part of the postwar agricultural settling was done in those parts of the German Reich situated east of the Elbe, which is due to the fact that the majority of the large farms in Germany are in East and West Prussia and Silesia.

PREFERENCE NOW GIVEN TO FARM LABORERS

As during the first 10 years after the close of the war a great number of farm laborers were thrown out of work by this procedure, the Prussian Minister of Agriculture in 1929 ordered that in the future a larger number of this class should be given consideration when distributing land derived from the division of large farms in Prussia, and that those farm laborers who had been in the employ of the former landowner should be given preference above other applicants. Since that time about one-half of the settlers in Prussia have consisted of farm hands who formerly worked on the estate and the other half of free-lance farm laborers, former independent farmers who had lost their property, and other persons in some way or other connected with the soil.

HOUSES AND LOTS FOR FARM LABORERS

In addition to the principal settlement movement described in foregoing paragraphs there is also another movement of some importance called the "own-home

movement for farm laborers" which was inaugurated some years ago. The idea was to provide German farm laborers with small farms of their own consisting of a small dwelling house, a barn, and a small piece of land usually not larger than 2 acres. Inhabitants of such small farms do not live on the proceeds of their property but earn their living by working as farm laborers in near-by agricultural establishments. During the past three years the enlargement of farm laborers' lots into larger farms has made great progress.

Farm laborers with lots are not the only class to benefit by this practice since it has been extended to cover farms which are considered too small or too poor to afford the owner a reasonable prospect for making a livelihood.

FINANCING OF SETTLEMENTS IN PRUSSIA

The Prussian State has founded several institutions both for the financing of new settlements and the enlargement of small settlements, and the other German States have acted likewise.

In the first place, the State of Prussia is financially interested in a number of semigovernmental "settling societies," the membership of which is made up of counties, cities, provinces, and agricultural societies. Being on the ground and with local interests at stake, these societies are the moving spirit in the development. The funds at their disposal come from their own treasury as well as from appropriations of the State. Additional funds are often provided by the two state-owned banks, one of which does a regular banking business, and the other of which was especially created to handle general agricultural credits.

An example of the financial working of the scheme is of interest. A bankrupt estate is bought up by one of the settling societies. It is broken up into small farms and distributed to persons considered by the society to be responsible and capable. The individual settler receives from the bank a short-term loan, usually six months, for the purpose of buying seed, implements, and other things necessary to put the farm on a producing basis. As soon as the farm is in an operating condition the settler receives another loan with which he pays off his two creditors, the settling society and the bank. This loan is secured by a mortgage on the settler's farm running usually 40 to 50 years.

LABOR MARKET ONLY SLIGHTLY RELIEVED

Settlements of the German type afford very little direct relief to the labor market. The only way in which the industrial labor market has been relieved to a certain extent has been by the check imposed on the farm-to-city movement. It is not believed that unemployed industrial workers will be taken into consideration for agricultural settlements to any great extent during the next 5 or 10 years. At the very utmost, it might be possible to distribute as many as 25,000 or 30,000 settlements per year. This would mean that 12,000 to 15,000 families per year would find a new means of livelihood, the other 12,000 or 15,000 farms being given to former farm hands. In other words, in the course of, say, 10 years it might be possible to provide 120,000 to 150,000 families with sufficient land to offer them a means of existence and to keep them from burdening the labor market.

The above number is not very impressive as in 10 years the total number of persons kept from being unemployed in this manner would not amount to more than 300,000, assuming that there are two persons to a family who may be considered laborers in the usual sense of the word. On the other hand, it must not be forgotten that unemployment relief in this manner is of a permanent nature whereas all other plans generally have to do with work which is temporary and will keep the persons in question at work for not more than six months or a year. The present practice of giving a very small number of the agricultural settlements to industrial workers who at one time or another have already done farming work might be continued but even in that case the number of industrial workers to which this practice would apply would amount to no more than a few thousand.

This report shows that the German Government has lent its support to the agricultural settlement program and that good progress has been made and worthwhile results obtained. The report further brings out the very striking fact that agricultural settlement work never has and in all probability never will be a strong factor in relieving the unemployment situation in the industrial centers, but that it has stimulated a healthy growth in the farming communities where people can live in comparative comfort and not be faced with the possibility of being out of work. In order to accomplish substantial results such a program must be extended over a long term of years.

In 1926 Congress authorized an appropriation and investigation to obtain information as to how potential agricultural lands might best be developed and used for the establishment of rural homes. Pursuant to this authority the Secretary of the Interior appointed a board of special advisors to investigate such possibilities in the Southern States and, as a result of this report, bills were introduced which, if enacted into law, would have given an opportunity to try out this line of work in the United States. The financial condition of the country was such that Congress did not see fit to appropriate any money for this work and thus far nothing tangible has been accomplished.

Surveying in Black Canyon

(Continued from p. 173)

transits to establish communication between the transitmen and the rigger. The rigger was lowered by three-quarter-inch rope snubbed around two drills driven securely into crevices in the canyon rim. When he reached the river's edge, he removed the rope and returned by trail and ladders to the top. While one was returning, another was being lowered at a different location.

The data secured from this survey are plotted by drawing the intersecting lines according to the recorded horizontal angles of the transits and scaling on the map the distances from transits to the point of intersection. The elevation of the point is then calculated from this scaled horizontal distance, the vertical angle recorded by the transits and the known instrument elevations.

Surveying is never slow or monotonous in Black Canyon. The contractor is creating records in the rapid removal of large quantities of excavated material and the speed with which unusually large structures are being built. Accurate location and quantity surveys must precede all operations and be carried along with them. Responsibility for maintaining surveys in precedence of the contractor's undertakings rests upon the field engineer who is in charge of field work for the Government and upon an associate engineer who is directly in charge of field surveys.

The work of the surveyor is ordinarily taken as a matter of course, is seldom mentioned in reports of construction activities and is soon forgotten when the structure is completed. It is well to remember when viewing or reading of some masterpiece of the constructor's art that its design was founded on the surveyor's data, its foundations were laid under the surveyor's directions, and the structure was built in accordance with the surveyor's measurements. His work is done in an unobtrusive manner, but its importance is of first-order value.

Crop conditions on the Lower Yellowstone project are reported as excellent. Sugar beets have made a good growth and give promise of producing as high tonnage as that of any previous year.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, accompanied by S. O. Harper, assistant chief engineer, L. N. McClellan, chief electrical engineer, and J. L. Savage, chief designing engineer, sailed from New York on September 22 for the Panama Canal Zone to inspect the site of the Madden Dam, the Denver office engineers having stopped in Washington for a couple of days to consider important engineering problems. After a week in the Canal Zone the party will leave Balboa for Los Angeles, arriving October 15.

From Los Angeles Doctor Mead will make a trip to the Boulder Canyon project and from there to Sacramento, Calif., for a discussion with State officials of the report on California's water resources. From Sacramento Doctor Mead will go to Portland for a conference with B. E. Stoutemyer, district counsel, and while there he will address the City Club on reclamation matters. The Commissioner's itinerary next calls for a visit to Seattle, there he will meet with leaders of the State of Washington to consider reclamation problems in general. He will then visit the Yakima project, and from there will go to Helena, Mont., where he will confer with the governor, the land commissioner, State engineer, and others on irrigation development in Montana. If time permits, visits will be made to the Huntley and Lower Yellowstone projects. Doctor Mead will return to Washington by way of Denver, about November 1.

During the absence of the commissioner P. W. Dent, assistant commissioner, is acting commissioner.

The committee on the distribution of the waters of Snake River and its tributaries, to which R. F. Walter, chief engineer, was appointed by President Hoover as the representative of the Department of the Interior, has been completed by the appointment of John A. Whiting, State engineer of Wyoming, and Frank Martin, of Boise, Idaho, to represent their respective States. Arrangements for the first meeting of the committee will be held in abeyance until funds are provided by the Federal and State Governments to cover the expenses of their representatives.

H. E. Wilbert, assistant engineer on the Yakima project, has been transferred from the Kennewick division to Cle Elum Dam. James A Callan, instrumentman, has been transferred from the Kennewick division to the Colorado River investigations at Pinedale, Wyo.

N. E. Fordham, master mechanic, made a recent visit to the Kittitas division of the Yakima project, where he supervised the installation of the penstocks at the Wippel pumping plant. From Yakima he went to the Shoshone project and arranged for cleaning the débris from one of the 42-inch diameter pipes through the base of Shoshone Dam, returning to Denver to complete arrangements for the equipment required for the work.

John A. Whiting, State engineer of Wyoming, was a recent visitor to the Shoshone project in the interest of the proposed compact between Montana and Wyoming relative to the division of the waters of the Yellowstone River.

Kittitas Valley

(Washington)

By Alice Lee Eddy, Kittitas, Wash.

Fertile valley of green and blue,
Valley of bird song and wild flower's hue;
Purple blue of mountains,
Azure blue of sky,
Lustrous, opalescent blue
Of waters slipping by.
Smoky blue of hills sun-kissed,
Joyous valley of blue and green,
Valley of sunlight and stardust sheen.
Lacy green of willows,
Lavish green of plain,
Dull gray-green of sage-clad slope,
Tender green of grain.
Magic valley of green and blue,
Dear home Valley of Dreams Come True.

Walter I. Swanton, engineer in the Washington office, has been designated to represent the Department of the Interior on the special subcommittee of the Interdepartmental Board of Simplified Office Procedure vice Dr. Hugh A. Brown, deceased.

Albert W. Walker, superintendent of the Sun River project, and Miss Esther McArdle, former teacher of the Greenfields school, were married in Seattle on the afternoon of September 5. The couple left Seattle following the ceremony, visited Glacier Park and other points of interest, and are now at home at the residence of the superintendent in Fairfield.

Pursuant to resolution of Congress the chairman, Senator John Thomas, and five other members of the Senate Committee on Irrigation and Reclamation, on August 30 made an inspection of conditions at Boulder City, Nev. Although not included in the resolution, the committee, while at Boulder City, had hearings relating to certain complaints made regarding issuance and use of scrip, labor conditions, housing, and meals for employees of Six Companies (Inc.), and other related problems. The committee from August 31 to September 3 made a thorough inspection by automobile of conditions in the San Joaquin and Sacramento Valleys. This inspection was made in connection with the State-wide plan of the State of California regarding navigation, flood control, irrigation, power development, and salinity control in the San Joaquin-Sacramento delta. The committee also had a hearing at Portland on September 6 and at Lewiston, Idaho, on September 7 relating to improvement of navigation on the Columbia and Snake Rivers. The committee was accompanied on the greater part of this trip by Chief Engineer Walter and Assistant Commissioner Dent. During a portion of the trip there were also present engineers E. B. Debler and H. W. Bashore.

T. S. Martin, master mechanic, spent a month at Birmingham, Ala., during which he inspected the manufacture of butterfly valves and slide gates for Madden Dam and bulkhead gate hoists for Hoover Dam. He also made a trip to Huntington, W. Va., and inspected stems for the slide gates for Madden Dam.

S. L. Jeffords, county agent of Spartanburg, S. C., was a recent visitor in the Washington office of the Bureau of Reclamation.

L. H. Mitchell, assistant director of reclamation economics, returned to Washington on September 20 after a visit to the Grand Valley, Uncompahgre, Strawberry Valley, Klamath, and Newlands projects. Mr. Mitchell reports economic conditions on the projects not unlike those in other farming sections. The project settlers realize that they are not alone in the general unrest throughout the country but that they are in a better condition than those in the industrial centers. Normal crops, according to Mr. Mitchell, will be harvested.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent, C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief Clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thraikill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Do.
						J. R. Alexander	Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peck	E. A. Peck	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Ore.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. Constr. Eng.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	I. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val., W. U. A	Montrose, Colo	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tont	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	Paul G. Gebauer	President	Mahel J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg		Reser. supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation districtct	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE *Editor*

Clemson University Library

KITTITAS DIVISION, YAKIMA PROJECT, WASHINGTON

1, Second cutting of alfalfa, Badger Pocket area—field seeded 1 year ago; 2, first crop of carrots after clearing the land; 3, potato field—first crop from sagebrush; 4, first crop of wheat from sagebrush land.

U. S. GOVERNMENT PRINTING OFFICE: 1932

7.5

THE RECLAMATION ERA

VOL. 23, NO. 11 NOVEMBER, 1932

CLEMSON COLLEGE LIBRARY
GOVERMENT PUBLICATIONS

Moisture Conservation and a Good Start in the Spring Demand

FALL PLOWING

MOISTURE must be saved and hoarded. Latest figures for precipitation for the period, January 1 to September 1, 1932, showed Longmont precipitation 4.53 inches below normal; Denver, 2.79 inches below normal; Fort Morgan, 1 inch below, and Greeley and Fort Collins less than one-half inch below normal. Julesburg was 1.40 above normal for the period.

Fall plowing traps winter moisture and early spring moisture.

Fall plowing permits winter elements to firm the soil.

Fall plowing helps to destroy insects and weeds.

Fall plowing enables timely planting.

FALL PLOWING MEANS MORE THAN JUST PLOWING!

Fall plowing means fall seed-bed preparation.

Disk before plowing where necessary.

Work down the soil after plowing, just as you do in spring.

Done right, fall plowing is tremendously beneficial. Done wrong, it may cause difficulties. This climate is relatively dry. Big clods become hard as rocks over the winter and are almost impossible to work down in the spring. Most of the soils are heavy enough for fall plowing.

ONE OF THE GREATEST BENEFITS OF FALL PLOWING IS TO ENABLE YOU TO PLANT ON A GOOD SEED BED AT THE RIGHT TIME IN THE SPRING.

—*Through the Leaves, September, 1932*

DENVER UNIVERSITY LIBRARY

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 11 NOVEMBER, 1932

Coachella Valley, Calif., has new State Highway

IN a recent issue of California Highways and Public Works there is a story by District Engineer E. Q. Sullivan about the 14 miles of new State highway in the Coachella Valley which will replace an old pavement built many years ago. The writer makes the following interesting comments regarding this section of California:

Night and day a stream of vehicles follows this highway. Many persons prefer night driving in the desert areas and the truck traffic also starts in the evening from the Imperial Valley gardens for the Los Angeles markets. Great trucks with huge trailers are used extensively to carry grapefruit, dairy products, hay, watermelons, lettuce, and the endless varieties of garden products coming into bearing the whole year round. This highway also connects with the Interstate Borderland Highway at El Centro and therefore also carries a stream of tourists. To the casual traveler the route might seem an endless desert waste flanked on the horizon by the shimmering colorful mountains. In reality the region abounds in things of interest that astonish the layman and in some instances puzzle the scientist.

As one leaves the green and prosperous Coachella Valley with its multitude of ranches one passes Travertine Rock. This landmark bears Indian writings, some so old that they are encrusted with shell growths, proving that they have stood beneath the waters of an ancient sea. The beach lines of this ancient sea are plainly marked along the rocky cliffs and sandy slopes. The ancient beach sands are filled with polished shells and other remnants of sea life, another evidence of geologic changes.

SALTON SEA

The waters of the present Salton Sea, some 30 miles long and 7 miles wide, gleam to the east a topaz blue, its possibilities as a winter playground hardly touched. Travelers have often compared the Salton Sea to the Sea of Galilee of the Holy Land. The present Salton Sea was formed during the break in the Colorado River in 1905 to 1907, but geologists generally agree that for a period of probably 400 to 500 years the Colorado River has discharged uninterruptedly into the Gulf of California, except for the brief period in 1905 to 1907. However, there were times in the olden days, confirmed by Indian traditions, when the Colorado River delivered its waters into the Salton Basin for long periods of time instead of into the Gulf of California and the whole Coachella Valley was a vast inland sea.

This Salton Basin was then an inland sea with a surface of nearly 2,000 square miles, embracing all of what is now known as Imperial and Coachella Valleys. The greatest depth of the sea was about 320 feet. Its margin is the well-marked beach line. The present beautiful Salton Sea is but a small portion of what was once this great inland sea.

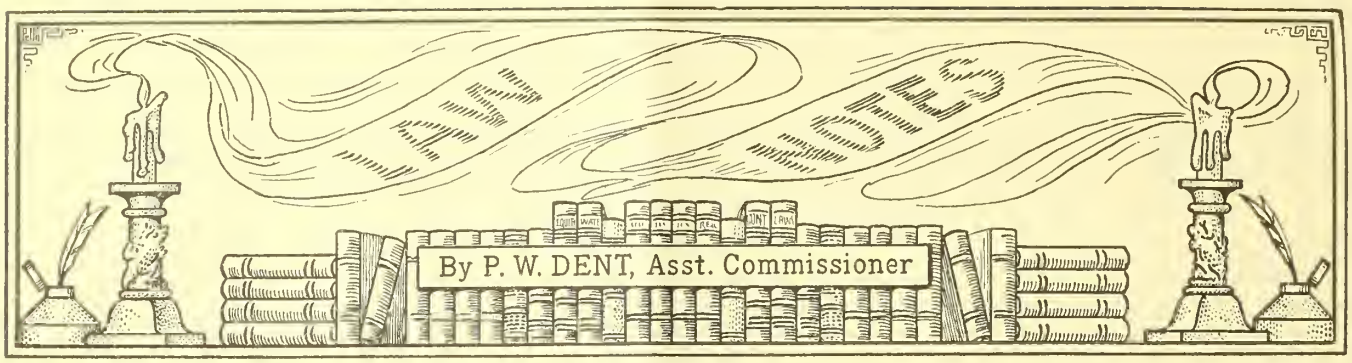
Fish Springs, situated half way between the highway and Salton Sea, was once a true oasis with its unfailing water for the pioneer immigrants. The modern autoist turns up his nose at the smell and taste of the alkaline water, but pauses to marvel at the flow coming out of the parched ground. A 60-foot plumb bob can not touch the bottom of the flow. Tiny pop-eyed fish emerge from the mysterious depths. The water is clear and limpid; strangely enough, some underground rock barrier divides the underground waters near Travertine Rock in such a way that, just to the north, gush forth from artesian wells waters as sweet as mountain streams, while just to the south in the vicinity of Fish Springs the artesian wells are alkaline.

The new highway provides for bridges or culverts to replace all of the 117 rough riding dips of the old highway. This is the land of sudden and torrential summer cloudbursts with enormous concentration of precipitation. They happen several times each summer. A cloud rapidly ascending from the horizon within an hour or two sometimes brings torrents of rain which may within a period of 15 minutes cause floods of water to race down the gullies. It has not been uncommon for an inexperienced motorist to attempt a crossing and have his car washed from the pavement. In another 30 minutes the brilliant desert sun may be shining again and the land steaming in the summer heat with only a trickle of water in the channels.

Though many people prefer to take summer trips on the desert at night, others taking long trips enjoy driving in the daytime; the dry air and the breeze created by driving keep the traveler reasonably comfortable and he will then have the cooler nights for sleep. The weather on the desert in winter is usually delightful.

The fascination of the desert increases with each succeeding trip. Moonlight on the desert is of such radiance that mountains and distant views stand out clearly. Perhaps the fascination of the desert lies in its variety. Each trip brings new beauties and experiences.

Many inquiries regarding settlement opportunities on the Riverton project have been received recently. During the month of September 41 prospective settlers were shown over the project, 21 farm applications were received, and 7 applicants paid water rental charges for the year 1933. Serious interest in the project lands seems greater than at any time since settlement operations were begun. The number of farm applications received during September exceeded those of any previous month.



The 1932 Relief Act

[*Public—No. 70—72d Congress*]

AN ACT For the temporary relief of water users on irrigation projects constructed and operated under the reclamation law

That any irrigation district, water-users' association, or other water-users' organization under contract with the United States for payment of construction charges under the Act of June 17, 1902 (32 Stat. 388), or Acts amendatory thereof or supplementary thereto, including the Act of February 21, 1911 (36 Stat. 923) (upon acceptance of this Act by resolution of its board of directors or corresponding body), shall be required to make no payment on the regular construction charge for the calendar year 1931, and in lieu of the regular installment of construction charge provided for under existing contracts, may pay for the calendar year 1932 on the basis of 50 per centum of the amount which, but for this Act, would be payable under said contracts, such amount to be computed and determined for that year in the manner provided in said contracts and the law applicable thereto. Interest and penalty as now provided by law and contracts for nonpayments when due shall apply on all charges for 1932 adjusted as herein authorized; and otherwise the deferred payments herein authorized shall bear interest until paid at such rate, and shall be paid at such times, as the Secretary of the Interior shall determine: *Provided*, That in determining the rate for the sale of power during the irrigation season of 1931 to irrigation districts from any power plant operated by the Bureau of Reclamation, interest on the cost of the power system shall not be included as an element, but interest at the rate of 2½ per centum per annum shall be included as an element of such rate for the sale of power to such districts during the irrigation season of 1932: *And provided further*, That the payments for construction charges and interest payments on the cost of the power systems referred to in this Act shall not be deemed waived, but only deferred, and shall be paid as provided in this Act.

SEC. 2. On projects or divisions of projects where no irrigation district, water-users' association, or other water-users' organization has assumed joint obligation for payment of construction charges individual water-right applicants or entrymen upon acceptance of this Act in a manner satisfactory to the Secretary of the Interior, shall be required to make no payment on the regular construction charge for the calendar year 1931, and in lieu of the installments payable under existing contracts, may pay their regular installments of construction charges for the calendar year 1932 on the same basis as that authorized in section 1 hereof for districts, associations, and other water-users' organizations.

SEC. 3. The Act of Congress approved January 31, 1931, entitled "An Act for the relief of the Uncompahgre reclamation project, Colorado" (Private, Numbered 300, Seventy-first Congress), is hereby amended to extend for one year from and after January 1, 1932, the time for beginning construction of drainage system upon the Uncompahgre project, and any and all construction charges accruing upon or for said project for or during the year 1932, shall be deferred and included in and made payable as a part of the project supplemental construction charge provided for in said Act of January 31, 1931; and in order to afford opportunity to complete the construction authorized by the Act of Congress approved February 21, 1931 (Public, Numbered 708), relating to the Grand Valley reclamation project, Colorado, any and all construction charges accruing upon or for said project for or during the year 1932 shall be deferred and shall be included in and made payable as project supplemental construction charges under the terms as provided in this Act.

SEC. 4. At the expiration of the period for which deferment of charges is made under this Act, all districts, water-users' associations, or other water-users' organizations, and all individuals accepting the provisions hereof shall resume payment of charges on the basis of and in accordance with existing contracts and shall continue payments thereafter until the entire indebtedness of said districts, water-users' associations, or other water-users' organizations, and individuals to the United States shall have been fully paid. In the case of a district, water-users' association or other water-users' organization, or individual having contracts executed pursuant to the Act of February 21, 1911 (36 Stat. 925), the Act of August 13, 1914 (38 Stat. 686), or the Act of May 25, 1926 (44 Stat. 636), or any special Act the deferred construction installment or installments for the calendar year 1931, and that portion of the 1932 installment or installments deferred, together with the installment or installments of deferred construction and/or operation and maintenance for 1931 and 50 per centum of the installment and/or installments of such deferred charges for 1932, shall be paid as an additional installment to be due and payable one year after the date the last installment under existing contracts shall become due, except in those cases in which the Secretary of the Interior, whose decision shall be final, shall find necessary additional installments, which he is hereby authorized to fix. In the case of any district, water-users' association, or other water-users' organization, or individual under contract for payment of construction charge pursuant to subsection F, section 4, Act of December 5, 1924 (43 Stat. 702), construction payments shall

be continued on the basis of existing contracts until the entire indebtedness to the United States, including all charges deferred pursuant to this Act, shall have been fully paid. Installments so carried over shall be subjected to the reductions provided for in section 8 hereof.

SEC. 5. The Secretary of the Interior, in his discretion, and upon acceptance of the provisions of this section by the water users affected, in the manner provided in sections 1 and 2 hereof, may permit adjustment of construction and/or operation and maintenance charges heretofore deferred by contracts made pursuant to existing law to be made for the years 1931 and 1932 on the basis authorized in sections 1 and 2 hereof or on such other basis as the Secretary may find to be required in each case.

SEC. 6. The Secretary of the Interior, in his discretion, is further authorized to defer the payment to the United States from any water-users' organization, as defined in section 1 hereof and from any individual water-right applicant or entryman of construction charges and installments of deferred construction and/or deferred operation and maintenance charges for the calendar year 1930 and prior thereto. Such deferred charges, together with penalty or interest to December 31, 1931, under existing laws and contracts shall be paid in such annual installments as the Secretary of the Interior may fix.

SEC. 7. Any irrigation district, water-users' association, or other water-users' organization which has contracted to pay construction charges and which is not in arrears for more than one calendar year in the payment of any construction, operation, and maintenance, or other charge due by it to the United States may, at its option, deliver or authorize the delivery of water during the years 1932 and 1933 to water users who may be more than one year in arrears in the payment of charges or assessments due from such landowner or water user to the district or association.

SEC. 8. In the case of any irrigation district, water-users' organization, or individual, receiving credits on account of power profits or other revenues under the provisions of subsections I and/or J, section 4, Act of December 5, 1924 (43 Stat. 703), or any other Act of Congress, when any extension is granted as provided in section 1, 2, or 4 the amount of such credits shall be deducted from the amount of any payment so extended: *Provided*, That the provisions of this section shall not apply to power profits or other revenues derived from works not constructed at the expense of the United States. The credits, if any, in excess of the payment so extended shall be applied as now provided by law and contract. Acceptance of the provisions of this Act shall operate as a waiver of any law and/or contract providing for application of credits different from that in this section prescribed.

SEC. 9. Collections of construction charges for the calendar year 1931 (which charges are subject to adjustment and are adjusted under sections 1, 2, and 4 of this Act) and penalties and interest, if any, from water-users' organizations and individual water-right applications or landowners, heretofore made under existing contracts, shall be credited upon the succeeding payments as they become due, including operation and maintenance charges.

SEC. 10. That the Act of June 25, 1910, entitled "An Act to authorize advances to the reclamation fund, and for the issue and disposal of certificates of indebtedness in reimbursement therefor, and for other purposes," as amended, and the Act of March 3, 1931 (46 Stat. 1507), are hereby amended so as to provide that payments in reimbursement of moneys so advanced under these Acts and not heretofore repaid shall be made by transfer annually from the reclamation fund to the general funds of the Treasury beginning July 1, 1934.

Approved, April 1, 1932.

A 24-inch automatic siphon wasteway has been installed in the main canal at Arrow Creek wasteway on the Huntley project. Repairs have also been made to the Arrow Creek structure, where the concrete had deteriorated, to the hydraulic pumps, and to one of the head gates at the pumping plant.

Yuma has excellent grapefruit season

According to the Yuma Morning Sun a record grapefruit crop on the Yuma project, with an excellent market, is in prospect. One company has started packing and expects to ship about 275 carloads within the next nine months, during which it will employ 50 men. The payroll will be about $3,500.

With a late Florida crop and only 50 per cent of normal; the Texas crop, which last year was only 60 per cent of normal, this year only 30 per cent of the 1931 crop; and the Puerto Rico crop ruined by a hurricane, Yuma seems to occupy the field. The exchange which will market the crop will handle the largest volume of grapefruit in its history. The Yuma fruit will be stamped "Yuma" and this name will also appear on the wrappers and boxes.

The sugar-beet factory at Belle Fourche, S. Dak., was opened on October 1 with a good supply of beets. It was estimated that 100,000 tons grown on about 8,000 acres would be sliced this year.

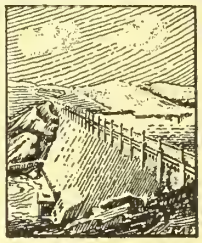
The new cannery at Tornillo, Tex., Rio Grande project, owned by one of the project farmers, has put up 190,000 cans of tomatoes this season. The owner paid $10 per ton for ripe tomatoes delivered by other growers.

Photo by F. C. Bohlson

City Hall, Ontario, Oreg., headquarters of Bureau of Reclamation, entire second floor

ENGINEERING

GEORGE O. SANFORD, Chief, Engineering Division



Boulder City Water Supply

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

AFTER a decision had been made, for reasons of climate, accessibility, and from the standpoint of health of the workers, to locate the construction camp for Hoover Dam at the present site of Boulder City, Nev., the Government was confronted with the problem of procuring an acceptable water supply for the camp.

Two sources were available—one from artesian wells located in the basin near Las Vegas and the other from the Colorado River. Water from the wells in the Las Vegas plain was clear and free from bacteria, but possessed an average hardness of 633 parts per million. The pressure line to Boulder City from an assured source of adequate supply would be approximately 25 miles in length and pumps would be required to lift the water a difference in elevation of 600 feet.

Colorado River water possessed an average hardness of 367 parts per million, the source of supply was 6 miles from Boulder City, and pumps would be required to lift the water from low river elevation 645 feet to top of storage tank in Boulder City at 2,670, a difference of 2,025 feet in elevation. Additional disadvantages of river water were its high silt content, an average of 6,000 parts per million, and its large bacteria count.

COLORADO RIVER WATER SELECTED

Studies were made of both sources, and it was decided to use the river water principally because the supply was sufficient and determinable, and the estimated cost of the system was nearly $200,000 under that for the artesian supply. There was also grave danger, if the Las Vegas Basin supplied Boulder City as well as the Las Vegas Valley, that the additional water requirement might deplete the underground basin storage to such an extent that a shortage would result.

To obtain acceptable water for domestic use, it has been found necessary to remove the silt from the river water, soften it to approximately 100 parts per million of hardness, and treat it chemically to destroy harmful bacteria. The lift of 2,025 feet from low-water surface at the river to a storage tank in Boulder City is provided by four pumping stations—the first by the intake plant from the river to a presedimentation basin, the second by pumping plant No. 1, which forces the water to pumping plant No. 2, which in turn lifts the water to a receiving tank in Boulder City. From this tank it flows by gravity to the filtration plant and from there it is pumped into the distribution line or to the storage tank.

The location for the intake pumping plant was selected downstream about 3,000 feet from the Hoover Dam site, at the mouth of Water Trail Canyon, where a break in the wall of Black Canyon extends westward toward Boulder City. Sometime in the future the intake will be moved to a point upstream from the dam, after this structure is completed, in order to procure clear water and take advantage of the higher water surface in the reservoir, thus eliminating a certain amount of pumping and the necessity for removal of silt.

INTAKE PLANT

The intake plant consists of three 550-gallon per minute 115-foot head centrifugal pumps, each operated by a 25-horsepower induction motor. The pumps and equipment are mounted on a carriage, which is supported and moved on 4 wheels, running on 45-pound rails, laid 7 feet apart on a 47½° incline. The carriage is raised or lowered by an electrical hoist to suit the stage of the river. A 10-inch diameter cast-iron pipe, with 8-inch laterals at 9½-foot intervals for connection to the discharge side of the pumps, is laid between the rails and leads to a 225,000-gallon concrete presedimentation basin located at the mouth of Water Trail Canyon.

This presedimentation basin is 13 feet high, 55 by 55 feet inside dimensions, and is situated with its base at elevation 734. Approximately 97 per cent of the silt is removed here by a detention period of two and a half hours. The basin is equipped with a traction clarifier and a 94-gallon per minute sludge pump for removal of the settled solids. On a basis of 500,000 gallons of water flowing through the sedimentation tank in 24 hours, the sludge pump will be required to remove nearly 15 tons of solids.

From the presedimentation basin the clarified water flows by gravity to a 30,000-gallon sump tank, from which it is lifted by the three 500-gallons-per-minute, 1,150-foot head centrifugal pumps of plant No. 1, the power being furnished by three 200-horsepower induction motors, through 3.9 miles of steel pipe, the first 1,834 feet of which is 10-inch inside diameter and the remainder 12-inch, to pumping plant No. 2. This line is laid from elevation 726 at the pumps of plant No. 1, to elevation 1,712 at the pumps of No. 2. The trench for the pipe was excavated for more than half the distance in solid rock and the pipe laid by the Wheelwright Construction Co. of Ogden, Utah, during the summer of 1931, when it was necessary that all work be done at night or in the early hours of the morning on account of high temperatures. During the day all steel exposed to the sun would blister the hands when touched and the temperatures in the trenches would rise to nearly 150°.

The profile of the pipe line has three sharp changes in its grade, where automatic air valves are installed, and one summit where an air vent has been placed. Two gate valves have been provided at low points on the line for drainage purposes, and immediately preceding the entrance of the pipe into plant No. 2, a steel tank of 4 feet inside diameter and 95 feet high serves to equalize the flow through the two high-head pumping stations.

Pumping plant No. 2 is equipped with the same type and number of pumps as in plant No. 1 and is likewise housed in a structural steel building. Walls and roof of the building are respectively of tile and metal lath stucco, differing from those of plant No. 1, where the walls and roof are of "Transite," an asbestos fiber composition. The pipe line is protected from surges and water hammer by means of automatic surge suppressors, one of

which is installed near the lower end of each section of the pipe line. These surge suppressors open automatically upon a drop in pressure such as that caused by stopping of the pumps upon failure of power supply and they remain open a sufficient period of time to permit the surge to damp itself out after which the surge suppressors close at a very slow rate. All pumps are automatically controlled by means of pressure or float switches.

WATER TREATMENT

Water from pumping plant No. 2 flows through 2.7 miles of steel pipe, the first 3,050 feet of which is 10-inch inside diameter and the remainder 12-inch, to an aerator installed at the top of a 100,000-gallon steel receiving tank in Boulder City. The maximum static lift between these two stations amounts to 824 feet, as the inlet to the aerator is at elevation 2,554.

The aerator consists primarily of a tank 7 feet in diameter, having outlets through U-shaped pipes to the centers of two horizontal circular plates of approximately 36 inches in diameter and equipped with small vertical baffles. The water is aerated in its passage over the vertical baffles to the edges of the circular plates and in its fall of 6 feet or more to the water surface in the receiving tank.

The aerated water flows by gravity from the receiving tank to the filtration plant, where it is submitted to complete clarifying, chemical, and filtering processes, emerging at the end of this treatment perfectly clear, entirely free from harmful bacteria, and with hardness reduced to about 100 parts per million. The manner in which the river water is treated to secure this pure product will be discussed in a future article. Suffice to say that there are now only five of this type of filtration plants in existence, and the water softening features observed here will be found only in those plants that have been designed within the last two years.

The treated water from the clear well of the filtration plant is pumped by three 600-gallons-per-minute pumps, powered by 30-horsepower induction motors, against a maximum static head of 160 feet to a storage tank of 2,000,000 gallons capacity located on a hill northeast of the plant. The storage tank, situated on Water Tank Hill, on the northerly edge of Boulder City, has an inside diameter of 100 feet and a height of 35 feet. Its walls are of 5/16 to 7/8-inch steel plates, the floor is composed of 1/4-inch steel plates resting on a concrete floor slab and sand cushion, and the roof is made up of 10-gage steel plates supported laterally by 10 and 15 inch channels bearing on 15 columns, each constructed of two 12-inch channels.

The water-supply system is placed in operation by starting the pumps at the intake station and the presedimentation tank equipment. The clarified water discharging into the sump tank actuates a float-control switch placing in operation the number of pumps in plant No. 1 that were preset for starting. Water raising in the equalizing tank at plant No. 2 operates a pressure-control switch, when sufficient head has been developed, and places in operation the pumps in plant No. 2, that are in starting position. The equipment at the filtration plant is manually controlled with the exception of the three pumps which force the water from the plant to the storage tank. These are started by three float-controlled switches, located in the clear well. To shut down the system, the intake pumps are stopped and all other stations automatically cease operating as the water supply is cut off.

DISTRIBUTION SYSTEM

A complete distribution system covers the entire occupied area of Boulder City and is so designed and laid out that all mains are in loops and there are no dead ends. The distribution system is supplied by two mains each consisting of a 12-inch cast-iron pipe from the main storage tank. Cast-iron mains, 4 to 10 inches in diameter, branch from the main supply lines in each intersecting street. Service connections from mains to consumers are 3/4 to 1½ inch copper tubing. Fire protection for the town is provided by 89 fire hydrants and by 2-inch and 4-inch standpipes in dormitories and public buildings. Nearly 13 miles of mains and more than 15 miles of service lines have been laid to date. The static pressure for the distribution system varies from 90 feet in the buildings at the north side of town to 220 feet at the south, the average being 160 feet, or nearly 70 pounds per square inch.

Water pumped from the river at the present time amounts to approximately 15,860,000 gallons per month, requiring 200,400 kilowatt-hours of electrical power for pumping purposes. All water used in Boulder City is on a metered service. The cost of the supply, treating, and distribution system totaled approximately $470,000.

With the question of title to the site for the new Federal building at Yuma satisfactorily settled, it is understood that construction of the building will start shortly. The original appropriation for this work was $190,000. When started this work will provide employment for local labor.

Notes for Contractors

Boulder Canyon project.—Under invitation for bids (A-3031-C) for furnishing 50,000 barrels of Portland cement in sacks, eight bids were received at the opening on September 8. The Riverside Cement Co., of Los Angeles, Calif., submitted low bid of $1.55 per barrel, f. o. b. mill, Crestmore, Calif., and award of contract was approved on September 22.

Bids were opened on September 26, under invitation A-3020-A-1, for furnishing 400,000 barrels of Portland cement. Seven bids were received. The Union Portland Cement Co., of Denver, Colo., was low bidder, at $1.04 per barrel, f. o. b. mill, Devils Slide or Salt Lake City, Utah, and was awarded a contract for 67,500 barrels. A joint bid of $1.24 f. o. b. mills Crestmore, Colton, Victorville, and Monolith, was made by the Riverside Cement Co., California Portland Cement Co., Southwestern Portland Cement Co., and the Monolith Portland Cement Co. These four companies will furnish 332,500 barrels.

Under specifications No. 537, bids were opened at Denver on September 26 for furnishing, installing, and painting a 150-ton capacity, electrically operated cableway, together with hoisting equipment, motor-generator set, motors, control apparatus, track cables, conveying and hoisting ropes, brakes, carriage and fall blocks, sheaves, structural steel tower, telephone system, signal system, etc. The Lidgerwood Manufacturing Co., of Elizabeth, N. J., was low with a bid of $172,110, shipment of materials to be made on Government bills of lading. Six bids were received. Approval of award of contract to the low bidder was given by the Secretary on October 7.

Conferences have been held in the Denver office with representatives of the Bureau of Power and Light of the city of Los Angeles, the Westinghouse Electric & Manufacturing Co., the General Electric Co., and the Allis-Chalmers Manufacturing Co., regarding the design of generators for the Hoover power plant. The city of Los Angeles requires that the generating units be designed for both 50 and 60 cycle operation and that the generators have very large flywheel effect to improve system stability. To meet these requirements, units of larger physical dimensions are required and some increase in dimensions of the power plant building will be necessary. Revisions have been made in the turbine specifications for use in purchasing the initial group of turbines and governors by incorporating the changes desired by the city. Studies are being made of the general layout of the

(Continued on page 184)

Boulder Canyon Project Notes

In addition to lining the diversion tunnels the contractors are excavating for intake towers, benches for cableway structures, enlargement of Nevada inclined spillway tunnel, and foundation of cut-off for the upstream cofferdam.

During the week of September 11–17 a rock barrier was constructed, jutting into the river from the Nevada side, downstream from the inlet portal of diversion tunnel No. 2, which is the inner tunnel. Excavation was then started for the cut-off of the upstream diversion dam. This was the beginning of construction of the river diversion works. The original construction progress schedule called for commencement of work on the cofferdam and rock barrier on October 1, 1933. The contractors are therefore one year ahead of schedule.

Concrete footings for runways for five cableways to span the canyon at the dam site are being constructed by the Six Companies. Two of the spans will be among the longest ever built, each being 2,575 feet in length. The cable will be 3 inches in diameter and will have a 20-ton load capacity. On the canyon rim on either side of the river there will be movable towers on the runways so that the entire construction area may be covered.

Six Companies already has two cableways in operation over the portals of the diversion tunnels and the Government has just awarded a contract for installing a 150-ton capacity cableway for handling pipe sections and power plant machinery. This will make a total of eight cableways across the canyon.

Stage connection from Boulder City across Arizona to Phoenix will be available November 1, a franchise having been granted by the Arizona Corporation Commission to the Kingman Motor Co. The buses will run to Kingman and then south through Sandy Valley to the Santa Maria River, joining the Hassayampa Trail at Congress Junction.

Concrete lining in three of the diversion tunnels is practically completed. On October 8, the percentages of completion for invert, sidewalk, and arch were, respectively, No. 2 (Nevada), 100–92–66; No. 3 (Arizona), 100–91–83; No. 4 (Arizona), 100–100–85.

W. A. Bechtel, president of Six Companies (Inc.), on a recent visit to Washington, D. C., predicted that the Colorado River would be diverted through the two Arizona tunnels by December 1 and that pouring of concrete in the main dam would be commenced June 1, 1933.

J. E. Trainor, general superintendent, and H. L. Tucker, superintendent, both of the Babcock & Wilcox Co., are on the project looking after the erection of a 30 by 80 foot office building, dormitory, and cottages.

The 34-room frame dormitory in Boulder City for the use of Government employees was occupied on October 10 and partly relieves conditions which existed in camp No. 1, where bureau employees have been living in tents.

Six Companies is now extending the construction railroad in the canyon and hewing out a railroad right of way in the sheer cliff of the Nevada side, above the crest elevation of the dam, to make ready for the high-level concrete mixing plant.

A drainage tunnel over 800 feet in length and 10 feet in diameter has been driven under the Black Canyon highway on the Nevada side. A draw heads in toward the river at a point about opposite the downstream end of the power plant. To safeguard against possible heavy flow of water down this draw in a cloudburst, with resulting damage to the works, the tunnel has been driven under the highway to carry flood waters to the river at a point below the power plant.

Notes for Contractors

(Continued from p. 183)

power plant as affected by a change in location and the change from 60 to 62½ feet center to center spacing of the units made necessary by the increased size of the turbines.

Specifications have been prepared for the purchase of one 40-ton, one 20-ton, and three 5-ton traveling cranes for installation in the hoist house for the 150-ton cableway, in the operating houses for the 50 by 35 foot Stoney gates at Hoover Dam, in the cylinder gate house at Cle Elum Dam, and in the gate tower of the tunnel No. 1 controlling works on the Owyhee project.

Minidoka project, Gooding division.—Under specifications No. 577–D bids were opened at Burley, Idaho, on September 15 for constructing lateral system structures. Gabbey & McNeil, of Boise, Idaho, submitted the low bid of $8,111.

Owyhee project.—Bids under specifications No. 538 were opened at Denver on October 20 for furnishing eight 4-foot 6-inch by 12-foot emergency and regulating gates, gate hangers, and Venturi meter pressure rings for the tunnel No. 1 controlling works.

Specifications No. 539 have been issued covering the construction of the concrete structures at the inlet of tunnel No. 1, including the installation of the gates and other equipment purchased under specifications No. 538.

A Federal-aid highway contract in excess of $100,000 has recently been awarded on the Lower Yellowstone project for a road leading from the new Sidney bridge to the North Dakota line. A contract of similar size covering about 13 miles of the main highway through the project has also been awarded. In both of these, local labor will be employed as far as possible.

Grapefruit Marketing Simplified on Yuma Mesa

The Yuma Mesa Fruit Growers Association, which is a cooperative organization, with a present membership representing approximately 50 per cent of the bearing area of groves on the Yuma project, has canceled its former packing and marketing contract and has elected to operate its own packing plant and do its own marketing. The members believe they can realize a material saving per packing box as compared with prices paid for packing and marketing under their old contracts. The association has leased an empty warehouse in the city of Yuma and will equip it with packing machinery in time to handle this season's crop. Other growers who will continue to pack and market their fruit as formerly have agreed together with exchange members in other sections of Arizona and California to prorate their shipments of fruit this season. This fruit will probably be sold through a seasonal pool as formerly.

Accretions to the reclamation fund, repayments to the reclamation fund, and expenditures for construction and operation and maintenance of reclamation projects to June 30, 1932

(1) State and project	(2) Accretions to reclamation fund to June 30, 1932	(3) Collections (repayments to reclamation fund) to June 30, 1932	(4) Total accretions and collections (column 2+column 3)	(5) Expended for construction of reclamation projects to June 30, 1932	(6) Expended for operation and maintenance to June 30, 1932	(7) Total expenditures to June 30, 1932 (column 5+column 6)
Alabama	$71,692.16		$71,692.16			
Arizona:						
Salt River		$11,615,320.53		$15,106,942.10		$15,106,942.10
Yuma [1]		6,313,539.93		8,479,209.60	$2,682,051.64	11,161,261.24
Yuma auxiliary		27,942.86			167,800.12	167,800.12
Total Arizona	2,578,009.15	17,956,803.32	20,534,812.47	23,586,151.70	2,849,851.76	26,436,003.46
California:						
Orland		1,456,719.09		2,506,960.16	514,648.83	3,021,608.99
Klamath [1]		530,000.00		2,352,345.61	112,565.00	2,464,910.61
Yuma [1]		2,116,853.07		1,619,958.73	987,302.43	2,607,261.16
Total California	16,795,224.41	4,103,572.16	20,898,796.57	6,479,264.50	1,614,516.26	8,093,780.76
Colorado:						
Grand Valley		1,112,241.89		5,418,904.63	210,108.67	5,629,013.30
Uncompahgre		3,019,395.03		7,913,211.94	1,191,517.30	9,104,729.24
Total Colorado	10,585,543.70	4,131,636.92	14,717,180.62	13,332,116.57	1,401,625.97	14,733,742.54
Idaho:						
King Hill		130,224.99		1,905,918.80	156,734.25	2,062,653.05
Minidoka		13,159,723.76		15,286,168.08	2,294,448.53	17,580,616.61
Minidoka-Gooding division		304,901.39		4,021,078.98	40,064.73	4,061,143.71
Boise [1]		8,016,280.77		16,877,168.12	2,787,934.93	19,665,103.05
Owyhee [1]		8,500.00		2,765,527.01		2,765,527.01
Total Idaho	6,976,652.17	21,619,630.91	28,596,283.08	40,855,860.99	5,279,182.44	46,135,043.43
Kansas: Garden City	1,032,764.48	58,002.27	1,090,766.75	395,831.78		395,831.78
Louisiana	24,615.75		24,615.75			
Montana:						
Bitter Root		1,349.01		547,641.05		547,641.05
Huntley		1,259,105.34		1,562,302.99	1,014,941.03	2,577,244.02
Milk River		732,371.66		7,497,235.35	296,932.62	7,794,167.97
Sun River		839,702.57		7,579,692.24	320,876.88	7,900,569.12
Lower Yellowstone [1]		653,445.56		2,399,549.56	877,289.55	3,276,839.11
Total Montana	16,219,284.09	3,485,974.14	19,705,258.23	19,586,421.19	2,510,040.08	22,096,461.27
Nebraska: North Platte [1]	2,095,367.55	6,253,047.33	8,348,414.88	15,200,385.76	2,571,289.60	17,771,675.36
Nevada: Newlands	1,020,107.81	2,848,954.53	3,869,062.34	7,956,911.58	1,453,490.54	9,410,402.12
New Mexico:						
Carlsbad		1,894,500.72		1,464,649.87	935,096.47	2,399,746.34
Hondo		34,956.70		381,573.39		381,573.39
Rio Grande [1]		4,639,492.82		8,617,500.55	1,955,735.93	10,573,236.48
Total New Mexico	6,695,603.17	6,568,950.24	13,264,553.41	10,463,723.81	2,890,832.40	13,354,556.21
North Dakota:						
Buford-Trenton		17,873.93		223,423.06	74,781.07	298,204.13
Williston		601,854.59		517,630.09	904,662.04	1,422,292.13
Lower Yellowstone [1]		290,295.53		1,292,065.14	472,386.63	1,764,451.77
Total North Dakota	12,308,524.77	910,024.05	13,218,548.82	2,033,118.29	1,451,829.74	3,484,948.03
Oklahoma	5,926,670.90		5,926,670.90			
Oregon:						
Baker		10,901.88		280,489.97		280,489.97
Umatilla		1,211,316.72		5,137,937.20	696,559.65	5,834,496.85
Vale		39,982.62		3,441,047.18		3,441,047.18
Boise [1]		80,000.00		204,600.00	28,100.00	232,700.00
Klamath [1]		2,592,982.69		3,909,168.00	1,214,277.16	5,123,445.16
Owyhee [1]		21,856.43		7,111,355.18		7,111,355.18
Total Oregon	11,927,205.75	3,957,040.34	15,884,246.09	20,084,597.53	1,938,936.81	22,023,534.34
South Dakota: Belle Fourche	7,724,977.47	1,699,352.04	9,424,329.51	4,508,674.77	1,652,432.03	6,161,106.80
Texas: Rio Grande [1]		3,770,833.52	3,770,833.52	7,250,592.71	1,676,609.58	8,927,202.29
Utah:						
Salt Lake Basin		91,144.31		2,825,286.95		2,825,286.95
Strawberry Valley		2,330,182.97		3,519,935.39	437,856.39	3,957,791.78
Total Utah	4,484,736.34	2,421,327.28	6,906,063.62	6,345,222.34	437,856.39	6,783,078.73
Washington:						
Okanogan		702,807.46		1,456,465.81	649,647.22	2,106,113.03
Yakima		12,241,399.42		15,984,467.16	4,761,535.68	20,746,002.84
Yakima-Kittitas division		169,549.62		8,600,620.21	111,616.91	8,712,237.12
Total Washington	7,456,545.21	13,113,756.50	20,570,301.71	26,041,553.18	5,522,799.81	31,564,352.99
Wyoming:						
Riverton		209,965.03		3,883,997.04	79,319.08	3,963,316.12
Shoshone		2,372,862.39		10,045,619.71	917,189.94	10,962,809.65
North Platte [1]		1,080,000.00		5,009,336.67	242,736.46	5,252,073.13
Total Wyoming	39,370,097.88	3,662,827.42	43,032,925.30	18,938,953.42	1,239,245.48	20,178,198.90
All States:						
Secondary project investigations		1,336,096.36	1,336,096.36	2,829,920.80		2,829,920.80
Federal power licenses	365,723.44		365,723.44			
Other collections (general offices, etc.)		715,113.75	715,113.75			
Loans from General Treasury		15,000,000.00	15,000,000.00			
Grand total	153,659,346.20	113,612,943.08	267,272,289.28	225,889,300.92	34,490,538.89	260,379,839.81

[1] Interstate projects, collections and expenditures partly prorated on area basis.

The Riverton Project, Present and Future[1]

By H. D. Comstock, Project Superintendent

AN attempt will be made to give a picture of the present status of the Riverton project and of conditions which will undoubtedly prevail when the entire project is completed and developed.

The Government has spent about $4,300,000 on the survey, construction, and operation of the project. Its total cost is estimated to be about $9,000,000, or in other words, the project is about half completed from the standpoint of expenditure. The heavy work has all been done except the Bull Lake Reservoir and a tunnel into Muddy Creek Valley. Works are now completed to serve about 32,000 acres. When completed the project will include something over 100,000 acres of irrigable land. The exact area depends on plans not yet fully developed for getting into Muddy Creek Valley and on the bench north of Muddy Creek.

Some of the completed items are the following:

General surveys	$125,000
Diversion dam	500,000
Pilot Butte Reservoir	350,000
Power system	275,000
17½ miles Wyoming Canal	1,400,000
25 miles Pilot canal	600,000
150 miles laterals	750,000
6 miles open drains	30,000

In all, 212 miles of ditches of all sizes have been constructed. This work has involved the excavation of 6,600,000 cubic yards of material, of which about 860,000 cubic yards has been shale or sandstone. More than 77,000 sacks of cement have been used and about 1,950 individual structures have been built.

WATER SUPPLY AMPLE

It is not necessary to tell Fremont County folks anything about their soil or climate, the superior yield and quality of their crops, the excellence of water for domestic use, or the inexhaustable water supply for irrigation. It may be mentioned that with one exception every well drilled on the Riverton project in the past 6 years has produced ample water suitable for domesite use. Canal water stored in cisterns is similar to the Lander city water and is entirely satisfactory, although it takes a very large cistern to provide for wintering many stock. The lowest recorded flow of Wind River occurred in 1931, yet there was ample water for all canals diverting from the Wind and Big Horn Rivers. The Fourt or Dinwoody glacier constitutes an enormous reservoir which few have seen and none has tried to measure.

IRRIGATION DISTRICT ORGANIZED

Now what will all this cost the settlers and when and on what terms will they be expected to repay this cost? An answer to this question must be given in some detail if it is to be understood. Experience in all the Western States has shown that an irrigation district organization offers the solution for the problems of management and repayment of construction cost most equitable to the investor, the water user, and the general public. Consequently the Midvale Irrigation District was organized in 1921. In 1930 this district made a contract with the Government covering many features, but principally the amount and terms of repayment. This contract sets a total construction cost of $5,000,000, plus the deficit incurred by the Government in operating the project until its operation is taken over by the district. This amount will include the cost of completed canals south of Five Mile Creek and of doing necessary drainage work. The estimate for future work is thought to be liberal and if the cost is less than the estimate the total obligation of the district will be reduced accordingly. It is estimated that the irrigable area to which this cost applies will be about 57,000 acres. The total cost of the water right should then be about $90 per acre, and, as stated above, this includes the cost of all laterals, storage, and drainage, as well as the main canals. The $5,000,000 includes no interest on investment or profit to the Government. In fact, items of cost amounting to about $1,000,000 have been eliminated as not properly chargeable to this portion of the Riverton project.

REPAYMENTS TO GOVERNMENT

The cost will be paid to the Government in 40 annual installments beginning on December 31, 1935 as follows:

3 years, 1935–1937, 1 per cent of the total, or about $0.90 per acre.
2 years, 1938-39, 1½ per cent of the total, or about $1.35 per acre.
9 years, 1940–1948, 2 per cent of the total, or about $1.80 per acre.
15 years, 1949–1963, 2½ per cent of the total, or about $2.25 per acre.
6 years, 1964–1969, 3 per cent of the total, or about $2.70 per acre.
3 years, 1970–1972, 3½ per cent of the total, or about $3.15 per acre.
2 years, 1973–74, 5 per cent of the total, or about $4.50 per acre.

The date of beginning these payments may be postponed if economic conditions are such as to make such postponement desirable. Special attention is called to the fact that these payments do not bear interest. They are about the equivalent of those required by a cost of $28 per acre bearing interest at 5 per cent also payable in 40 annual installments.

As on all irrigation projects there will be an annual maintenance charge to cover the actual cost of operating and maintaining the system. The amount of this charge will vary from year to year, but when the project is on a going basis it should not exceed $1.50 per acre nor is it probable that it will average less than $1.25 per acre.. At present to help the new settlers get started the charge for 1932 and 1933 is set at 50 cents per acre, entitling the water user to 2-acre feet of water for each 50 cents, additional water

[1] Address delivered before Lander Chamber of Commerce, June 13, 1932.

to be furnished at 25 cents an acre-foot. This charge covers only a fraction of the actual expense at present. For 1933 the charge will be assessed against all land for which water is available even though the water is not used. Attention is again called to the fact that this maintenance charge will cover the cost of maintaining all laterals and the cost of delivering water to each farm as well as the maintenance on drains.

DISTRICT TO ASSUME OPERATION IN 1935

The irrigation district has agreed to take over the operation and maintenance of the project on January 1, 1935, after which the entire control of affairs will be in the hands of the settlers. This date, however, is subject to postponement if economic conditions and the status of the settlement should then be such that the district can not finance the operation with a reasonable maintenance charge.

Prior to 1932, 110 farm units of public land had been opened to entry. About 40 of these have been taken. On June 1 of this year, 43 additional farms were opened. These may be taken only by ex-service men until September 1, 1932. Ex-service men no longer have any preference in taking the 70 farms remaining from earlier openings. This land is taken under the homestead law by men who have previously been accepted by the local examining board. The principal qualifications are a full homestead right, 2 years' experience in farming, and capital or backing in property useful on a farm amounting to at least $2,000. One who wishes to take a homestead may make application and if he is found by the examining board to have these qualifications he will be assigned the farm unit he has selected. He will then sign an application for water, paying 50 cents per irrigable acre as the first year's water charge, and subsequently make homestead entry at which time he will pay the filing fee, ranging from $6.50 for 40 acres to $16 for 160 acres plus 50 cents an acre for the entire area, which is the first payment on the Indian charge of $1.50 per acre, the remainder to be paid in 4 annual installments of 25 cents per acre each.

PRIVATELY OWNED FARMS FOR SALE

For those who have already used their homestead right or who for other reasons do not care to take land under the homestead law, there are many unimproved privately owned farms for sale at $5 to $10 an acre. Some farms are offered at a lower price provided a substantial cash payment can be made. The Government is equally interested in seeing both the public and privately owned lands settled and developed. The Reclamation office at Riverton has available for distribution a list of privately owned land for sale. The employees of that office will as far as possible show the land, both Government and private, to homeseekers and give them any possible assistance in getting located.

Formerly the demand for land was such that little effort was necessary to interest homeseekers in irrigated land. For example, at a land opening held on the North Platte project in 1920 some 3,200 applications were received for 80 farm units. In 1930 A. G. Keys, of Pavillion, with assistance of funds contributed by Riverton citizens, began to insert small classified advertisements in farm papers. From this source in about three years he received some 3,000 inquiries. In 1931 the Government placed a similar advertisement in six farm papers, as a result of which it is estimated about 1,000 replies were received. During the last nine months of 1931 approximately 1,500 homeseekers visited the project or wrote the Reclamation office. A similar advertisement has just been placed with Western Farm Life. A 10-page booklet describing the project was issued in 1927, of which about 15,000 copies were printed and distributed. This booklet was revised in 1931 with 10,000 copies printed. Mr. Keys prepared and printed a leaflet in three editions of 9,000 copies, supplementing the Government booklet. This leaflet proved very valuable.

The Wyoming Department of Commerce and Industry under the efficient management of our fellow citizen, L. L. Newton, distributed much of our literature, conducted correspondence with many homeseekers, and in 1931 placed exhibits at the State fairs at Des Moines, Iowa, and Lincoln, Nebr., and at the stock show at Kansas City, which were designed primarily to boost settlement on the Riverton and Shoshone projects. His successor, Charles B. Stafford, is continuing this work and is now using advertisements in the weekly Kansas City Star over the names of some of our settlers, with excellent results. In 1931 this department printed 2,000 copies of a leaflet describing the land opening and has recently printed 4,500 copies of a similar leaflet describing the opening this spring. A leaflet describing opportunities on the project has been issued recently by the Chicago and North Western Railroad.

PROJECT'S DEVELOPMENT INCREASES TAXABLE WEALTH

Now, what will the development of the Riverton project do for Fremont County? On northern irrigation projects there is an average of 100 people on farms for each 2,000 acres of irrigable land. In towns supported by irrigated agriculture it is found that the town population is about 100 to each 3,000 acres. On this basis the development of 32,000 acres for which water is now ready will bring into the county an additional farm population of 1,600 and a town population of 1,100, or a total of 2,700. In 1930 the entire population of Fremont County was 10,490.

Based on present-day valuations it may be fairly assumed that 32,000 acres of irrigated land will have an assessed valuation of $1,250,000 instead of perhaps $50,000, the present valuation of land in private ownership, or an increase of $1,200,000. Livestock and implements on the same farms would have a valuation of at least $500,000. Property in towns supported by these farms should increase in assessed valuation by at least $1,000,000, even assuming little industrial development. On this basis there should be a net increase in the assessed valuation of the county of $2,700,000. The total valuation of Fremont County property in 1931 was approximately $15,000,000. In other words, the settlement and development of only that portion of the Riverton project for which water is now available should cause an increase in the county's population of 26 per cent and an increase in assessed valuation of at least 18 per cent.

If we go further and assume that the entire project of 100,000 acres will be completed and settled, a result which will certainly follow if all sit in the game and work, then following the same line of thought, an increase of population of 8,300, or 80 per cent over 1930 figures, and an increase in assessed valuation of perhaps $8,500,000, or 57 per cent over 1931, may be fairly estimated. Is not that well worth while, especially in view of the insignificant contribution asked of Fremont County citizens?

Nor is that all that may be looked for. It is recognized that the area in the county now adapted to and accessible to sugar-beet culture is insufficient to support a sugar factory. With the addition of the Riverton project's 32,000 acres the area will be ample for one factory. When the entire project is completed there should be enough beet acreage to support two or three factories in the county. What that will mean in the way of cash pay rolls and building up of livestock feeding is too well understood to need discussion.

The excellent quality of our Fremont County potatoes is well known, yet our yield is now too small to permit building up a satisfactory market. We all know that the quality of our Fremont County strawberries, tomatoes, cantaloupes, as well as other products, is unexcelled anywhere in America. Yet our production now is insufficient in quantity to justify any concerted effort to develop a market. Surely the inevitable consequences of developing this great agricultural area are sufficient to command the active cooperation of every progressive citizen of Fremont County.

Educational Facilities in Boulder City

By Sims Ely, City Manager (in charge of schools)

BOULDER City is the largest construction camp ever operated in this country by the Government in a time of peace. The preliminary construction work for Hoover Dam began early in 1931 and the number of workers quickly reached 3,000. The average has continued above that figure. Practically all the workers are employees of Six Companies (Inc.), the main contractor on the dam. The main contract is scheduled to be completed in January, 1938. Because of the long period during which construction must proceed, the very hot summers of the desert on which the camp is situated, and the very considerable distance from any other town, the Government and the contractor, working in close cooperation, had decided that, for humanitarian reasons, extraordinary steps must be taken to provide for the residents of the camp all the comforts and conveniences that might be obtainable without extravagance.

It was foreseen that, because of the long period of employment and the depressed conditions throughout the country, there would be a large proportion of married men on the job, and since the work started men of families have been in the majority. Eleven commodious dormitories for men living alone were provided by the contractor, these dormitories having a separate and well furnished, air-cooled room (air-heated in winter) for each occupant; but it is an unsocial condition for men to live away from their families, and to avoid this condition as far as might be practicable the contractor constructed 660 family cottages. The Government constructed two dormitories and 100 residences for its officials and employees. The miscellaneous additional dwellings number 140, and thus there are 900 family houses in the camp.

The camp is a community of young families, the average age of the workers being about 34. There are already more than 800 children in Boulder City and the number is steadily on the increase, the birth rate being much higher than in any other town in the United States, owing to the fact that this is the only community in the whole country in which substantially all the families are young.

The matter of providing educational facilities for these children created a very important problem for the Bureau of Reclamation, as no funds were available from State or National sources. Last spring Congress appropriated the sum of $70,000 for the construction of a school building and for the expenses of school operation, but this sum was insufficient for construction, equipment, and maintenance of the building.

This school building is a brick structure of two stories (half basement and upper story) and has 14 completed rooms. Two additional rooms can be provided in the basement area when funds are available.

CONTRACTOR PAYS TEACHERS' SALARIES

As Boulder City is situated on the Boulder Canyon project Federal reservation (this reservation having been ceded to the Government by Nevada under the provisions of a State statute), the efforts of the State to assess and collect taxes on the property of the Six Companies and other owners of property within the reservation met with no success, and that question has at this writing not been decided by the Federal courts. Six Companies (Inc.) is paying the sum of $5,000 monthly to the Government as rental for the ground occupied by that corporation in Boulder City and for the town facilities provided, in addition to which the contractor pays for the water and light used. As more than 80 per cent of the school children on the reservation belong to the families of the company's employees and the bureau had no money for teachers, Six Companies met the situation with fine public spirit and agreed to contribute the sum of $18,800 to pay the salaries of teachers in the elementary grades for the present school year.

This contribution by the contractor enabled the bureau to open the elementary schools on Monday, September 26, by which date the building had been made ready from the congressional appropriation of last spring.

Boulder City is operated under a city manager (the writer), who is responsible to the construction engineer, the Government's chief officer on the project; and to the city manager, who had had long experience as president of a school board and in school management in a city, was assigned the duty of selecting teachers and acting as a superintendent of the schools. Applications from teachers in large number were received from the States of the Colorado Basin, and in a considerable number from all sections of the country. Eleven teachers of outstanding ability were engaged, one of them to act as principal and also to give full time as a teacher.

SCHOOL BUILDING STILL INADEQUATE

The schools opened with an enrollment of 550 in the eight grades, the greater number being in the first, second, and third grades. The number in these grades was so large that the method of having the pupils attend in half-day groups was adopted. The number attending was, of course, greatly in excess of the number indicated by the census of last spring (423), and was due in part to changes in the roster of employees of the Six Companies during the past summer—families with children of school age having taken the places of those without families or having children under school age; and in part to the fact that many families previously living outside the reservation (the fathers driving in to the works) had moved into Boulder City as additional housing was found. The enrollment in the elementary grades would be still larger if there were additional rooms in the school building, and if teachers could be provided, as there are many children living near the reservation whose fathers are employed on the works. Most of these children now attend the schools at Las Vegas, which is 23 miles from Boulder City.

Instruction for all the children of elementary grades living in Boulder City having been provided, through the contribution from the Six Companies, the problem remaining was to provide for high-school instruction, three rooms having been reserved in the school building for that purpose. The census of last spring had shown a potential high-school population of 90. A census in September had indicated only 67, but it could not be exact as many houses were closed when visited by the census takers, and some families were not certain whether some of the children should be assigned to the eighth elementary the first high-school grade. Also, it was known that some children would attend the Las Vegas High School, because instruction in the fourth grade of high school was not contemplated for Boulder City because of the lack of any laboratory or other scientific equipment.

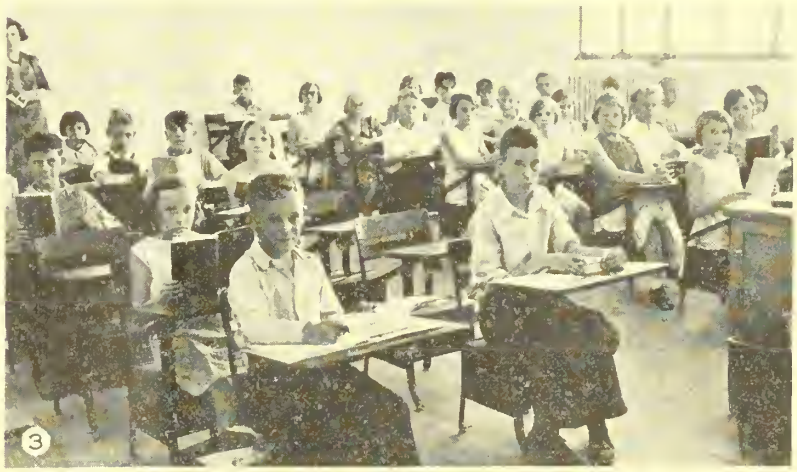
BABCOCK & WILCOX MAKE GIFT TO SCHOOL FUND

It had previously been decided by the local officials of the bureau that, if funds could be found for the payment of teachers' salaries, instruction would be given in the fundamental high school subjects of English, mathematics, history, and, if possible, general science, and one foreign language (Spanish), all for the first, second, and third grades of high school. For solution of this salary problem the cooperation of another contractor on the Hoover Dam, the Babcock & Wilcox Co., was sought. That company had recently obtained the contract for construction of the steel penstock tubes at the Hoover Dam. Among their

(Continued on p. 190)

EDUCATIONAL FACILITIES IN BOULDER CITY

2



3

4

Photo by B. D. Glaha

1. Teaching staff of Boulder City grade school, left to right, front row: Misses Leila Tilley, principal, Ruth Chadburn, Florence Smith, Alice Marie Connoly; middle row: Misses M. Hunt, Therese Winston, Audrey Reber, Carol Beecher; back row: Mrs. Leila Campbell Duffy, Mrs. H. C. Gossett, Mrs. F. A. Gustin. 2, School children enrolled in grades, in front of building, including 400 of a total enrollment of 550. 3, Fourth grade, Miss Therese Winston, teacher. 4, Eighth grade, Miss Leila Tilley, teacher

Reclamation Organization Activities and Project Visitors

Secretary of the Interior Ray Lyman Wilbur recently visited the Klamath project and was met at Klamath Falls by E. C. Solinsky, superintendent of Crater Lake Park; C. M. Blair, Indian agent; and B. E. Hayden, superintendent of the project. The party, with a number of prominent citizens, including the president and secretary of the chamber of commerce, had breakfast at the Willard Hotel, after which the Secretary spent the day with Messrs. Solinsky and Blair, during which he discussed matters under their supervision.

Dr. Elwood Mead, Commissioner of Reclamation, returned to the Washington office on October 31 after his inspection of the Madden Dam foundation, Panama Canal Zone, and short visits to the Boulder Canyon and Yakima projects.

Upon the recommendation of the chief engineer, in which the Commissioner of Reclamation concurred, W. W. Glass, living within 2 miles of Thief Valley Dam and on the shore of the reservoir, on the Baker project, Oregon, has been selected by the Lower Powder River irrigation district to fill the position of reservoir superintendent at the dam, and his appointment was approved by the Secretary of the Interior on October 5.

Robley J. Schmalhausen 1871-1932

Robley J. Schmalhausen, reservoir superintendent on the Rio Grande project, died on Saturday, October 8, at Hot Springs, N. Mex., as the result of an automobile accident. While rounding a sharp curve Mr. Schmalhausen lost control of the car and it plunged down a steep embankment.

Mr. Schmalhausen has had a wide experience in engineering matters. He was first appointed in the Bureau of Reclamation as superintendent of construction at Elephant Butte Dam, remaining in charge of that work until the project was completed in 1916. In 1925 he was reemployed by the service as engineer to care for the dam which he had built, and has since been continuously employed as reservoir superintendent with the exception of the period January, 1927, to May, 1928, when he was granted a leave of absence to construct a dam across the Conchos River in Chihuahua, Mexico. Before entering the Federal service Mr. Schmalhausen was employed on construction projects in Chile and at one time was division superintendent on the Southern Pacific of Mexico.

The Colorado River Board is scheduled to meet in Denver on November 14 and continue in session through November 19.

L. S. Oakes, president, and W. H. Gardiner, western manager, of Winston Bros. Co., contractors on the Cle Elum Dam, accompanied by R. J. Newell, construction engineer, were recent visitors on the Yakima project.

G. C. Wiggen, recorder of water records at Yakima, who had been assisting with the engineering work in the Yakima project office, has been appointed to the position of clerk in the Tieton office of that project.

P. A. Kinzie, who has been in Washington officially for several weeks, has returned to the Denver office.

Tom Mead, associate engineer, has returned to Denver from Green River, Wyo., where he spent a short time in connection with the Colorado River investigations.

O. R. Wycoff, special representative of Jones & Dillingham Co., of Spokane, Wash., called at the Denver office in regard to making experimental tests by his company for protection of the downstream face of Arrowrock Dam from weathering.

Boulder City School

(Continued from p. 189)

employees will be many families, to be established in Boulder City, some months hence. When apprised of the situation confronting the bureau the Babcock & Wilcox Co., with the same public spirit manifested by the Six Companies Inc., made a gift of $5,400, to be used as salaries of high-school teachers or for such other school salaries or expenses as the bureau might find necessary during the first year's operation. Thus a considerable number of high-school pupils whose fathers were not financially able to pay their transportation charges to the Las Vegas High School, and perhaps later tuition charges, will receive proper instruction in the Boulder City school.

EDUCATIONAL ADVANTAGES OF HIGH TYPE

It is believed that the measures which have been taken, namely, arrangements for funds to pay the salaries of 14 teachers during the present school year, great care in the selection of teachers of unusual ability, and the close supervision to be given this educational section by the bureau, will assure to the children of Boulder City the facilities of elementary schools of the very highest type. For the children of high-school age the fundamental instruction in the three lower grades will be equal to that obtainable in the best schools of the country.

As it is reasonably certain that the pupils for the elementary grades next year will exceed the number attending this year, and as more rooms and more teachers are actually needed now, it is expected by the bureau that additional accommodations will have to be provided in the form of a temporary school building of 4 rooms, and completion of the 2 rooms in the basement of the present building, thus giving Boulder City a total of 20 school rooms, inclusive of an assembly and study room for the high school.

Thereupon it was decided to organize a high-school division comprising the eighth elementary grade and the first, second, and third grades of high school, to which three teachers, all of exceptional ability, were assigned. Through a reassignment of duties, and with the consent of the Six Companies, this left 10 teachers in the elementary grades, and sufficient money in the Babcock & Wilcox appropriation to provide for other teachers as the coming of the additional families shall make their employment necessary. As may become necessary one of the school rooms now used as an assembly and study room for the high-school division will be available, and the "court room" in the municipal building, which is directly across the street from the school building, will be used as an assembly and study room. Thus 15 rooms will then be in use.

The high-school division opened on October 10 with an enrollment of 109, comprising 45 pupils in the eighth grade, 32 in the ninth, 20 in the tenth, and 12 in the eleventh. This left 500 in 7 lower grades with a grand total of 609.

The September census having shown that there were approximately 50 children of kindergarten age (5 to nearly 6), the bureau has permitted an experienced primary teacher to have the free use of a basement room in the municipal building for a kindergarten, to be operated on a subscription basis, and this school opened on October 3 with a large attendance.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy**, Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel, L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief Clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz.	R. M. Priest	Superintendent	J. C. Thraikill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev.	Walker R. Young	Constr. engr.	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif.	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg.	F. A. Banks	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont.	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex.	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg.	C. L. Tice	Reserv. supt.		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	Chas. C. Ketchum	Superintendent		F. C. Bohlson	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg.	F. A. Banks	Constr. engr.	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash.	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash.	R. J. Newell	Constr. engr.	C. B. Funk	do	do	Do.
Yakima, Kittitas Div.	Ellensburg, Wash.	A. A. Whitmore	Act. Constr. Eng.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo.	I. B. Hosig	Acting supt.		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

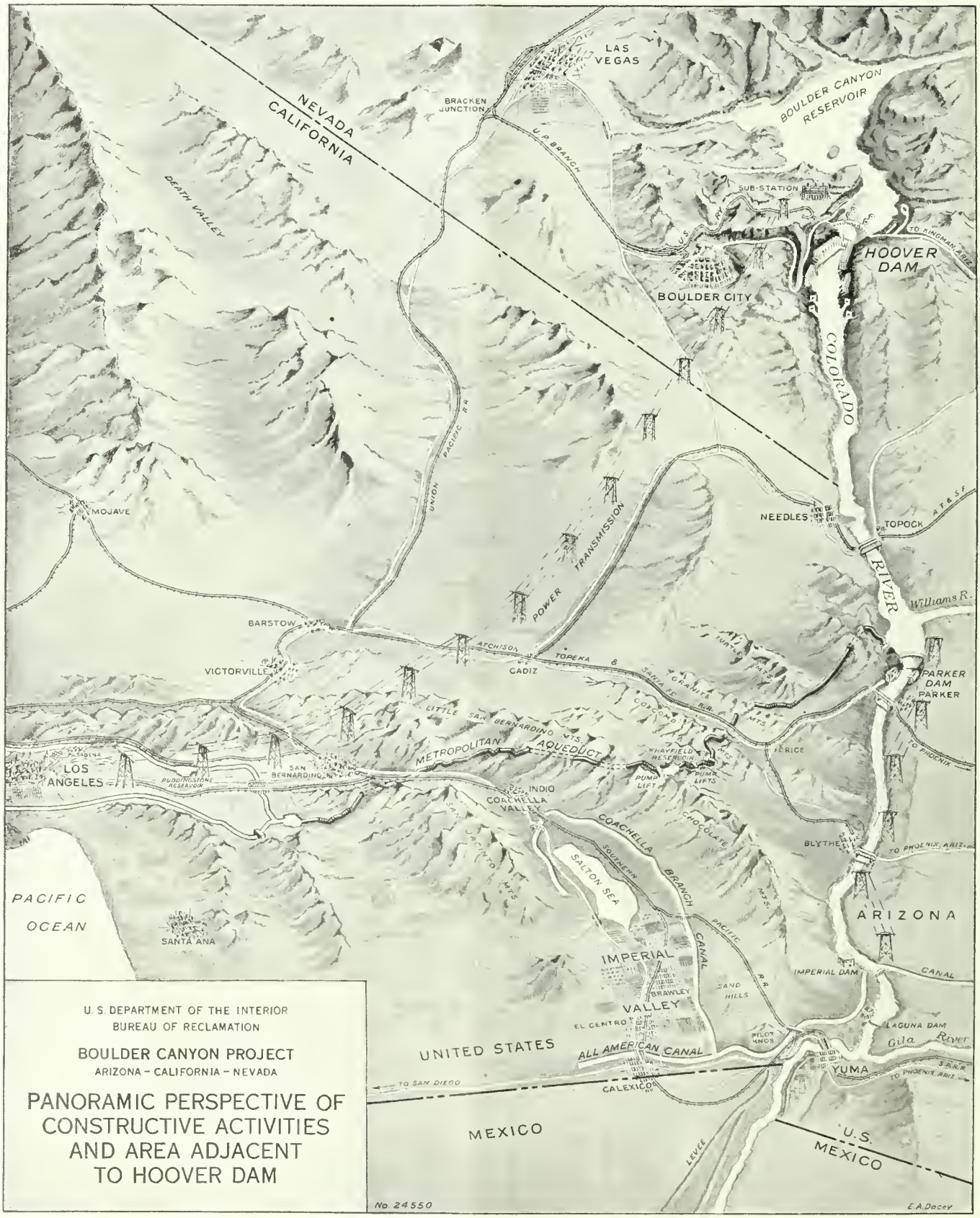
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo.	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A.	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont.	Charles J. Johnson	Superintendent	Geo. H. Tont	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont.	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont.	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev.	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg.		Reser. supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg.	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg.	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A.	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo.	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg.	E. O. Larson	State of Utah.
Humboldt River, Nev.	Winnemucca, Nev.	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg.	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*



U. S. GOVERNMENT PRINTING OFFICE 1932

I 27.5
CLEMSON COLLEGE LIBRARY
GOVERNMENT PUBLICATIONS

THE RECLAMATION ERA

VOL. 23, NO. 12 DECEMBER, 1932

Photo by G. K. Griffith

THIEF VALLEY DAM, BAKER PROJECT, OREGON

HEIGHT 66 FEET; CAPACITY OF RESERVOIR 17,400 ACRE-FEET. COMPLETED JUNE 1, 1932 (SEE PAGE 194)

The Irrigation Farmer

THE difficulties and the failures in farming on new irrigation projects have been much heralded in recent years, and the irrigation farmer seems to have had more than his share of discredit for the failures that have occurred. Undoubtedly, a strong vigorous man who has been reared on an irrigated farm and had experiences in irrigation farming, when aided and inspired by a devoted, intelligent, industrious, rural-minded wife, will succeed under conditions that will cause the failure of a man inexperienced in irrigation farming who is also discouraged and weakened by a discontented city-minded wife unaccustomed to the privations of pioneer life. Between these two extremes there are, of course, a great variety in the capacities, the experience, the determination, the vision, the industry, and the courage of irrigation farmers and their wives. The financial difficulties that have developed on some of the newer American irrigation projects since the World War, including the Federal projects, have adequately demonstrated the need of reasonable selection of the irrigation farmer in the settlement of new irrigation projects in order to guard against unfortunate misfits on the land, preventable financial failures, and pathetic family disappointments sometimes followed by permanent weakening or wrecking of individuals.

However, the student of irrigation should keep continuously in mind the fact that on the older irrigation projects of the West, and of other countries, average men and women are maintaining permanent homes and rearing families successfully. As in humid-climate farming, and indeed in other phases of American industrial life, the man of high native capacity, great vision, and untiring energy, ultimately acquires a position of leadership and financial security, whereas the man who is seriously lacking in these characteristics ultimately reaches a place of servitude if not one of actual financial dependence. In writing the "specifications for the irrigation farmer," who will succeed on the new American irrigation project, there has been a tendency to specify only the type of man who will succeed in spite of adverse conditions on the farm, and who can, if necessary, leave the farm and acquire success in the competition of industrial city life. This tendency is probably justified, in part at least, by the importance of guarding against the failure of individuals on new irrigation enterprises, because the project success rests so largely on the success of every unit in the entire enterprise.

—*Orson W. Israelsen, Ph. D.*

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 23, No. 12 DECEMBER, 1932

Rehabilitation of Distressed Irrigation Districts[1]

By W. P. Stapleton, Western Agricultural Development Agent, Northern Pacific Railway Co., Seattle, Wash.

TO DEFEND irrigation as a national policy is not the purpose of this paper. Let us not overlook the fact that the future of agriculture in the arid areas of the Pacific Northwest is in a most substantial measure dependent upon irrigation. Vast areas of fertile desert, with which this territory is so abundantly endowed, must eventually be watered if the Pacific Northwest is to retain its position with other sections of the United States in the march of progress. In view of this fact, it is nothing less than fundamental that the few black marks in the irrigation map of the Northwest, representing distressed, bankrupt, or troubled irrigation districts —and too often pointed to as mute evidence of the futility of irrigation as a national policy—be effectively wiped out. So that our needs for the future may be properly protected, let us make sure that what we have to-day is properly safeguarded.

Let us briefly consider some of the major factors that have led to irrigation district difficulties in the past. To my mind, the most fundamental of these difficulties was buried deep in the motives of some of the original builders or promoters—that of making quick profits from their enterprises. Do not construe this remark as intended to impugn the characters of the pioneers in irrigation development. Their purposes were honest. However, they were operating in a new field, which was surrounded with unseen or unappreciated hazards and were faced with the necessity of attempting to make a profit on their investments.

Quality of land included in the development and the ability of this land to lift the annual charges necessary for operation, maintenance, drainage, and bond service, which, incidentally, were frequently underestimated, a sufficient and dependable supply of water, sound design of works and permanent construction, adequate drainage facilities, true economic use of the soil and climate, and ample provision for settler placement—all factors of vital importance to the ultimate success of the project—were too frequently shoved to the background. In other words, the building of permanent farm homes was not the guiding motive. I have in mind one district for which water was pumped 85 feet. As much as 70 per cent of this highly expensive water was lost through evaporation and seepage before it reached the land. Is it necessary to enumerate any other reasons as showing why such a district was eventually headed for serious trouble? I am also reminded of the case of a ditch company organized in one of the central Washington counties several years ago. For light sandy land, this ditch company provided a so-called perpetual water right of 1½ acre-feet of water. Subsequent scientific investigations proved that a minimum of 54 inches of water was necessary for the production of crops. Land with this water right, worth not more than $10 to $20 per acre, was sold to gullible purchasers at prices ranging from $150 per acre upward. The story of this particular deal is not complete without saying that the ditch company later proved unable to furnish the 1½ acre-feet of water called for. Is there any reason to believe that irrigation farming should be expected to be successful under such conditions?

Hoover Dam Has Distinguished Guests

President Hoover honored the Boulder Canyon project and Hoover Dam by a visit on the evening of November 12. His special train arrived at Boulder City at 7.30 p. m., where he was welcomed by Bureau of Reclamation officials. The presidential party, consisting of President and Mrs. Hoover, the Secretary of the Interior and Mrs. Wilbur, railway officials, and others, after an inspection of Boulder City motored to the dam site and down into the canyon, where the night shift was at work under floodlights. In a brief speech President Hoover described the project as "the greatest engineering work of its character ever attempted at the hand of man."

CHECKERBOARD SETTLEMENT

Checkerboard settlement of the land, with thought of effecting quicker sale of intervening tracts, is also one of the common fallacies of the past. Here is an interesting illustration: One of the early Washington irrigation districts had two pumping lifts, one of 87 feet and another of 120 feet. Both units were constructed at about the same time. Settlers were widely scattered throughout the entire project and there was never a sufficient number of them to represent more than 25 per cent settlement. The district was finally saved from complete ruin through the courage of the farmers on the high lift unit who, as an economy measure, abandoned their holdings and improvements in this unit and moved to the lands under the low lift. The high-lift lands have subsequently been abandoned and the district has reorganized on the basis of including in the new plan only the good lands located under the low lift. Eventually the high-lift lands will be developed, but certainly there is no point in doing so until the low-lift lands have become wholly

[1] Excerpt from paper prepared for Oregon Reclamation Congress, Bend, Oreg.

settled. Checkerboard settlement almost sealed the doom of this district.

The inclusion of relatively large acreages of land unsuited to irrigation has not been an uncommon practice with a great many irrigation developments. For instance, three districts on which we have done considerable work present this picture:

District No. 1 out of a total acreage of 11,000 had but 3,500 acres of land suited to irrigation. In district No. 2 there were but 5,000 acres of good irrigable land out of a total of 9,800, while in No. 3 only half of a total acreage of 10,000 could be considered high enough in quality to warrant irrigating. Figures quoted are approximate.

The results of such a situation are obvious. Under the principle of unlimited liability, the better land gradually assumes the obligations of the poorer land as it becomes abandoned. Eventually the obligation becomes unbearable for the good land and trouble begins.

CROPS ADAPTED TO SOIL AND CLIMATE

Some bankrupt or near bankrupt irrigation districts are in their present condition partly because of the fact that the true economic use of the soil and climate was not known. It was necessary for the farmers to bear the brunt of developing through the expensive method of trial and error, the kind of agriculture best suited to their conditions and this of course meant terrific losses. Abandoned or nearly abandoned orchards in certain sections of the Northwest stand as testimony to the misguided efforts of landowners to raise tree fruit where they should have engaged in general farming. There are many instances of record during the past few years of new settlers moving into irrigation districts and purchasing abandoned orchards which have been torn out. They are paying for this land at prices ranging from $10 to $30 per acre, whereas the original purchaser paid from $150 to $500 per acre, in addition to his heavy investment in fruit trees. Then, again, we have innumerable instances of farmers who have attempted to carry an irrigation overhead charge of upward of $10 per acre annually, raising grain and alfalfa hay, whereas later developments have proven conclusively that the soil and climate are ideally suited to the production of early and late truck crops. Under the first condition an overhead charge of $10 was hopeless, while under the second condition it becomes economically practical.

After new crops were developed, it was then necessary to pioneer the organization of efficient marketing associations through which to dispose of them. The many difficulties attending the marketing of a new crop are well known.

FINANCIAL SET-UP

Frequently the financial set-up was poor. Not only was there a heavy bond burden being carried, but in addition to this, the bonds usually fell due in large blocks, and too frequently sinking-fund requirements had not been taken care of. Then, too, the privilege of issuing warrants with no funds available for payment has been used as a means of meeting the situation brought about by nonpayment of assessments for operation and maintenance. Laxity in enforcing collection of assessments for operation and maintenance has been the cause of much trouble.

It is, of course, obvious that the situation in most distressed irrigation districts has been brought about as a result of a combination of several of the factors just mentioned. Generally speaking the illustrations I have used are extreme. It is apparent that each individual district is a problem of and by itself, and that the degree to which the given factors have been important in its downfall vary tremendously. The important point is that practically all of the distressed districts in which I have observed conditions are fully feasible, if they had been organized with the primary thought of building productive farm homes rather than making quick profit from real-estate promotions. That many of these districts have been able to carry along as far as they have under the conditions is nothing short of marvelous and may be taken as evidence of the fundamental soundness of irrigation agriculture.

FUNDAMENTAL PRINCIPLES

Here are a few homely principles, briefly stated, that we have found from experience to be fundamental in dealing with the problem: Adjustment of the bonded indebtedness is almost always the basic part of the program; and I want to testify right here and now that the moment an irrigation district makes an effort to repudiate its just obligations, trouble begins. When the landowners assume the attitude, either intentionally or unintentionally, of attempting to drive a so-called "good bargain," the situation definitely begins to acquire the earmarks of hopelessness. I know of no reason why a holder of irrigation-district bonds should be willing or should be expected to enter into a bargaining process. Let us not forget that irrigation districts will be more or less permanently in need of credit and that purely for selfish purposes, if for no other reason, each individual district will do well to go the limit in maintaining a good credit standing. There is no reason under the sun why a holder of irrigation bonds should be expected to submit to a downward revision of his claim, except in so far as such revision will eventually mean a better business deal for him. It should also be remembered that in the final analysis it is strictly up to the individual bondholder to decide whether a given adjustment is or is not a good business proposition for him.

I also want to testify to my belief that from the standpoint of the bondholders' interests, procrastination on their part is a very costly indulgence. If a given irrigation district is headed for the financial rocks, the fact becomes obvious, and to allow such a condition to continue without adjustment for any great length of time means only a loss to all concerned—the bondholders as well as the landowners. The situation has very definite characteristics. Gradually the farmers on the poor land begin to lose out. Unable to pay assessments, their land reverts to the ownership of the county and district. Through operation of the principle of joint liability, the obligation incurred for construction of works to serve the poor land gradually transfers itself to the good land. This means constantly increasing assessments, discouraging further settlement of the good land. Operating property begins to break down, and the district finds itself faced with declining population, increasing assessments, necessity of extensive repair, and replacement of works, and no credit. This is usually followed by default of obligations, further loss of population, and in some cases complete collapse.

Now it is my contention that in such a situation the bondholders' opportunity to salvage the maximum percentage of his investment is in direct proportion to the speed with which adjustment is made after all of the facts have become known. I have yet to find a single instance of where the bondholder's equity has not depreciated by letting the matter ride along for another year to see what happens. Invariably, by the time another year comes around, the situation in the district has become worse instead of better. The uncertainties involved have a most telling effect upon the morale of the individual farmer and if his morale is to be sustained, it is important that quick relief be administered. Evidence of this assertion is to be found wherever there are irrigation districts in the throes of financial trouble.

What about the question of legal rights? Fundamentally the problem is not a legal one. There is no way by which, through legal process, the ability of the land to pay may be altered. Then why go to law about it? Doing so merely creates added

expense, eliminates the spirit of cooperation by injecting a barrier between the principals and postpones the day of settlement. Everybody loses. My advice is to direct negotiations into channels which will, if at all possible, eliminate the necessity of having anyone exercise his legal rights.

To my way of thinking there is only one logical method of proceeding. The bondholders and the landowners should work together, forgetting for the moment whether the bonds in question will pay out 100 cents on the dollar or some figure less than this amount. The answer to this question is of importance only incidentally and when arrived at in some sort of logical fashion. The land within the district should be classified, preferably by some qualified individual selected by both parties in question, and upon the basis of this classification the amount that each tract of land may be expected to carry annually for irrigation charges determined. From this figure should be subtracted the amount necessary annually for operation, maintenance, and drainage. The balance would then be available to apply upon the bonded indebtedness.

In my opinion this is the logical procedure. The element of bargaining is entirely eliminated and there is applied to the bonded indebtedness the amount of money, scientifically determined, that the land may be expected to carry, and at the same time permit the farmer to carry on. The individual landowner should be willing to consent to such an adjustment, in that it usually means somewhat of a scaling down of his obligations and, in my opinion, the bondholders should likewise accept such an adjustment, as it in reality represents all that the land is able to pay. To the bondholder it simply means that he had adjusted his claim for the purpose of protecting that portion of it that the land is able to pay out.

Common experience is that bondholders are usually interested in protecting their investments and are willing to cooperate when it is known that an effort is not being made to deliberately bargain them out of a part of their claims. The average bondholder is quick to realize that the only practical security behind his claim rests in the landowner who is able to stay on his land and continue to pay assessments from year to year. Obviously, unless a situation is brought about by which the landowner can meet his assessments, then the bondholder bids fair to lose out entirely.

The adjusted debt should be amortized. I can see no reason why an irrigation district should assume any kind of an obligation that is not amortized. This principle is well proven and it is not necessary to enter into any lengthy argument to support it.

SETTLEMENT OF LAND

The question of land settlement is a pressing one. In many districts there is not a sufficient percentage of the land in cultivation to properly carry the district's obligations and make it a really going concern. I consider it a fundamental part of the program of rehabilitation for any distressed district that its vacant lands become settled with resident farmers and our program calls for particular attention to this problem. As you all well know, this question of securing settlers is a science of its own. However, that settlers can be secured, even under present adverse conditions is evidenced by the fact that our company has been successful in placing upward of 50 settlers during the past 18 months in one Washington irrigation district that was directly headed for collapse prior to its reorganization two years ago.

The rehabilitation of a distressed irrigation district is not an overnight job. Bondholders are usually scattered widely and under the best of working conditions, negotiations are bound to drag out. Usually a bondholders' protective committee, representing the major bond interests, is easily organized, but it should not be discouraging if a year's time is required to arrive at a basis of settlement and another year is required to secure the consent of all the bondholders. Even then it is necessary that some organization make a project out of the job and stay faithfully by the execution of the many details that require attention.

Yuma Has Excellent Grapefruit Season

Picking and packing of this season's grapefruit crop on the Yuma auxiliary project started the latter part of October and will continue until April or May. The rapidity with which this crop is marketed depends upon prevailing market prices. It is anticipated that this year's crop will show an average increase in yield of 35 per cent over last year's crop, with individual groves yielding 60 per cent above that of 1931. The quality of the fruit is the best experienced locally with a marked improvement in size, skin texture, and general appearance. The percentage of first-grade fruit this season has shown a marked increase to date, and it is believed locally that this general improvement in quality and yield will continue to increase until the groves reach full bearing age.

Notes for Contractors

Boulder Canyon project.—The award of contract to the Lidgerwood Manufacturing Co., of Elizabeth N. J., under Specifications No. 537 for furnishing and installing the 150-ton permanent cableway, was protested by the Washington Iron Works, of Seattle, Wash., through the Comptroller General's office.

In the Denver office, work was continued on preparation of specifications for the generating units in the power plant. Work was done on the general design of the power-house substructure, and studies were in progress of alternate locations for the main transformers and high-voltage switching equipment to be located on top of the canyon, which will involve several inclined tunnels from the power house to the cayon rim.

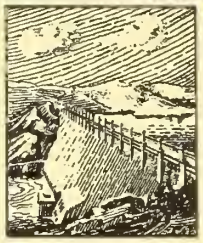
The Denver office has completed preliminary designs of the welded-steel cylinder gates and gate frames for installation in the intake towers. Detail drawings of the 100 by 16 foot spillway drum gates are being prepared.

Specifications have been prepared for the 40-ton overhead crane for the 150-ton cableway hoist house. These specifications will also cover the 5-ton cranes to be installed in the Stoney gate hoist houses at Hoover Dam, the 20-ton crane for the cylinder-gate operating house at Cle Elum Dam, and the 5-ton crane to be installed in the gate house for tunnel No. 1 controlling works on the Owyhee project.

Specifications No. 540 have been issued covering the purchase of the initial group of hydraulic turbines for the power plant at the Hoover Dam. Bids will be asked for three, four, or five 115,000-horsepower, and one or two 55,000-horsepower vertical-shaft turbines. Provision is made in the specifications for purchasing the turbines either with or without butterfly type shut-off valves. The specifications also provide for the purchase of a governor for each turbine. Bids will be opened at Denver, Colo., on February 3, 1933.

Yakima project, Kittitas division.—Specifications No. 541 have been issued covering the construction of the Badger Creek wasteway. The principal items of work and estimated quantities involved are as follows: 137,000 cubic yards of all classes of material; 2,800 cubic yards of backfill; 190 cubic yards of concrete; placing 16,500 pounds of reinforcement bars; erecting 58.5 M feet board measure of timber in bridges and flumes; erecting 540 linear feet of intake flume; driving 2,000 linear feet of timber piling; and laying 445 linear feet of 54-inch concrete pipe.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Construction of Thief Valley Dam

By Clifford A. Betts, Engineer, Bureau of Reclamation, Owyhee, Oreg.

ON JUNE 1, 1932, nine months after a contract had been awarded for the construction of Thief Valley Dam for the purpose of providing 17,400 acre-feet of storage for 7,000 acres of lands of the lower Powder River irrigation district, the full reservoir, spilling about 500 second-feet over the crest of the completed Ambursen type dam, was turned over to the water users for operation and maintenance.

This work, involving an expenditure of about $235,000, illustrates the service that the Bureau of Reclamation is able to render agricultural districts under repayment agreements, and at the same time it shows how small projects may be constructed with a minimum of overhead by slight expansion of the organization of a near-by major project.

Situated on the lower Powder River, 16 miles north and 10 miles east of Baker, Oreg., the dam site is reached from the nearest railway point, Telocaset, on the Union Pacific main line by 7 miles of standard-gage logging railroad and 6 miles of unsurfaced road, which is practically impassable during the winter season when snows usually accumulate to a depth of several feet.

The reservoir created by the dam floods 744 acres of meadow lands, extending for 4½ miles up river, and impounds 17,400 acre-feet when water is at the spillway crest elevation of 3,133 feet above sea level. The drainage area behind the dam is 1,110 square miles.

DESIGN

The dam is of the concrete buttressed or Ambursen type with reinforced-concrete face slabs 18 inches to 34 inches thick and an ogee spillway crest, 267 feet 10 inches long, capable of passing 34,000 second-feet under 10-foot head. The length of the dam is 390 feet, including the 7-foot walkways at each end of the spillway and 10 feet above it. The maximum height of the walkways above lowest foundation is 70 feet and above river bed 50 feet.

Outlet works consist of two 4.8 by 6 foot slide gates operated by gas engine or by hand from a gallery extending through the center of the buttresses from the west end of the dam. A trash rack of ⅞ by 6-inch bars, spaced on 6-inch centers in an opening 15 feet 6 inches by 25 feet in the up-stream face, protects each gate. The downstream side of the dam is open between buttresses. In the gage section a concrete apron extends 15 feet downstream from the buttresses terminating in a cut-off 3 feet deep in solid rock. Plans for the structure were prepared by the Denver office of the Bureau of Reclamation and embodied in Specifications No. 523.

Bids opened at Nyssa, Oreg., on July 27, 1931, ranged from $67,835 to $121,733. Award was made to W. H. Puckett Co., of Boise, Idaho, the second low bidder, on September 3, 1931; the low bidder was unable to furnish satisfactory evidence of experience or financial ability to complete the work.

PRELIMINARY CONSTRUCTION

Clearing of the site was begun on September 12 and excavation for foundation was started five days later. Earth stripping, varying up to 10 feet in depth, was wasted by drag line along both sides of the river up and down stream from the site and across the channel 30 feet downstream to form a low cofferdam, the abutment stripping being first cast by hand down the steep slopes to the drag line in the river bottom. Unwatering was unnecessary for this operation.

By arranging with irrigators up river to waste water on their land, the river flow during excavation was kept down so that it could be handled from sumps by a 6-inch pump until the concrete was poured above river channel after which the water was diverted through the panels as convenient. After November 1, when a flow of several second-feet developed, low dams were constructed from one-half to 2 miles above the dam to hold back the flow until a flume through the dam was ready.

Rock excavation for the footings, cut-off, and abutments was well underway by October. When the foundation excavation had been carried down to the point originally contemplated in the plans, it became evident that the hard quartzite which had been encountered in diamond drill holes in the central section of the dam site at about elevation 3093, did not follow up the abutments as had been assumed from shallow test pits to rock at the hillside, but underlay a rotten rock which had to be removed thus increasing the quantities.

Grout holes were drilled about 5 feet apart along the cut-off trench in the foundation rock to a depth of 10 to 20 feet prior to the placing of concrete and 2-inch pipes extended up through the forms until at least 10 feet of concrete was poured within a radius of 50 feet. Thereafter grouting with neat cement or sand-cement grout was done from time to time with a 2-cubic-foot gun using 100 pounds pressure per square inch. Altogether 134 sacks of cement and 56 sacks of sand were required for the grouting.

CONCRETING OPERATIONS

Preliminary tests of sand and gravel deposits within a radius of 130 miles had established the fact that the cost of transportation of superior aggregates precluded the possibility of their use, leaving the mediocre local stream-bed deposits as the only alternative. Strict control of proportions and gradation was therefore essential.

Two classes of concrete were required, one having a minimum strength of 2,000 pounds per square inch for abutments, cut-offs, and buttresses, and the other having a minimum strength of 3,000 pounds per square inch for reinforced sections, face slabs, and the thin sections. For the former a mix (by weight) of 1–2.5–4 (with 5½ sacks of cement to the yard) was used, and for the latter a mix, 1–2.25–3.75 (5.8 sacks per yard) which was changed to 1–2.22–3.47 (6.3 sacks per yard) when gradation control became more difficult toward the end of the job. A slump of 2 inches to 4½ inches was maintained with water-cement ratios between 0.8 and 0.9. (See summary of tests.)

As soon as excavation was completed at the dam and while the concreting plant was being finished at the east end of the dam above high water level, the drag-line that had excavated the foundation was moved one-half mile upstream to the most suitable sand and gravel deposits and used to load trucks serving the crushing and screening plant.

Rotary, wet screens divided the aggregates into the following sizes: Sand (passing ¼ inch); gravel, ¼ inch to ¾ inch, ¾ inch to 1½ inch, 1½ inch to 2¾ inch, discharging each into 40-yard bins. The sand bin was divided in half so that, after passing from the screens through a drag-type washer, the wet sand could be discharged into one bin and drained while the other was being emptied.

Sand, gravel, and cement were fed through chutes equipped with slide gates into the weigher above the mixer. Water from the river was measured into the mix from a tank with glass gage calibrated to half gallons. The mixing period was 1½ minutes. From the 1-yard mixer the concrete was discharged into a 1-yard car on a track at elevation 3,143.

Chutes from the trestle paralleling the downstream side of the dam delivered the concrete to various parts of the structure during the early pours but were soon replaced by buggies fed from hoppers or the chutes in order to decrease segregation.

Summary of Concrete Control Tests

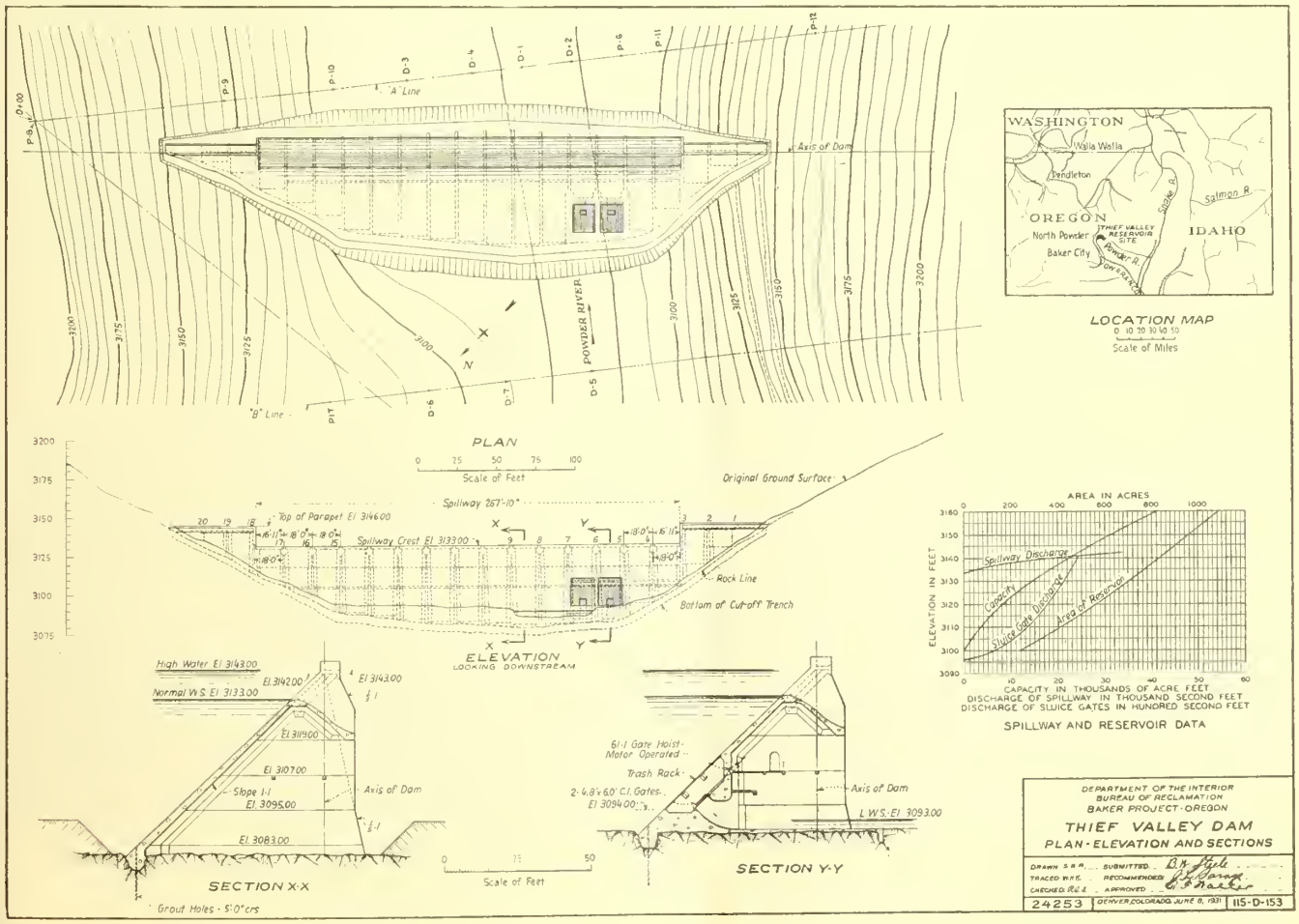
(FOR 6,300 CUBIC YARDS OF CONCRETE)

	Mix by weight				
	For footings, buttresses, etc., requiring 2,000 pounds per square inch		For thin reinforced sections requiring 3,000 pounds per square inch		
Mix	1-2.25-5	1-2.5-4	1-2.22-3.47	1-2.25-3.75	1-2.19-3.79
Sacks of cement per cubic yard	4.8	5.5	5.5	5.8	6.3
Number of cylinders	1	23	9	30	4
Average compressive strength, 28 days	2,900	3,250	3,410	3,370	4,000
Per cent of cylinders within 10 per cent of average	----------	70	89	60	----------
Per cent of cylinders within 15 per cent of average	----------	78	100	80	----------
Maximum strength	----------	3,820	3,890	4,480	4,730
Minimum strength	----------	2,345	3,060	2,580	3,260
Average water-cement ratio	.85	.91	.85	.89	.85
Average slump in inches	4.0	3.5	2.8	3.0	4.0

NOTE.—Frozen samples not included in above.

Wooden forms faced with No. 22 gage sheet metal were used and their construction proved to be the "bottle neck" of operations as well as the most expensive item of concrete costs. A ⅞-inch cableway, 10 feet upstream from the axis of the dam, was equipped with gas-driven hoists for handling forms.

Curing and protection of the concrete was particularly burdensome owing to the necessity of continuing concreting through the winter, which in this locality, is unusually severe. The winter of 1931–32, with 5 feet of snow and subzero temperatures convinced engineers and construction crews alike that Thief Valley and Valley Forge had much in common. From November to March transportation was limited to bobsleds and a day was required for the trip to North Powder, 20 miles away. The placing of 468,000 pounds of reinforcing steel in the dam



kept two men working about 50 per cent of the time.

PHYSICAL PROPERTIES OF AGGREGATES

Material	Specific gravity	Fineness modulus	Weight per cubic foot dry rodded
			Pounds
Sand	2.69	3.348	105.6
Gravel	2.79	7.86	110.0
Concrete			150.7

When the installation of the gates at elevation 3094 (6 feet above river bed) was completed on February 25 a sudden rise in temperature precipitated a corresponding rise in the river and necessitated the erection of an emergency cofferdam to protect the placing of the face slab between buttresses Nos. 4 and 5 where the river had been carried during the placing of the gates.

Filling of the reservoir began on April 2, 1932, 10 days before the last of the 6,288 cubic yards of concrete was placed. Part of the river discharge passed through the gates until cleaning up was completed and the equipment removed. On May 1 the gates were closed, and on May 13 water began to flow over the spillway.

Hoover Dam Cement Specifications

Tentative specifications for Portland cement for use in concrete to be placed in the dam, power plant, and auxiliary structures have been prepared by the Denver office. The specifications embrace two types of cement, one of low heat properties (type A) and the other of moderate heat properties (type B). The proportionate requirement for each type of cement is not known at this time, but it is not anticipated that the requirement for type B cement will exceed 25 per cent of the total cement requirement (after July 1, 1933), of about 4,000,000 barrels, or that type B cement will be used in any appreciable amount, if at all, during the summer season. Probably the first advertisement for cement under the new specifications will be for 300,000 to 500,000 barrels total, and subsequent advertisements will be issued annually for amounts ranging from 1,000,000 to 1,500,000 barrels each. The bureau contemplates the erection and operation of a cement-blending plant at Boulder City for blending cements of the same type but originating from different mills, and for combining cements of the two types in any desired proportions.

Copies of the tentative cement specifications have been sent to the following companies for their comments: Monolith Portland Cement Co., Los Angeles; Southwestern Portland Cement Co., Los Angeles; California Portland Cement Co., Los Angeles; Yosemite Portland Cement Corporation, San Francisco; Pacific Portland Cement Co., San Francisco; Santa Cruz Portland Cement Co., San Francisco; Calaveras Cement Co., San Francisco; Henry Cowell Lime & Cement Co., San Francisco; Utah-Idaho Cement Co., Ogden, Utah; Union Portland Cement Co., Denver; Idaho Portland Cement Co., Pocatello, Idaho.

Low-heat Cement

AFTER more than a year's study, itself based on long prior researches, a radically new specification for Portland cement has been written to govern the manufacture of cement for Hoover Dam. Its trend was foreshadowed by the recently published results of investigations at Riverside and Berkeley and the Pine Canyon specification, but it goes well beyond these in respect to both quality requirements and tests. In view of the high rank of the experts who cooperated in drafting it, the specification may be taken as proof that success has been attained in producing cements of low-heat evolution that will give good strength and reasonably rapid set.

As to the background of this development: The great concrete masses of Hoover Dam obviously called for a cement that would generate the least possible heat in setting, in order to simplify the problem of controlling the interior temperature of the setting blocks. Heating means expansion and subsequent contraction, and this in turn implies the risk of cracking, which is especially dangerous in dams—several dams of recent years have developed objectionable cracking—but also may be serious in other engineering structures of massive proportions. Hence the importance of keeping down heating, either by the novel refrigerating pipe system projected for the Hoover Dam construction or by the use of low-heat cement. The temperature problem of Hoover Dam was considered so important as to call for both expedients. According to the new specification the desired reduction of heat evolution during the setting of the cement is to be attained by controlling the composition so that a minimum of tricalcium aluminate and a maximum of dicalcium silicate is formed, although where more moderate effect is adequate a large proportion of tricalcium silicate, which produces more heat but also more strength, is allowed.

CHANGE IN CEMENT PROGRESS

These innovations have special meaning because they represent a sharp change in the direction of cement progress. For 15 years or more the art of making cement has been advancing in the direction of greater strength and early hardening, in response to the continuous pressure of engineering demand. The development was largely empirical in nature, but was notably successful; refinement of mill procedure, including thorough burning, overcame difficulties that might have arisen from increased lime content and finer grinding. Many users believed that some of the virtues of the coarser cements of a quarter century ago, among them high stability, were lost in the change. Nevertheless, concrete practice as a whole progressed greatly. In time, however, it came to be recognized that for certain kinds of service the development was in the wrong direction, and the present search for low-heat cement may therefore be regarded as an expression of dissatisfaction with the trend of the recent past and a departure on a new course. Viewed in this way the new specification is a resultant of long-accumulating forces, rather than merely a solution of the Hoover Dam problem.

As already suggested, low-heat cement has practical importance far beyond this single application. Its ultimate place in the field of concrete must develop from experience, but even now it is clear that many problems of dam construction and some other cases of massive concrete work offer proper occasion for considering its use. This fact, as well as the significant character of its service in connection with the great work of damming the Black Canyon of the Colorado, suffices to rank it as a lasting development in the cement art.

Above all, the Hoover Dam specification is welcome because it will bring a new and potent inspiration to the art and industry of cement making. There has long been crying need for such inspiration; art and industry alike have suffered from being centered all too much on production, too little on how cements might be made of broadest service to man. Especially in the present era of industrial stress can this inspiration exercise momentous influence by shaping thought and practice, by reorienting the industry, and by revitalizing the art of concrete making and use.—*Engineering News-Record.*

Boulder Canyon Project Notes

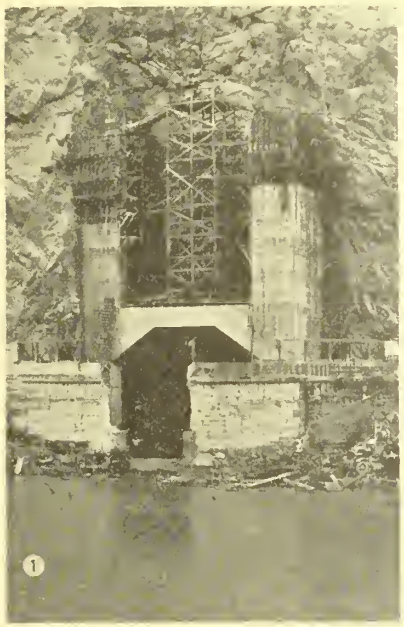
The Hoover Dam concrete research and consulting boards met at Boulder City on October 19 and held joint sessions until the 25th, when they adjourned after submitting a report on tentative cement specifications for the dam.

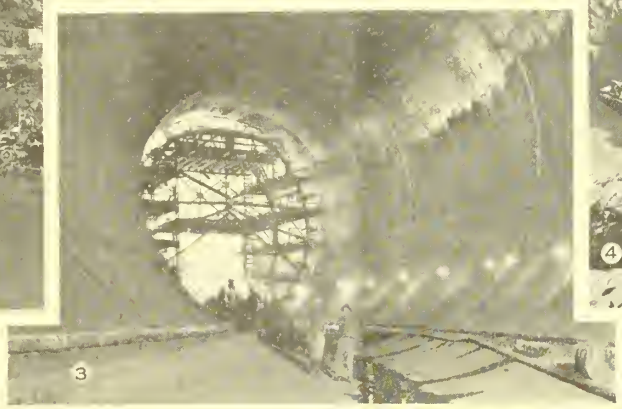
It is estimated that over 1,000 teachers attending the State institute meeting in Las Vegas and their friends, in 476 automobiles, entered the reservation on October 26 to view construction activities, which broke all previous daily records. Most of these visitors were taken for a trip through tunnel No. 2, which will probably be the last to be made through the diversion tunnels.

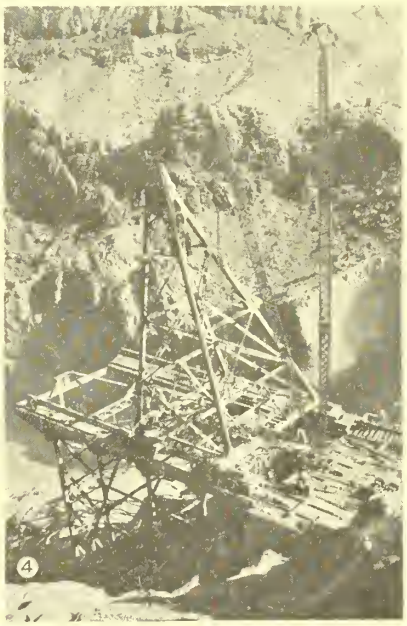
Percentages of completion on November 5 for concrete lining in the two incompleted diversion tunnels for invert, sidewalls, and arch, respectively, were as follows: No. 1 (Nev.) 56–38–7; No. 2 (Nev.) 100–92–76.

The Boulder City post office furnishes the information that on September 30 the balance due depositors in postal savings was $178,069, as against $128,969 on June 30 and $88,332 on March 31. This shows an increase of $49,100 over the previous quarter, of which over $18,000 was made during the month of September. As indicating the value of the project work to other communities, money orders issued during the last quarter amounted to $154,656.89.

The Searchlight Ferry Co. has made application to the War Department for permission to erect a cableway across the Colorado River at or near the Searchlight ferry between Clark County, Nev., and Mohave County, Ariz. It is proposed to have a clear height of 30 feet above high water level. It is understood that the purpose of the cableway is to transport automobiles and passengers across the river in traveling between Searchlight, Nev., and Kingman, Ariz.







PROGRESS OF WORK

BOULDER CANYON PROJECT

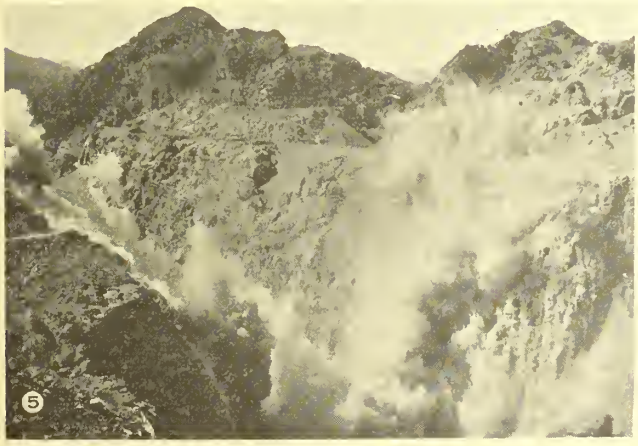


Photo by B. D. Glaha

1, Bulkhead gate structure at inlet portal of diversion tunnel No. 4; 2, steel for two 50 by 50 foot bulkhead gates arriving at Boulder City, requiring 41 cars; 3, completed tunnel lining at intake portal of diversion tunnel No. 4; 4, erecting movable tower for 20-ton cableway to operate over damsite; 5, blasting operations in Arizona and Nevada intake towers locations; 6, looking downstream into upper cofferdam excavation, dike and constricted river channel at left

The Commercial Association of Boulder City has decided to broaden its membership scope and range of activities to conform to the usual functions of a chamber of commerce. The organization now has the official name of Boulder City Chamber of Commerce.

Babcock & Wilcox Co. have awarded a contract for material and erection of an office building and steel fabrication plant at Bechtel Siding to the Colorado Fuel & Iron Co., which has sublet the erection to the Consolidated Steel Corporation of Los Angeles. The subcontractor started work on November 4.

The Nevada spillway inclined tunnel was holed through into diversion tunnel No. 1 the first week in November. Six Companies (Inc.) has commenced the erection of a high-level concrete mixing plant near the rim of the canyon, above the dam site. A steel-truss double-track railroad bridge across the river has been constructed above the inlet portals of tunnels Nos. 1 and 2.

In a recent talk before the Rotary Club of Las Vegas, Frank T. Crowe, construction engineer for Six Companies, made some interesting observations regarding the project. There are now 3,500 at work representing a monthly pay roll of $500,000. Tunnel No. 2 (Nevada)will be kept open for some time to provide a means of travel up and down river. The gravel plant, with a maximum capacity of 1,000 tons an hour, is the largest in the world. Two of the five cableways installed will be the longest in the world. Aluminum-body trucks tried out on the project have proven a success. Only 37 men have been killed in 1,250,000 man-hours of work. The average rate of fatalities in tunnel construction is 1 man to every 750 feet, while Six Companies' record to date has been only 1 in every 1,800 feet.

A contract has been let for construction of the Dotsero cut-off on the Grand Valley project which is expected to improve rail facilities on the project greatly. Work is under way on the Fifth Street bridge over the Colorado River at Grand Junction.

Harvesting of crops, especially sugar beets and potatoes, has continued actively on the Minidoka project. The yield of both crops is heavy and the quality exceptionally high. Many fields of beets are reported to be producing 20 tons or more per acre.

Colorado River Turned from Its Course

On November 13 at 11.30 a. m. the Colorado River, which for centuries past has flowed undisturbed through Black Canyon, was turned from its course and diverted around the site of the Hoover Dam through the 50-foot diameter No. 4 diversion tunnel on the Arizona side of the canyon. Just before noon, a mighty blast was fired which tore a hole in the barrier in front of the tunnel. A few hours later, entrance to the No. 3 (Arizona) tunnel was opened, allowing river water to enter a second of the four mammoth tubes. These two Arizona tunnels can accommodate the Colorado's flow this winter. The diversion was witnessed by officials of the Bureau of Reclamation and Six Companies and also representatives of the press, but the public was excluded from the canyon. And so an important milestone in project construction was reached. Work was immediately started on building a rock barrier completely across the river bed just below the tunnel portals, which will turn aside the entire river. This upstream cofferdam of rock, sand, and gravel with 6 inches of reinforced concrete paving on the upstream face will be completed first, to be followed by construction of the downstream cofferdam, thus completely protecting the dam site from water. In the meantime, the concrete lining in the two Nevada tunnels will be finished and before the 1933 flood waters come down from the upper basin in May or June, all four tunnels will be ready for use. Soon work will be started on excavating over 1,000,000 cubic yards between the two cofferdams, going down 140 feet below the river bed before foundation rock for the dam is reached.

Metropolitan Water District Starts Construction

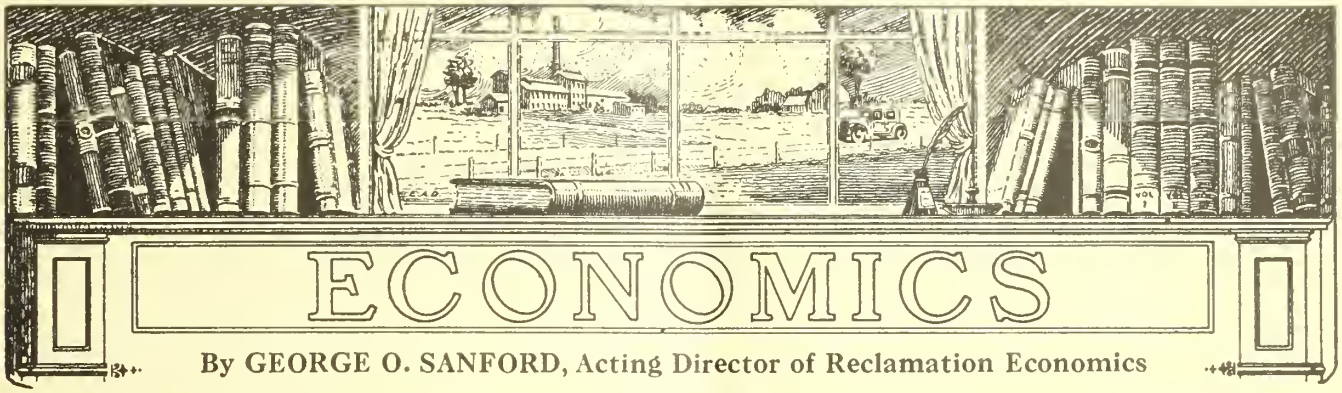
Bids were opened at Los Angeles on November 29 for construction of the San Jacinto tunnel of the Colorado River Aqueduct. This is the first construction contract to be let by the Metropolitan Water District. The aqueduct is closely related to the Boulder Canyon project, which will supply water to the aqueduct from storage in the reservoir behind the Hoover Dam and also power from the power plant at the dam for pumping the water over the mountains. The tunnel is 67,408 feet, or 12.8 miles, in length and 16 feet in diameter, with a lining of concrete. Among the principal items of work are 750,000 cubic yards of tunnel excavation (rock), 195,000 cubic yards of concrete, 2,250,000 board feet of timber (supplied by contractor), placing 500,000 pounds of steel supports, placing 500,000 pounds of reinforcing steel. The work is located near the towns of Cabazon, Banning, Beaumont, and San Jacinto in Riverside County, Calif. Five years and nine months will be allowed the contractor to complete the job.

Turbines for Hoover Power Plant

Contracts are about to be placed for the initial installation of turbines in the power plant at the Hoover Dam. The bureau is advertising for bids on furnishing five 115,000-horsepower and two 55,000-horsepower hydraulic turbines. Many of the features of the Boulder Canyon project are superlative, and in this instance the turbines are the largest hydraulic units ever constructed, far exceeding in size those in the Dnieper (Russia) plant and those being constructed for the Diablo plant in Washington. The Hoover plant turbines will work under a maximum head of 590 feet and an average head of 530 feet. Invitations to bid have been sent to the Pelton Water Wheel Co., Allis-Chalmers Manufacturing Co., S. Morgan Smith Co., Newport News Shipbuilding & Dry Dock Co., and other leading water-wheel manufacturers. From 620 to 1,435 days are allowed for delivery. Bids will be asked on turbines with or without 14-foot and 10-foot diameter butterfly valves, and on governors for each turbine.

About $17,000,000 will be expended for machinery to be installed in the power plant by the Government. The capacity of the plant will be 1,835,000 horsepower, or over three times the capacity of either the Niagara Falls (United States) or Wilson (Muscle Shoals) plant. According to the present progress schedule, work on the power plant will start in February, 1933, the two wings will be completed in September, 1934, and the center portion in July, 1937. The first unit of the power plant should be in operation by September, 1935.

A decided back-to-the-land movement is taking place in our country according to figures furnished by the Bureau of Agricultural Economics, of the Department of Agriculture. During the first three months of 1932 about 432,000 persons moved from farms to cities, and during the same period 564,000 moved from cities to farms. The net gains in farm population in 1930 and 1931, plus the projected gains this year, will more than offset the decrease of approximately 1,500,000 persons in the farm population from 1920 to 1930.



By GEORGE O. SANFORD, Acting Director of Reclamation Economics

Plan Proposes Farmers Unite into Colonies

Yale School Director Says Cooperative Groups Would Aid Them

A plan which would make most of the 6,000,000 farmers in this country self-supporting and independent of prevailing economic conditions, is presented by Dr. Alvin Johnson, director of the New School of Social Research and associate editor of the Encyclopædia of Social Sciences, in the autumn issue of the Yale Review. The plan, described under the title "Relief From Farm Relief," is that of a community of farms cooperating to produce not only food, but its other necessities as well, and capable of withholding its products from a depressed market until prices are readjusted. Doctor Johnson points out that there are two such agricultural communities already in existence, Castle Hayne, in North Carolina, and a similar colony in Devonshire, England. He proposes that a cooperative colony be established in each State as an example.

Between 150 and 200 families settled on a 10,000 to 20,000 acre tract of fairly good land is the beginning of the unit.

The tract should be laid out by competent engineers, rough parts set aside for a permanent community forest, and tracts subject to erosion for permanent pasture and plow lands divided so that each holding, properly tilled, would maintain its man, with a fair surplus.

CAREFUL SELECTION OF SETTLERS

Settlers should be carefully selected not only for experience in farming but for the general intelligence and reliability needed in community development. A minimum of shelter should be provided at the outset, but the individual farmer should be left to develop, with the cooperation of his neighbors, a really adequate complement of buildings.

Later on this community, similar to the Devonshire colony, would set up a small woolen mill, to work up the local wool into quality products; a lumber mill, furniture factory, a quarry, and a building company. For the complete independence of the colony, Doctor Johnson advocates an educational system similar to that of the Danish folk schools. Such a community, he says, is the only type of agricultural unit that could weather depressions or droughts without asking for outside aid.

Castle Hayne, near Wilmington, N. C., established by Hugh MacRae, has been in operation for 20 years, and the farmers, already capable of living mostly on their own products, are out of debt and have money in the bank, Doctor Johnson says. This, he points out, is in a State where other farmers are now paying more for bread and meat than they receive for the crops which they grow.

"It would be fatuous, however," he writes, "to suppose that the mere abatement of a burden which has helped to crush the life out of farm self-sufficiency would be enough to restore it. It takes much more time and effort to raise up an institution than to kill it. Nothing but a deliberate policy, patiently and persistently pursued, can repair our rural losses and set us in the way of developing a rich and sound agriculture. The policy would be essentially educational, but less by the written and spoken word than by example."

Doctor Johnson holds that the State should give the land for the community farms which are to serve as examples, and that the Government bureaus should be generous in their aid and advice. The plan is not a political impossibility, he says, for a bill to that end was introduced in the House of Representatives and passed.—*The Christian Science Monitor.*

Butte County (S. Dak.) Agricultural Exhibit Wins First Place at State Fair

The Belle Fourche irrigation project, which is the principal agricultural unit of Butte County, S. Dak., scored heavily in September at the State fair at Huron. To win in the West River division had become a habit with the winning of five successive pennants, but this year the county stepped out with an outstanding display that captured the sweepstakes, not only for quality of products, but for the finesse of the exhibit.

A complete line of grains and grasses, seed, vegetables, and fruits is shown in the picture on the back cover. In the selection of specimens the choice leaned toward marketable sizes rather than pompous samples of doubtful quality. A score of 1,485 out of a possible 1,500 points speaks for the perfection of details, the arrangement and blending of colors, and the general high-grade products on display.

In addition to the award of championship honors in the agricultural section, Butte County was also first in its rural school display and several irrigation farmers won the blue ribbon on individual exhibits. Mr. Charles Wilson, of Newell, was first in Northwestern Greering apples; Mrs. John Hanes, of Nisland, won the prize for Ben Davis and Pattens Greering apples; and Mrs. Chris Brandsberg, of Fruitdale, led in Hyslop crabs, Beta grapes, and plums.

Over 100 varieties of food for man and beast included in the exhibit are representative of the abundant crops raised in this section in contrast to the scarcity of the previous year. Market prices may tumble and profits may vanish but at least the livestock can live well on full mangers of hay and full rations of 12-cent oats in the feed box.

But even the farmers' ledgers are not altogether in the red. Specialized crops under irrigation and well-balanced operations have supported activities through the lean years and low prices. A sugar-beet crop of 475 tons from 30 acres on the Alex Getty farm brings a smile of satisfaction and permits a substantial pay-off on the mortgage debt at a time when ordinary kinds of crops are a burden on the market.

The Development of Boulder City as a Social Unit

By B. D. Glaha, Senior Engineering Draftsman, Bureau of Reclamation

WITHIN the relatively brief span of a year and a few months a student of sociology might have witnessed in Boulder City those processes of communal development which, in cities of more normal growth, extend over a number of decades at least. Every step by which a community expands from a primitive group of rude shelters into a highly organized, efficiently articulated city has been paralleled, except that in Boulder City the process of growth was greatly accelerated by the urgent need for which the model town was planned. Boulder City is the construction headquarters for the workmen of the Boulder Canyon project.

Man's first crying need is for shelter and food. In Boulder City the first buildings that went up after the establishment of the temporary tent camp were the dormitories and mess halls. In rapid succession came the homes to house the individual family groups and the offices and shops. Streets, sidewalks, telephone system, lights, municipal services and agencies followed and bound the groups more compactly into a civic unit. Then came the industrial and commercial establishments required to serve the needs of the newly imported population.

But with this impelling material development the social, recreational, religious, and cultural needs of the community have not been neglected. The social aspect of the scene grew naturally, as was to be expected when a group of people is brought together for a common purpose. The theater and various civic organizations, notably the American Legion, soon answered the need for group recreation. Three religious denominations; the Episcopal, Roman Catholic, and Latter Day Saints, have recently occupied newly erected church edifices, and plans for a community church for the worshippers of other religious sects are at present active. The beautiful new school erected by the Federal Government received its first pupils at this fall term opening on September 26. An article on the school system appeared in the November issue of the Era.

The accompanying photographs depict Boulder City's communal growth. All of the buildings shown have been but recently erected or are in the process of construction.

Answer These Questions If You Can

1. What three States lead in the production of apples?
2. Name the two leading grape-producing States in order.
3. Which State produces the most peaches, Georgia or California?
4. How many times larger is California's orange trade than Florida's?
5. How many times larger is Florida's grapefruit trade than California's?
6. Is any State beside California a commercial producer of lemons?
7. What three States lead in strawberry production?
8. Which State ranks first in cantaloupe production, Colorado or California?
9. Which is the greatest watermelon production, California, New York, or Florida, or Texas?
10. What one State produces one-third of all the cabbage grown in the United States?
11. Which of these States leads in celery production, California, New York, or Florida?
12. What single State produces half the lettuce grown in the country?
13. Does New York produce more onions than any Western State? How does California rank?
14. Which of these States leads in potato production, Minnesota, Pennsylvania or Maine?
15. Pick the leader of these three sweet potato States, Louisiana, Tennessee, North Carolina.
16. Try to arrange these in order as the leading tomato-growing States, California, Indiana, New Jersey.
17. What Pacific Coast State leads in pear production?
18. Which two Western States lead all others in sugar-beet production?

(Answers on p. 202.)

A New Irrigation Institute

The Institute of the American Farm Bureau Federation is a newly established organization. Its executive council is represented by L. M. Freudenthal, president of the New Mexico State Farm Bureau, chairman, and other members as follows: L. M. Lawson, International Boundary and Water Commissioner; J. D. Yeager, president of the Nevada State Farm Bureau; R. W. Blackburn, president of the California Farm Bureau; Frank Adams, University of California; William Peterson, Utah State Agricultural College; and W. W. McLaughlin, United States Department of Agriculture.

One purpose of the institute is to outline the more important economic and legislative problems peculiar to irrigation farming; another is to obtain available unbiased information concerning these problems from the various public and private scientific and governmental agencies, for use in correlating this material and advice with practical irrigation farming experience in formulating sound policies and practicable methods of working towards a solution of these problems.

1 - Roman Catholic Church and Rectory. The church was dedicated on April 10, 1932

2 - Church of the Latter Day Saints which was recently occupied by members of that denomination.

3 - St Christopher's Episcopal Church rapidly nearing completion.

4 - The present Boulder City Masonic Temple, located on a hill southeast of the town.

5 - The home of the Boulder City Post of the American Legion which houses the social activities of the organization and where community dances and other events take place.

6 - School building erected by the Federal Government. The classes enrolled with the opening of this Fall term.

7 - The Boulder Theater, a modern air-cooled structure.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, left Washington on December 1 for the West. On December 5 he attended an irrigation conference in Salt Lake City, called by Governor Dern of Utah, after which he planned a brief visit to the Boulder Canyon project. Doctor Mead expects to return to Washington about December 15. During his absence P. W. Dent, assistant commissioner, has been designated acting commissioner.

Miss Mae A. Schnurr, assistant to the commissioner, addressed the Educational Conservation Society at a public meeting held on November 25 in the American Museum of Natural History, New York. Miss Schnurr's address, which was on the subject The History of Federal Reclamation and its Social Aspects, was illustrated with lantern slides. Hon. Royal S. Copeland, United States Senator, was the guest of honor and the principal speaker of the evening.

John L. Savage, chief designing engineer in the Denver office, has been designated by Assistant Secretary John H. Edwards to succeed himself as a representative of the Department of the Interior on the Standards Council for the period 1933–1935. Mr. Edwards also designated W. G. Hoyt, engineer in the Geological Survey, and George O. Sanford, chief of the engineering division, Bureau of Reclamation, as alternates for Nathan C. Grover, chief hydraulic engineer, Geological Survey, and John L. Savage, respectively, for the year 1933 on the Standards Council.

Maj. Gen. William L. Sibert, chairman of the Colorado River Board, has tendered his resignation to the Secretary of the Interior. General Sibert has given valuable service during his connection with the board and it is regretted that the press of other duties has compelled him to sever this relation. The Boulder Canyon project act provides that one member of this board shall be an Army officer, and as the vacancy created by the resignation of General Sibert will not be filled at once, notice has been sent to the other members of the board that its activities are hereby terminated.

Mark Rose, M. J. Dowd, Charles L. Childers, and John L. DuBois, representing the Imperial irrigation district, El Centro, Calif., and Dr. Harry W. Forbes, Dr. S. S. M. Jennings, and A. B. Shaw, jr, of the Coachella County water district, arrived in Washington November 15 to discuss revision of the All-American Canal contract form. The Imperial district proposes execution of contract for building the canal required for that district only, with provision that the Coachella district may, by inclusion proceedings, become a part of the Imperial district and thereby provide for construction of the Coachella branch. The Coachella district desires a separate contract for constructing the Coachella branch and covering its proportionate part of the cost for providing works to be used jointly. Conferences are being held for the purpose of securing an agreement, if possible, on controverted points. If this is not possible, the Imperial district desires to proceed under separate contract. Richard J. Coffey, district counsel, Los Angeles, Calif., came to Washington for the purpose of participating in the discussions.

Federal Reclamation Laws Annotated Brought up to Date

A supplement to the 1931 edition of Federal Reclamation Laws Annotated, compiled under the direction of the assistant commissioner and chief counsel of the bureau, has just been received from the press. As announced in the November, 1931, issue of the Era, the 1931 edition of Federal Reclamation Laws Annotated supersedes all prior issues, bringing up to the date of May, 1931, the United States statutes, with annotations, affecting this bureau. The supplement now available contains the laws affecting reclamation, with notes of decisions of the courts, etc., of the session of Congress which adjourned in July of this year. There are also notes of recent decisions under laws published in the 1931 edition. The Washington office has available for distribution without charge a few copies of the 1932 supplement which may be had upon application to the commissioner.

Answers to Questions on Page 200

1. Washington is the first apple State, followed by New York and Virginia.
2. California produces over 85 per cent of the country's grapes, with New York second with 9 per cent.
3. California produces over twice as many peaches as Georgia, the "Peach State."
4. California's orange crop is normally twice that of Florida.
5. Florida's grapefruit shipments are nearly 90 per cent of all shipments, with Texas and California following in the order named.
6. Production of lemons is confined almost wholly to southern California.
7. Louisiana is way out in front when it comes to producing strawberries, with California and Oregon in the order named.
8. California, with her Imperial Valley, ships 70 per cent of all cantaloupes, with Arizona 12 per cent and Colorado 8 per cent.
9. Georgia leads the country in watermelon growing, with Florida, Texas, and California bringing up the rear.
10. New York truck farmers supply about 33 per cent of the Nation's cabbage, with Wisconsin second and Texas a close third.
11. Florida is the premier celery State, with California a close second and New York third.
12. No State is within hailing distance of California when it comes to shipping lettuce. Arizona, New York, and Washington are next in order, with their total about one-third that of California.
13. Texas leads in production of the country's onion crop. New York and California run neck and neck for second honors.
14. Maine is still the premier potato State, well out in front of Minnesota, New York, and Pennsylvania, second, third, and fourth in rank, with Michigan and Idaho almost tied for fifth place.
15. North Carolina leads in the production of sweet potatoes, with Tennessee and Louisiana taking second and third place.
16. Indiana first, New Jersey, second, and California third.
17. California is the leading Pacific coast pear State, with Washington and Oregon following. These three States ship over 85 per cent of the commercial crop.
18. Colorado leads in the production of sugar beets, with more than twice that of California, its nearest competitor.

○

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy**, Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F Kubach, Chief Accountant
C. N McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent, C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief Clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thraikill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent		F. C. Bohlson	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. Constr. Eng	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont
Shoshone [8]	Powell, Wyo	L. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

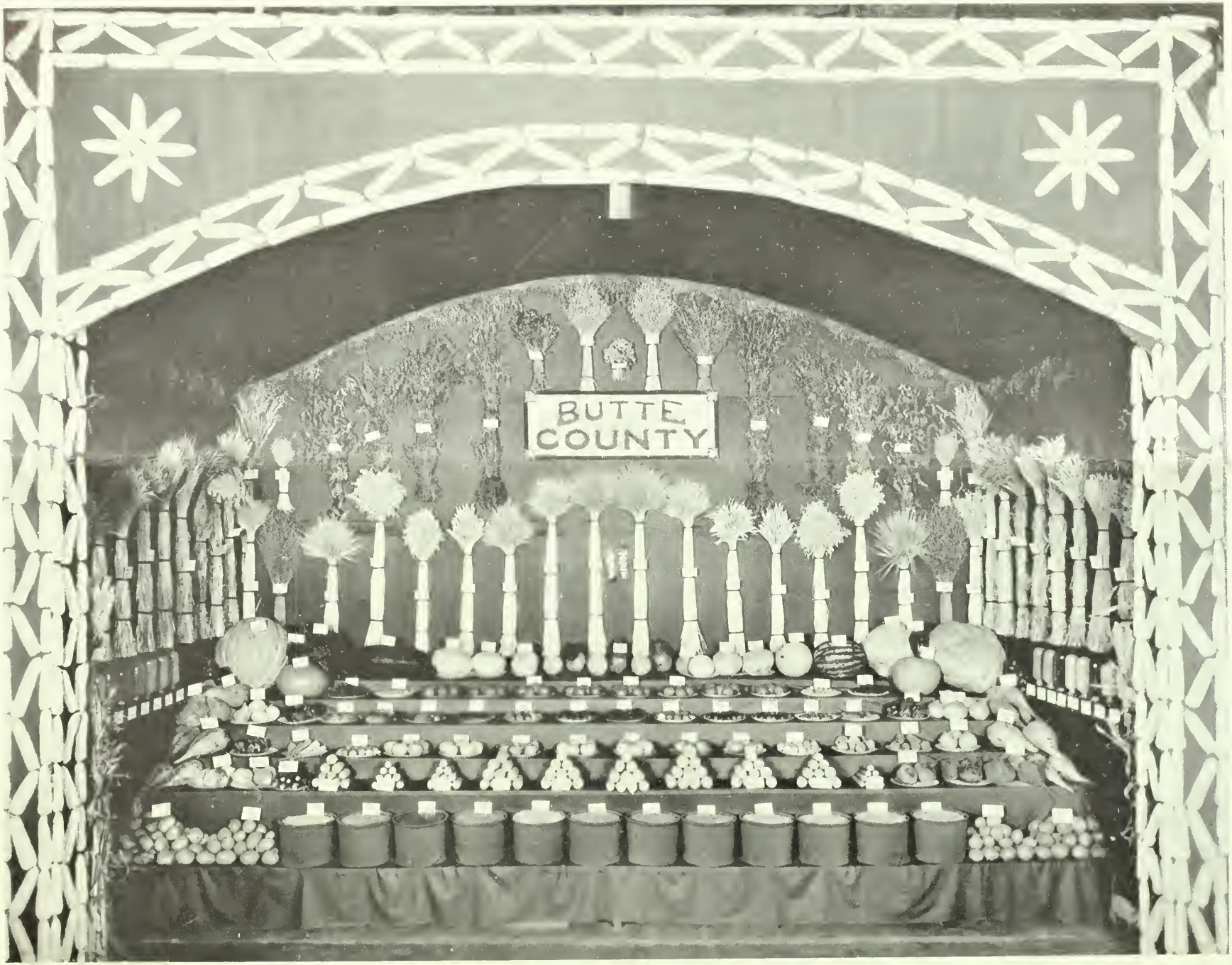
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division.	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overeast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery.	Do.
Sun River, Fort Shaw division.	Fort Shaw irrigation district	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nebr	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nebr.
Baker	Lower Powder River irrigation district.	Baker, Oreg		Reservoir supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg.	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	do	Lee N. Richards	Deaver, Wyo

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*



PRODUCTS OF IRRIGATION FROM THE BELLE FOURCHE PROJECT, SOUTH DAKOTA

(SEE PAGE 199)

U. S. GOVERNMENT PRINTING OFFICE: 1992

CLEMSON COLLEGE LIBRARY
GOVERMENT PUBLICATIONS

INDEX

THE RECLAMATION ERA. VOLUME XXIII

For the year 1932

Page numbers for separate issues

No.	Month	Pages	No.	Month	Pages
1.	January	1–20	7.	July	121–136
2.	February	21–44	8.	August	137–152
3.	March	45–68	9.	September	153–164
4.	April	69–88	10.	October	167–178
5.	May	89–104	11.	November	179–190
6.	June	105–120	12.	December	191–202

A

Page

Accretions to the reclamation fund, repayments to reclamation fund, and expenditures for construction and operation and maintenance to June 30, 1931 (including tabulation) 18
Accretions to the reclamation fund, repayments to reclamation fund, and expenditures for construction and operation and maintenance to June 30, 1932 185
Advantages of farm over city life 163
Agricultural exhibit wins first place at State fair—Belle Fourche project 199
Agricultural settlement work in Germany 176
All-American Canal contract approved by Imperial Irrigation District 45
Allen, Mrs. Carrie B., retires from active service 155
Appropriations for Bureau of Reclamation for 1933 118
Arbor Day in Federal Reclamation States 69

B

Baker project—construction of Thief Valley Dam 194
Ballard, E. L., reservoir superintendent, retirement of 55
Banks, F. A., Owyhee Dam dedication address 153
Retirement of E. L. Ballard 55
Belle Fourche project—Butte County (S. Dak.) agricultural exhibit wins first place at State fair 199
Betts, Clifford A., construction of Thief Valley Dam 194
Bicentennial book, engineering activities for 36
Bien, Morris, dies 147
Black Canyon, surveying in 172
Boulder Canyon project—article by W. R. Nelson entitled "Lookout Point," removed to make way for a cableway structure 168
Boulder City a social unit, development as 200
Boulder City administration organization chart 51
Boulder City boasts a band 155
Boulder City celebrates its first Thanksgiving 12
Boulder City, educational facilities in 188
Boulder City—from a woman's viewpoint 66
Boulder City hot, but not enervating 141
Boulder City organization chart 51
Boulder City, permits and leases at 137
Boulder City, some phases of life in 128
Boulder City, the desert flora near 150
Boulder City water-purification plant 33
Boulder City water supply 182
Brookhart (Senator) defends Federal reclamation 38
Brown, Hugh A., reclamation, a paying investment 113
Brown, Hugh Arbuthnot, 1877–1932 157
Burke, William J., liability of an irrigation district for crop damage because of seepage 6
Summary of 1931 irrigation legislation in South Dakota, Wyoming, Nebraska, and Montana 5

C

California legislation, 1931, summary of 53
Canal construction by Bureau of Reclamation (including tabulation of principal canals) 7
Carmody, Mrs. D. L., Boulder City—from a woman's viewpoint 66
Under the eagle's wing—some phases of life in Boulder City 128
Cash basis, on a, at last 135
Cement, low-heat 196
Cheese factories on the North Platte project, Neb.-Wyo 34
Chiesman, W. J., financing operation and maintenance costs, Grand Valley project 135
Christmas fund, Washington office 20
Cle Elum *v.* Harper et. al., decision in case of 123
Coachella Valley, Calif., has new State highway 179
Coffey, Richard J., summary of 1931 legislation in California concerning reclamation matters 53
Colonial Realty Company, Klamath County *v.* (7 Pac. 976) 109
Colorado River air surveys 111

Page

Colorado River Basin investigations 127
Colorado River Basin surveys 168
Colorado River Boards to meet 169
Colorado River investigations 22
Colorado River resents being harnessed 169
Colorado River turned from its course 198
Colorado River waters, Federal court upholds California's apportionment of 171
Colorado, summary of session laws, 1931 72, 92
Columbia Basin project declared feasible 21
Columbia Basin project report shows feasibility 52
Columbia River compact act extended 156
Compact between Idaho and Wyoming regarding Snake River waters 156
Compact between Montana and Wyoming regarding Yellowstone River waters—act of June 14, 1932 156
Comstock, H. D., the Riverton project, present and future 186
Concrete for Hoover Dam:
Part I 94
Part II 125
Part III 142
Construction charges, methods of repaying, and of financing operation and maintenance 40
Construction results to June 30, 1932 161
Cooperative creamery of Boise Valley prospers 49
Cooperative groups among farmers, plan for 199
Cooperative marketing on the Yuma Federal project 84, 100
Cooperatives on the Klamath project, Oreg.-Calif 148
Cost of efforts of Bureau of Reclamation 62
Crop production, rank of States in 200, 202

D

Damage to crop because of seepage—liability of an irrigation district for 6
Dams, card index of, in Bureau of Reclamation 141
Dams, Cle Elum, Owyhee, and Thief Valley, progress at 96
Dams—high, large, and unusual:
Part 1 28
Part 2 58
Part 3, foreign countries 74
Debler, E. B., Colorado River investigations 22
Dent, Porter W., some economic aspects of Western Federal irrigation 47
Devries, H. J. S., Texas legislation in 1931 24
Diet and exercise, proper 102
Diversion, changes of point of—decision of Supreme Court of Colorado 93

E

Echo Dam, Salt Lake Basin project, dedication of 147
Economic aspects of Western Federal irrigation (address by Porter W. Dent) 47
Economy act, special provisions 170
Eddy, Alice Lee, Kittitas Valley (poem) 178
Reclamation (poem) 164

Page

Educational facilities in Boulder City 188
Educational facilities on the Federal irrigation projects September inside front cover.
Electrical development in Federal reclamation, social and economic value of 121
Elephant teeth remains found on Yakima project 36
Ellensburg, Kittitas project, article by Mrs. M. Olive Schnebly 86
Ely, Sims, educational facilities in Boulder City 188
Permits and leases at Boulder City 137
Engineers—Contractors' committee finds Hoover Dam conditions satisfactory 32

F

Farm development by Mr. and Mrs. F. C. Krause, Shoshone project, Powell, Wyo 162
Farm life advantages superior to those of city life 163
Farm Loan Association, satisfactory progress of, Orland project 61
Federal Reclamation Laws Annotated brought up to date 202
Federal reclamation—Paper presented by Miss Mae A. Schnurr, substituting for Commissioner Mead 50
Federal reclamation policy indorsed by National Drainage, Conservation and Flood Control Congress May inside front cover.
Financing operation and maintenance costs, Grand Valley project, Colo 135
Fire protection in Boulder City 63
Flag placed at Hoover Dam in honor of George Washington 57
Four-H baby beef clubs improve feeding and management practices on Sun River project 65

G

Germany, agricultural settlement work in 176
Glaha, B. D., Boulder City boasts a band 155
Colorado River resents being harnessed 169
The development of Boulder City as a social unit 200
Grand Valley, new map (No. 23888 A) available 127
Grand Valley project, financing operation and maintenance costs 135
Grapefruit marketing simplified on Yuma Mesa 184
Grapefruit, Yuma has excellent season 181, 193
Greeson *v.* Imperial Irrigation District—decision regarding apportionment of Colorado River waters 171
Guilford, R. W., future farmers are busy at Orland 16

H

Hayden, B. E., cooperatives on the Klamath project, Oreg.-Calif 148
Home economics clubs in Kittitas Valley, work of 116
Homestead planning on Federal reclamation projects 82

Page

Honey exhibit at fall fair wins first prize—Minidoka project 35
Hoover Dam cement specifications 196
Hoover Dam, concrete for—
Part I 94
Part II 125
Part III 142
Hoover Dam conditions found satisfactory by engineers-contractors committee 32
Hoover Dam consulting board to meet at Berkeley, Calif 81
Hoover Dam, excavation of diversion tunnels for 158
Hoover Dam, panoramic perspective of construction activities and area adjacent to November back cover.
Hoover Dam, pipe contract awarded 145
Hoover Dam visited by President Hoover 191
Hopson, Ernest George, death of 141
Hosig, I. B., farm development by Mr. and Mrs. F. C. Krause, Shoshone project, Powell, Wyo. 162
Huntley project observes twenty-fifth anniversary 162

I

Imperial irrigation district signs contract (Cory project) 147
Income of the Federal Reclamation Bureau 167
Insurance, cost of workmen's compensation (Comp. Gen. Dec.) 110
Interior Department welfare committee 136
Irrigation districts 163
Irrigation institute, a new 200
Israelsen, Dr. Orson W., publishes book entitled "Irrigation Principles and Practices" 171
The Irrigation Farmer December inside front cover.

J

Johnson, Dr. Alvin, plan proposes farmers unite into colonies 199

K

Kaiser, H. J., new head of general contractors 110
Keck, H. H., honey exhibit at fall fair wins first prize 35
Keimig, J. A., cheese factories on the North Platte project 34
Kirk, E. A., the Orland orange show 133
Kittitas creamery makes record 36
Kittitas Reclamation District, Yakima project, aid to new settlers in 134
Kittitas Valley (poem) 178
Klamath County *v.* Colonial Realty Company (7 Pac. 976) 109
Klamath land classification (amendatory act of June 23, 1932) 156
Klamath project, cooperatives on 148
Krauss, Dr. Frederick, soil robbers June inside front cover.

Page

Kubach, W. F., appropriations for Bureau of Reclamation for 1933 118
Methods of repaying construction charges and of financing operation and maintenance 40
Reclamation fund, accretions, repayments, and expenditures to June 30, 1931 18

L

Land Use Planning Committee, personnel of subcommittees of 115
Landscaping of Boulder City 70
Legislation, irrigation, in South Dakota, Wyoming, Nebraska, and Montana (1931) 5
List of Engineering Articles No. 7 available 168
Los Angeles Aqueduct (act of June 18, 1932) 157

M

McClellan, L. N., power development on Federal reclamation projects 90
Mathews, W. B., death of 11
Mead, Dr. Elwood, Federal reclamation (presented by Miss Mae A. Schnurr) 50
Income of the Federal Reclamation Bureau 167
Proposed relief measures for settlers on Federal irrigation projects 46
Requests for a moratorium and the effect of such action on Federal reclamation 2
Social and economic value of electrical development in Federal reclamation 121
Metropolitan Water District, confirmation of bond issue of 123
Metropolitan Water District of Southern California, right of way for aqueduct (act of June 18, 1932) 157
Metropolitan Water District starts construction 198
Minidoka project holds farm mangement conference 81
Minutes of Orland Unit Water Users' Association published in local newspaper 71
Mitchell, L. H., are the efforts of the Bureau of Reclamation worth the cost? 62
Homestead planning on Federal reclamation projects 82
Stick to your bush 97
Montana Irrigation Committee studies water problems 134
Moon Lake project reports 49
Moratorium act of 1932 180
Moratorium—Effect of such action on Federal reclamation 2
Morocco builds irrigation project 4
Mundy, E. E., aid to new settlers in Kittitas Reclamation District, Yakima project 134
Kittitas creamery makes record 36

N

National Drainage, Conservation, and Flood Control Congress, at Louisville, Ky., adopts resolution indorsing Federal reclamation policy May inside front cover.

Page

Nelson, W. R., Boulder City water supply 182
Concrete for Hoover Dam—
Part I 94
Part II 125
Part III 142
Construction power for Hoover Dam 85
Excavation of diversion tunnels for Hoover Dam 158
Fire protection in Boulder City 63
Landscaping of Boulder City 70
"Lookout Point" removed to make way for a cableway structure 168
Ring Bolt Rapids in Black Canyon near Hoover Dam site 23
Surveying in Black Canyon 172
Thanksgiving Day in Boulder City 12
Newell, Frederick Haynes, dies 139
Newlands, Francis G., western reclamation aids eastern development (excerpt from The Public Papers) October inside front cover.
Newman, Mrs. Jess, work of home economic clubs in Kittitas Valley 116
North Platte project, cheese factories on 34

O

Offutt, Armand, summary of session laws of Colorado, 1931 72, 92
Trinchera Ranch Co. et al. *v.* Trinchera Irrigation District (300 Pac. 614) 93
Olives, dried, on Orland project 163
Onion, What do you know about it? 16
Oppedyk, Ruth, and Fern Wittwer, the desert flora near Boulder City 150
Orange show, the Orland 133
Orland, California, recent improvements at 149
Orland, future farmers are busy at 16
Owyhee Canyon and Dam site, Oregon (poem) 87
Owyhee Dam completed, highest in world 147
Owyhee Dam dedication address 153
Owyhee Dam, work temporarily discontinued 11

P

Pellen, John H., retires from active service 141
Permits and leases at Boulder City 137
Philebaum, Edward M., retires after 50 years in Goverment service 79
Pipe contract awarded for Hoover Dam 145
Plowing, fall November inside front cover.
Population, growth of, and area irrigated in three decades in the eight Mountain States 42
Potato-flour factory on Minidoka project, new 14
Power, construction, for Hoover Dam 85
Power development on Federal reclamation projects 90
Powers, W. L., and Teeter, T. A. H., enlarge their book on Land Drainage 171
President's message to Congress, February 17, 1932, extracts from "The Reclamation Service" March inside front cover.
Priest, Frankie B., Yuma project schools since 1910 38

Page

Priest, R. M., cooperative marketing on the Yuma project 84, 100
The Yuma Mesa Fruit Growers Association 114

R

Reclamation (poem) 164
Reclamation a paying investment 113
Reclamation Fund, accretions, repayments, and expenditures to June 30, 1931 18
Reclamation Fund, accretions to, etc., to June 30, 1932 185
Rehabilitation of distressed irrigation districts 191
Relief act of 1932 180
Relief measures (proposed) for settlers on Federal irrigation projects 46
Resolutions adopted approving reclamation policy at Third National Water Users Conference April inside front cover.
Restoration of lands to mineral entry (act approved April 23, 1932, Public, No. 104) 110
Résumé of work accomplished during calendar year 1931 and proposed for calendar year 1932 105
Revenue act of 1932, provisions applicable to bureau 140
Ring Bolt Rapids in Black Canyon near Hoover Dam site 23
Riverton project, present and future 186

S

Salads, spring 103
San Gabriel No. 1 (Rockfill) Dam to be constructed 159
Schmalhausen, Robley J., dies 190
Schnebly, Mrs. M. Olive, Ellensburg, Kittitas project 86
Schnurr, Mae A., keep fit by proper diet and exercise 102
Schools on reclamation projects September inside front cover.
Schools, Yuma project, since 1910 38
Secondary projects 79
Six Companies pays more than a million dollars for one month's work 12
Snake River and tributaries, 1931, normal flow and storage of 54
Snake River waters, compact regarding 156
Soil robbers June inside front cover.
Stapleton, W. P., rehabilitation of distressed irrigation districts 191
Steel for Hoover Dam 111
Stoutemyer, B. E., decision in case of City of Cle Elum *v.* Harper 123
Klamath County *v.* Colonial Realty Co 109
Twin Falls Canal Co. *v.* American Falls Reservoir District No. 2 124
Sun River products excel at State fairs 35
Sun River settlers carry award from State fair 171
Swanton, W. I., compiling chapter on Federal engineering activities for book entitled "The planning and building of Washington"—Bicentennial 36

T

Page

Taylor, P. I., Dams, high, large, and unusual 28, 58, 74
Templin, Dana, new potato-flour factory on the Minidoka project, Idaho 14
Texas legislation in 1931 24
Thief Valley Dam, construction of 194
Thompson, John P., elephant teeth remains found on Yakima project 36
Thurber, D. P., 4-H baby beef clubs improve feeding and management practices 65
Tree planting, Burlington representative approves 115
Trees, why plant 79
Trinchera Ranch Co. et al. *v.* Trinchera Irrigation District (300 Pac. 614) 93
Tunnels, diversion, excavation of, for Hoover Dam 158
Turbines for Hoover power plant 198
Tuttle, Mrs. Ella S., the labors of Yakima (poems) 117
Twin Falls Canal Co. *v.* American Falls Reservoir District No. 2 124

V

Vacation of withdrawals of public lands (act approved April 23, 1932, Public, No. 104) 110
Vale-Owyhee organization makes good showing 115
Vegetable plate, a good combination 103
Verde River—big dam to be monument to Bailhache 10

W

Walter, R. F., résumé of work, 1931, and proposed for 1932 105
Washington, George, as a farmer July inside front cover.
Water supply of Boulder City 182
Water users' conference (third national), sponsored by American Farm Bureau Federation, approve reclamation policy, April inside front cover.
Weber, R. C. E., recent improvements at Orland, Calif 149
Welfare Committee of the Department of the Interior 136
Western development must not be throttled 101
Western reclamation aids eastern development October inside front cover.
Willcocks, Sir William, death of 152
Wittwer, Fern, and Ruth Oppedyk, the desert flora near Boulder City 150
Workmen's compensation insurance, cost of (Comp. Gen. Dec.) 110
Wyoming irrigation products excel at stock show 15

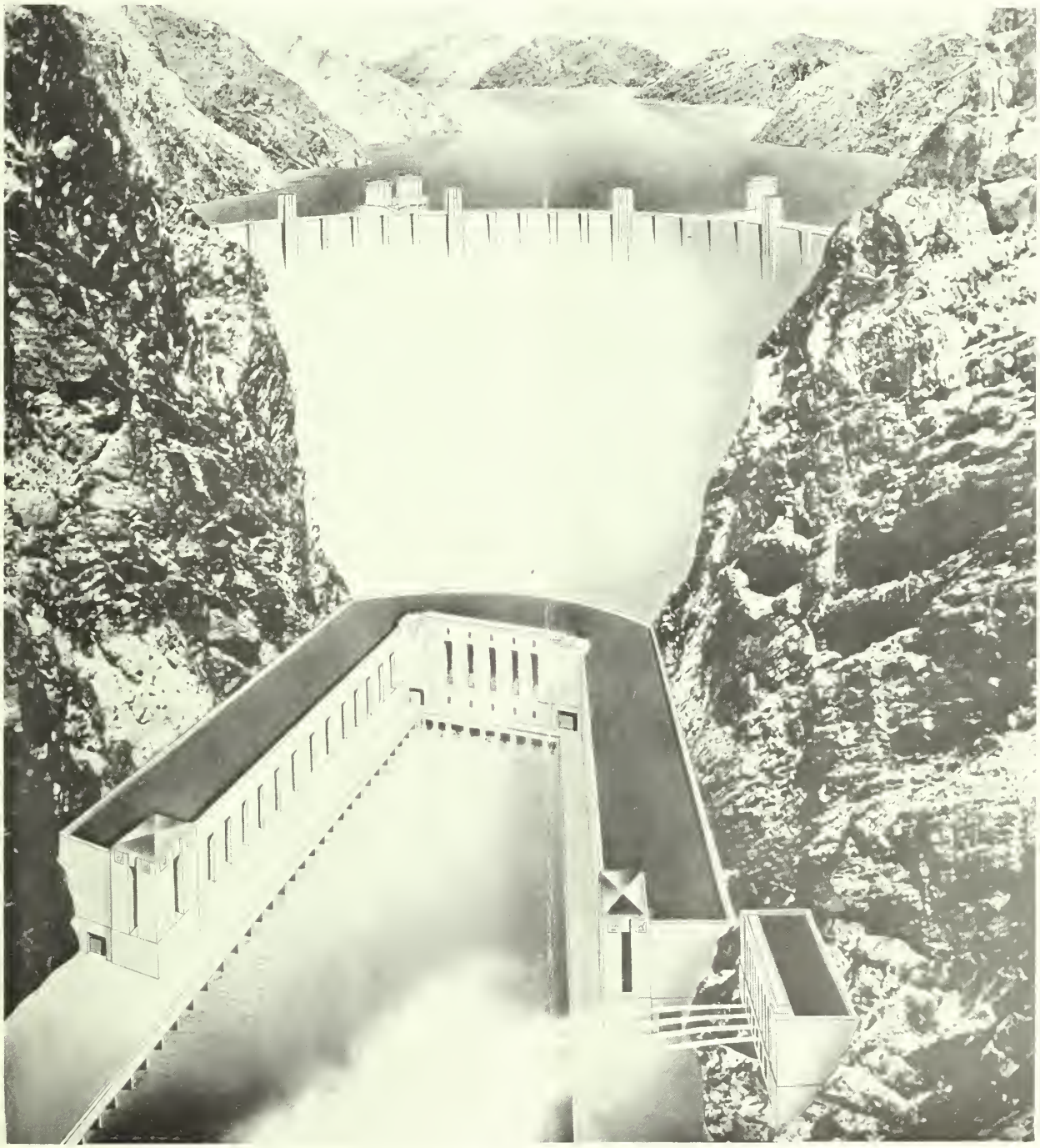
Y

Yager, Thomas C., dies 6
Yakima Daily Republic, western development must not be throttled 101
Yakima (River), The Labors of (poems by Mrs. Ella S. Tuttle) 117
Yeargain, Ethel, Owyhee Canyon and dam site, Oreg 87
Young, Mrs. Margaret G., Washington office Christmas fund 20
Yuma has excellent grapefruit season 181, 193
Yuma indoor baseball league 146
Yuma Mesa Fruit Growers Association 114
Yuma Mesa, grapefruit marketing simplified on 184

U. S. GOVERNMENT PRINTING OFFICE: 1933

THE RECLAMATION ERA

VOL. 24, NO. 1 JANUARY, 1933



HOOVER DAM AND POWER PLANT AS THEY WILL APPEAR UPON COMPLETION

PROJECT WEATHER AND WATER-SUPPLY CONDITIONS

November was generally characterized by exceptionally mild weather which permitted the completion of crop harvest and caused some demands for late irrigation and domestic water. On the extreme northwestern projects heavy rains were experienced, which materially increased storage accumulations.

Snow began to accumulate at the higher altitudes of the watersheds, although the cover at the end of the month was generally deficient. With the bulk of the winter precipitation normally occurring in the succeeding months, it is yet too early for predictions concerning next year's run-off. For the more easterly and southerly watersheds a near normal precipitation will have to occur during the remaining winter months to insure adequate water supplies for projects located therein.

The content of project reservoirs is now normal or above. In some cases the content is such that an ample water supply is already assured for next year. For reservoirs with concurrent data available the total content on November 30, 1932, was 4,794,000 acre-feet compared with 1,830,000 acre-feet for the same date last year.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 24, No. 1 JANUARY, 1933

Problems Confronting the Western Section of the United States

By Gov. George H. Dern of Utah [1]

IT HAS become customary for the chairman of the executive committee to preside at the opening session and to speak of the functions of the conference and of the program. It is my privilege to discharge that duty this morning.

The Western Governors' Conference was organized at Salt Lake City in 1929, at a well attended and very important session. In 1930 it again met here immediately preceding the National Governors' Conference, which convened here on June 30. Utah was not trying to monopolize the conference, but the governors preferred to come here because they could attend both conferences on the same trip.

Last year our meeting was held at Portland, Oreg., on October 27, 28, and 29. In three strenuous days a great deal of hard work was done, and the proceedings were printed. A few copies are still on hand and may be had by those who are especially interested.

The conference accepted the invitation of Governor Rolph to hold this year's meeting at Los Angeles, Calif., at the time of the opening of the Olympic games. As the time approached we commenced to make preparations, but discovered that only three or four governors were planning to attend. The executive committee did not like to imitate the three tailors of Tooley Street, and therefore adjourned the meeting indefinitely. It was thought that the governors might have more time after election and that the conference might possibly be held in November or December.

In October there appeared a good reason for holding a meeting this year. Organizations interested in reclamation were becoming alarmed over eastern propaganda to abolish Federal reclamation and asked for a reclamation conference to be held at Salt Lake City. After some consultation it was the consensus of opinion that if the subject were handled by the Western Governors' Conference the conclusions and resolutions would carry more weight and prestige than if they came from a voluntary, nonofficial gathering.

The upshot of the deliberations was a decision to hold a reclamation meeting for a special purpose on December 5 and a Western Governors' Conference on December 6 and 7. Salt Lake City, on account of its central location, was the choice of most of the States as the meeting place, and Governor Rolph very graciously released us from our promise to hold this year's meeting in California. As chairman of the executive committee I therefore sent out the call, which read as follows:

"On November 21, I wired you as follows:

"'Will you attend personally and appoint additional delegates to a meeting of Western Governors' Conference to be held in about two weeks to consider reclamation, the short and long haul, and other subjects stop Would you prefer that such conference be held in Salt Lake, Sacramento, or Denver Please wire me immediately.'

"The identical telegram was sent to the governors of all the other public land States which are members of the Western Governors' Conference. The replies have been submitted to the executive committee, and as chairman I have been directed to issue a call for a Western Governors' Conference to be held at the State Capitol, in Salt Lake City on December 6 and 7, 1932.

"At the request of various organizations interested in reclamation I also hereby call a National Reclamation Conference, to be held at Salt Lake City on December 5. This meeting will convene in the State Capitol at 10 o'clock a. m. I cordially invite you to attend both of these conferences and to appoint as many additional delegates from your State as you please.

"The Western Governors' Conference is composed of the Governors of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, plus such additional persons as each governor may appoint to represent his State.

"The chief purpose of both of these conferences is to set up a campaign for the continuance of the Federal reclamation policy, which is believed to be seriously threatened. It is deemed desirable that each State should be competently represented by reclamation leaders, preferably three or more, and that if possible a technical adviser, such as the State engineer, should accompany or be included in the membership of the State delegations. These men should be named as delegates to both conferences. Probably the actions of the reclamation conference will be reported to the Western Governors' Conference for the ratification and approval of that larger and more official body.

"The Western Governors' Conference will also discuss the long and short haul clause of the interstate commerce law. An effort is being made to bring about the repeal of this clause which is deemed vital to the welfare of every Western State. If you will confer with the shippers of your State you will probably find them deeply interested and anxious to participate in this discussion, and hence you should not have any trouble in securing delegates interested in this subject.

"If you would like to have any other topics put on the agenda of the Western Governors' Conference, please advise me promptly so that your suggestions may be submitted to the executive committee before the program is completed. I sincerely hope that you will be able to attend in person, but if, for any reason, this is impossible, may I respectfully request that you endeavor to secure proper representation from your State for the discussion of the foregoing vitally important subjects. We are already definitely assured of representation from 8 of the 11 States, and are hopeful of representation from the other 3 as well. While the conference is being held on rather short notice, it promises to be unusually interesting and may prove of historic importance."

[1] Address delivered before Western Governors' Conference, Salt Lake City, Dec. 6, 1932.

In response to this call we had about 91 distinguished delegates at a highly successful reclamation conference in this chamber yesterday, although I was the only governor present. All of those delegates were also appointed as regular and active delegates to this Western Governors' Conference and I think they are practically all here.

I had hoped that we might have seven or eight governors here this morning, but we have only four, including myself. The Governors of Arizona and Colorado were unable to come because they are ill. I regret that so few of the others felt it necessary to be here. May I take the liberty of making a few friendly observations in this connection?

My conception of the duty of a governor is that he should be interested in everything that concerns the welfare of his State. No governor can properly advance and protect the interests of his people by sitting in his office every day, attending to the mere routine of his administrative functions, important as these may be. A governor can waste more time in his office than anywhere else, and he can make himself such a slave to petty detail that he never gets the broader view of the big problems of his Commonwealth, and hence can only give a mediocre administration.

In my judgment, it is the business of a governor to go wherever duty calls him. If he can serve his State by cooperating with other States it is his solemn duty to participate in interstate conferences on common problems. The present conference is a case in point. What higher duty can a western governor have this year than to resist the attacks upon the Federal reclamation policy, which is vital to every Western State? Is a governor rendering full service to his people if he sits supinely in his office, paying no attention to an active program that would work incalculable harm to his State? Not according to my way of thinking.

IMPORTANCE OF STATE COOPERATION

Last year at Portland I emphasized the importance of cooperation on the part of the Western States, in the following language:

"The purpose of this organization is to crystallize and unify western opinions on subjects of common interest, especially relations with the Federal Government. The States of Washington, Oregon, California, Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, and New Mexico are called the public-land States, because each of them contains large areas belonging to Uncle Sam. In Utah, for example, about three-fourths of the land belongs to the United States Government, leaving approximately one-fourth as the property of the State and its citizens. A similar condition prevails in each of the other public-land States, hence all of them have many important problems in common. Past experience has shown that the only way for these States to protect their rights is to unite on a program and then all work for the same thing.

"I am not advocating government by blocs instead of government by parties, but a western Senator once called my attention to the fact that the New England Senators nearly always vote as a unit. So conspicuous is this fact that they are often referred to as the 'Granite Bloc.' This unity of action has given the New England States great power and prestige, and their interests are always well guarded. The Western States would do well to profit by their example, for in union is strength. If we do not unite, the ambitious bureaucracies at Washington will keep up their encroachments upon the rights of the States often to our permanent detriment.

"It is not our purpose to trespass upon the prerogatives of our Senators and Representatives. On the contrary, it is our object to aid them in finding out what the West needs and wants. Obviously they will welcome the advice of thinking men from the great western territory, which they represent. They are always anxious to find out what the folks back home really want."

This sort of cooperation is more important right now than ever before, since we of the West have been dubbed "the sons of wild jackasses," and since serious magazine articles are belaboring the Western States as ugly, dreary, worthless deserts, grossly overrepresented in Congress. Moreover, the present threat to reclamation is a real danger.

The States singly can do little to repel these enemies, but collectively they can do much. United we stand, divided we fall. The most influential body to express western sentiment obviously is the Western Governors' Conference, or would be if all the governors would give it their active and enthusiastic support.

I was one of the organizers of the Western Governors' Conference, and have steadfastly kept my faith in its potential usefulness, provided all the governors give it the prestige that goes with their offices. I confess, however, that I have become somewhat discouraged by the apathy and indifference of a good many of the governors. I regret that more of them do not respond to their opportunity for leadership in building up this whole western country through concerted action. I do not want to be understood as scolding any of my fellow executives. I do, however, want to make a plea that they make effective use of this conference as the best available means for ascertaining and expressing western opinion on western problems. Moreover, influential citizens should encourage their governors to take part in important interstate problems instead of criticising them for so doing.

Turning now to the program of to-day and to-morrow, we have three topics listed for discussion, or perhaps four, namely, reclamation, silver and depreciated currencies, and the long and short haul clause of the interstate commerce act.

RECLAMATION

We discussed reclamation yesterday, and since we are substantially the same group to-day as we were yesterday I need not take much time in stating that problem. The chairman of yesterday's reclamation conference will report to us on the proceedings.

Western agriculture is almost entirely carried on by irrigation, and this important part of the United States is building up an irrigation civilization, which is still more or less in the formative stage.

The early settlers diverted water from the streams to irrigate adjacent lands. There was usually more land than water, and it was hard to resist the temptation to reclaim more land than the natural stream flow would serve. Hence we have farms with good soil but with inadequate secondary water rights. These farms are settled, developed, and equipped. They are in localities which have their railroads and highways, their markets and their consumptive capacity, their schools and churches, their social and cultural activities, and everything else that makes for satisfactory living except enough water to mature their crops. Additional water may be obtained by building reservoirs to impound the flood waters of the streams.

The construction of such reservoirs is not attractive to private capital, and the States are unable to finance it. To meet this need the Federal Reclamation Service was created. It does not get its money out of the Federal Treasury, and Federal reclamation has not been a burden on the taxpayer. The Western States themselves furnish the money for their reclamation projects. It comes out of their natural resources, for the reclamation fund is derived from mineral royalties and from the sale and rental of public lands.

The Reclamation Service is the finest example of interstate cooperation ever conceived. All the public-land States throw the proceeds of their oil and coal royalties and of the sale or rental of their public lands into a common pot and then hire the Federal Government to build and manage their reclamation works.

The Western States are parts of the United States. They have the right to live and to grow and to fulfill their desti-

nies. For other States to consign them to stagnation and decay would be rank injustice and sectionalism, especially since crops grown on these irrigated areas are noncompetitive with the staple crops of the great agricultural area of the Middle West, and are not the kind of crops of which there is a surplus.

Let us plead for a square deal for all the States and a patriotic desire to build up the whole United States instead of encouraging one section to try to build itself up by tearing another section down.

We shall have a full discussion of the various phases of the reclamation problem during the day.

SILVER AND DEPRECIATED CURRENCIES

The silver problem was ably discussed at Portland a year ago, and resolutions were adopted favoring an international silver conference. The Western States may have a selfish reason for wanting silver rehabilitated, but they are fully conscious of the fact that they can not expect that anything will be done for silver merely to benefit the silver miners. They believe, however, that the silver problem is a national problem, which is as important to the Middle West and the East as it is to the far West. They believe this because the silver problem is a money problem, and money is at the root of our economic troubles.

Perhaps akin to silver is the problem that arises from the dumping of commodities in the United States by countries having depreciated currencies. We shall have some discussion of this question as well as of the silver problem in general.

LONG AND SHORT HAUL CLAUSE—INTERSTATE COMMERCE ACT

The remaining topic is the one I have spoken of as the long and short haul clause of the interstate commerce act, otherwise designated as the fourth section of the interstate commerce act. Perhaps the problem involved in this matter is not very familiar to most of us, and I therefore state it at some length.

At the time the vast territory west of the Mississippi River was annexed to the United States, it was thought by many people that this land was a worthless desert, and could not be made available for any productive enterprises. However, after the discovery of gold in California in 1849, the leading minds along railroad lines began to visualize the possibility of transcontinental transportation systems by rail. The romances in connection with the construction of these lines are familiar to all. The construction of the four or five major railroad systems west of the Mississippi River involved the solution of many extremely technical engineering problems. Lofty mountain ranges had to be tunneled and gorges bridged in many instances, vast desert lands had to be traversed, and in one instance, a great inland lake was spanned.

Eventually these railroad lines became links in transcontinental systems entering into competition with each other. Coast cities and towns grew very rapidly, largely because of the availability of cheaper water and rail transportation facilities, while cities and towns in the interior appeared to be at a disadvantage, and, therefore, grew much more slowly.

As a result of the numerous problems and practices involved in railroad transportation, the necessity for a regulatory body soon became apparent, and in 1887, an act of Congress was passed, creating the Interstate Commerce Commission. This commission was empowered, among other things, to regulate the rates, rules, and practices of all interstate railroad lines, as well as interstate railroad and water lines when under the same control or management. However, jurisdiction was not given to regulate intercoastal steamship lines.

Early in the twentieth century, one of the greatest engineering feats of history was realized in the completion of the Panama Canal, connecting the Atlantic Ocean with the Pacific Ocean. After the completion of the Panama Canal, large ocean freighters began moving between Atlantic coast points and Pacific coast points via the canal. Inasmuch as transportation by water could be made at much less expense than by rail, and due to the fact that many commodities were transported by water at very low rates as necessary ballast for steamships, the railroads were faced with the necessity of endeavoring to meet this competition.

Subsequently, terminal railroad rates between Pacific coast points and Atlantic coast points were inaugurated, and in practically every instance these terminal rates were considerably lower than the rates to intermediate points. These rates immediately became the subject of serious controversies between the railroad carriers and the shippers located at intermediate points. The inauguration of such terminal rates seriously retarded the growth and development of intermediate territory.

The controversies finally resulted in the enactment of what is known as the fourth section of the interstate commerce act. This section provides that it shall be unlawful for any common carrier subject to the provisions of the interstate commerce act to charge or receive any greater compensation in the aggregate for shorter than for longer distances over the same line or route in the same direction, the shorter being included within the longer distance. It also provides that it shall be unlawful to charge any greater compensation as a through rate than the sum of the intermediate rates; however, a carrier may upon authority, charge as high a rate for a shorter as for a longer distance. There is a provision contained in said section empowering the Interstate Commerce Commission to authorize carriers, upon application in special cases after investigation, to charge less for the longer distance than for the shorter distance. In other words, the Interstate Commerce Commission has authority in special cases to authorize the waiver of the provisions of the fourth section. The commission is also empowered to grant permission to a common carrier which has a circuitous line or route, for competitive purposes to make the same charges as a direct line or route serving the same points, and to maintain higher charges to or from intermediate points on such circuitous line or route which are not competitive. There is also a provision that in the issuance of this authority, the commission shall not permit the establishment of any charge to or from the more distant point that is not reasonably compensatory for the service performed.

While it is apparent that the enactment of the fourth section has been of material benefit to the intermountain region, it is likewise apparent that this section could be strengthened to the further benefit of the intermediate territory. Previous to the year 1925, the Intermediate Rate Association was organized, composed of shippers in all of the intermountain and Pacific Coast States, and in that year great efforts were made by this association to have passed by Congress what was known as the Gooding amendment, introduced by the late Senator Gooding, of Idaho. This amendment would have relieved the Interstate Commerce Commission of the power to waive the provisions of the fourth section. However, this amendment failed to pass.

There have been numerous cases involving the waiver of the fourth section provisions, before the Interstate Commerce Commission, but in most instances, the applications of the carriers have been denied, the most recent case being the application of the Southern Pacific Co. for authority to establish competitive rates between California points and the Atlantic seaboard, via rail to Galveston, and then water to New York. This application was denied by the Interstate Commerce Commission.

It would seem that one of the first steps necessary for the protection of the Mountain Pacific States, should be the placing of the intercoastal water carriers under the jurisdiction of the Interstate

(Continued on p. 11)

Report of Colorado River Board

THE following report was submitted to the Secretary of the Interior under date of November 19 by the Colorado River board, consisting of Daniel W. Mead, acting chairman; Charles P. Berkey, secretary; Warren J. Mead; and Robert Ridgway:

The Colorado River board has the honor to make the following report covering questions pertaining to plans and designs for the Boulder Canyon project, which have arisen since November 6, 1931, the date of its last report.

The major question submitted to the board at this time was presented by Acting Chief Engineer S. O. Harper, under date of November 11, 1932, as follows:

"The board has been called together at this time for final consideration of the general plan and cross section of the dam. The contractor will soon be ready to start abutment excavations and definite approval of the design of the dam is needed so that these excavations can be staked."

Several additional matters bearing only indirectly on the design of the dam proper, but vitally pertinent to certain subordinate works and to the success of the project, which were considered by the board and discussed with the engineers in charge, are, at the request of Chief Engineer R. F. Walter, also treated in this report.

The board greatly regrets the absence, through resignation, of General Sibert, chairman since its organization in 1928, and the consequent loss of his wise counsel and sound judgment.

The remaining four members spent several days during the past week at the dam site under the personal guidance of Chief Engineer R. F. Walter and Construction Engineer Walker R. Young. Particular attention was given to the relations of the natural features of the site to questions before the board, in the light of information now so well disclosed by the work in progress. Both the natural physical conditions at the site and the general conduct and execution of the work appear to the board as thoroughly satisfactory.

Additional time has been spent with the engineers in charge of design and research in Denver. The board is impressed with the progress made in those studies and with the thoroughness, care, and ingenuity with which these investigations are carried on.

DESIGN OF THE DAM

The board approves the plan and maximum section of the dam as shown in drawing No. 45-D-2080 of study No. 37, dated September 22, 1932. It is understood that such design is subject to possible minor changes, such as the substitution of a straight instead of a curved downstream profile in the lower part of the dam and of such additional fillets on the upstream profile and at the arch abutments as continuing studies of these features may indicate as advisable.

ADDITIONAL PROBLEMS

Abutment excavation.—It is obvious that the best possible seating of the dam against the canyon walls is essential and that every precaution must be taken to attain that end. The rock of the abutments is of such excellent quality and so much superior in strength to the concrete which would replace any excess removal that excavation should be limited to the requirements of proper abutment stress design.

Despite the superior quality of the rock, it can be materially weakened by heavy blasting. The board is informed that these possibilities are appreciated by the engineers of the Reclamation Bureau.

Information disclosed by tunneling operations.—The excavation of the four great 50-foot diversion tunnels has now been completed.

These tunnels have explored the side walls of the canyon back of the abutments of the dam and have shown the rock condition and quality in detail and in a wholesale manner. It is now a matter of record that the rock behavior during tunneling operations has been exceptionally good. Only in rock formations of the highest quality can tunneling on such a scale be done in safety. It is in general to be expected in driving large tunnels that zones of weakened rock requiring roof support will be encountered, that falls of rock from the roof will occur, and that there will be a certain amount of overbreak due to the weakened condition of the rock. Here, however, in 16,000 feet total length of finished bore, not a single place required support and the excavation was carried remarkably true to the specified cross sections. No element of weakness or of questionable behavior was developed in the four diversion tunnels around and back of the abutments of the dam.

The thoroughly dependable character of the walls of the canyon, a matter wholly of judgment and interpretation when this site was selected, therefore, is now fully proven. There is no doubt of the satisfactory quality and condition of the rock formation which is to support and hold the dam.

Tunnel No. 1 outlet.—The outlet portal of the spillway tunnel on the Nevada side (tunnel No. 1) is of necessity so located as to require a deep side cut over 600 feet long, the wall of which turns slightly toward the river. For part of this distance the excavation cuts a zone of fractured rock not occurring elsewhere in the immediate vicinity of the dam site. The rock slope of the excavation through this section is so unstable as to appear to require protection from heavy spillway discharge to obviate the hazard of undercutting the canyon wall. This could be avoided by extending a concrete conduit downstream from the portal 400 feet or more, but the cost would be excessive. It is believed that adequate protection can be afforded also by a properly designed concrete wall. Some such provision should be made if experience during the construction period, while the tunnel is used for diversion of the river flow, indicates the necessity of it.

The upper cofferdam.—The board has observed with much satisfaction the suitable character of the foundation, the excellent quality of the material being used in the fill, and the acceptable manner in which the work is being done on the upper cofferdam.

In the portion of the river bed exposed in the westerly half of the cofferdam now under construction, after the removal of some 20 feet or more of silt and loose gravel, a fairly uniform bed of compact and well-assorted gravel was encountered furnishing better foundation for this structure than was originally anticipated. The material for the dam which is being placed on this foundation is obtained from the Hemenway Wash and, when wetted and properly rolled in place, is a dense, fairly impervious mass well suited to the purpose.

The steel sheet piling so far as placed in its final position at the time of the visit of the board, had been set in a concrete footing in open excavation to bedrock and back filled by puddle on both sides. The compact and relatively impervious and stable nature of the river fill as disclosed in the excavations and the manner in which construction work is being carried on promise a thoroughly successful structure for protection of the work of excavation and the construction of the lower portion of the main dam. No difficulties are anticipated provided that no unusual flood occurs during the early stages of the cofferdam construction.

River fill and its behavior.—One of the elements of greatest uncertainty in the beginning and through the whole period of development to very recent date has been the river fill. Normally the gorge is filled to a depth of more than a hundred feet with sand, gravel, and bowlders, the exact physical character and behavior of

which could not be predicted. It was realized from the beginning that great difficulty and expense might have to be met if this material should prove to be loose and pervious and inclined to slump and ravel when the excavation for the dam is made, whereas all these difficulties would be greatly simplified if the river fill should prove to be stable and comparatively tight.

On this matter there is now considerable additional information. The excavation made for the westerly half of the upper cofferdam has exposed this river-bed material to a depth of over 30 feet. Its quality with respect to physical structure and stability and its relatively low permeability are both more satisfactory than originally anticipated. Not only does the material exposed at the site of the cofferdam furnish an eminently suitable foundation for that structure but it stands well in the excavation walls and yields surprisingly little water. The amount of inflow from the immediately adjacent river into an excavation over 700 feet in length and about 30 feet below the river level, covering half the width of the river trench, is so small as to be almost negligible in handling the work.

This is new and very important information. There is good reason to believe that similar conditions will be encountered in the excavation for the main dam, and, although much variability in character of material as well as increase of seepage with increase of head is to be expected in a deposit of this kind and of such great depth, there is now little doubt about its general stability and comparative freedom from costly and dangerous behavior.

The excavation to be made for the main dam will furnish a unique opportunity to determine the structural detail of the river fill of this great gorge of which advantage should be taken to make a complete descriptive and graphic record. Such a record will be of use not only in case of additional developments on the Colorado River but will be of future value on other rivers of similar history.

Spillway geology and treatment.—Sufficient variation in quality of foundation rock has been encountered in both the Nevada and the Arizona spillway excavations to warrant making special provision for the foundation of the weirs and preventing undesirable water seepage. In each case the proposal to excavate for the foundation of the weir at least as low as the excavation for the spillway channel at the particular places where more broken and porous rock have been disclosed, is a suitable treatment of the situation and there is no doubt of the safety of the structure when adequately grouted and drained.

The Arizona spillway exhibits somewhat special geologic conditions. The so-called spillway breccia is made up of a mixed lot of volcanic débris filling an ancient volcanic vent up through which hot vapors continued to issue for a long time after the accumulation had completely filled the crater and the site had been covered with later deposits. It is because of this history that the material is so variable in make-up and in physical condition. Certain portions have more open texture and are more porous and more modified than other portions of the same mass, and it is one of these more porous portions of the vent that has been encountered in the excavation.

This ground introduces no particular difficulty or danger and affords an adequate foundation for the spillway structures. The deeper excavation proposed in the most porous rock near the center of the foundation of the weir is undoubtedly an advisable precaution for securing stable foundation, but it is not necessary to carry the rest of the excavation to equal depth. The whole spillway excavation requires heavy concrete protection backed up by thorough grouting and adequate drainage.

Structural material.—The material as developed in the Arizona gravel deposit is admirably suited for the concrete aggregate and it is doubtful if material of a better quality and grading for the purpose could be found. The stripping of the deposit is light, and the material is so well graded that there is little waste and there appears to be a sufficient quantity for all demands.

Observation tunnel beneath the river.—A tunnel intended to serve as a drainage sump for the foundation excavation has been driven by the contractor beneath the floor of the gorge. At the present stage this tunnel does not reach beneath the deepest notch in the floor and it ends at a point some distance downstream from the toe of the dam. For its original purpose little more may be required, but the usefulness of this tunnel is not confined to its service as a sump.

Already it has added materially to the accuracy of knowledge concerning the quality and condition of the rock floor beneath the dam. It is especially encouraging to note that the tunnel thus far has encountered only sound rock. At the time of the board's inspection this tunnel was inaccessible, but reports indicate that there is virtually no leakage into the tunnel under the river.

The opportunity for obtaining other kinds of information, however, is of greater importance. Advantage should be taken of it to carry a branch tunnel of small cross section for observation purposes, entirely across the river beneath the toe of the dam. Such a tunnel would explore the remaining portion of the rock beneath the deepest section of the gorge and is fully warranted even for that purpose alone. It would make possible in addition a series of important direct observations bearing on matters now necessarily treated wholly on theoretical lines.

Measurements can be taken of the strain conditions now existing in the rock beneath the gorge and it is desirable that these measurements be continued during and following the construction of the dam. It would give unique opportunity to measure the effect of loading this rock foundation with the dam itself and the additional effect of filling the reservoir.

This is a most important service and the opportunity should not be lost for gathering whatever data may be furnished by the extraordinary conditions imposed by the new structure at this place. The tunnel should be kept open and should be fitted with whatever devices are necessary to secure reliable data.

Research and publication.—The unprecedented nature of this great work has created the necessity of extensive research in order to secure information necessary to the solution of many problems that have not hitherto been of equally vital importance. In this connection there have been developed new methods of procedure and an unusual refinement of technique not ordinarily possible in work of lesser magnitude. The magnitude of the structures and the importance of utilizing every advantage in the proper control of the immense forces to be imposed, together with the severe conditions under which operation must be conducted, have led to refinements in methods of analysis and design which had not been previously developed.

This vast amount of valuable information which is accumulating during the design and construction of the work should be published in order that the advances made in methods of study and design may not be buried or lost. This information would then be available for future similar work, eliminating duplication of the effort and expense which in work of lesser magnitude would be impossible.

A large amount of important and valuable geological information is being brought to light by the numerous and extensive surface and underground operations. As a matter of good engineering practice it is important that the geological features be accurately noted and recorded. This information can best be obtained during the progress of the work and provision should be made for it as one of the contributions.

Salt Lake City Irrigation Conference

THE conference at Salt Lake City was called by Governor Dern of Utah for December 5 in connection with the conference of the western governors, which followed on December 6 and 7 and dealt with the problem of Federal reclamation. There were 91 delegates to the reclamation conference. An organization was effected to be known as the National Reclamation Association, and the following officers unanimously chosen:

President, Marshall N. Dana, associate editor, Oregon Journal, Portland, Oreg.; secretary, Kenneth Miller, agricultural livestock agent, Spokane, Portland & Seattle Railway, Portland, Oreg.; first vice president, Sam Stephenson, of Montana; second vice president, W. R. Wallace, of Utah; treasurer, E. O. Larsen.

Executive committee: Perry Jenkins, of Wyoming; George W. Malone, of Nevada; Sam Stephenson, of Montana; A. B. Tarpey, of California.

The following resolutions were unanimously adopted by the National Reclamation Association and the governors' conference:

"On the third decennial of Federal reclamation, it is fitting that we pay tribute to the memory of that great President of the United States, Theodore Roosevelt, whose broad vision and statesmanship was responsible for and under whose administration the beneficent policy of the Federal reclamation was inaugurated in 1902.

"His familiarity with the West was such that he clearly envisioned its future. He realized that reclamation was of such scope and of such economic importance to the welfare of our entire country as to justify and require the aid and direction of the Federal Government and his dominancy and clear-visioned statesmanship in the matter prevailed.

"As a result, the West has increased its population, in wealth, in commerce and trade, and it has provided a defensive strength and security for the whole Nation. Within the short period of 30 years, an internal trade has developed between the western semiarid States and the other States of the Nation amounting annually to hundreds of thousands of cars of railroad cargo and to an enormous tonnage of ship cargo. These Western States send eastward their fruit, their lumber, their fish, their cattle and sheep, and their other raw products and receive in exchange the more expensive finished products of the industrial East.

"Since the initial passage of the reclamation act the Federal Government has reclaimed nearly 3,000,000 acres of land, has provided rural homes for 60,000 families, has been responsible for a like increase in urban population, has added a billion dollars to the Nation's taxable wealth and has set up in this western half of our country an impregnable zone of defense against any possible attempt of alien invasion of our land. It is to preserve these values, and to hold a continuing policy of Federal reclamation, as contemplated in the original act, that we again militantly dedicate ourselves in order that the great work inaugurated by Theodore Roosevelt when President of the United States may go on unabated. To these ends, therefore, we offer the following specific resolutions:

"CALIFORNIA RESOLUTION NO. 2

"Whereas we believe that the broad principle of Federal aid to reclamation should be extended to economically sound projects of regional and national importance too costly for local or community effort, we hold that the immediate construction activity of the Bureau of Reclamation should be mainly confined to providing supplemental water supplies and completing or reconstructing works on existing Federal and non-Federal projects which are economically sound and on which such aid is urgently needed.

"We recognize further that due to several conditions, payments accruing to the revolving funds have been materially decreased. Under the principles heretofore set forth, the activities of the Reclamation Bureau will contribute materially to the recovery of now existing agricultural areas in the Western States and therefore, assist in farm relief. Therefore, be it resolved by the reclamation conference here assembled that we indorse the principle of further advancement to the revolving funds of the Bureau of Reclamation to be repaid at definite and stated periods.

"While seeking to bring support to a continuing and effective policy of Federal reclamation, consistent with the general economic situation, we can not fail to recognize that an emergency exists on reclamation projects comparable with that existing in all agricultural districts as well as in other lines of industry and due to the same causes. This condition makes necessary some provision for an extension in the repayments of construction charges commensurate with existing needs.

"We commend this problem to the sympathetic consideration of the Congress in the belief that it can and should be met in such a way as to maintain the ultimate integrity of the revolving reclamation fund.

"Whereas we deem the existence and continuance of the Bureau of Reclamation of vital importance to the West and the entire Nation;

"Whereas it has been the policy of every administration to appoint a western man as Secretary of the Interior, and selections have been able men with an intimate knowledge of western problems;

"*Therefore be it resolved:* We urge the Bureau of Reclamation be maintained as a part of the Interior Department, which alone has acquaintance with the problems of water administration and conservation, and

"*Be it further resolved:* That the secretary of this conference be instructed to furnish a copy of these resolutions to each member of the conference, to the governors of all States interested in irrigation, to the Senators and Congressmen representing these States in Congress, and to the Department of the Interior.

"*Be it resolved by this conference:* That we heartily thank Governor Dern and the good people of the State of Utah, the management of Hotel Utah, and the press for favors and hospitality so uniformly and graciously extended this conference and its members."

Marketing conditions on the Orland project have made considerable improvement, the price of butterfat having advanced to 30½ cents a pound, representing an increase of 50 per cent during a recent month. During the same period alfalfa responded by advancing to $7.50 a ton for baled hay.

Seventy-nine carloads of feeder cattle were recently received on the Yuma project for pasturing. When fattened this stock will be shipped to Pacific coast markets.

This season's grapefruit continues to show increased yields and a high percentage of first-grade fruit on the Yuma auxiliary project. Two cars each of olives and oranges, 1 of almonds, 5 of lemons, 3 of prunes, and 3 of mixed fruits were shipped during a recent month from the project.

G. Eisemann has the distinction of producing the first sugar beets on the Riverton project.

The Union Pacific Railroad Co. has completed construction of a stock-feeding station at Gering, Nebr., North Platte project, at a reported cost of $70,000.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, returned to Washington on December 15, from a brief western trip, during which he attended the irrigation conference in Salt Lake City on December 5, which was called by Governor Dern of Utah, and visited the Boulder Canyon project.

R. F. Walter, chief engineer, spent two days early in December in Cheyenne, where he conferred with representatives of the States of Idaho and Wyoming, with relation to the distribution and apportionment of the waters of the Snake River.

S. O. Harper, assistant chief engineer, has returned to Denver from a trip which included the Grand Valley project, Boulder Canyon project, and Parker Dam site on the Colorado River near Parker, Ariz.

J. L. Savage, chief designing engineer, made a recent inspection of the work at Cle Elum Dam, Yakima project. On his return to Denver Mr. Savage stopped at the Owyhee, Boise, and Boulder Canyon projects, and Parker dam site, Arizona.

E. B. Debler, hydraulic engineer, attended the recent conference at Salt Lake City of governors of the Western States.

D. C. Henny, consulting engineer, spent two days in the Denver office early in December.

Dnieprostroy Dam in Soviet Russia—746,000-horsepower development

Field work on the Colorado River Basin investigations in the vicinity of Green River, Wyo., was discontinued at the end of November. On December 1 the parties split, part going to Parker, Ariz., under Engineer J. R. Iakisch, and the remainder to Shiprock, N. Mex., under Associate Engineer H. F. Bahmeier. Engineer Porter J. Preston left Denver on December 5 to confer with and instruct the engineers in charge of the field parties.

Charles P. Berkey, Warren J. Mead, Daniel W. Mead, and Robert Ridgway, members of the Colorado River board, recently spent several days in the Denver office, where they passed on final designs for Hoover Dam.

H. H. Johnson, superintendent of the Milk River project, recently visited the Lower Yellowstone project in connection with the preparation of the crop census.

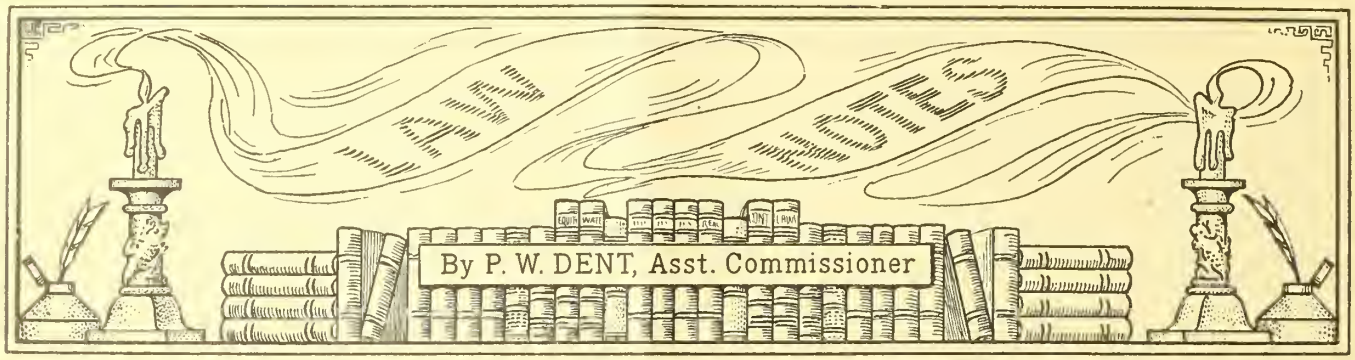
E. B. Debler, hydraulic engineer, left Denver for Washington the latter part of December. During his several weeks' stay in the Washington office Mr. Debler will assist with pending legislation.

J. S. Moore, superintendent of the Yakima project, spent his recent accumulated legislative furlough in a visitation of several projects, including Boulder Canyon, Umatilla, Owyhee, Minidoka, Orland, and Klamath, stopping at Denver en route.

Frank Fyfe, of Grandview, Yakima project, Washington, has been elected president of the Washington Irrigation Institute. In the midst of a busy life Mr. Fyfe has taken time to aid in the general progress of the district and under his leadership the institute may be expected to concern itself largely with the development and ultimate welfare of the small homes which characterize the Yakima Valley.

Former Bureau Official Dies

Ralph B. Williamson, vice chairman of the Federal Power Commission, died at his home in Washington, D. C., of a heart attack on December 10, at the age of 53 years. Mr. Williamson, a graduate of Cornell University and of Harvard Law School, was legal adviser for the Bureau of Reclamation from 1906 to 1910, with headquarters at Yakima, Wash.



Indian Relief Act Construed by Department

THE act of Congress of July 1, 1932, 47 Stat. 564, reads as follows:

"An act to authorize the Secretary of the Interior to adjust reimbursable debts of Indians and tribes of Indians.

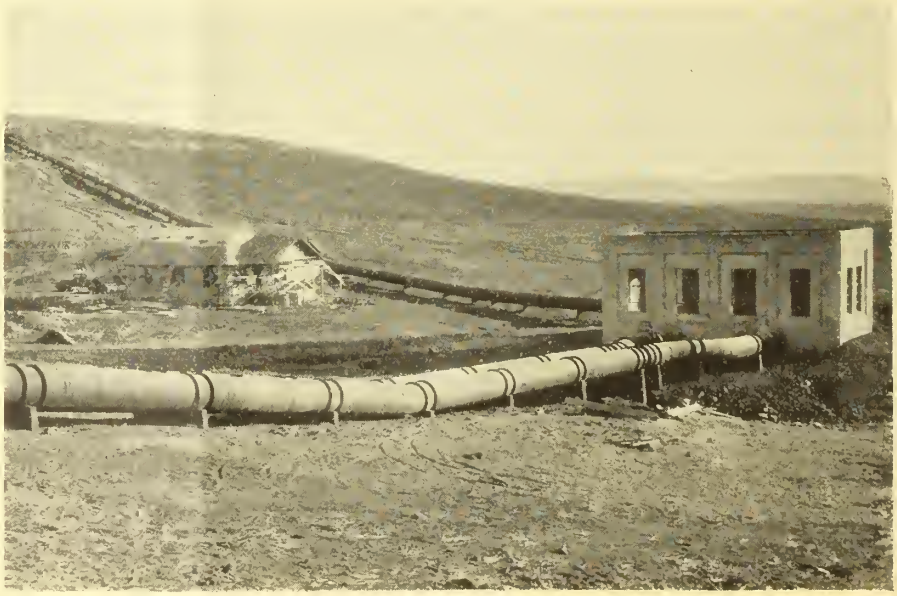
"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of the Interior is hereby authorized and directed to adjust or eliminate reimbursable charges of the Government of the United States existing as debts against individual Indians or tribes of Indians in such a way as shall be equitable and just in consideration of all the circumstances under which such charges were made: *Provided, That the collection of all construction costs against any Indian-owned lands within any Government irrigation project is hereby deferred, and no assessments shall be made on behalf of such charges against such lands until the Indian title thereto shall have been extinguished,* and any construction assessments heretofore levied against such lands in accordance with the provisions of the act of February 14, 1920 (41 Stat. 409), and uncollected are hereby canceled: *Provided further,* That a report shall be made to Congress annually, on the first Monday in December, showing adjustment so made during the preceding fiscal year: *Provided further,* That any proceedings hereunder shall not be effective until approved by Congress unless Congress shall have failed to act favorably or unfavorably thereon by concurrent resolution within sixty legislative days after the filing of said report, in which case they shall become effective at the termination of the said sixty legislative days."

The solicitor of the department in a decision dated November 25, 1932, and approved on the same date by the First Assistant Secretary, held that the language of the act which we have italicized above, is applicable to Indian reclamation projects, but not to reclamation projects constructed under the act of June 17, 1902, 32 Stat. 388.

The following quotation is taken from the decision:

"If it had been presumed that the legislation affected Government reclamation projects, constructed by the Bureau of Reclamation, the legislation would have been referred to that bureau for report, or it would have been asked to appear before one of the congressional committees when the legislation was under consideration. No one appeared before the committees except employees of the Office of Indian Affairs, and the hearings clearly indicate that the bills proposed were to benefit Indians on Government Indian irrigation projects. As to the construction charges on the 30 acres of excess lands [on Indian homesteads on the Yuma reclamation project, on which 30 acres of each 40-acre Indian homestead the Indian entryman made water right application], in each homestead, it is believed that these homesteads are not within the first proviso to the act of July 1, 1932, supra. The proviso bears express reference to and is an amendment of the Indian appropriation act approved February 14, 1920 (41 Stat. 408). It is in pari materia with that act which has reference to Government Indian reclamation projects.

"In connection with this reclamation legislation it appears that only three months earlier, by the act of April 1, 1932 (47 Stat. 75), Congress had covered quite fully the matter of deferment of the payment of construction charges on Government irrigation projects that have been constructed by the Bureau of Reclamation, and it would be an unusual procedure for Congress to make a further deferment on such projects for the benefit of one class of landowners, thus amending the act of April 1, 1932, without expressly so stating. The Hon. Scott Leavitt, who was manager of the legislation in the House, repeatedly referred to the bill which became the act of July 1, 1932, as relating to *Indian reclamation* and *Indian irrigation projects,* and the whole history of the legislation shows such to be the case. This act of July 1, 1932, was the result of combining two bills (H. R. 8898 and H. R. 10886) into one. The part relating to irrigation projects was taken from H. R. 8898, and the House report on that bill stated: 'The provisions of this bill apply only to Indian lands on *Indian irrigation projects.*'" (Emphasis supplied.)



Wippel Pumping Plant, Kittitas Division, Yakima Project, Washington

Articles on Irrigation and Related Subjects

Carpenter, Jay A., and Alfred M. Smith:
Electro-chemistry and Hoover Dam. Electrical Engineering, October, 1932, v. 51, No. 10, pp. 714–716.

Clyde, Geo. D.:
Forecasting water supply. Snow surveys in Utah. Illus. and maps. Civil Engineering, October, 1932, vol. 2, No. 10, pp. 610–614.

Darwin, A. Gilbert:
Colorado River aqueduct construction, illus. (long article with maps and profiles), Western Construction News and Highways Builder, November 10, 1932, v. 7, No. 21. pp. 622–631. (Editorial, p. 621.)

Dunnewald, T. J., and others:
Soil survey of Shoshone area, No. 38, of 1927 Series, Publication of Bureau of Chemistry and Soils, Dept. of Agriculture, 50 pages, illus., and map.

Gallison, Norman S.:
Construction of Hoover Dam (ninth article). Illus. Compressed Air Magazine, September, 1932, v. 37, No. 9, pp. 3907–3912.

Kellog, F. H.:
Clay grouting at Madden Reservoir. Illus. Eng. News-Record, October 6, 1932, v. 109, pp. 395–399. (Editorial, p. 415.)

Lawson, L. M., commissioner:
High September floods along the Rio Grande, illus., Eng. News-Record. November 10, 1932, v. 109, p. 557.

McNeill, R. W.:
Electric shovels handle tunnel muck at Hoover Dam. Illus. Construction methods, October, 1932, v. 14, pp. 17–19.

Mead, Elwood:
Law covering power revenue of Reclamation project urged, Commissioner Mead says hydroelectric plants should be Federal property, U. S. Daily, December 6, 1932, v. 7, p. 5 (p. 1777).
Need for immediate aid for reclamation, Federal loan for construction of private projects advocated, U. S. Daily, November 17, 1932, v. 7, No. 209, p. 8 (p. 1684).
State responsibility for irrigation; Need to overcome opposition to development, U. S. Daily, October 28, 1932, v. 7, No. 195, p. 8 (p. 1570).
Transforming arid lands into irrigated farms, U. S. Daily, November 16, 1932, v. 7, p. 8 (p. 1676).

Nelson, W. R.:
Concrete for Hoover Dam, Pt. 3, Lining of Diversion Tunnels, The Architect and Engineer, October, 1932, Vol. III, No. 1, pp. 55–58.
Hoover Dam, lining the diversion tunnels with concrete, illus., Contractors and Engineers Monthly, November, 1932, v. 25, No. 5, pp. 24–27 (also cover illustration).

Park, Allen S.:
Construction of the Hoover Dam, sand and gravel plant for concrete aggregates. Illus. Compressed Air Magazine, October, 1932, v. 37, No. 10, pp. 3937–3942; Cov. illus. and frontispiece.

Prine, W. E., Editor:
Two years construction program on Colorado River aqueduct. Illus. Southwest Builder and Contractor, September 23, 1932, v. 80, pp. 40–42.

Savage, John L.:
Hoover Dam cement specifications tentatively formulated, charts, Eng. News-Record, November 10, 1932, v. 109, pp. 558–560. (Editorial, p. 571.)

Schmitt, F. E., editor:
Preparing for river diversion at Hoover Dam, illus., Eng. News-Record, November 24, 1932, v. 109, p. 622–624. (Editorial, p. 630; additional illus., p. 633.)
Record-size cableway for Hoover Dam. Illus. Eng. News-Record, October 6, 1932, v. 109, pp. 408–410.

Southwest Builder and Contractor:
Construction of San Jacinto tunnel nearly a 6-year job, illus., November 4, 1932, v. 80, No. 19, pp. 48–50.

Vivian, C. H.:
Construction of the Hoover Dam (concrete mixing plant) tenth article, illus., Compressed Air Magazine, November, 1932, v. 37, No. 11, pp. 3970–3974.
Construction of the Hoover Dam—Lining of the diversion tunnels with concrete, illus., Compressed Air Magazine, December, 1932, v. 37, No. 12, pp. 4010–4017. (Editorial, p. 3992.)

Young, Walker R.:
Hoover Dam. Illus. Scientific American, October, 1932, 88th year, pp. 222–223.

Contract with Imperial Irrigation District

Secretary Wilbur on December 3 announced his approval of a form of contract with the Imperial irrigation district for repayment of the cost of the proposed All-American Canal.

This contract was negotiated in Washington by representatives of the department, the Imperial irrigation district, and the Coachella Valley County water district.

Those participating on behalf of the department were Dr. Elwood Mead, Commissioner of Reclamation; Northcutt Ely and Charles A. Dobbel, assistants to the secretary; E. C. Finney, solicitor; Porter W. Dent, asst. commissioner, Reclamation Bureau; and R. J. Coffey, district counsel for the Bureau of Reclamation in Los Angeles. The Imperial irrigation district was represented by Messrs. Mark Rose and John DuBois of the board of directors; Charles L. Childers, counsel; and M. J. Dowd, chief engineer.

The Coachella Valley interests were represented by Dr. Harry W. Forbes, and Dr. S. S. M. Jennings, of the board of directors, and Attorney Arvin B. Shaw, jr.

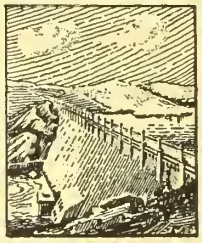
The contract provides for unification of the lands to be served, by inclusion in the Imperial irrigation district. It incorporates, however, a number of provisions especially requested by the Coachella Valley interests, including arrangements by which the present Coachella district will retain its corporate entity and certain financial functions. It represents a compromise of the previously conflicting views of the Imperial and Coachella interests.

The canal is estimated to cost about $38,500,000 and will carry water from the Colorado River to the Imperial and Coachella Valleys. This contract will not become effective until certain proceedings are concluded in California, including an election within the Imperial irrigation district, followed by the usual validation decree. When these proceedings are completed and the contract goes into effect it is planned to request an initial appropriation of Congress for commencing construction. The work will require several years and will employ a large number of men.

During the month of November the price of butterfat on the Yakima project advanced from 18 to 27 cents a pound.

The annual report of the Shoshone irrigation district shows its financial affairs to be in excellent condition, with a cash surplus of $23,500 on October 1. This surplus is the result of the strict economy practiced by the district during the past season.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Treatment of Colorado River Water for Boulder City Supply

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

IN PROCURING a water supply for Boulder City, Nev., the Bureau of Reclamation was confronted not only with the problem of lifting water from the Colorado River to the construction camp but also with the necessity for clarifying, softening, and purifying the water to make it suitable for domestic use.

Erosion is heavy in the watershed of the Colorado River, particularly in the spring run-off and during the summer cloudbursts. The average content of silt in river water over several years period has amounted to 6,000 parts per million and after violent storms this value has been raised to more than 85,000 parts per million.

The basin of the Colorado contains many underground and surface deposits of hardening compounds, as gypsum, epsom salts, and magnesite, and, as a result, the river water carries an average of 367 and a maximum of 904 parts per million of hardness throughout the year.

Following investigations to determine the most feasible method for treatment, decision was made to remove a greater portion of the silt by detention in sedimentation basins; purify and soften the water by combined lime, soda ash, and carbon-dioxide gas application; filter through sand beds to remove particles not precipitated in the clarification basin; and add chlorine for complete purification of the water before pumping to the supply tank and distribution lines of Boulder City.

Under ordinary circumstances as much as 98 per cent of the suspended solids in the Colorado River can be precipitated by plain subsidence during a 2½-hour detention period. Normally the carbonate hardness of the river water is readily changed to a heavy precipitate by the addition of slaked lime, $Ca(OH_2)$, and the noncarbonate hardness can be precipitated by the addition of soda ash, Na_2CO_3. Theoretically, no further treatment would be needed to reduce the water hardness, but in actual practice an excess of lime is added to assure a maximum precipitation of certain undesirable calcium and magnesium compounds, resulting in a water of slight causticity. This condition is then remedied by the addition of CO_2 gas during a 30-minute carbonation treatment.

PUMPING SYSTEM

As described in a previous article, water is pumped from the Colorado River to a 225,000-gallon presedimentation tank from which it flows to a 30,000-gallon sump tank and is then pumped by two lifts to a 100,000-gallon receiving tank in Boulder City. Flowing by gravity to the filtration plant, it is treated, filtered, chlorinated, and then pumped to the 2,000,000-gallon storage tank on a hill north of Boulder City. The mains of the town are supplied by gravity from storage, under pressures as great as 80 pounds per square inch.

The 225,000-gallon concrete presedimentation basin is so designed and of such size that water pumped from the river by three 550 gallons-per-minute centrifugal pumps will flow through the basin to the sump tank of pumping plant No. 1 in a specified minimum period of 2½ hours. The silt deposited in this time is collected at the center of the basin by a Dorr traction clarifier and is removed by a 94-gallons-per-minute sludge pump.

The pumps of plants Nos. 1 and 2 force the water through 6 miles of 10 and 12 inch steel pipe, connected by Dresser couplings to the receiving tank in Boulder City where the flow is through an Aero-Mix aerator, consisting of a series of baffle plates especially designed for air mixing, before falling into the tank. This aerator serves to oxidize certain minute vegetable organisms and to liberate entrained CO_2 gas, an objectionable presence in the following procedure of treatment.

FILTRATION AND PURIFICATION PLANT

The filtration and purification plant in Boulder City consists primarily of a series of reinforced concrete tanks and chambers constructed mainly below the ground surface, including four chemical mixing tanks, two 45-foot square clarifier tanks separated by two narrow recarbonization chambers, four rapid sand-filter chambers, a clear well, a pipe gallery, and minor compartments and chambers, combined in one monolithic reinforced concrete structure 100 by 115 feet in plan. A 2-story building, 19 by 54 feet in plan, with a tower, inclosing a filter wash-water tank, rising an additional story, has been constructed over the pipe gallery. A 1-story wing, 18 by 41 feet in plan, extends over the rapid sand-filter chambers, and another 1-story wing has been built at the end of the building for a storage room and loading platform. The first floor of the main part of the building is utilized as an operating room and the second floor for storage. The outside walls are of brick and the partitions and roof framing of wood construction. The 5,000-gallon wash-water tank in the tower, and the second floor are supported by structural-steel framework. The mechanical equipment consists of 2 dry chemical feeders, 4 chemical mixing units, two 45-foot Dorr clarifier units, 2 sludge pumps, 1 carbonization unit, 4 control tables, 2 chlorination units, and 3 clear well pumps, together with the piping system, valves, fittings and specials, motors, and miscellaneous operating and control mechanism and apparatus.

Water is received at the filtration plant in No. 1 agitator chamber where a known amount of lime and soda ash and an excess of lime are supplied automatically by dry chemical feeders. The mixture is violently agitated for 15 minutes to insure complete mixing and then passes to agitator No. 2, where a 15-minute period of gentle agitation procures a thorough combination of all elements and a maximum flocculation of the precipitate.

The flocculated water flows into clarifier basin No. 1, and the majority of precipitate settles during a 2-hour detention period. A Dorr traction clarifier moves the precipitant to the center of the basin from which a portion of the sludge is recirculated to aid in precipitation, and the remainder is removed at intervals by a sludge pump.

The water, made slightly caustic by the excess of lime, passes from clarifier No. 1 to a carbonation chamber where CO_2 gas is injected and then flows to agitators Nos. 3 and 4 where mixing is carried on

for 30 minutes in a manner identical with that of agitators Nos. 1 and 2. Minute particles of normal carbonate are formed by this treatment, and alum or recirculated sludge from clarifier No. 2 is added to the water in the carbonation chamber, causing the minute precipitates to adhere to the larger particles.

The flocculent solids are removed in clarifier No. 2 by an installation identical with clarifier No. 1. A portion of the sludge is recirculated, and the remainder removed. The overflow from clarifier No. 1 is given a second period of carbonation to convert any remaining normal carbonates into soluble bicarbonates, thus preventing sand incrustation of the filters, and then passed through rapid sand filters, of which there are four in the plant. When a filter becomes partially clogged, slowing the rapidity of operation, it is washed by passing treated water from the tower tank through the filter sand in a direction reverse to the normal filtering process.

A clear well receives the water from the filters and from the clear well it is pumped to the 2,000,000-gallon storage tank. As a final treatment, chlorine is added in the suction pipe of the pumps in a sufficient amount to destroy all bacteria.

The above-described water treatment is the normal series operation of the plant, but piping and control works have been provided so that a unit, consisting of twin agitators, clarifier basin, and chlorination chamber, may be operated singly, the two units may be operated in series or in parallel, or the entire plant may be by-passed.

DETAILS OF OPERATION

During July of this year, a normal summer month, 18,725,000 gallons of water passed through the plant in the 31-day period, 355,000 gallons were used for washing filters and the remainder, 18,370,000 gallons, was pumped to the storage tank. The average daily consumption amounted to more than 120 gallons per person, as at that time the population of Boulder City was nearly 5,000.

The monthly consumption of chemicals was 23,100 pounds of lime, 16,800 pounds of soda ash, 6,200 pounds of coke for manufacturing carbon-dioxide gas, and 150 pounds of chlorine. The average hardness of the river water during the month was 238 parts per million and the average silt content 8,460 parts per million. The water treatment system softened the water to an average of 103 parts per million and removed all of the silt, the resultant product being a sparkling, clear, and unadulterated liquid. The cost of chemicals amounted to $485.80, electricity $267.48, and labor repairs and other expenses $701, making a unit cost for treatment of 8 cents for each 1,000 gallons delivered to the storage tank. The Government expended approximately $95,000 for materials and equipment in the filtration plant and for its construction.

The operation of the filtration and purification system has been effective and satisfactory from the time it was placed in operation in February, 1932, with the exception of a 10-day period in September of this year, when cloudbursts in Utah washed thousands of tons of earth and fine clay into the river, raising the silt content to 85,000 parts per million, or 8½ per cent by weight of solid matter.

Notes for Contractors

Owyhee project, Oregon.—Bids under specifications No. 539, for the construction of tunnel No. 1 controlling works, were opened at Ontario, Oreg., on November 22. Three bids were received, as follows: T. E. Connolly, San Francisco, Calif., $66,505.80; Morrison-Knudson Co., Boise, Idaho, $89,921; General Construction Co., Seattle, Wash., $97,874. The contract has been awarded to the low bidder.

Palo Verde irrigation district, California.—Surveys indicate that 14 miles of levee will have to be raised and strengthened. From incomplete computations, it is estimated that possibly 250,000 cubic yards are involved. The work is being prepared for advertisement. The levees are on the Colorado River near Blythe, Calif.

Boulder Canyon project.—Under specifications No. 580–D bids were received at Denver, Colo., on December 20 for furnishing overhead traveling cranes for the Boulder Canyon, Owyhee and Yakima-Kittitas projects. Bids were taken on one 40-ton, one 20-ton, and two 5-ton cranes.

Bids will be opened on February 3, 1933, at Denver, Colo., for furnishing f. o. b. factory shipping point, three, four, or five 115,000-horsepower, and one or two 55,000-horsepower vertical shaft hydraulic turbines with or without butterfly type shut-off valves; and governors for the turbines. Specifications and plans have been furnished to the following concerns: Pelton Water Wheel Co., San Francisco, Calif.; Allis-Chalmers Manufacturing Co., Denver, Colo.; S. Morgan Smith Co., York, Pa.; Newport News Shipbuilding & Dry Dock Co., New York City; James Leffel & Co., Springfield, Ohio; I. P. Morris Co., Philadelphia, Pa.; J. M. Voith Co. (Inc.), New York City; Woodward Governor Co., Rockford, Ill.; Lombard Governor Co., Ashland, Mass.; Union Steel Casting Co., Pittsburgh, Pa.; Allegheny Steel Co., Breckenridge, Pa.; Bethlehem Steel Co., Bethlehem, Pa.; American Locomotive Co., Dunkirk, N. Y.; The Midvale Co., Midvale, Pa. The turbines, valves, and governors will be installed by the Government.

Specifications No. 541 have been issued calling for bids on furnishing, f. o. b. factory shipping point, eight welded plate-steel cylinder gates, 32 feet in diameter and 10 feet in height, together with semisteel entrance liners, welded plate-steel nose liners, and semisteel and cast-steel throat liners, which material will be installed by the Government in the intake towers at the Hoover Dam. The weight of the material is approximately 9,000,000 pounds. Bids will be opened at Denver, Colo., January 27.

Specifications have been issued covering the first purchase of electric overhead traveling cranes for the Hoover power plant. The specifications provide for the purchase of 5 cranes, 4 of which will be 300-ton cranes having a span of approximately 60 feet and 1 will be a 100-ton crane.

Yakima project, Kittitas division.—Bids were opened at Ellensburg, Wash., on December 23, under specifications No. 581–D, for construction of the Badger Creek wasteway of the North Branch Canal lateral system. The work is divided into two schedules and is located near Kittitas and Thrall, Wash.

Shoshone project, Wyoming.—Bids for cleaning and painting two 60-inch riveted plate-steel power outlet pipes at the Shoshone Dam (specifications No. 582–D) were received at Powell, Wyo., on December 10.

Western Problems

(Continued from p. 3)

Commerce Commission. At the present time these water carriers can charge any minimum rate they see fit without interference. This situation results in constant rate wars, demoralizing to both water carriers, rail carriers, and the shipping public.

The recent activities of the United States Chamber of Commerce as to fourth section relief would indicate that this is a question which could be profitably discussed at this Western Governors' Conference. It has been argued that this subject should be left to the Interstate Commerce Commission, which is the duly constituted public tribunal for that purpose. This point would be well taken if all parties would govern themselves accordingly, but if the Chamber of Commerce of the United States is taking a referendum of the subject instead of leaving it to the commission it would seem that this conference has a similar right to discuss it.

Boulder Canyon Project Notes

The upstream cofferdam is rapidly nearing completion. River-bed material was excavated at the rate of 22,000 cubic yards a day, hauled out of the canyon by trucks and dumped into railroad cars. These cars brought in embankment material from Hemenway Wash, being loaded by three steam shovels. The trains ran down into the canyon just above the dam and dumped their loads from a timber trestle. The material was then loaded into trucks by two steam shovels, and these trucks delivered 120 loads per hour, or a truck was dumped every 30 seconds. The dam is built up in horizontal layers not too wide, a foot in thickness, and is leveled and tamped by means of caterpillar bulldogs and caterpillar rollers with sheep-foot projections. Where the dam unites with the canyon walls the material is puddled. The completed cofferdam has a height of 80 feet above the river bed and a top width of 70 feet. It contains 164,000 cubic yards of rock, 568,000 cubic yards of earth, 3,500 cubic yards of concrete, and 704,000 pounds of steel-sheet piling driven to rock at the upstream toe. The upstream face of the dam has 6 inches of concrete paving and a slope of 3 to 1. There is a rock fill on the downstream face with a slope of 4 to 1.

Thirty small houses from the famous "Olympic Village" used by Olympiad athletes in Los Angeles last year have been moved to Boulder City and will help to solve the housing problem. Each house has two rooms and a bath.

In manufacturing 1,000 cubic yards of concrete for the diversion tunnel lining, the Canyon mixing plant used approximately 1,330 barrels of cement, 1,213 tons of gravel, 532 tons of sand, and 22,500 gallons of water.

Employees of Six Companies Inc., numbering over 3,000, enjoyed a 48-hour vacation over the Christmas holiday, the entire job shutting down from 7.30 a. m. Saturday, December 24, to 7.30 a. m. Monday, December 26.

Mr. Oliver Cowan, high scaler for Six Companies Inc., saved the life of Inspector B. R. Rutledge, of the Bureau of Reclamation, on November 21. Rutledge, employed as scaling inspector on the Nevada wall of the canyon, had lost hold of his suspension rope and started to plunge to the floor of the canyon 400 feet below. Cowan saw Rutledge lose his hold and swung himself by his suspension rope in the way of the falling body, stopping Rutledge after he had fallen 25 feet and wedging his body against the canyon wall until assistance arrived. Rutledge was scratched and bruised, but returned to work the following day.

Sheriff Joe Keste of Clark County recently conducted a raid of the "speakeasies" and saloons along the highway between Las Vegas and the Federal reservation. According to newspaper reports, 23 resorts were closed along the 18-mile stretch of road.

Visitors to the project from November 24 to 26, inclusive, numbered 2,006 and were traveling in 622 automobiles.

Owing to an influenza epidemic, the schools of Boulder City were closed on November 21 and remained closed until December 1. According to reports there were approximately 1,000 cases in the town, all of which were mild with no deaths resulting.

On November 29 work was started on preliminary operations for installation of the 30-foot plate-steel main header pipe in the penstock tunnels. In diversion tunnel No. 2, Nevada side, drilling was commenced for a service adit to the canyon, through which the pipes will be taken to the tunnels.

A party of 72 members of the San Diego (Calif.) Chamber of Commerce made a motor trip to the dam site on December 2.

Excavation progress on the intake towers on December 1 was as follows: Nevada side, upstream tower 80 per cent completed, downstream tower 70 per cent; Arizona side, upstream tower 80 per cent, downstream tower 66 per cent. Other work in progress includes construction of the downstream cofferdam and rock barrier, and excavation of the four penstock tunnels.

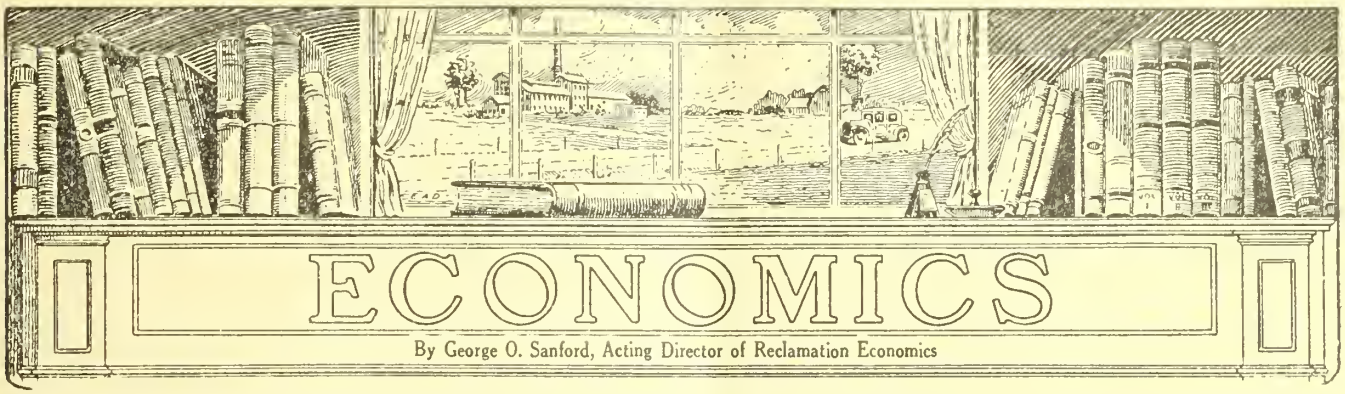
The first of five cableways being installed by the Six Companies has gone into operation. These huge cableways are being strung between movable towers across the canyon, and each has a 3-inch cable weighing 14 tons and about 1,400 feet in length. A 500-horsepower electric hoist motor for a 3-drum hoist is to be installed in each tower on the Nevada side. Another electric motor will move the towers along the tracks at the canyon rim.

The Babcock & Wilcox Co., contractors for furnishing and installing the outlet pipes, has under erection at Bechtel, about 1 mile west of the dam site, a steel fabrication plant, which will cost about $600,000, of which $90,000 represents the cost of the building. The building will be 670 feet long, 85 feet wide, and 55 feet high. Railroad track will be run from the Boulder City-Hoover Dam line into the plant. Machinery installation in the fabrication plant will include a bending mill, vertical rolling mill, welding equipment, X-ray equipment, boring and turning machinery air compressor, and shop laboratory. An office building, 30 by 80 feet, of frame construction, is being erected near the fabrication plant.

When the Bureau of Reclamation begins its purchase of 4,000,000 barrels of cement for the mass concrete in the Hoover Dam, hundreds of men will be given employment in near-by cement plants which will run to capacity for two years in order to supply the demand.

Six Companies Inc., has constructed 703 buildings at a total cost of $1,130,000. These buildings comprise 16 dormitories, 10 four and five room cottages, 136 three-room cottages, 264 two-room cottages, 250 one-room cottages, 1 executive lodge, 2 residences for general superintendent and insurance supervisor, 1 commissary, 1 commissary warehouse, 3 general warehouses, 2 office buildings, 1 machine shop, 1 hospital, 2 garages, 1 clubhouse, 1 laundry, 3 mess halls and mess-hall dormitories, 1 nurse's residence, 1 doctor's residence, 1 cold storage building, 1 carpenter shop, 1 schoolhouse, 1 railroad and gravel plant shop and warehouse, 1 warehouse addition and office, 1 warehouse for Government material. Nearly all of of these buildings are located in Boulder City.

The first snowstorm of the season occurred on December 11, the fall in Boulder City being 5½ inches during the day. On December 13, the project thermometers registered 17°, the lowest to date.



What Becomes of the Farmer's Income?

By L. H. Mitchell, Assistant Director of Reclamation Economics, Bureau of Reclamation

RECENT editorials in magazines and newspapers, and waves of broadcasting convey the impression that excessive taxes alone are responsible for the deplorable condition of our farmers. Articles in many advertising periodicals published by both business and commercial organizations endeavor in good faith to show the farmers how their conditions can be bettered. Some of these articles will have three, five, and seven point programs; others will have set-ups showing how to cut the cost of production by using more modern machinery; still others will explain why the farmer can help his cause by producing more at a less cost, hoping thereby that the farmer can spend more money in the community. Some of this advice is good and wholesome and some of it has selfish motives in the background.

When high taxes are mentioned one often thinks only of the grand total payment. An analysis of an individual tax statement for 1931 showed that out of the total payment approximately 7 per cent was on account of State levies, and the balance was for local purposes such as schools, roads, poor, sinking fund, bond interest, county agricultural service, county fair, general and special. It is my desire in writing this article to impress our project settlers with the importance and value of keeping account of all expenditures. Keeping the attention of the farmer on high taxes may have the effect of a smoke screen which will hide from him some equally important items of costs.

There is another factor that has always helped to keep the farmer from making the cost of production equal the value of the crop, and that is the cost of labor. It is fully appreciated that a large number of laborers have only their services to sell. However, too often demands for high wages, which the farmers can not afford to pay, have been responsible for the substitution of the combine, the corn harvester, and other labor-saving devices for hand labor. Those laborers who followed the grain and corn-picking harvest are now out of employment. This may be somewhat off the subject, but it does show that taxes alone are not wrecking the farmer.

Let us consider several classes of farmers, namely, A, those who own a farm but do not own it as a home; B, tenants; and C, those who own their farms and are living thereon for the main purpose of making a home. Those grouped under A are, generally speaking, retired farmers, although a large number of people own farms who are not or never were farmers; some are not even agriculturists. The experience obtained by being reared on a farm and owning real estate has convinced me that the returns from a farm are sufficient for the support of one family only, and that the profits from a tenant-operated farm can not be expected to maintain the farmer and his family and in addition pay the taxes and support comfortably or even in a very modest way the nonresident owner and his family. Farming is a mode of living. To be successful as a farmer a man must use his head as well as his hands. Hands and machinery can only do a small portion. A farmer on an irrigated farm can not be successful if he does not devote his entire time to his farming operations. That is, he can not be a successful farmer and at the same time carry on the activities of a barber or a banker. Likewise barbers and bankers, generally speaking, are more successful if they do not devote a part of their time to farming.

WISE FARMER KEEPS BOOKS

In order to answer the question, What becomes of the farmer's income? I have confined my thoughts to the farmer under class C.

During my short time as Assistant Director of Reclamation Economics, I have endeavored when visting Federal projects to have the settlers keep books, not so much for the purpose of knowing what it costs to produce a certain crop or which cow is a boarder, but for the purpose of knowing where the incomes goes. Only by doing this can any farmer realize whether taxes, labor, gasoline, interest, or something else is keeping him from making both ends meet.

It is earnestly hoped that this article will influence our project settlers under class C to keep books, and that they will start this as a New Year's resolution on January 1, 1933. The primary object of such accounting should be to show where the dollar goes.

Last summer I located a farmer on one of our projects who keeps books. His accounts show that in 1931 more of his returns from a good crop went for interest than for taxes. I am of the opinion that a large number of our farmers will find themselves in the same boat. I also found some who are paying 40 to 50 per cent of their income for labor. If a large number of our farmers could know where their dollars go or could give the accounts the Babcock test, I am sure they would find something besides taxes that needs reducing.

I once asked an agent of a leading farm-machinery company why the rate of interest charged during the war had never been changed and his answer was "So many farmers don't pay interest we have to charge the high rate to make up for the loss." In other words, as is often the case in operating a country store, the thrifty must pay for the poor accounts. While endeavoring to find ways of helping the farmer, let's consider along with the program of cutting governmental costs the following factors:

1. *Consolidation of counties and school districts.*—In the days of old dobbin, before trucks using the good highways were in competition with the railroads, it was considered proper to have small counties and

rural schools. In these days with our good highways and high-speed automobiles 20 miles can be traveled as quickly and much more comfortably than 1 mile was traveled when these counties were formed. Economies could be effected by consolidating small counties as well as school districts.

2. *Consolidation of banks.*—It has been stated that one of the principal causes of the present depression is too many banks and too few bankers. Be that as it may, it is obvious that few farmers can pay 10 per cent interest on mortgages of any kind without receiving war prices for their products. Would it not be better for both farmer and investor if the slogan were followed "5 Per Cent 'Yes' is Better than 10 Per Cent 'Maybe'."

3. *Temporary reduction of highway construction.*—It may be argued that this will put out of employment a large number of laborers. It is my conviction that if the highways used by the large freight trucks were self-supporting through taxation of the concerns benefited, it would not be long before our railroads in the rebuilding of their equipment, rolling stock, and trackage, would be using several times the number of men now employed on the highways. The latter part of September, 1932, I was traveling by railroad through some of the sparsely settled portions of our country. Within view of my train there had been recently constructed a fine oiled surfaced highway. Over a distance of 30 miles I counted only 3 trucks, one runabout, and one touring car. It occurred to me then and there how much better it would have been for all concerned, especially the tax-paying farmer who is receiving the sympathy of so many, if the money used in the construction and maintenance of that highway could have been used in contributing to the cost of the educational institutions of the State or county. If some of the gasoline-tax revenue could be temporarily diverted from the construction of additional highways that compete with the railroads to the education of our boys and girls, the taxes of the farmer would be greatly reduced.

Some may argue Why not materially reduce the activities of the Bureau of Reclamation? The answer is simple. This governmental service is constructing self-supporting and self-liquidating works; it costs the general taxpayer nothing additional; it is creating homes, which have always been greatly needed; and its projects are not responsible for our surplus of wheat, cotton, or certain other farm products.

Transportation in the Klamath Basin—Then and Now

By B. E. Hayden, Superintendent Klamath Project

EARLY in the morning of May 28, 1906, the writer with his Texas girl bride got off the Shasta Limited at Thrall, Calif., and there transferred to a jerk-water logging railroad that twisted and turned and puffed and switchbacked up the mountain side a distance of about 26 miles to a lumber camp called Pokegama. At that point we transferred to an old-fashioned stagecoach and four—in fact two such conveyances were waiting to speed the travelers on their way to Klamath Falls, the new name for the old town of Linkville, for those were the days when the big lumber interests were waking up to the fact that tributary to this town and lying within the Klamath Basin were 40,000,000,000 feet of fine timber mostly ripe for the harvest and waiting to be sawed and transported to outside markets, and travel was picking up in spite of the crude methods of transportation. For four hours we bumped and jostled along over the worst kind of mountain roads imaginable to the tinkle tinkle of harness bells that the famous Poe never had the good fortune to hear, while covering a distance of 25 miles which brought us to the little village of Keno where the Klamath River ceases to be a placid lakelike stream and starts roaring down canyons and tumbling over rapids on its way to the Pacific Ocean. The day was about spent and darkness was creeping over the tall pine forests when our little caravan transferred from the cramped-up coaches to the spacious and locally famous "Canby," an old flat-bottomed sternwheeler that made daily trips between Klamath Falls and Keno so that the road-weary travelers would have opportunity to massage the sore spots and rest up their aching joints sufficiently before reaching the end of their journey to be willing to stay over a few days instead of taking the next boat out. Such were the conveniences or inconveniences of travel into and within the Klamath country a quarter of a century ago. Materials and supplies were brought in over the same roads and by the same means as were used for passenger travel.

In 1905 the United States Reclamation Service decided to build the Klamath irrigation project, and work on the tunnel and main canal was rushed during 1906 to permit the delivery of water to some of the more accessible lands during 1907. Information relative to the agricultural and industrial possibilities of the district was being disseminated by the chamber of commerce, the Klamath Development Co., and interested citizens so that within a few years the large undeveloped agricultural holdings were pretty well split up into units suitable in size for the farmer with average capital and equipment.

FIRST RAILROAD SERVICE IN MAY, 1909

About this time considerable interest was shown by the Southern Pacific (and a few years later by the Great Northern) Railway in the possibilities of traffic that the district would afford when developed both as an agricultural and timber area. The California Northeastern Railway Co., a subsidiary of the Southern Pacific, was incorporated July 6, 1905, and immediately began the reconstruction and extension toward Klamath Falls of the old Weed logging road running around the north base of Mount Shasta. By September, 1906, 25 miles of this road had been built and put into operation. Work progressed slowly from this point northward and it was May 20, 1909, when the first train pulled into Klamath Falls, Oreg. During the day a number of excursions were run between Klamath Falls and Dorris, Calif., a distance of 18 miles, to permit the old settlers to enjoy the thrill of their first passenger-train ride.

ADVENT OF RAILWAY FACILITIES STARTS DEVELOPMENT

The entrance of railway facilities into Klamath Falls marked the beginning of a remarkable period of development in the Klamath Basin. Since that time the town of Klamath Falls has grown from a mere village of 2,000 inhabitants to the proportions of an industrial city of 16,000 people with outlying settlements of several thousand additional, and the lumbering industry has increased from 2 small sawmills with a daily capacity of only a few thousand feet of sawed lumber to 26 modern plants capable of turning out 1,500,000 feet board measure every day, working on a basis of one 8-hour shift in every 24, besides 11 box factories and 4 lumber-manufacturing plants.

During the year the Southern Pacific Co. was organizing the California Northeastern Railway Co. to take over the Weed logging road; the Oregon Eastern Railway Co. was incorporated with the announced intention of building a line from Natron, near Eugene, Oreg., on the

Southern Pacific main line in the Willamette Valley eastwardly through the center of the State to Ontario, Oreg., on the Snake River, with branch lines to Klamath Falls and Lakeview, Oreg. Work on this line was commenced in August, 1909, and completed as far as Oakridge, a distance of 34 miles, late in the season of 1911. The project was taken over a few months later by the Central Pacific Railway Co. and placed in operation by the Southern Pacific Co. At this point construction was shut down for an indefinite period pending the outcome of the noted Central Pacific case.

During the three years following the arrival of the first train into Klamath Falls, the California Northeastern Railway was extended to Kirk, Oreg., a distance of 40 miles, where work was stopped, thus leaving a gap of 110 miles between Kirk and Oakridge to complete the easy grade direct connection between San Francisco, Calif., and Portland, Oreg. This link was destined to wait many years before finally being welded into the Southern Pacific chain from Mexico to the Columbia River.

Another interesting chapter of railroad construction leading into the Klamath Basin was the race up the Deschutes River from the Columbia River to Bend, Oreg., in 1910, by the Union Pacific Railway Co. and the Great Northern Railway Co., the latter operating through its subsidiary, the Oregon Trunk Railway Co. The surveys ran on opposite sides of the river most of the way and construction crews on either side could note the feverish haste of the other to reach the gorge of the Deschutes where only one feasible route lay for several miles. The Great Northern reached the gorge first and proceeded upstream to Bend, Oreg., while the Union Pacific gave up the race at Metolius and later effected a joint-use agreement which permits its trains to enter Bend over Great Northern tracks. The Great Northern suspended work at Bend, which remained the terminus of its line for 14 years.

RAILROAD STRATEGIST SPURS RAILWAY EXTENSION

For more than a decade following the suspension of railroad work by the three transcontinental lines mentioned above, the hopes of Klamath Falls to be located on a main line railroad with through connections within a reasonable time had little of actual accomplishment to support them, but when the outlook appeared most doubtful the people of Klamath Falls, backed by business interests in Portland, succeeded in interesting one of the most picturesque railroad pioneers the West has produced, Robert E. Strahorn, of Spokane, Wash. Mr. Strahorn, who had already become famous for his railroad work in the State of Washington and his construction many years ago of the North Bank Railroad, now the principal link in the S. P. & S. line, entered the field at a time when the big companies with their network of roads and seemingly unlimited resources hesitated for one reason or another to proceed in a territory that had undoubted possibilities of future development and traffic. The Central Pacific case had not been settled and the Southern Pacific Co. was naturally apprehensive of what the court decision might be. The hardships encountered and the heartbreaking disappointments that were met and overcome by this railroad strategist need not be described here, but suffice it to say that although he actually built only 40 miles of line—from Klamath Falls to Sprague River—out of more than 150 miles planned and surveyed, he created enough interest in the district to cause the larger companies to rush completion of their lines through the district to San Francisco and eastern connections.

In 1923, immediately after the United States Attorney General announced the Government would not contest Southern Pacific ownership of the Central Pacific, the Southern Pacific Co. resumed work at Oakridge and Kirk to finish building the Natron cut-off and completed the connection in 1926, a distance of 110 miles at a cost of about $16,000,000. Later, in 1926, in order to make a fast line from Weed to Portland, the Southern Pacific Co. built what is known as the Black Butte cut-off, which leaves the old main line a few miles south of Weed, Calif., and skirts Mount Shasta for 24 miles to Grass Lake. The cost of this reconstruction, about $4,000,000, brought the total cost of the Klamath Falls line between Black Butte, Calif., and Eugene, Oreg., a distance of 280 miles, to about $40,000,000. The completion of this line, which traverses an empire with limitless possibilities and unsurpassed recreational attractions, was memorialized at Eugene, Oreg., August 19 and 20, 1926, by the Trail to Rail celebration and was attended by some 50,000 people from all over Oregon.

Whether the revival of interest in 1925 by the Great Northern Railway Co. in central Oregon and its apparent desire to secure a San Francisco terminus influenced the Southern Pacific Co. to hasten work on their more feasible east-west route to the Central States or whether the best minds of the organization realized the time was ripe for such development and were willing to proceed on their own initiative regardless of the activities of other concerns would be difficult to judge; nevertheless, the Southern Pacific Co., in November, 1926, secured control of the narrow-gage Nevada-California-Oregon Railway running from Wendel, Calif., to Lakeview, Oreg., a distance of 155 miles, and soon began its reconstruction as a standard gage line. The completion of this work was celebrated at Lakeview on September 1, 1928, by an old-fashioned Out West jubilee. A few months later the Southern Pacific Co. began the construction of its Klamath Falls-Alturas line to effect connection at Fernley, Nev., with the San Francisco-Ogden line for the shortest and easiest grade route from southern Oregon to Ogden and Mississippi Valley points. This gap of 96 miles was completed and ready for traffic in the fall of 1929. On September 14 of that year some 3,000 people, mostly citizens of northern California and southern Oregon, met at Hackamore, Calif., to celebrate the breaking through of "the last barrier to the last frontier" which brought residents of that section 210 miles nearer to the markets of the East.

While the Southern Pacific Co. was making costly improvements and extensions of its lines in southern Oregon and northern California, the Great Northern system was perfecting plans and securing rights of way preparatory to extending the Oregon Trunk Line from Bend, Oreg., to connections on the Western Pacific Railway line that would give them an outlet to San Francisco, Calif.

In 1928, a traffic agreement with the Southern Pacific Co. for joint use of that company's line from Chemult to Klamath Falls, Oreg., was the first step accomplished in forwarding the plan. For more than two years negotiations were carried on between the two companies relative to effecting a common use agreement covering the first 25 miles of the Southern Pacific Modoc Northern line running southeast from Klamath Falls. These negotiations bore no fruit and the final outcome resulted in the Great Northern building its own line from Klamath Falls to Bieber, Calif., a distance of 92 miles to connect with a 112-mile line built northward by the Western Pacific Railway Co. from Keddie, Calif., a station on its main line. The Western Pacific commenced construction in August, 1930, and in spite of much heavy work and rough country to traverse was able to run trains into Bieber on November 6, 1931. The Great Northern was considerably delayed on the Oregon end of the line by negotiations with the Southern Pacific Co. and did not begin work out of Klamath Falls until early in April, 1931, although work on the Bieber end had been under way for 6 months. To complete its portion of the line on schedule it was necessary to establish a number of construction camps along the right of way and to take advantage of every means available for speed. The contract for grading was let to A. Guthrie & Co., of Seattle, Wash.,

(Continued on p. 16)

Future Orland Farmer to Fight Depression with Holsteins

Wayne Muchow, son of August Muchow, and the Orland High School Future Farms Chapter's star orator, believes in the best blooded stock. The five calves he is raising as his "home work" are of the most aristocratic of blue bloods.

Wayne has it all figured out. His father is a dairyman on the Orland project. He intends to be. "The only way for dairymen to get out of the depression is to feed high producing stock," he says. "A cow that produces 200 pounds of butterfat a year runs the cost of the butterfat up to 42 cents a pound. A 450-pound producer costs only 22 cents a pound for her production."

Wayne is going to have the start of a fine herd of high producers when he finishes high school and is ready to go into the dairy business himself. Butterfat at 18 to 25 cents a pound does not scare him. He is now building a herd that he expects to pay him a profit at that price.

Wayne started his dairy project in January, 1931, with one grade Holstein heifer calf. Last year he took second prize in the junior division of the Glenn County Fair with the calf. A younger brother took first prize away from him with his entry. Since then Wayne has added four more calves, one of which is registered. The sire of his first grade calf is a great-grandson of Segis Pietertje Prospect, world's highest milk producer, and his dam had a butterfat record of 580 pounds in a year. The ancestry of this one is a sample of the others, all from the same herd, all Holsteins.

Wayne Muchow, owner of blooded stock

Wayne expects to be able to produce butterfat at a good deal less than 20 cents with a herd of this type, and is not worrying about depressions.—*The Orland Unit.*

Sugar Beets Well Adapted to Milk River Project

The Utah-Idaho Sugar Factory, at Chinook, Mont., is operating continuously at full capacity, with the usual day's run in excess of the rated factory capacity. It is estimated that between 75,000 and 80,000 tons of beets will be harvested within the factory district, which will greatly exceed the yield of any previous season and necessitate a factory run of at least 60 days. This marks the eighth year of the sugar industry on the project, and each year, with the exception of the first, the growers have harvested 100 per cent of the matured crop.

There has been a gradual increase in yields, culminated by the remarkable crop of this season and the project farmers no longer need to be encouraged to raise the crop. The project has successfully demonstrated its high adaptability to the growing of sugar beets, and it is very probable that the acreage seeded next season will provide a maximum factory run for 1933.

Transportation in Klamath Basin

(Continued from p. 15)

which moved on to the job in September, 1930. Fifteen drag lines, 10 McMillan scrapers, and about 400 men were employed. Excellent progress was made and the two roads were joined at Bieber on November 11, 1931. Freight service was immediately established and although regular passenger service has not yet been established, we expect soon to see the "Empire Builder" stop every day in Klamath Falls on its way to San Francisco.

Crop Exhibit at Kittitas County Fair

By Ellison Mundy, Ellensburg, Wash.

The excellence of crops within the Kittitas reclamation project automatically prompted a display booth during the county fair at Ellensburg, Wash. The accompanying photograph was taken of the booth and illustrates the diversity of crops grown. The 16-foot front by 12 feet deep did not allow enough space to hold all of the exhibit material.

Cereal grains, seed peas, potatoes, alfalfa hay, many varieties of flowers, and numerous vegetables filled the booth to overflowing capacity. A large portion of the crops exhibited were from the first productions following sagebrush. The Kittitas Valley requires no soil building crop, fertilizer, or innoculation treatment to secure high yields.

The exhibit material was gathered and displayed by a committee of farmers in the project district. The committee included John Koreski, chairman; Arthur Pedersen, Grover German, and Claude Catlin.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief Clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thraikill	Jacob T. Davenport	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chahot	E. E. Chahot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent		F. C. Bohlson	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Sieheneicher	J. P. Sieheneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. Constr. Eng.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	I. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

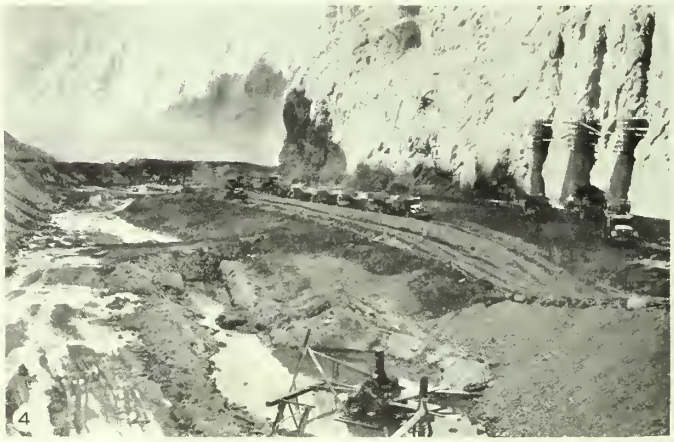
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stont	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tont	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gehaner	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrg. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg		Reservoir supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A.	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

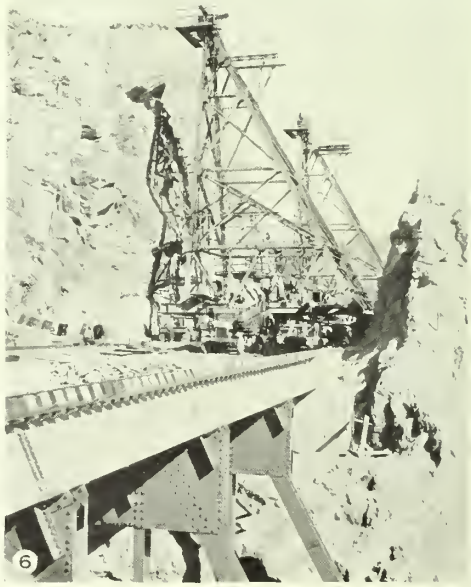
Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*

PROGRESS OF WORK ON BOULDER CANYON PROJECT



1. View of Black Canyon looking upstream toward the damsite, showing conditions prior to the diversion of Colorado River
2. Conditions at outlet portals of Diversion Tunnels Nos. 3 & 4 after diversion. Blasting operations on Arizona abutment
3. Inlet portals of Diversion Tunnels Nos. 3 & 4 showing diversion of river flow by temporary dike shown at right
4. Looking downstream into upper cofferdam excavation. Percolation stops seen at right against Nevada abutment
5. High-scalers working in Arizona abutment
6. Movable cableway towers under construction on rim, Nevada side



U. S. GOVERNMENT PRINTING OFFICE: 1933

2 1.9

THE RECLAMATION ERA

VOL. 24, NO. 2 FEBRUARY, 1933

CLEMSON COLLEGE LIBRARY GOVERNMENT PUBLICATIONS

KITTITAS DIVISION
YAKIMA IRRIGATION PROJECT
WASHINGTON

CLEARING NEW LAND

CUTTING ALFALFA ON DEVELOPED LAND

East and West Interdependent

▽

The East needs the West and the West needs the East. The welfare of the various sections of the country is interdependent. What helps one helps the other; conversely, what hurts one is an injury to the other. The wiping out of sectional lines and a realization that general prosperity is a matter of the whole and not of any of the component parts is one way out of our troubles. Therefore, it is inconsistent for the East to insist that the appropriation of funds for reclamation must stop, as announced by Commissioner Mead at the Salt Lake Reclamation Congress. To shut off these funds is not conducive to the desired harmonious feeling which the East professes to have. Nevertheless, it is pleasing to learn that the East is beginning to realize it can't have welfare and happiness unless the West has its proper share. So perhaps a change of heart toward reclamation will be experienced. Let us hope so.

—*The Emmett (Idaho) Index.*

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 24, No. 2 FEBRUARY, 1933

Necessity for Organized Western Support of Federal Reclamation

By Dr. Elwood Mead, Commissioner of Reclamation

FEDERAL reclamation is confronted with antagonism which menaces its future usefulness. Residents of the arid region do not realize the nature and extent of this hostility or sense its portent if unchecked. Generally such opposition is based on the belief that there now exists an agricultural surplus in certain products which the Government is aggravating by appropriating money for building additional irrigation works. This statement on its face seems plausible and is generally believed by those not fully informed. What the situation needs is an educational campaign; the facts should be assembled, analyzed, and given publicity.

What are the facts? How would the West be affected if Congress should heed the clamor for curtailment or discontinuation of Federal reclamation?

SUSPENSION OF RECLAMATION WOULD BE A NATIONAL LOSS

The first fact is that practically all of the Federal Government work to-day is the rescue of old-established communities where more people are settled on the land than the unregulated water supply justifies, or where the works that provide water are inadequate. These western communities have not the credit or the money to do this work. The Federal Reclamation Bureau is doing it under conditions that bring security and prosperity. If this work is stopped it will leave a large portion of unfinished works. It will destroy hope that now enables communities to carry on. It will bankrupt scores of them. It will close banks. It will cut off business. It will drive people from their farms, and it will do infinitely more harm to the East by closing the markets for manufactured goods where the workmen are now fed from eastern farms than could possibly be done by any increase in Federal reclamation. It should be realized that the prosperity and development of the East and the South are influenced in no small degree by conditions in the West. A balanced industrial and agricultural development is necessary to general and continued prosperity. Narrow provincialism must be avoided both because of its unfairness and its deterrent effect upon the welfare of the whole country.

CROP SURPLUS NOT INCREASED BY FEDERAL RECLAMATION

The second fact is that Federal reclamation has not added and will not add to the general farm surplus. The whole area irrigated on Federal irrigation projects is less than 1 per cent of the farmed area of the whole country. Many of the products raised on these projects come upon the market at a time when no similar products emanate from other sources. Here there is no competition with the humid region but a need is supplied. Of such products, lettuce, other winter vegetables, early strawberries, and cantaloupes are illustrations. Many crops are of a character of which there is no surplus. Of these sugar beets, dates, flax, and long staple cotton are examples. Since our imports of these products are large it can not be said that the raising of them contributes to the surplus. Arguments being made against Federal reclamation show that the people making them do not understand the social and economic benefits to the whole country that come from these small oases scattered over the sparsely settled arid States which create markets for eastern farm products that more than compensate for the small quantity of products from Federal projects that find their way to eastern markets. One timely rain in the Mississippi Valley will do more to increase the crop surplus than the whole area irrigated under Federal projects. On the other hand, these projects supply cheap local food for western towns and cities, and provide winter feed for range live stock. These needs are indispensable to the existence and growth of the West. Long hauls and high freight rates prevent such necessities being brought in from the humid regions. The same reasons prevent local products being shipped to any appreciable extent into the humid region to compete with the products there raised.

WHAT RECLAMATION IS DOING

What is the Reclamation Bureau doing and seeking to do?

Beginning in 1926 it started on a 10-year program having for its object the completion of unfinished works. None of the money was to come from the Federal Treasury. It was to come wholly from the revolving reclamation fund.

Some of these uncompleted works were to supply water to people on the land; some were to make profitable works on which large sums had been spent.

No one then objected; on the contrary, the whole Nation said this was good business, and it has been. Among the works built is the American Falls Reservoir. Before it was completed irrigators on half a million acres of land had to depend on an unregulated stream. The floods ran to waste. Their crops were in danger of drying up in the low-water seasons. In the two years after the reservoir was built it saved the crops on a quarter of a million acres of land, worth more to these farmers than the cost of the reservoir. If it had not been built every farmer below it would now likely be bankrupt, and this would be reflected in the condition of other interests in the region. It has built the Echo Reservoir, one of four, which is to supply needed water to the farms between Ogden and Salt Lake. This water has saved their farms to many of the pioneers of this region. It reconstructed a failing canal and saved the homes of the pioneers of

Bitter Root Valley, Mont. This is only part of the record of the rescue work of the last six years. The money spent has brought as large returns to this Nation in cash, in purchasing power, and in social benefits as that spent in any other section of the country for any purpose.

NEED FOR MORE WORK URGENT

The need for more work of this character was never so urgent as now. What will happen to the West if Federal appropriations are stopped? It will leave the Owyhee Reservoir and distribution system unfinished. It will leave old settled districts of that project, now desperately struggling to subsist until gravity water from storage can be supplied, without hope. It will leave the Cle Elum Reservoir of the Yakima project uncompleted. Without this storage old settled districts and the Kittitas division recently developed will be threatened with a serious water shortage. It will defer completion of this project, started more than 20 years ago. It will prevent completion of the Shoshone project and full utilization of the storage already provided at large expense. It will prevent construction of the Wyoming division of the North Platte project contemplated from its inception and needed to stabilize and to equitably apportion the water supply of the North Platte River as between States in the watershed. It will turn thousands of men now employed out of work. They and their families can not be allowed to starve. The Nation has a choice between continuing a work needed to save farms and homes, where the outlay will be repaid, or feeding idle workers with doles. This is the time to increase this relief instead of destroying it.

Private development in the country carried on without direction for 25 years brought more land under cultivation than is now watered from Federal projects. Under these private projects there is more land settled and improved than can be irrigated from existing works. What the people and agriculture need are more reservoirs. Scores of them are needed. This is a work that requires the highest engineering skill and wide experience because many of the dams necessary will be constructed in the channels of rivers. They must be designed and built to insure safety and permanence. The Reclamation Bureau has built up a reputation for designing and building dams unequaled by any other organization in the world. Nothing could be more suicidal to this country than to stop this work by withholding appropriations and so destroying this organization. The communities that need an increased water supply are to be found in every arid State. How the people feel is illustrated by one letter, of which the bureau has hundreds, reading as follows:

"I have wondered many times if the United States Reclamation Bureau could be interested in saving this valley from drying up. It would appear more useful to the country to save a productive region like this than to spend our money trying to place more land under cultivation. Much greater investment per acre is usually required to reclaim waste land than will be needed to save this valley from destruction. And after the saving is done the revenue from this valley is many times as much as any possible revenue from reclaimed waste land.

"The lands of this district, comprising about 130,000 acres, have an assessed value of $39,000,000. The total assessed value of land and improvements is about $84,000,000. Of the land within the district approximately nineteen and one-half million dollars is the assessed value of that within incorporated cities, while eighteen and one-half million is outside such cities.

"It might appear from the high valuation of the district property that the local people should make the investment necessary to save the water needed to save the valley. One year ago we placed before the voters of the district a plan for storage that would save our waste water. But the fear of taxes brought out a vote of 7 to 1 against the bonds.

"If the Reclamation Bureau undertook the work, we would secure a low rate of interest and with a long amortization period, all of which might lead the people to indorse the plan. If you think it wise, I should be happy to have you present our case to the bureau."

If the Nation is made acquainted with what Federal reclamation has done for the Yakima Valley, Wash., and how badly its people need the water of the half-built Cle Elum Reservoir, this work will be continued. It will be done if they know the kind of people who are waiting for the water of the Owyhee and Agency Valley Reservoirs, and the economic disaster which will come to the States of Idaho and Oregon if this work is stopped. Work in Sun River Valley in Montana and Wind River Valley in Wyoming will not be stopped unless ignorance and prejudice are to dominate. The reservoirs needed in Ogden Valley, Logan Valley, and Provo Valley in Utah will not add irrigated land, but they will end the shocking waste and loss due to recurring drought.

The pioneer farmers of Nevada need reservoirs on Humboldt and Truckee Rivers, not to add to the irrigated acreage but to save what they have. Down in Texas and New Mexico the Rio Grande project needs money to complete the drainage system and to rehabilitate the Hudspeth district.

The economic restoration of the arid West depends in large part on enabling drought-stricken farmers to use the wasted water of streams. For this purpose a large sum of money could be spent to the advantage of the whole Nation, but we are faced with the danger of having nothing to spend in 1934.

The entire income available for construction, if all the money due from settlers were paid, would be about $7,000,000. Of this $3,500,000 annually would come from settlers, but on many of these remote western farms where mines and factories are closed, where western stockmen are broke, where credit does not exist, there is no market for hay at any price. Unless the whole Nation goes broke this is only a temporary condition, but it is paralyzing this year. Some of the projects have asked for a moratorium on next year's construction projects.

If this moratorium is granted, it will withhold $3,500,000 of construction payments for 1933. Loss of income from other sources makes a total of $5,000,000. That will leave the reclamation fund with only income sufficient to meet repayments to the General Treasury on account of advances made to the reclamation fund. There will be no money with which to continue work on the projects. Men will have to be discharged and the disaster to the regions affected can only be understood by those who know local conditions.

Should a moratorium be granted, there should be a further loan from the General Treasury of not less than $5,000,000 to compensate for the loss suffered on account of deferred payments from settlers and loss of revenues from other sources.

To secure this and to avert drastic action, an organization is needed to educate the whole country and to correct the misstatements being made. Statistics need to be gathered. A representative should be placed in Washington to disseminate information and rally the West to repulse attacks. The expense will be small because it only needs to have the facts gathered and presented, but that takes time and hard work. Whoever does it should be paid.

The "On-to-Oregon" advertising campaign by the Oregon State Chamber of Commerce and the advertising conducted by the Vale-Owyhee Land Settlement Association are having a cumulative effect and many prospective settlers are requesting data as to the project lands. To date 515 inquiries have been received through these mediums. Fifty inquiries were received by the association during a recent month and a sale of 160 acres and one of 70 acres were made.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, gave an illustrated talk at the Cosmos Club before the Washington Society of Engineers on Wednesday evening, January 18. His lecture was illustrated by colored lantern slides and motion-picture reels.

As a director of the National Bureau of Economic Research Doctor Mead attended a meeting of the Bureau at the Century Club in New York City on February 6.

R. F. Walter, chief engineer, has returned to the Denver office from Cheyenne, Wyo., where he attended a meeting of the Snake River Compact Commission on the distribution and apportionment of the waters of Snake River in the States of Idaho and Wyoming.

E. B. Debler, hydraulic engineer, left Washington on January 11 on his return trip to Denver after a stay of three weeks during which he assisted the commissioner's staff in reporting on legislation affecting the bureau.

Recent visitors on the Boulder Canyon project from the Denver office included D. C. McConaughy, senior engineer, and R. S. Lieuranee, engineer. The purpose of the former was to obtain data for designs of spillways at Hoover Dam, and that of the latter to make important strain measurements in the tunnels below the bed of the river.

Walter L. Hersh, who was recently appointed electrical-mechanical engineer on construction of Madden Dam and power plant, spent two days in the Denver office during which he went over designs of the mechanical and electrical work for the project.

T. S. Martin, master mechanic in the Denver office, spent the month of December at Birmingham, Ala., continuing the inspection of the manufacture by Hardie-Tynes Manufacturing Co. of butterfly valves, and by the Goslin-Birmingham Manufacturing Co. of slide gates and hoists for the Madden Dam, and the manufacture by the same contractors of slide gates and hoists and Venturi meter rings for Tunnel No. 1 controlling works on the Owyhee project.

D. C. Henny, consulting engineer, was a visitor in the Washington office on January 11.

Roosevelt S. Christensen, rodman on the Yakima project, has been transferred to the Colorado River Investigations at Parker, Ariz.

H. H. Plumb, engineer in the Denver office, left headquarters early in January for the Grand Valley project, where he made the final inspection of the recently completed Grand Valley power plant.

Jacob Berger, junior engineer, and Leonard R. Dunkley, assistant engineer, have been transferred to the Colorado River Basin investigations at Parker, Ariz., the former from Cle Elum Dam, Yakima project, Wash., and the latter from the Salt Lake Basin secondary investigations.

Carl A. Lyman, field representative, left Denver recently for an official visit to the Orland project.

L. R. Smith, chief clerk of the Denver office, and Ronald E. Rudolph, chief clerk of the Kittitas division, Yakima project, visited Los Angeles the latter part of January in connection with the audit of accounts under the Charles and George K. Thompson contract, Yakima pressure tunnel, Kittitas division, Yakima project.

L. C. Hill, consulting engineer, of Los Angeles; F. A. Banks, construction engineer of the Owyhee project; and W. H. Nalder, assistant chief designing engineer of the Denver office, met at Boulder City on January 10 for the purpose of examining the abutments excavation of Hoover Dam.

Prof. S. C. Hollister, of Purdue University, consulting engineer for the Babcock & Wilcox Co., in company with J. E. Trainer, general superintendent of the company's Barberton plant, recently spent a day in the Denver office in connection with detailed designs of stiffener rings and supports for the 30-foot penstocks for Hoover Dam.

F. B. Headley, chief, department of farm development, University of Nevada, recently visited the Newlands project in connection with the compilation of the 9132 agricultural and livestock census.

Andrew Weiss, a former superintendent of the North Platte project, and Mr. Howell, of the J. G. White Engineering Corporation of Mexico, and a party of Mexican engineers, visited the Rio Grande project shortly before the holiday season.

Charles G. Anderson, of the Cle Elum Dam, Yakima project, was a recent visitor on the Minidoka project.

Charles A. De Kay, engineering draftsman, Boulder Canyon project, was found dead from heart trouble on December 31, 1932, in his room in the Sal Sagev Hotel, Las Vegas, Nev. Mr. De Kay was born November 8, 1877, and had been employed as a draftsman on various reclamation projects for about 19 years. He was an efficient draftsman, an accurate computer, and an energetic, quiet, and conscientious worker.

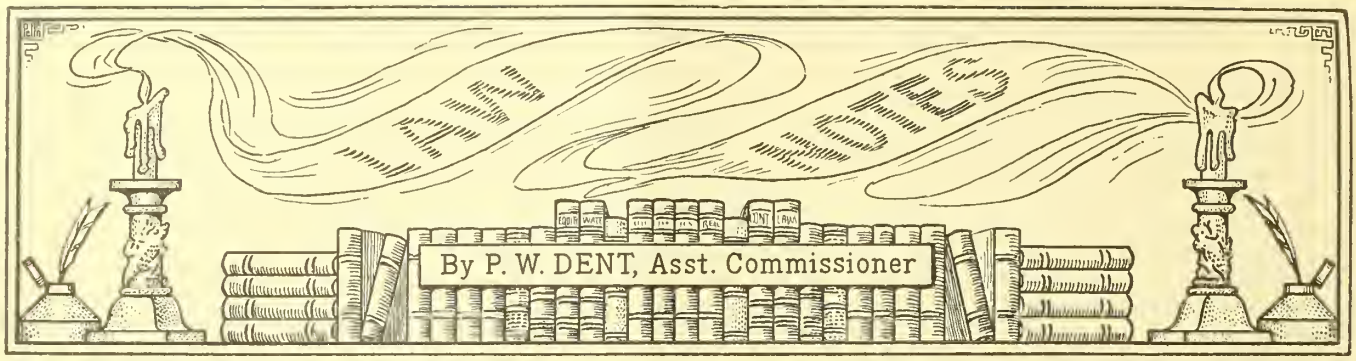
Public Land Openings on Federal Irrigation Projects

Public land openings in the early spring are anticipated on the Kittitas division of the Yakima project, Washington; the Gooding division of the Minidoka project, Idaho; and the Pavillion and Pilot divisions of the Riverton project, Wyoming. Requests for literature, including farm application blanks, should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C.; the Construction Engineer, Bureau of Reclamation, Ellensburg, Wash.; the Superintendent, Minidoka Project, Burley, Idaho; or the Superintendent, Riverton Project, Riverton, Wyo.

Yuma Enjoys a Snowstorm

On the night of December 12 approximately 1.5 inches of snow fell on the Yuma project, the only appreciable snowfall locally in the 62 years of record. This unusual occurrence was naturally attended by much comment locally as a great many of the residents had never witnessed a snowstorm and others had seen snow only at a distance.

For project reservoirs with concurrent data available, the total storage content on December 31, 1932, was 5,050,000 acre-feet, compared with 2,340,000 acre-feet for December 31, 1931.



Act of April 22, 1932, Making Appropriations for Bureau

[*Public No. 95, 72d Congress*]

AN ACT Making appropriations for the Department of the Interior for the fiscal year ending June 30, 1933, 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 following sums are appropriated out of any money in the Treasury not otherwise appropriated, for the Department of the Interior for the fiscal year ending June 30, 1933, namely:

Office of the Secretary

CONTINGENT EXPENSES, DEPARTMENT OF THE INTERIOR

[Appropriations are first made for certain contingent expenses, and the act then continues:] * * * And in addition thereto sums amounting to $34,800 for stationery supplies shall be deducted from other appropriations made for the fiscal year 1933, as follows: * * * Bureau of Reclamation, $12,000, any unexpended portion of which shall revert and be credited to the reclamation fund. * * *

For the purchase or exchange of professional and scientific books, law and medical books, and books to complete broken sets, periodicals, directories, and other books or reference relating to the business of the department, $500, and in addition thereto there is hereby made available from any appropriations made for any bureau or office of the department not to exceed the following respective sums: * * * Bureau of Reclamation $1,800 * * *.

Bureau of Indian Affairs

IRRIGATION AND DRAINAGE

* * * For payment of annual installment of reclamation charges against Paiute Indian lands within the Newlands reclamation project, Nevada, $5,381; and for payment in advance, as provided by district law, of operation and maintenance assessments, including assessments for the operation of drains to the Truckee-Carson irrigation district, which district, under contract, is operating the Newlands reclamation project, $10,243 to be immediately available; in all $15,624.

For surveys and investigations for the construction of a dam or dams across the Owyhee River, or other streams within or adjacent to the Duck Valley Indian Reservation, Idaho and Nevada, as authorized by and in accordance with the act of February 28, 1931 (46 Stat., p. 1458), $10,000 to be made immediately available. * * *.

For reimbursement to the reclamation fund the proportionate expense of operation and maintenance of the reservoirs for furnishing stored water to the lands in Yakima Indian Reservation, Washington, in accordance with the provisions of section 22 of the act of August 1, 1914 (38 Stat., p. 604), $11,000. * * *

Appropriations herein for irrigation and drainage of Indian lands shall be available only for expenditure by and under the direction of the Commissioner of Indian Affairs, except for such engineering and economic studies and construction work as the Secretary of the Interior decides may be more advantageously performed by the Bureau of Reclamation. * * *

Bureau of Reclamation

The following sums are appropriated out of the special fund in the Treasury of the United States created by the act of June 17, 1902, and therein designated "the reclamation fund," to be available immediately:

Commissioner of Reclamation, $10,000; and other personal services in the District of Columbia, $130,000; for office expenses in the District of Columbia, $20,000; in all, $160,000;

For all expenditures authorized by the act of June 17, 1902 (32 Stat., p. 388), and acts amendatory thereof or supplementary thereto, known as the reclamation law, and all other acts under which expenditures from said fund are authorized, including not to exceed $170,000 for personal service and $16,000 for other expenses in the office of the chief engineer, $20,000 for telegraph, telephone, and other communication service, $5,000 for photographing and making photographic prints, $45,000 for personal services, and $10,000 for other expenses in the field legal offices; examination of estimates for appropriations in the field; refunds of overcollections and deposits for other purposes; not to exceed $15,000 for lithographing, engraving, printing, and binding; purchase of ice; purchase of rubber boots for official use by employees; maintenance and operation of horse-drawn and motor-propelled passenger-carrying vehicles; not to exceed $40,000 for purchase and exchange of horse-drawn and motor-propelled passenger-carrying vehicles; packing, crating, and transportation (including drayage) of personal effects of employees upon permanent change of station, under regulations to be prescribed by the Secretary of the Interior; payment of damages caused to the owners of lands or other private property of any kind by reason of the operations of the United States, its officers or employees, in the survey, construction, operation, or maintenance of irrigation works, and which may be compromised by agreement between the claimant and the Secretary of the Interior, or such officers as he may designate; payment for official telephone service in the field hereafter incurred in case of official telephones installed in private houses when authorized under regulations established by the Secretary of the Interior; not to exceed $1,000 for expenses, except membership fees, of attendance, when authorized by the Secretary, upon meetings of technical and professional societies required in connection with official work of the bureau; payment of rewards, when specifically authorized by the Secretary of the Interior, for information leading to the apprehension and conviction of persons found guilty of the theft, damage, or destruction of public property: *Provided,* That no part of said appropriations may be used for maintenance of headquarters for the Bureau of Reclamation outside the District of Columbia except for an office for the chief

engineer and staff and for certain field officers of the division of reclamation economics: *Provided further*, That the Secretary of the Interior in his administration of the Bureau of Reclamation is authorized to contract for medical attention and service for employees and to make necessary pay-roll deductions agreed to by the employees therefor: *Provided further*, That no part of any sum provided for in this act for operation and maintenance of any project or division of a project by the Bureau of Reclamation shall be used for the irrigation of any lands within the boundaries of an irrigation district which has contracted with the Bureau of Reclamation and which is in arrears for more than twelve months in the payment of any charges due the United States, and no part of any sum provided for in this act for such purpose shall be used for the irrigation of any lands which have contracted with the Bureau of Reclamation and which are in arrears for more than twelve months in the payment of any charges due from said lands to the United States;

Examination and inspection of projects: For examination of accounts and inspection of the works of various projects and divisions of projects operated and maintained by irrigation districts or water-users' associations, and bookkeeping, accounting, clerical, legal, and other expenses incurred in accordance with contract provisions for the repayment of such expenses by the districts or associations, the unexpended balance of the appropriation for this purpose for the fiscal year 1932 is continued available for the same purpose for the fiscal year 1933;

For operation and maintenance of the reserved works of a project or division of a project when irrigation districts, water-users' associations, or Warren Act contractors have contracted to pay in advance but have failed to pay their proportionate share of the cost of such operation and maintenance, to be expended under regulations to be prescribed by the Secretary of the Interior, the unexpended balance of the appropriation for this purpose for the fiscal year 1932 is continued available for the same purpose for the fiscal year 1933;

Yuma project, Arizona-California: For operation and maintenance, $50,000; for continuation of construction of drainage, $20,000; in all, $70,000: *Provided*, That not to exceed $25,000 from the power revenues shall be available during the fiscal year 1933 for the operation and maintenance of the commercial system;

Orland project, California: For operation and maintenance, $35,000;

Boise project, Idaho: For continuation of construction, Arrowrock division, $15,000; for operation and maintenance, Payette division, $20,000; in all, $35,000;

Minidoka project, Idaho: For operation and maintenance, reserved works, $55,000; continuation of construction gravity extension unit, $100,000, together with the unexpended balance of the appropriation for this purpose for the fiscal year 1932: *Provided*, That not to exceed $50,000 from the power revenues shall be available during the fiscal year 1933 for the operation of the commercial system; and not to exceed $125,000 from the power revenues shall be available during the fiscal year 1933 for continuation of construction, south side division; in all, $155,000;

Bitter Root project, Montana: For loaning to the Bitter Root irrigation district for necessary construction, betterment, and repair work, $100,000, as authorized by the act entitled "An act for the rehabilitation of the Bitter Root irrigation project, Montana," approved July 3, 1930 (46 Stat., pp. 852, 853);

Milk River project, Montana: For operation and maintenance, Chinook division, $4,000; continuation of construction, $27,000; in all, $31,000: *Provided*, That the unexpended balances of the appropriations for continuation of construction, fiscal years 1931 and 1932, shall remain available for the same purpose during the fiscal year 1933;

Sun River project, Montana: Of the unexpended balance of the appropriation for continuation of construction for the fiscal year 1932, $25,000 is reappropriated and made available for the fiscal year 1933 for drainage construction, Greenfields division;

North Platte project, Nebraska-Wyoming: Not to exceed $80,000 from the power revenues shall be available during the fiscal year 1933 for the operation and maintenance of the commercial system;

Carlsbad project, New Mexico: For operation and maintenance, $25,000: *Provided*, That the unexpended balance of the appropriation for the fiscal year 1932 shall remain available for the same purposes during the fiscal year 1933;

Rio Grande project, New Mexico-Texas: For operation and maintenance, $300,000; for continuation of construction, $46,000; in all, $346,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1932 shall remain available for the same purposes for the fiscal year 1933;

Owyhee project, Oregon: For continuation of construction, $500,000: *Provided*, That the unexpended balances of the appropriations for continuation of construction for the fiscal years 1929, 1930, 1931, and 1932 are hereby reappropriated for the same purpose for the fiscal year 1933;

Baker project, Oregon: The unexpended balance of the appropriation for the fiscal year 1932 shall remain available for the same purposes for the fiscal year 1933;

Vale project, Oregon: For operation and maintenance, $20,000;

(To be continued in March issue)

All-American Canal Contract

As the manuscript for the February issue of the ERA was about to go to press telegram was received from F. H. McIver, secretary of the Imperial Irrigation District, advising that the contract for the construction of the All-American Canal was carried by a 7-to-1 vote. This contract was summarized on page 9 of the January issue.

An air mail letter from the district counsel states that the vote was 4,947 in favor of the contract and 729 against it.

Articles on Irrigation and Related Subjects

Engineering and Contracting:
- Electrically operated power shovels at Hoover Dam, illus. Engineering and Contracting, Dec. 1932, v. 71, pp. 267–270.

Engineering News-Record:
- *Hoover Dam Number*, Engineering News-Record, Dec. 15, 1932, v. 109, No. 24, pp. 701–728 (editorial, p. 730).
- Separates of Hoover Dam Number printed Jan. 1933, 28 pages.

Hines, Pierre R.:
- The Owyhee tunnels, Part II, illus., Explosives Engineer. Jan. 1933, v. 11, No. 1, pp. 20–25.

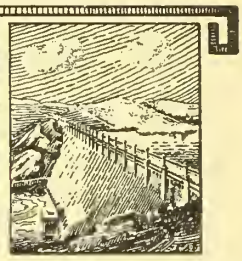
Mead, Elwood:
- The construction income of the Reclamation Bureau. The Commonwealth Review, Nov. 1932, v. 14, pp. 177–179.

Rothery, S. L.:
- A problem of soil in transportation in the Colorado River, illus., Proc. Am. Soc. C. E., Dec. 1932, v. 58, No. 10, pp. 1639–1659.

All local civic and charity organizations on the Yuma project joined the local Elks Lodge in furnishing Christmas baskets to the needy of the community. Some 450 baskets of food were distributed on Christmas Eve, assuring a Christmas dinner for all impoverished families in the community. In addition, the Elks held their annual Christmas tree celebration for the children of Yuma and the countryside and dispensed 1,600 stockings filled with candy and nuts to the youngsters attending the exercises.

ENGINEERING

GEORGE O. SANFORD, Chief, Engineering Division



Boulder City Sewage Disposal System

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

REALIZING the extreme importance of adequate health facilities and in line with its policy to create a pleasant, modern, and healthful place for the builders and operators of Hoover Dam to live, the Bureau of Reclamation included in its construction of Boulder City an extensive sanitary sewer system covering the entire occupied area and built an efficient sewage disposal plant.

The lines of the sewer system were laid in conjunction with the water-distribution system and preceded the construction of walks, curbs, and street paving. Service lines of 4-inch to 6-inch diameter lead to 6-inch and 10-inch mains and thence by 12-inch outfall to a sewage disposal plant located at the head of a ravine, approximately one-half mile southeast of the town. All sewer mains and laterals are of vitrified tile. Cast-iron soil pipes lead from services outside the house foundations to plumbing fixtures.

The sewage-disposal plant is of the separate sludge digestion type and is designed to afford primary treatment for an average sewage flow of 1,500,000 gallons a day. The structure consists principally of reinforced concrete tanks and chambers, constructed mainly below the ground surface, including a 30-foot clarifier tank of 8-foot side water depth, a digester tank 24 feet square of 13-foot side water depth, and a chamber containing a sludge pump and heating apparatus, all combined in one monolithic reinforced-concrete unit approximately 45 by 61 feet in plan. A 1-story brick building, 27 by 38 feet in plan, has been built over the digester tank, sludge pump, and heating chamber. The roof of the building is of timber construction covered with asphalt composition shingles laid over one layer of asphalt-saturated felt roofing. The concrete roof of the digester tank is supported by structural steel trusses that also partially support the roof of the building.

PLANT EQUIPMENT

The mechanical equipment includes a Dorr clarifier equipped with a scum skimmer, a sludge pump, a Dorr digester tank mechanism, a gas-fired boiler, and a circulation pump, together with the piping system, valves, fittings and specials, electric motors, and operating mechanism.

The raw sewage enters the plant through bar screens of 1-inch openings, to remove the larger particles of indigestible foreign matter from the flow. It is then introduced into the clarifier tank for a subsidence period of two hours at maximum rate of flow to allow the suspended solids to settle to the tank bottom as sludge. Approximately 97 per cent of the suspended solids are removed in this tank.

The clarifier mechanism consists essentially of an arm equipped with scrapers that revolves very slowly, so as to create a minimum of disturbance, around the conical-shaped bottom of the tank. The sludge that settles to the bottom is carried by these scrapers to a small sump in the center of the tank, where it is removed periodically by the sludge pump to the digester. Mounted at the water surface of the clarifier is another arm which revolves with the scraper arm at the bottom. The function of this arm is to convey the scum that constantly forms on the sewage to a sump at the side of the tank. As this sump fills it raises a float which actuates a switch and automatically starts the sludge pump which pumps the scum to the digestive tank. The float stops the pump when the sump is empty. The effluent from the tank, which is practically free from nuisance-forming properties, flows over the weir on the opposite side of the tank from which the sewage enters, through a short outfall sewer to a near-by ravine. The effluent is deficient in dissolved oxygen and is therefore unstable as it leaves the tank. The outfall sewer discharges down a series of concrete steps to permit intimate contact with oxygen from the air, and the effluent is clear and free of obnoxious odors.

The digester is equipped with heating coils and a stirring mechanism to break up the sludge and release the gas which is produced in the process of digestion. The digestion process, consisting of a reduction of all organic solids to inorganic solids, is accomplished by anaërobic bacteria and requires an alkaline reaction of the sewage and a temperature of about 90° F. to secure the best results. The alkaline reaction is maintained by the addition of lime when necessary. A maximum of 150 pounds per day is used to prevent foaming during the hot summer months.

The gas produced by action of the bacteria contains approximately 80 per cent methane (CH_4) and has a heat value of approximately 700 B. t. u. per cubic foot. The gas is trapped in a gas dome installed in the tight roof of the digester and is utilized as fuel to heat the water which is circulated through the digested sludge by a system of 1½-inch coils. The gas not needed for heating purposes passes through a water seal to a stack, opening above the plant. Approximately 6,000 cubic feet of gas are produced daily, and the sludge temperature is maintained near the optimum point for maximum digestion and gas formation without difficulty.

The digester is designed for a 60-day digestion period at 1,500,000 gallons daily of sewage flow. At the present time the flow is approximately 500,000 gallons a day and digestion is maintained for nearly 90 days. The effluent from the digester flows to a near-by ravine. The digested sludge, an inoffensive, black, nonodorous, inorganic humus-like material, is deposited on drying beds at intervals of approximately six months.

The cost of the sanitary sewerage system in Boulder City was approximately $62,000 and the sewage-disposal plant $25,000, or $87,000 for the entire system. A health and sanitation board, appointed by the construction engineer, maintains general supervision of all sanitation features and makes frequent inspection of the sanitary measures in force in Boulder City and elsewhere on the Federal reservation.

A 30-acre farm about 2 miles from Rupert, Minidoka project, with fair improvements, sold for $4,000. The deal involved a substantial cash payment.

Boulder Canyon Project Notes

On December 31, the peak of employment was reached by the Six Companies, when 3,882 men were at work. According to Frank T. Crowe, construction superintendent, the number of workmen will gradually decrease from now on. Approximately 4,580 persons are now employed on the entire project.

The inclined 37-foot diameter tunnel connecting diversion tunnel No. 2 (Nevada) with the Nevada upstream intake tower was holed through on January 8. This connecting tunnel is 325 feet in length and will carry one of the 30-foot plate-steel pipes.

The office building for the Babcock & Wilcox Co. at Bechtel is completed and work on the fabrication plant is progressing rapidly. The Consolidated Steel Corporation of Los Angeles, is doing the steel framework.

Construction power was off for 3 hours and 3 minutes on December 10 and 8½ minutes on December 11, owing to conduction failure caused by snow and sleet loading in the San Bernardino Mountains.

At the close of 1932 there were 22,000 applications for employment at Hoover Dam on file with Leonard T. Blood, superintendent of the Federal employment bureau office at Las Vegas. On January 1 a new list to supersede the old one was started and all applicants will have to register again.

Eighty-two contracts, representing 158 tracts of land in the reservoir site, had been executed by the landowners and the Government at the end of December. Payments amounting to $445,502.60 have been made to 79 owners for 154 tracts. The Government has acquired 6,287.33 acres of land.

At Boulder City during the month of December the maximum temperature was 64° and the minimum 17°. On December 11 an unusual snowfall of 5½ inches occurred.

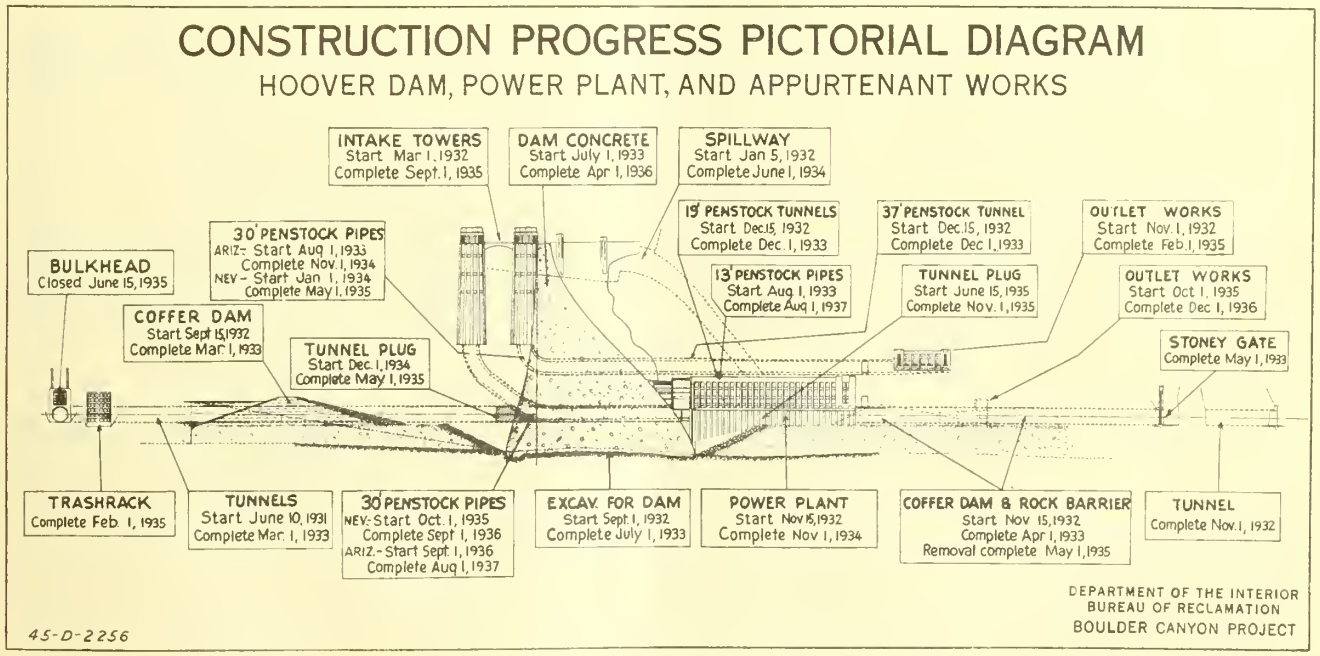
The children of Boulder City were guests at two Christmas parties on December 24. In the afternoon the Boulder Theater admitted all children free to a special performance. Candy, nuts, and fruit were distributed to the children after the show. That evening there was a Christmas tree and program at the American Legion Hall, at which gifts, candy, and oranges were given to the children present. Included in the organizations that cooperated to present these entertainments were the Boulder Theater, Boulder City Co., American Legion Auxiliary, Anderson Bros. Supply Co., and the various church organizations.

During December 5,505 visitors entered the reservation, arriving in 2,086 cars. Of these, 369 persons in 138 cars were traveling the route between Kingman and Las Vegas via the Black Canyon ferry.

A board of engineers, comprising L. C. Hill, F. A. Banks, and W. H. Nalder, met at Boulder City on January 10 for the purpose of considering the abutment excavations for Hoover Dam.

A golf club has been organized and a course of nine holes staked out at a site southeast of Boulder City. The initial organization was effected at a meeting on January 4, when Office Engineer John C. Page was elected president and District Counsel J. R. Alexander secretary.

On January 21, at the Barberton, Ohio, plant of the Babcock & Wilcox Co., tests were made of a 15-foot diameter buttstrap section, such as it is planned to use with the plate-steel outlet pipes for the Hoover Dam, to be furnished under the B. & W. $11,000,000 contract. It was designed in accordance with test data, the result of research work by Prof. S. C. Hollister, of Purdue University. This is the largest section of its kind yet constructed. C. M. Day, chief mechanical engineer, was present at the tests as a representative of the Bureau of Reclamation. In working out a design for the connection of these pipe sections and determining the composition of the steel of which they are to be made, more than $100,000 has been spent by Babcock & Wilcox and the Illinois Steel Co.



Colorado River Aqueduct Tunnel by Force Account

The Metropolitan Water District recently awarded a $7,000,000 contract for construction of the 13-mile San Jacinto tunnel of the Colorado River Aqueduct to the Metropolitan Engineering Corporation, of Los Angeles. Bids are now being asked on construction of the Valverde tunnel, 7.2 miles long and 15 feet 3 inches in diameter, and the Bernasconi tunnel, 1.1 miles long and 15 feet 3 inches in diameter. On the recommendation of F. E. Weymouth, chief engineer, the board of directors has decided to build the West Coachella and East Coachella tunnels by force account to obviate delay in calling for bids and provide immediate work for the unemployed.

The Coachella tunnel section of the aqueduct is located along the base of the Little San Bernardino Mountains, north of the Coachella Valley. The eastern end of this section is almost due north of Mecca and the western end of the section is the Morongo Canyon, north of Palm Springs. The section includes 10 separate tunnels totaling 33 miles in length. The eastern part of the section will be one tunnel, the length of which will be 96,238 feet, or approximately 18 miles. Access is given to this tunnel at four intermediate points from level adits, from which tunnel driving will proceed to the east and west of each adit. The western part of the Coachella tunnel section is broken up into nine units. The respective length of these units from east to west is as follows: 15,020 feet, 39,080 feet, 13,807 feet, 720 feet, 16,380 feet, 15,100 feet, 6,700 feet, 15,330 feet, and 1,720 feet, or a total length of approximately 15 miles.

Access to these nine tunnels is available from five different points where the tunnels emerge to cross mountain washes. In driving the tunnels, the tunnel tracks will be built to continue across these narrow washes so that equipment can be shuttled back and forth and thus permit drilling operations to proceed on one side while excavation work is in process on the other side. The total estimated cost of construction of the Coachella section, including the 33 miles of tunnels, is $18,000,000. The time required for completion is estimated at approximately five years and six months.

Approximate quantities for the two tunnels are as follows: West Coachella, excavation 1,059,000 cubic yards, concrete 280,000 cubic yards; East Coachella, excavation 1,045,000 cubic yards, concrete 278,000 cubic yards.

Reclamation Engineer Wins Thomas Fitch Rowland Prize

Clifford Allen Betts, engineer on the Owyhee project, Oregon-Idaho, was awarded the Thomas Fitch Rowland prize for his paper, Completion of Moffat Tunnel of Colorado, at the Eightieth annual meeting of the American Society of Civil Engineers held in New York City on January 18–21.

Mr. Betts is an expert in the field of hydraulic and concrete research, whose engineering accomplishments include municipal and sanitary work in the East, railroad surveys, mill construction, a map of the Columbia River in the Northwest, and water investigations and tunneling in Colorado. Following his work on the Moffat Tunnel in Colorado, he has been with the United States Bureau of Reclamation since 1928, employed on the construction of the Owyhee Dam in eastern Oregon. A graduate of Yale and of the University of Wisconsin, he was, in 1914, a scholar in hydraulic research work at the Hydraulic Laboratory of the University of Wisconsin.

The paper in question appeared in the 1931 issue, volume 95 of the Transactions of the A. S. C. E.

The Utah-Idaho Sugar Co. factory at Chinook, Milk River project, had a 78-day run this season, the longest in the history of the plant. Approximately 78,000 tons of beets were converted into sugar, representing an 81,635-ton production from the farms within the factory district. The estimated capacity of the factory is around 100,000 tons, and, with the prospective increase in acreage for 1933, it is anticipated that this capacity will be reached the coming season. The average yield for the entire district was 13.57 tons per acre, and the average for the 4,837 acres harvested on the project was 14.57 tons per acre, the Malta division averaging 15.13 tons per acre. The average sugar content of all beets was 16.85 per cent.

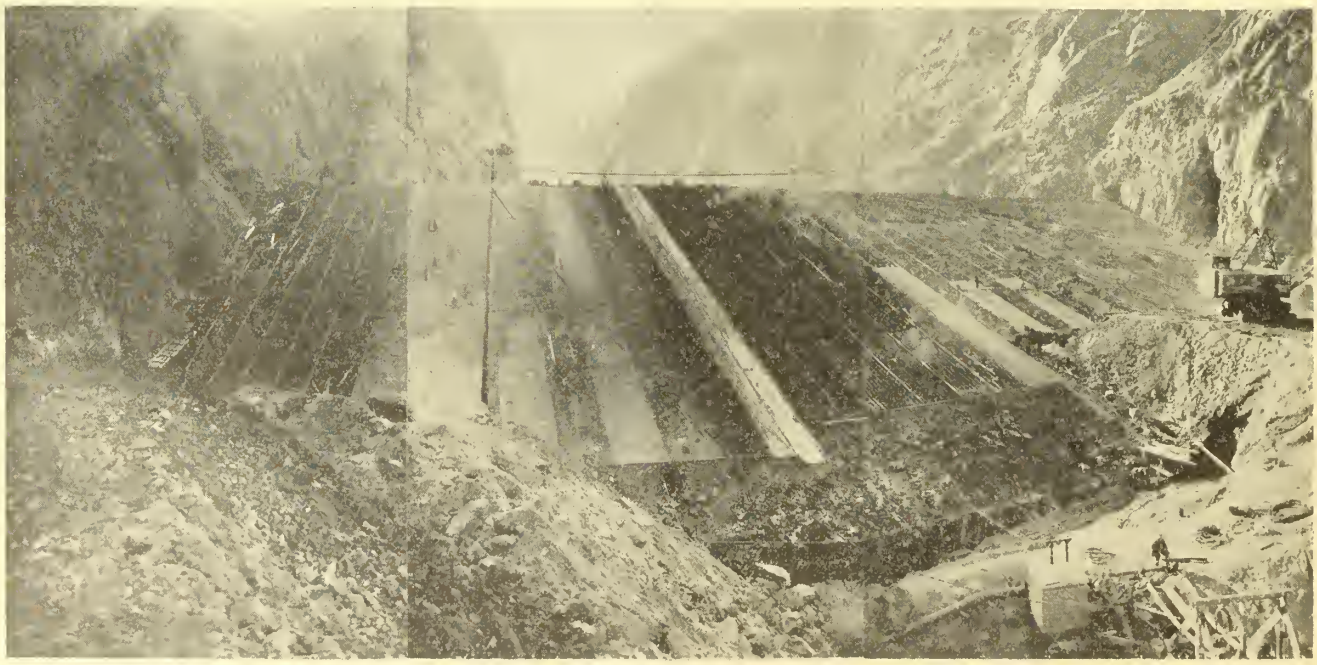


Photo by B. D. Glaha

BOULDER CANYON PROJECT, ARIZ.—NEV.

Upstream cofferdam at Hoover damsite—Crest of fill at maxium elevation 720

Notes For Contractors

Boulder Canyon project.—Under invitation A-3087-A, bids opened December 2, the Minneapolis-Moline Power Implement Co., 817 Chapman Building, Los Angeles, Calif., has been awarded a contract at $3,625.60 (f. o. b. destination) for furnishing structural steel for the 150-ton cableway hoist house at the Hoover Dam. Material will be erected in the field by the Government. Seventeen bids were received.

On January 27, bids under specifications No. 541 were opened at Denver, Colo., for furnishing, f. o. b. cars at the factory shipping point, eight 32-foot diameter welded plate-steel cylinder gates with appurtenant throat liners, nose liners, entrance liners, etc., for installation in the four intake towers at the Hoover Dam. Bids were asked on two schedules, No. 1 covering entrance liners and appurtenances and No. 2 the cylinder gates and appurtenances.

Specifications have been issued covering the bulkhead gate control apparatus for the two 50-foot by 50-foot bulkhead gates at Hoover Dam. The specifications cover the fabrication of a control panel and other mechanical parts and the furnishing of pipe and fittings for the control piping.

Specifications have been prepared covering the construction of a cement blending plant at Boulder City, Nev. The plant will consist of 8 concrete silos, each 26 feet in inside diameter and 58 feet in total height, into which bulk cement will be unloaded, and 2 concrete silos, each 32 feet in inside diameter and 83 feet in total height, for storage of cement after blending and for loading purposes, together with unloading, blending, and conveying equipment. Materials and equipment to be installed in the plant will be furnished to the contractor by the Government.

Boulder Canyon, Owyhee and Yakima projects.—Bids were opened at Denver, Colo., on December 20, under specifications No. 580-D, for furnishing overhead traveling cranes. Twenty-three manufacturers submitted bids, ranging as follows: 40-ton crane, $3,222 to $6,157; 20-ton crane, $2,518 to $4,975; two 5-ton cranes, $1,940 to $4,320; 5-ton crane, $1,040 to $2,230. All these bids were f. o. b. factory shipping point. The low bidders were as follows: Item 1, 40-ton crane, J. S. Mundy Hoisting Engine Co., Newark, N. J., $3,220; item 2, 20-ton crane, Euclid Armington Corporation, Euclid, Ohio, $2,518; item 3, two 5-ton cranes; and item 4, 5-ton crane, Maris Bros. (Inc.), Philadelphia, Pa., $2,980.

Yakima project, Kittitas division.—On December 23 bids were opened at Ellensburg, Wash., for construction of the Badger Creek wasteway of the North Branch Canal lateral system. Fifteen contractors submitted bids on the work, which comprises earth excavation and structures. The lowest bids received were as follows: Schedule 1, L. Coluccio & Co., Seattle, Wash., $17,403.95; Felix Arcorace, Seattle, Wash., $18,456.05; General Construction Co., Seattle, Wash., $19,390.25; schedule 2, Felix Arcorace, Seattle, Wash., $4,624; Winston Bros. Co., Minneapolis, Minn., $5,014; Henley & Meenan, Ellensburg, Wash., $5,148.50. Contracts were awarded to L. Coluccio & Co., and Felix Arcorace on December 28.

Owyhee project.—Bids were opened at Denver, Colo., on January 20, under specifications No. 583-D, for furnishing gate hoists, complete, with stems, shafting, and appurtenances, for the check, siphon spillway, and wasteway structure on the North Canal, Mitchell Butte division. The hoists and appurtenances will be installed by the Government.

Palo Verde Irrigation District.—Bids were received at Yuma, Ariz., on January 30 under specifications No. 584-D for raising the Colorado River levee near Blythe and Ripley, Calif. The work involves 210,000 cubic yards of excavation.

Most of the oranges shipped during December from the Orland project were sold to Pacific Northwest markets.

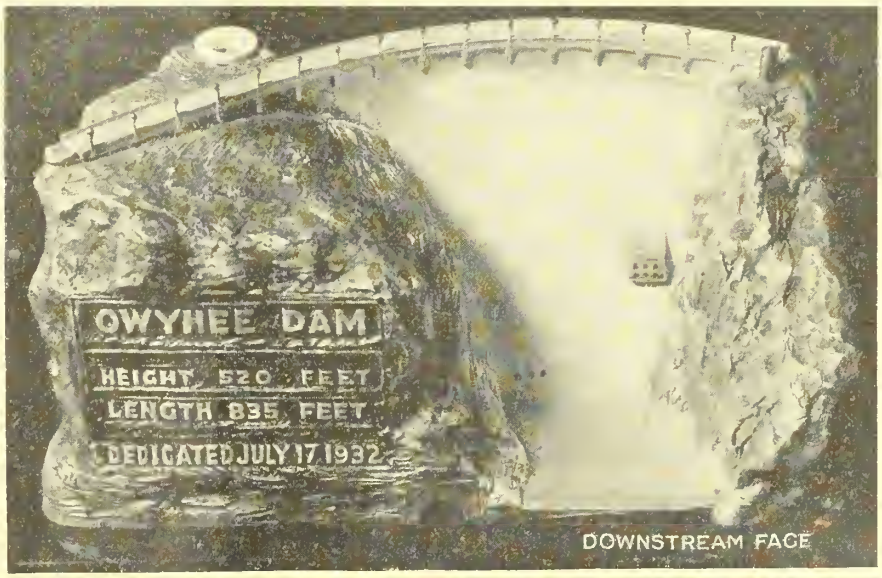
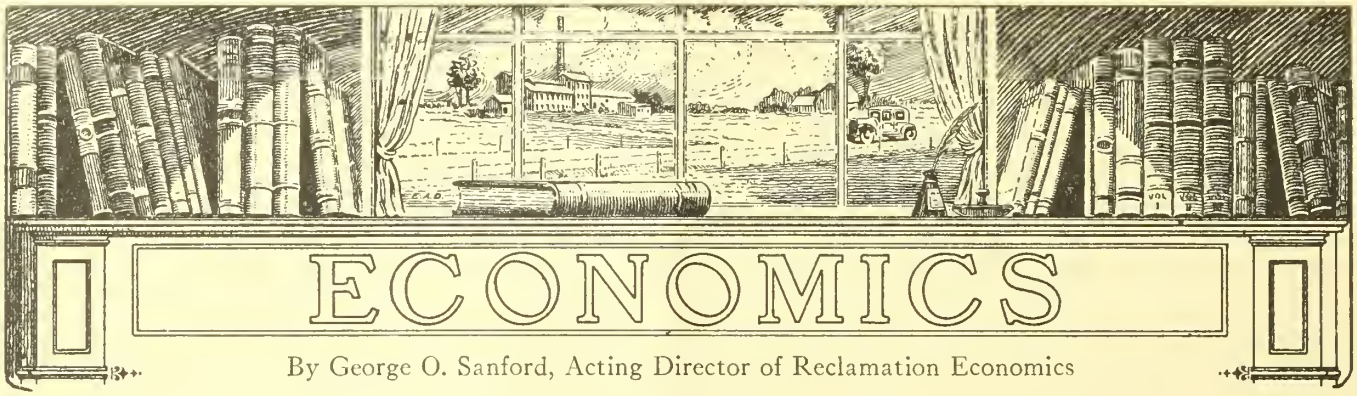


Photo by G. A. Beyer



By George O. Sanford, Acting Director of Reclamation Economics

Sugar Production and National Unemployment

By F. C. Grable, Ft. Collins, Colorado

It is often stated in these times when business is at such a low ebb, that there is an overproduction and an underconsumption of everything the farmer grows. But this is not quite right. Year after year there is a shortage in one particular article of food. It is sugar. If the United States produced as much sugar as it consumes there would be a different story to tell in unemployment circles. It is said there are 12,000,000 jobless in our country. But we pay people of other nations to grow and also to refine nearly 76 per cent of the sugar we use. There are 125,000,000 of us and we find sugar so healthful as food and so enjoyable as a luxury that 100 pounds are consumed by each person—every man, woman, and child—a total of 12,500,000,000 pounds. Of that enormous amount we buy from foreign countries 9,424,000,000 pounds. We pay them for the cost of raising it, the expense of refining much of it, the profit that goes to those who handle it, the charges on ocean-going vessels and railroads for shipping, many of which are foreign-owned, while at the same time we contribute a huge fund to our home people to support them as nonworkers for want of something to do.

But why? Enough of the soil of the United States is of such high quality as to be suitable for the growing of sugar, in some parts cane, in other sections beets; we have rainfall or irrigation that is fully sufficient for productive purposes; our sunshine and climatic conditions are ideal; railroads have long been established in many sections for moving a sugar crop; there are factories already erected for refining sugar and they could manufacture much more than they do now without any additional capacity or the extra investment of a dollar for machinery, by just running longer than at present, which in the West is from October to December.

UNEMPLOYMENT REDUCED BY HOME PRODUCTION

Take, for instance, the Great Western Sugar Co., which is the greatest beet sugar manufacturing company in the world. Their capital is $30,000,000 and they own 22 plants for making sugar. Every day they run they handle 43,000 tons of beets and make 11,180,000 pounds of sugar, converting into sugar the beet production from 225,000 acres of land. Their factories in Colorado are at Brush, Brighton, Eaton, Fort Collins, Fort Lupton, Fort Morgan, Greeley, Johnstown, Longmont, Loveland, Ovid, Sterling, and Windsor; in Nebraska, at Bayard, Gering, Lyman, Mitchell, Minitare, and Scottsbluff; in Wyoming, at Lovell and Wheatland; and in Montana, at Billings. Other sugar companies operating in the same section on a lesser scale are the American Beet Sugar Co. and the Holly Sugar Corporation.

The factories are built very much after a formula. Red brick walls of great solidity, always four stories high; floors, stairs, and partitions of concrete and steel, with no wood in the construction anywhere, so one never was known to burn, which unusual conditions give the lowest insurance rate possible; immense quantities of machinery which is improved upon in each new building.

The beet acreage handled by the 22 factories named gives employment to 10,000 farmers, 21,000 field workers, while 6,500 men are required to run the factories when in operation. In addition there is much other employment required. Trucking is a big item, and the replacement of machinery furnishes employment to many mechanics. About a ton of coal and half a ton of limestone are consumed in refining a ton of pure sugar. A plant uses 300 carloads of limerock of 112,000 pounds each for purification purposes, which must be mined, loaded, and hauled by trainmen to the plant. Each acre of sugar beets averages $35 in freight revenue to railroads. A factory requires about 45,000 tons of coal to feed its furnaces for a season, which gives more men work and more men pay. Just this one sugar company fills 11,000,000 cotton sacks each with 100 pounds of sugar, which cotton must be grown and the sacks made and shipped in over home-owned railroads, filled with sugar to be sent out, thereby helping to pay dividends on railroad stocks largely held by our own people. Seed for planting the sugar beets that was grown abroad at first and sent to this country by the shipload now is extensively raised here. The 225,000 acres grown in Colorado, Nebraska, Wyoming, and Montana, requiring 20 pounds to the acre, would need a total of 4,500,000 pounds of sugar-beet seed, the maturing of which furnishes work to a large force of men. Then there is the marketing of the remnants of the beet after the sugar is extracted, called pulp, which is carried out of the plant in a trough, lodged in a bin by the thousands of tons, hauled to the feed lots by trucks, and fed to the droves of sheep, cattle, and hogs for fattening purposes. The work of hauling and feeding both the pulp and the tops from the beets adds to the employment that the making of sugar furnishes so bountifully. I think it is safe to say that this one sugar company provides sufficient part-time employment to 40,000 men, enough to give them a living. And these men produce 1,100,000,000 pounds of sugar—only about one-twelfth of what is used in the United States, which is 5,475,000 long tons of 2,200 pounds each. Of this amount we import 4,182,600 long tons. We raise nearly 3,000,000,000 pounds of sugar in this country and it is produced on close to 600,000 acres of land. If we had about 2,000,000 acres additional

in sugar-growing, cane and beets, we would be producing the sugar we consume. The acreage thus employed would mean that much less of crops where surplus is now a national economic burden.

Sugar beets are grown in Colorado, California, Idaho, Iowa, Illinois, Indiana, Kansas, Montana, Michigan, Minnesota, Nebraska, New Mexico, Nevada, North Dakota, Ohio, South Dakota, Utah, Wyoming, Washington, and Wisconsin, there being 104 beet sugar factories in these 20 States. The greatest cane-producing State is Louisiana. Cuba, Java, and the Philippines stand high among cane-growing countries, over $1,000,000,000 American money being engaged in cane-sugar production in Cuba alone. Florida has recently established a mammoth sugar factory in the Everglades, where the soil is so rich that the cane grows to the height of nearly 20 feet and is filled to bursting with the most succulent of juices. It is said the cane there will grow and produce for nine successive seasons without replanting. Many thousands of our unemployed could be growing sugar in the Everglades for the sugar-loving home people of the United States. About half the sugar in the world comes from cane and half from beets. The two qualities are of equal value for all uses. Twenty-seven foreign countries are growing sugar beets, and only Holland excels northern Colorado in tonnage per acre. In our own country every acre producing sugar means one acre less planted to those crops whose surpluses have become a national burden. The investigations of the League of Nations show that land in cultivation to sugar beets gives employment to two and a half times as many laborers as other crops.

MAKING SUGAR, A STRICTLY SANITARY PROCESS

Making sugar from the beet is the product of an intricate refining process. No human food is prepared amidst cleaner surroundings. From the time the beet is topped where it is grown and thrown into a pile in the field, the hand never touches the beet nor the sugar made from it. Trainloads of beets on elevated tracks are unloaded by the side of concrete trenches where water carries them by gravity into the great vat of the factory to be washed by machinery and elevated to the top story. Here they are sliced into long shreds somewhat resembling shoestring potatoes; then hot water treatment follows that brings out the sugar juices; next is the application of a milklike fluid for purifying purposes made from limerock; comes then the treatment by dioxide gas for the elimination of the lime; filtering presses follow to add to the purifying processes; next is the boiling of the juices in vacuum pans to develop the grain in the sugar, which is done under the expert supervision of the sugar boiler, who can regulate the size, evenness, and hardness of the grain of the resulting sugar; then the crystals of pure sugar and the sirup go together to the centrifugal machine for separation; thence the sugar goes to a hot-air dryer and on to the immense storeroom where it is sacked and piled by derrick far up to the ceiling to await shipment by carload or trainload. The sirup goes to the factory at Johnstown, Colo., carrying with it nearly 50 per cent sugar crystals that can not be recovered by ordinary refining methods. Under the new process in use there 750 pounds of sugar are extracted from every ton of molasses. Only recently has it been discovered that the sweet water from this mill, hitherto a waste, possesses the finest fattening properties, producing a delicacy and flavor in the prime animals that are given this unusual ration as part of their food, causing them to top the market in prices.

The improvement in seed and in the experience of those representing the sugar company as advisers to the farmers, without any charge to them, has resulted in an advance in the average yield of sugar beets of about 2 tons to the acre, the yield being now an average of nearly 14 tons. The company during these unsettled sugar prices base their payment to the growers on what the sugar brings on the market, and also according to the percentage of sugar their crop yields. Some farmers now get $4.50 a ton for their beets, the average being about $4.25. When times are normal a price is agreed upon before the crop is planted. It is a cash crop, settlement being made on the 15th of October, November, and December. This year one company's final payment to the farmers will bring the total to about $13,000,000 for the beets grown on 225,000 acres planted tributary to its 22 factories, which is an average of $58 per acre gross.

One of the busiest and most interesting places in the mill is where they fill the sacks with sugar that is let down in pipes from the fourth floor to the immense concreted storage room on the first floor. "My machine, in three shifts of 8 hours each, fills and sews 5,000 ten-pound sacks every day," said one of three workmen handling that machine. Others were just as busy filling and sewing 100-pound sacks. Piling them in layers 50 feet high, and never once a carload or trainload toppling over, showed placing skill of the highest order.

Beet sugar, properly manufactured, is of equal purity, equal sweetness, and equal usability with the very highest grade of sugar made from cane or any other plant. This is the repeated testimony of the world's highest authorities, including the Bureau of Chemistry of the United States Department of Agriculture. If all the sugar used in the United States could be confined to home production it would employ nearly half a million men and through them contribute to the support and comfort of 2,500,000 people.

In most States where sugar cane and sugar beets grow, there is a State immigration agent located at the capitol of the State, of whom full information can be obtained touching the important industry of sugar production.

Death of Ira W. McConnell

It is with keen regret that announcement is made of the sudden death in Buenos Aires on January 7 of Ira W. McConnell. Mr. McConnell became vice president and chief engineer of Dwight P. Robinson & Co. (Inc.), in 1918, and was in charge of their work in South America at the time of his death.

Mr. McConnell was connected with the Bureau of Reclamation from 1903 to 1909, serving four years as project engineer on the Uncompahgre project, during which he was in charge of the construction of the Gunnison Tunnel, and two years as supervising engineer of the central district, embracing reclamation activities in Oklahoma, Kansas, Colorado, Nebraska, central and southern Wyoming, and South Dakota. Mr. McConnell later acted for a short time in a consulting capacity for the bureau.

The Black Hills Sugar plant, adjacent to the Belle Fourche project, closed its season after a run of 75 days. A total of 92,000 tons of beets were sliced, of which two-thirds were grown on the Federal project. Disbursements amounted to $455,000, including $60,000 for labor, and it was anticipated that $70,000 would be paid as a bonus in 1933. The sugar content of the beets, 16.63 per cent, was the highest of record.

The latest report from the Riverton project states that during a recent month three prospective settlers were shown over the project, five farm applications were received, one applicant paid the water charge for 1933, and two men made homestead entry. The applicant paying the water charge began to build his cabin within less than three days from the time he first visited Riverton.

The 1932 Corn-Growing Contest for Malheur County, Oregon

By Raymond G. Larson, County Agent and Chairman of the Corn-Contest Committee

THE 1932 corn-growing contest was the first held in Malheur County for a number of years. The main purposes of resuming the contest were to encourage the production of more corn and to study corn-growing methods so that proper practices might be determined and passed on to corn growers in the county. The total number of entries in the contest was 26, the contestants being divided into two classes, senior and junior. The senior class consisted of men over 21 years of age and the junior class of boys under 21 years of age. Contestants in the senior class were required to have not less than 5 acres of corn and in the junior class not less than 1 acre. In practically every case, the acreage grown by the contestant amounted to considerably more than the minimum required. Rules of the contest required that each contestant keep a record of his corn-growing operations and that entries should be made with the Commercial Club not later than July 15. The corn yields were to be determined on a shelled dry-corn basis according to rules formulated by the committee.

The high five yields in each division were as follows:

	Yield per acre (bushels)
Senior division (5-acre tracts):	
Ed. Durbin, Ontario, Oreg	112.5
D. C. Duvall, Nyssa, Oreg	107.7
Garrett Groot, Nyssa, Oreg	104.4
C. E. Peck, Parma, Idaho	97.5
William Peutz, Nyssa, Oreg	91.2
Junior division (1-acre tracts):	
Alvin Duvall, Nyssa, Oreg	121.8
Jacob Groot, Nyssa, Oreg	108.9
Walter Spicer, Weiser, Idaho	108.4
Carl Johnson	102.4
Joe Rupert, Ontario, Oreg	100

It is not to be expected that every corn grower in Malheur County will be able to produce the yields as shown in the corn-growing contest, but in two different years corn-yield surveys have been made which show our average production to run between 55 and 60 bushels per acre.

CONTEST REQUIREMENTS

One of the requirements of the growing contest was that each participant display 10 and 50 ear samples at a corn show to be held at the completion of the growing contest. This corn show was open to all residents of Malheur County, whether in the growing contest or not. Sixty-two entries were made. The corn in this show was of excellent quality and would stand up well in any show, regardless of where held.

In our opinion the corn-growing contest and the corn show should more than justify the expense and effort attached to it. There is a good demand for corn and it is one of the best paying grain crops produced this year on irrigated land. At the present time No. 2 corn is worth 85 cents per hundred, or 47.6 cents per bushel, at Ontario. The market on corn in the Corn Belt at the present time is from 11 to 12 cents per bushel.

In our judgment the acreage of corn in Malheur County may well be increased, and we hope that the efforts and support of the growers will result in an increased acreage. This county has normally been an importer of 15 to 25 carloads annually. This year for the first time sufficient corn has been produced for local needs, with a small surplus for outside market.

As the corn acreage increases, the number of hogs on the farms should increase accordingly. There is room for an increase in hog production, as the West is an importer of pork and pork products. Because of the fact that it is necessary to import pork, western hog markets are normally $1 to $1.25 higher on hogs than corn belt markets.

It is our belief that the Ontario Commercial Club through its efforts is encouraging an industry that is worth while and that its support of this project should be continued.

Library of Congress Sends Library to Boulder City

For the first time in the history of the United States, so far as can be learned, a library of books from the Library of Congress, Washington, D. C., has been made available for a town, and that town happens to be Boulder City.

Three thousand volumes, duplicates of books copyrighted in Washington, are now en route to Boulder City. The shipment includes fiction, adult and juvenile stories, religion and philosophy, personal history, language and literature, general history, American history, social and political science, music and finance, geography, education, military science, and agriculture.

The new library, which may be located in the court room of the Municipal Building, will be open to the public and school children. It will be in charge of Boulder City school teachers and will be open late afternoons and evenings.

The teachers are volunteering their services, being fully appreciative of the fact that the library is "just what Boulder City needs."

The books are an indefinite loan from the Librarian of Congress, and were secured through the efforts of Commissioner Mead, of the Bureau of Reclamation, and L. C. Cramton, former city manager of Boulder City.

Although a small fee may be charged adults, use of the books to children will be free.—*Las Vegas Evening Review-Journal, January 19, 1933.*

All the farm units opened to entry on the Sun River project in 1931 and 1932 have been entered with the exception of two of the less desirable units.

Drinking Curbed in Boulder City

Sims Ely, city manager of Boulder City, has issued the following bulletin stating in positive terms the penalty to be imposed for drunkenness upon employees engaged on Hoover Dam work:

"In the interest of the workers here, it should be understood by everybody that to be drunk on the Boulder Canyon Project Federal Reservation means expulsion from the reservation, with consequent loss of the job. It is, of course, well known that the transportation or unlawful possession of liquor is forbidden here, but because the rule forbidding intoxication was apparently not known by all, we were lenient with several cases of 'Christmas drunks.' Ignorance of this regulation will not be accepted as an excuse hereafter and no leniency can be expected.

"There are excellent reasons for the enforcement of this rule. Most bootleg liquor is poisonous * * * hence it impairs or shatters the health of the person who drinks it * * * and when a man with a 'hang-over' returns to a hazardous work he is not able to guard his own life properly, and he is a menace to his fellow workers.

"It is unfortunate that some of the men working here have very short memories concerning the terrible conditions of unemployment which prevail elsewhere. Within a short time after getting their jobs they forget all about the privations, hardships, and despair they underwent before they secured employment, and they proceed to 'blow' their money with bootleggers and toss away the jobs for which they have waited so long.

"If the workers on this reservation can not refrain from getting drunk, they must step aside for the sober men who are anxious for employment on this work. It is a matter of choosing between drink and the job."—*Christian Science Monitor.*

☆

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department.
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy**, Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Sehnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thraikill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev.	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do. / J. R. Alexander	Do. / Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston.	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks.	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington.	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson.	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power.	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster.	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill.	C. L. Harris.	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office.	B. E. Stontemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent		F. C. Bohlson.	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg	F. A. Banks.	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stontemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell.	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. constr. engr.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	I. B. Hosig	Acting supt		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho.	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho.	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division.	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery.	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district.	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	H. A. Parker	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division.	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	D. G. Klingman.	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	Paul G. Gebaner	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg		Reservoir supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah			Reed Stevens	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo.	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver, Wyo.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office.	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Capitol Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster.	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg.	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*

AIR VIEW OF BLACK CANYON DAM, POWER PLANT, AND RESERVOIR, BOISE PROJECT, IDAHO

U. S. GOVERNMENT PRINTING OFFICE 1933

I 27.5

THE RECLAMATION ERA

VOL. 24, NO. 3

MARCH, 1933

CLEMSON COLLEGE LIBRARY
GOVERMENT PUBLICATIONS

SLOGAN: A COW ON EVERY FARM

SEE PAGE 39 AND BACK COVER

Irrigation Development in Montana

The primary purpose of irrigation development is home building. Montana with its 35,000,000 acre-feet of unused water and 5,000,000 acres still to irrigate can furnish new homes for at least 50,000 farm families, an additional population of 250,000 farm people who will develop a commerce for 100,000 to 200,000 other families, for economic history shows that for every farmer there are 2 to 4 city families consuming his produce and serving his needs.

The people of Montana recognize that this development will safeguard our cattle, sheep, and dairy industry against the hazards of drouth and winter feed shortage; take our submarginal land out of wheat production; stabilize the farm and business income of our dependable wheat-growing areas; encourage us to further capitalize on specialized seed crops the quality of which commends a market premium; expand the cannery, sugar beet, seed house, stock fattening, creamery and other industries; greatly enlarge our purchasing power for manufactured products thereby stimulating trade and transportation; increase employment in allied industries; enlarge the carrying capacity and earning ability of our grazing lands; reduce the present tax burden by creating new taxable wealth; and eliminate recurring excessive demands for drouth relief.

—Report of the "Montanans, Incorporated,"
Committee on Irrigation

THE

RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 24, No. 3 MARCH, 1933

Contract for Parker Dam Executed

Secretary Wilbur Acts on New Colorado River Project

SECRETARY WILBUR has executed contract with the Metropolitan Water District of Southern California involving the construction of the Parker Dam.

The project will generate 80,000 horsepower of electricity. The dam will be for the joint benefit of the district and of Indian and public lands in Arizona.

The proposed dam will be located in the Colorado just below the mouth of the Bill Williams River. It will cost $13,000,000, raise the water level about 70 feet, and enable generation of about 80,000 horsepower of electric energy.

All of the money will be advanced by the Metropolitan Water District and construction will be effected by the United States, which will retain ownership of the dam. The dam will be for the joint benefit of the district and of Indian and public lands in Arizona. In return for its service the United States will retain one half of the power privileges. About 40,000 horsepower will thus be required for use in Arizona without capital investment, thereby advancing by many years the feasibility of reclamation of large areas in the Colorado River Indian Reservation and the proposed Gila project in Arizona. Statutory authority already exists for the construction of the dam in aid of reclamation of the Colorado River Indian Reservation.

Among other privileges which the United States will reserve under the contract will be the right to control all water passing the dam, and to utilize the top 10 feet of storage capacity for water regulation in connection with Hoover Dam power operations and flood control.

The district also will transmit Arizona's share of Hoover Dam power, 117,000 horsepower over its lines from Hoover Dam to Parker Dam, at cost, to the extent of the available capacity of the district lines.

The dam will control the flood of the tributaries of the Colorado River between Hoover Dam and Parker Dam and will assist in stabilizing the flow of the river. It will not interfere with irrigation uses, and its use will be subject to the Colorado River compact.

It is contemplated that construction will be effected while Hoover Dam is filling and the contract requires in any event that the district advance the necessary funds within 10 years.

The site chosen is the upper of the two Parker sites. The lower, about 10 miles down the stream, was originally identified with the proposed Parker-Gila project in Arizona. The present plan of the Bureau of Reclamation, however, will substitute the upper site, and employ the power generated there for pumping water to the Parker area and the Gila lands as separate projects in lieu of a 130-mile canal which would be required to connect either dam site with the Gila area. The availability of this cheap power will enable reclamation of these two areas by units instead of requiring the development as one large project served by a long canal. The upper site has the advantage of having been tested; the lower one is considered dubious by geologists. Articles 10 and 11 of the contract, which provide for the construction work by the United States and for the payment therefor by the district, are quoted as follows:

"CONSTRUCTION BY THE UNITED STATES

"10. The United States will, with funds advanced by the district as hereinafter provided, and for the purposes stated in this contract, construct in the main stream of the Colorado River at a point in the vicinity of Parker, Arizona, shown on the map attached hereto and described herein as Exhibit A, a dam, referred to herein as the Parker Dam, creating thereby a storage reservoir having a maximum water surface elevation of approximately four hundred fifty (450) feet above sea level (U. S. Geological Survey datum). Upon like conditions the United States will also construct outlet works, pressure tunnels, penstocks and other appurtenant structures to the extent that such structures may be necessary and/or economically desirable as parts of the original installation, and such facilities for navigation as the Secretary may find necessary. All buildings intended solely for the use of either party hereto shall be constructed at the sole expense of the party for whom such facilities shall be provided. The dam and appurtenant structures shall be so constructed that subsequent installation of diversion or outlet works shall be possible in the most feasible manner for canal connections with lands within the Colorado River Indian Reservation and with public and other lands in Arizona now or hereafter included in projects constructed under the reclamation law and supplementary legislation, or otherwise, subject to the consent and approval of the Secretary, and, if either party hereto requires it, so that one-half of the total installed capacity of electrical generating equipment may be located upon the Arizona side of the river and one-half on the California side. Outlet works, pressure tunnels, penstocks, connections for canals and appurtenant structures not required by the District shall be completed under this contract only to the extent necessary to permit their subsequent completion and use without risk of damage to the remainder of the work.

"In carrying out the proposed work hereunder and in acquiring supplies, materials and equipment therefor, the United States may proceed directly under the method commonly referred to as force account, or may proceed by construction contract. In the event that such con-

tract or contracts shall be let with reference to the construction of said dam, or the acquisition of supplies, materials or equipment therefor, the letting of such contracts shall be governed by the provisions of section 3709, United States Revised Statutes.

"FUNDS TO BE PROVIDED BY THE DISTRICT

"11. The district will advance to the United States, not to exceed the sum of thirteen million dollars ($13,000,000), or so much thereof as may be (a) the cost of preparation of plans and specifications described in article 13 hereof; (b) the actual cost of the said dam, including acquisition of lands and rights of way for reservoir and other incidental purposes, outlet works, pressure tunnels, and penstocks, to be constructed hereunder, and of the District's proportionate share as determined by the Secretary, of such power plant buildings and generating, transforming, and high-voltage switching equipment as may be installed for the joint use of the United States and the District, and (c) required to meet any overhead and general expense incurred by the United States in carrying out this contract.

"Said funds will be furnished to the United States by payment from time to time to the Secretary or such fiscal agent as he may designate in advance of expenditure thereof by the United States. The Secretary will submit estimates of the monthly anticipated expenditures not less than sixty (60) days in advance, and the District will then advance the amount not less than thirty (30) days prior to the month in which such funds shall be estimated to be required. If the United States effects such construction by contract, such contract shall recite that the United States shall not be liable for any loss occasioned by the failure of the District to advance funds as herein provided. The District agrees to hold the United States harmless from all claims whatsoever arising from any such failure. If the funds provided by the District are at any time insufficient, the United States will stop work (if proceeding under force account), when the funds so advanced are exhausted, or give notice to the construction contractor to stop work (if proceeding by construction contract), when the funds so provided are about to be exhausted, and will not resume or give notice to resume work until additional and sufficient funds are provided by the District; and, in any event, the United States shall not be obligated by this agreement beyond the expenditure of the amount actually provided by the District, whether the proposed works are completed or not. The failure of the District to provide funds shall not impose any liability on the District other than to hold the United States harmless from the consequences thereof, but the United States may be relieved, at its option, of any obligation under this contract, if such failure continues for twelve (12) successive months, after submission of estimate therefor, by the Secretary's giving the District written notice of the termination of any further obligation of the United States hereunder.

"The cost of the proposed works shall embrace all expense of whatever kind, growing out of or resulting from said works, including any overhead and general expense (as conclusively estimated by the Secretary) incurred by the United States in carrying out this contract. Nothing contained in this article is to be construed as obligating the United States to expend or Congress to appropriate money for any share of (a) said power plant buildings or (b) said generating, transforming, and high-voltage switching equipment intended for the joint use of the parties hereto."

Weather and Water-Supply Conditions

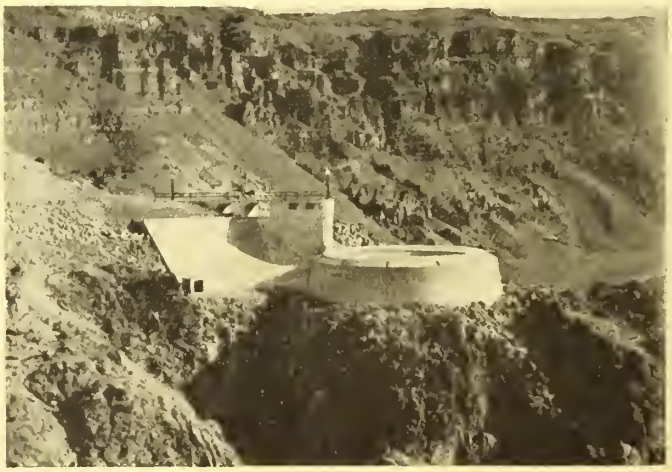
Heavy snows occurred during January throughout the region west of the Continental Divide and materially improved water-supply prospects for the coming irrigation season. Snowfall was particularly heavy in the Cascade Range and the Sierra Nevadas; in many instances the precipitation was the highest it had been for more than 10 years. Although it is yet too early for accurate predictions concerning this year's water supply, ample irrigation water is anticipated for all projects, except those located on streams which originate in the central portion of the eastern slope of the Continental Divide.

Water is being released from the Yakima project reservoirs in order to provide storage space for the control of anticipated spring floods.

For reservoirs with concurrent data available, the total storage content on January 31, 1933, was 5,460,000 acre-feet, compared with 2,810,000 acre-feet for the same date in 1932.

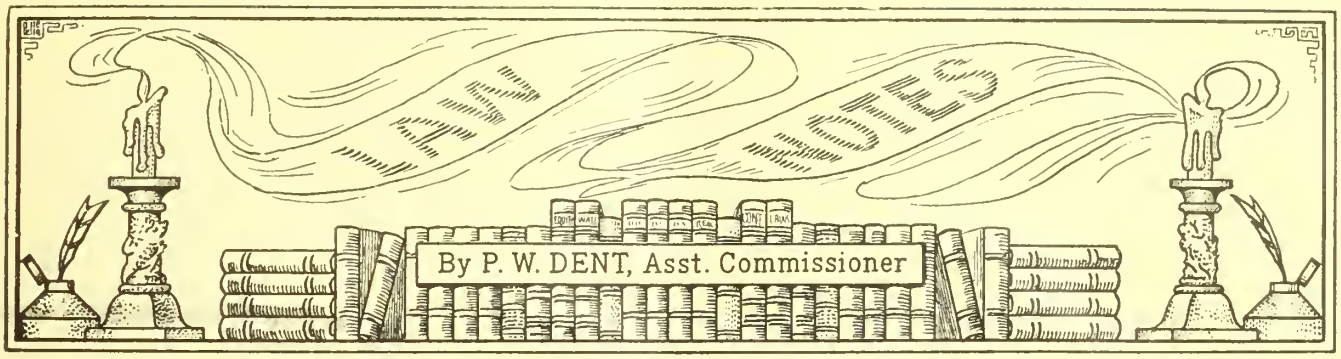
Photograph by C. A. Betts

Northeast end of dam



Ring gate spillway structure and filling reservoir

OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO



Act of April 22, 1932, Making Appropriations for Bureau

[*Public No. 95, 72d Congress*]

(Continued from March issue)

Klamath project, Oregon-California: For operation and maintenance, $45,000; continuation of construction, $75,000; in all, $120,000: *Provided*, That revenues received from the lease of marginal lands, Tule Lake division, shall be available for refunds to the lessees in such cases where it becomes necessary to make refunds because of flooding or other reasons within the terms of such leases: *Provided further*, That $40,000 of the unexpended balance of the appropriation for continuation of construction, Tule Lake division, fiscal year 1932, shall remain available for canal enlargement purposes during the fiscal year 1933;

Belle Fourche project, South Dakota: The unexpended balance of the appropriation of $150,000 for continuation of construction for the fiscal year 1932 shall remain available for the same purposes for the fiscal year 1933;

Salt Lake Basin project, Utah, second division: The unexpended balance of the appropriation for the fiscal year 1932, originally made in the appropriation act of May 14, 1930 (46 Stat. 308), for the Interior Department for the fiscal year ending June 30, 1931, and continued available for the fiscal year 1932 by the act of February 14, 1931 (46 Stat. 1115), shall remain available for the same purposes for the fiscal year 1933, the proviso to said original appropriation for said second division being hereby amended so as to read as follows: "*Provided*, That no part of this sum shall be available for construction work until a contract or contracts shall be made as required by the reclamation laws with an irrigation district or districts or water users' association or associations for the payment to the United States of the cost of such second division";

Yakima project, Washington: For operation and maintenance, $250,000; for continuation of construction, $500,000; in all, $750,000;

Yakima project (Kittitas division), Washington: For operation and maintenance, $40,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1932 shall remain available during the fiscal year 1933;

Riverton project, Wyoming: For operation and maintenance, $17,500: *Provided*, That not to exceed $20,000 from the power revenues shall be available during the fiscal year 1933 for the operation and maintenance of the commercial system;

Shoshone project, Wyoming: For operation and maintenance, Willwood division, $10,000: *Provided*, That the unexpended balance of the appropriation for construction, Willwood division, for the fiscal year 1932, shall remain available for the same purposes for the fiscal year 1933: *Provided further*, That not to exceed $20,000 from power revenues shall be available during the fiscal year 1933 for the operation and maintenance of the commercial system;

For cooperative and general investigations, including investigations necessary to determine the economic conditions and financial feasibility of new projects and investigations and other activities relating to the reorganization, settlement of lands, and financial adjustments of existing projects, including examination of soils, classification of land, land-settlement activities, including advertising in newspapers and other publications, and obtaining general economic and settlement data, the unexpended balances of the appropriations for these purposes for the fiscal year 1932 shall remain available for the same purposes for the fiscal year 1933: *Provided*, That the expenditures from this appropriation for any reclamation project shall be considered as supplementary to the appropriation for that project and shall be accounted for and returned to the reclamation fund as other expenditures under the reclamation act: *Provided further*, That beginning January 1, 1933, the expenditure of any sums from this appropriation for investigations of any nature requested by States, municipalities, or other interest shall be upon the basis of the State, municipality, or other interest advancing at least 50 per centum of the estimated cost of such investigation;

Giving information to settlers: For the purpose of giving information and advice to settlers on reclamation projects in the selection of lands, equipment, and livestock, the preparation of land for irrigation, the selection of crops, methods of irrigation and agricultural practice, and general farm management, the cost of which shall be charged to the general reclamation fund and shall not be charged as a part of the construction or operation and maintenance cost payable by the water users under the projects the unexpended balance of the appropriation for this purpose for the fiscal year 1932 is continued available for the same purpose for the fiscal year 1933;

Under the provisions of this act no greater sum shall be expended, nor shall the United States be obligated to expend during the fiscal year 1933, on any reclamation project appropriated for herein, an amount in excess of the sum herein appropriated therefor, nor shall the whole expenditures or obligations incurred for all of such projects for the fiscal year 1933 exceed the whole amount in the "reclamation fund" for the fiscal year;

Ten per centum of the foregoing amounts shall be available interchangeably for expenditures on the reclamation projects named; but not more than 10 per centum shall be added to the amount appropriated for any one of said projects, except that should existing works or the water supply for lands under cultivation be endangered by floods or other unusual conditions an amount sufficient to make

necessary emergency repairs shall become available for expenditure by further transfer of appropriation from any of said projects upon approval of the Secretary of the Interior;

Total, from reclamation fund, $2,414,500.

To defray the cost of operating and maintaining the Colorado River front work and levee system, adjacent to the Yuma Federal irrigation project in Arizona and California, subject only to section 4 of the act entitled "An act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved January 21, 1927 (44 Stat., p. 1010), the unexpended balances of the appropriations for the fiscal years 1931 and 1932 shall remain available for the fiscal year 1933.

Boulder Canyon project: For the continuation of construction of the Hoover Dam and incidental works in the main stream of the Colorado River at Black Canyon, to create a storage reservoir, and of a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from such reservoir; to acquire by proceedings in eminent domain or otherwise, all lands, rights of way, and other property necessary for such purposes; and for incidental operations, as authorized by the Boulder Canyon project act, approved December 21, 1928 (U. S. C., Supp. V, title 43, ch. 12A); $6,000,000, to be immediately available and to remain available until advanced to the Colorado River Dam fund, which amount shall be available for personal services in the District of Columbia and for all other objects of expenditure that are specified for projects included in this act under the caption "Bureau of Reclamation" without regard to the limitations of amounts therein set forth: *Provided*, That of this fund not to exceed $70,000 shall be available for the erection, operation, and maintenance of necessary school buildings and appurtenances on the Boulder Canyon project Federal reservation, and for the purchase and repair of required desks, furnishings, and other suitable facilities; for payment of compensation to teachers and other employees necessary for the efficient conduct and operation of schools on said reservation.

* * * * *

Sec. 2. Appropriations herein made for field work under the General Land Office, the Bureau of Indian Affairs, the Bureau of Reclamation, the Geological Survey, and the National Park Service shall be available for the hire, with or without personal services, of work animals and animal-drawn and motor-propelled vehicles and equipment: *Provided*, That no part of any money appropriated by this act shall be used for purchasing any motor-propelled passenger-carrying vehicle (except busses, ambulances, and station wagons) at a cost, completely equipped for operation, in excess of $750, except where, in the judgment of the department, special requirements can not thus be efficiently met, such exceptions, however, to be limited to not to exceed 10 per centum of the total expenditures for such motor vehicles purchased during the fiscal year, including the value of a vehicle exchanged where exchange is involved; nor shall any money appropriated herein be used for maintaining, driving, or operating any Government-owned motor-propelled passenger-carrying vehicle not used exclusively for official purposes; and "official purposes" shall not include the transportation of officers and employees between their domiciles and places of employment, except in cases of officers and employees engaged in field work the character of whose duties make such transportation necessary and then only when the same is approved by the head of the department. The limitations of this proviso shall not apply to any motor vehicle for official use of the Secretary of the Interior.

Sec. 3. No appropriation under the Department of the Interior, available during the fiscal years 1932 and/or 1933, shall be used after the date of the approval of this act to pay the compensation of an incumbent appointed to any position under the Federal Government which is vacant on the date of the approval of this act or to any such position which may become vacant after such date: *Provided*, That this inhibition shall not apply (a) to absolutely essential positions the filling of which may be authorized or approved in writing by the President of the United States, either individually or in groups, or (b) to temporary, emergency, seasonal, and cooperative positions. The appropriations or portions of appropriations unexpended by the operation of this section shall not be used for any other purposes but shall be impounded and returned to the Treasury, and a report of all such vacancies, the number thereof filled, and the amounts unexpended, for the period between the date of the approval of this act and October 31, 1932, shall be submitted to Congress on the first day of the next regular session: *Provided*, That such impounding of funds may be waived in writing by the President of the United States in connection with any appropriation or portion of appropriation when, in his judgment, such action is necessary and in the public interest.

Approved April 22, 1932.

Federal Purchase of Land Liable to Reassessment to Meet Cost of Local Improvements

By B. E. Stoutemyer, District Counsel, Portland, Oreg.

TWO cases of interest to reclamation in general, and to the contributors to the cost of American Falls Reservoir on the Minidoka project in particular, are those of John K. and Catherine S. Mullen Benevolent Corporation *v.* United States and the J. K. Mullen Investment Company *v.* United States, which originated in the United States District Court for the District of Idaho sitting as a court of claims.

The plaintiffs are holders of local improvement district bonds of districts created under the provisions of local law in that portion of the city of American Falls which was inundated as a result of the construction of American Falls Reservoir, Minidoka project.

Upon the creation of the improvement districts and the completion of the contemplated improvements, provision was made for payment therefor by spreading the cost, with interest, over the lots of the district in proportion to benefits and by amortizing principal and interest in annual installments over a 10-year period, which installments were by statute made a lien upon the lots affected.

The United States then acquired title to the lots, paying or requiring the owners to pay all such assessments.

Later the funds collected by the city from such assessments for the payment of the improvement district bonds and interest were found to be insufficient for the purpose, partly because of the loss of funds so collected which the city had on deposit in a bank when it suspended business, and partly because of principal losses from other causes and the consequent unanticipated increase in interest through delays in making payment of the principal.

The plaintiffs' contentions were that the United States was obligated upon implied contract to pay the unpaid principal of the bonds because the acquisition of the lots by the Government had rendered unavailable (Government property not being taxable) the plaintiffs' ordinary recourse to a reassessment upon the lots which, under certain circumstances, is permissible by the Idaho laws.

The Government's demurrers to the plaintiffs' complaints were overruled by the Federal District Court for Idaho.

(Continued on p. 33)

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, gave an illustrated lecture on February 3 before the officers and engineering student body at Fort Humphreys, Va.

On February 16 Doctor Mead attended and addressed the National Drainage, Conservation, and Flood Control Congress at its annual meeting in Columbus, Ohio. The subject of his address was "The Progress of Boulder Canyon Project."

W. J. Chiesman, superintendent of the Grand Valley project, has been confined to a Grand Junction hospital on account of an operation on February 2 for the removal of his appendix.

George O. Sanford, chief of the engineering division, Washington office, spoke before the Boston Society of Civil Engineers on February 15, his subject being "The Work of the Bureau of Reclamation and Hoover Dam." Mr. Sanford's talk was illustrated with a few lantern slides.

M. C. Hinderlider, State engineer of Colorado, has been appointed by Governor Adams and Governor-elect Johnson to act as director for Colorado in the National Reclamation Association, relieving E. B. Debler, hydraulic engineer, who had been acting temporarily on this assignment.

Gilbert H. Hogue, assistant engineer on the Minidoka project, recently visited the Boulder Canyon project, Grand Canyon, Salt River Valley, and the Roosevelt and Coolidge Dams. Completing a circuit he passed through the Yuma project, Imperial Valley, and southern California cities.

T. W. Parry and C. L. Cross, manager and director, respectively, of the Pathfinder Irrigation District, were recent visitors at Guernsey, Wyo., headquarters of the North Platte project.

T. S. Martin, master mechanic, has left Denver for Hawthorne, Nev., for the purpose of supervising the grouting of the Cat Creek Dam at the United States Naval Ammunition Depot. The Cat Creek Dam was designed and specifications prepared in the Denver office. Mr. Martin is accompanied in this assignment by A. W. Simonds, engineer also in the Denver office.

L. M. Lawson, former superintendent of the Rio Grande project and now commissioner of the American section, International Boundary Commission, was recently tendered a dinner at the Hilton Hotel in El Paso, Tex., under the auspices of the chamber of commerce. The dinner was given in recognition of Mr. Lawson's success in consummating the boundary and river rectification treaty between the United States and Mexico.

Commissioner Lawson gave a large share of the credit for the successful accomplishment of the treaty to Ambassador J. Reuben Clark, and also made special mention of the helpfulness of the late First Assistant Secretary Cotton of the State Department and the late Dwight W. Morrow, former ambassador to Mexico.

H. H. Plumb, engineer, returned to Denver the latter part of February from the Grand Valley project, where he made the final inspection of the recently completed Grand Valley power plant.

Carl A. Lyman, field representative, has been to Los Angeles, where with L. R. Smith, chief clerk of the Denver office, and Ronald E. Rudolph, chief clerk of the Kittitas division of the Yakima project, an audit has been made of accounts under the Chas. & Geo. K. Thompson contract, Yakima River pressure tunnel, Kittitas division, Yakima project.

F. W. Haversack, assistant engineer, returned to his headquarters at Denver early in February from Boulder City, Nev., where he had been temporarily assigned in connection with the inspection and installation of mechanical appliances for Hoover Dam.

N. E. Fordham, master mechanic, was detailed early in February for several months from the Denver office to Birmingham, Ala., where he will make an inspection of mechanical appliances being manufactured in that city and vicinity.

H. A. Parker, former superintendent of the Lower Yellowstone project and later employed in the same capacity by the board of control, has been appointed superintendent of the Shoshone project, effective March 1, succeeding I. B. Hosig, who has been acting superintendent since the transfer to the Washington office in January, 1932, of L. H. Mitchell.

Walter M. Bradley, jr., has been transferred from the Coast Guard Service in Washington to the position of junior clerk on the Owyhee project.

The following transfers to the Boulder Canyon project have been authorized: Charles S. Hale, assistant engineer, from the Owyhee project; Earl M. Pedersen, assistant clerk, from the Kittitas division of the Yakima project; Orville L. Kime, engineering draftsman, from Upper Snake River storage investigations; and Gilbert Waddell, levelman, from the Colorado River basin investigations at Parker, Ariz.

Liability of Federal Purchase of Land

(Continued from p. 32)

(See 40 Fed. (2) 937.) Issues of fact were joined and the cases were tried and decided adversely to the Government, the district court giving judgment (opinion not published) in favor of the plaintiffs for approximately $9,000.

Upon appeal to the United States Circuit Court of Appeals for the Ninth Circuit, the judgment of the trial court was reversed and judgment in favor of the United States ordered upon the pleadings and findings of the trial court.

The decisions of the circuit court of appeals were apparently based upon—

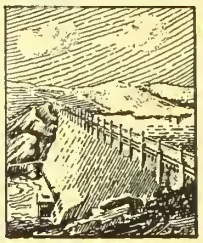
(*a*) A lack of jurisdiction in the lower court, the actions not having been commenced within six years of the acquisition of the lots by the United States and thus not being within the operation of the Tucker Act, and

(*b*) The fact that the plaintiffs' claims of right to have reassessments levied and collected, the reassessments not having been made upon the lots at the time of the transfer of title to the Government, were not in themselves liens or other interest in real estate such as the United States must recognize when acquiring land for right-of-way purposes.

The decisions of the circuit court of appeals in these cases were filed on January 23, 1933, and will probably be published in early advance sheets of the Federal Reporter.

It is expected that an application will be made for a writ of certiorari to the United States Supreme Court to review the decisions of the circuit court of appeals. Final disposition of the cases will likely be of further interest to the readers of the Reclamation Era and may be later reported.

ENGINEERING



GEORGE O. SANFORD, Chief, Engineering Division

Steel Gates for Diversion Tunnels

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

THE four diversion tunnels for Hoover Dam have been excavated to their 56-foot average diameters, three have been lined with a 3-foot thickness of concrete, lining is 90 per cent completed in the other, and since November 13, 1932, the two tunnels on the Arizona side have been carrying the entire flow of the Colorado River.

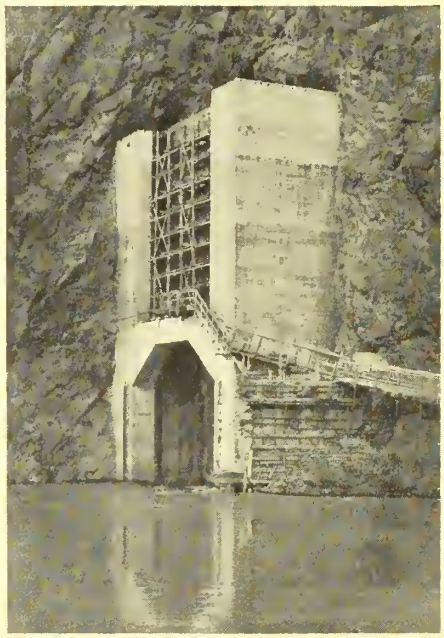
Reinforced concrete structures that have been built or are under construction at the portals of the tunnels comprise transition sections and portal structures at the inlets and outlets of all four tunnels; trashrack foundations at the inlets and Stoney gate structures at the outlets of the two tunnels nearest the river (the inner tunnels); and bulkhead gate structures at the inlets of the two tunnels farthest from the river (the outer tunnels).

PURPOSE OF GATES

The necessity for the bulkhead and Stoney gates during the construction period is best explained by a review of the general construction program. It is contemplated that the diversion tunnels will be lined, cofferdams built, gates erected, excavation for the dam structure finished and pouring concrete in the main structure started by the fall of 1933. Excavation and lining of the 37-foot diameter penstock header tunnels connecting with intake towers and the 18-foot diameter branch penstocks leading from header tunnels to power house are to be completed by January, 1934. Placing the 30-foot diameter steel headers in the 37-foot diameter tunnels will then be started, and it is expected these will be installed on the Arizona side by December, 1934, by which time the spillways will be completed, power-house structure finished, and installation of power machinery started.

The inner tunnels will then be closed, possibly one at a time, by temporary dams around the inlets and Stoney gates at the outlets. The upstream plugs and gates will be placed in these tunnels and trashracks installed at the inlets. The canyon wall outlet works are to be completed soon after, as well as the installation of the 30-foot header pipes in the Nevada 37-foot penstock tunnels.

After the plugs in the inner tunnels have been completed and gates installed therein, the Stoney gates will be lifted, the temporary dams at the inlets will be removed, and water allowed to flow through the inner tunnels. The bulkhead gates at the entrances to the outer tunnels will be dropped when the flood stage has reached such a point as is judged will provide water for power purposes by September, 1935. The water will then, under control of the gates in the plugs in the inner tunnels, start rising back of the partially completed dam.



Photograph by B. D. Glaha

Steel bulkhead in place at inlet end of diversion tunnel No. 4

By the late fall of 1935 the contractor proposes to finish the intake towers and the plugs in the outer tunnels at the intersection with the inclined spillway tunnels. Within the following 18 months it is expected that the main structure of the dam will be completed, the 30-foot steel penstock headers placed in the inner tunnels, penstock connections made through the 18-foot tunnels to the power house, and that all of the power machinery required at this time will be installed.

STONEY GATES

The Stoney and bulkhead gates have been shipped to the project and are being erected in their final positions. Each Stoney gate is 50 feet wide by 35 feet high and consists of seven horizontal structural steel girders, unequally spaced from 3 feet 3 inches at the bottom to 10 feet 5 inches at the top of gate, connecting the vertical girders at the sides and covered on the river or downstream face by 9/16-inch steel skin plates.

The steel cross girders are 51 feet 6 inches long, 6 feet 2 inches wide at center, and 3 feet 7½ inches at the vertical girder connections. Vertical girders are approximately 37 feet long, and 3 feet 7½ inches in width. Two carbon steel ear plates extend beyond the upper ends of the vertical girders to form connections for the operating hoist chains. Twenty vertical latticework trusses equally spaced are designed to stiffen the gate.

The concrete structure for the gate contains the counterweight wells; the gate recesses, equipped with guide plates; a rail-protected inspection platform 56 feet above the tunnel invert; a hoist house extending across the entire width of the structure, with its floor elevation 99 feet above the tunnel invert; and a spiral stairway connecting the inspection platform and hoist house.

The gate is raised and lowered by two hoists, each hoist consisting of a sprocket driven through gears from a lined shaft which is connected through a worm gear to a 10½-horsepower slip-ring induction motor.

A water seal is maintained by seal pipes of 3½-inch heavy brass tubing, one on each side of the gate. The seal pipe bears against a bronze plate on the outside corner of the gate recess and against the skin plate of the gate.

The operating chains, each 82 feet 10 inches in length, run from the gate up and around the hoist sprocket to counterweights and are constructed of 5-inch diameter bronze pins and 19 by 9 inch

link units of high carbon steel plates. Motor control is secured by a drum-type reversing controller with limit switches for upper and lower ends of gate travel.

Each of the two counterweights for a gate is composed of a steel hanger and nine 11,200-pound precast concrete blocks, and is connected by ear pieces to the hoist chain.

The suspended weight of each Stoney gate and chain, with gate down, is approximately 261,000 pounds and that of the counterweights and chains 215,500 pounds. Frictional losses in pins and sprocket bearings are estimated at 44,000 pounds. The gross lifting capacity of the motor and hoists is 212,000 pounds; thus a surplus lifting effort of 122,500 pounds is provided. The normal hoisting speed is 0.891 foot per minute and the total lift of the gate is 58 feet.

BULKHEAD GATES

The 50 by 50 foot steel bulkhead gates are of much heavier construction than the Stoney gates, being designed to withstand a hydrostatic head of 295 feet at the gate seat and closure under a maximum head of 60 feet, while the maximum head for a Stoney gate will be with water at its top, and operation of the gate will always be under balanced head. Except for testing purposes, it is not contemplated that the bulkhead gates will be lifted after once being lowered. Therefore, the gate operating mechanism was designed for controlled and sealed closure rather than for recurrent operation.

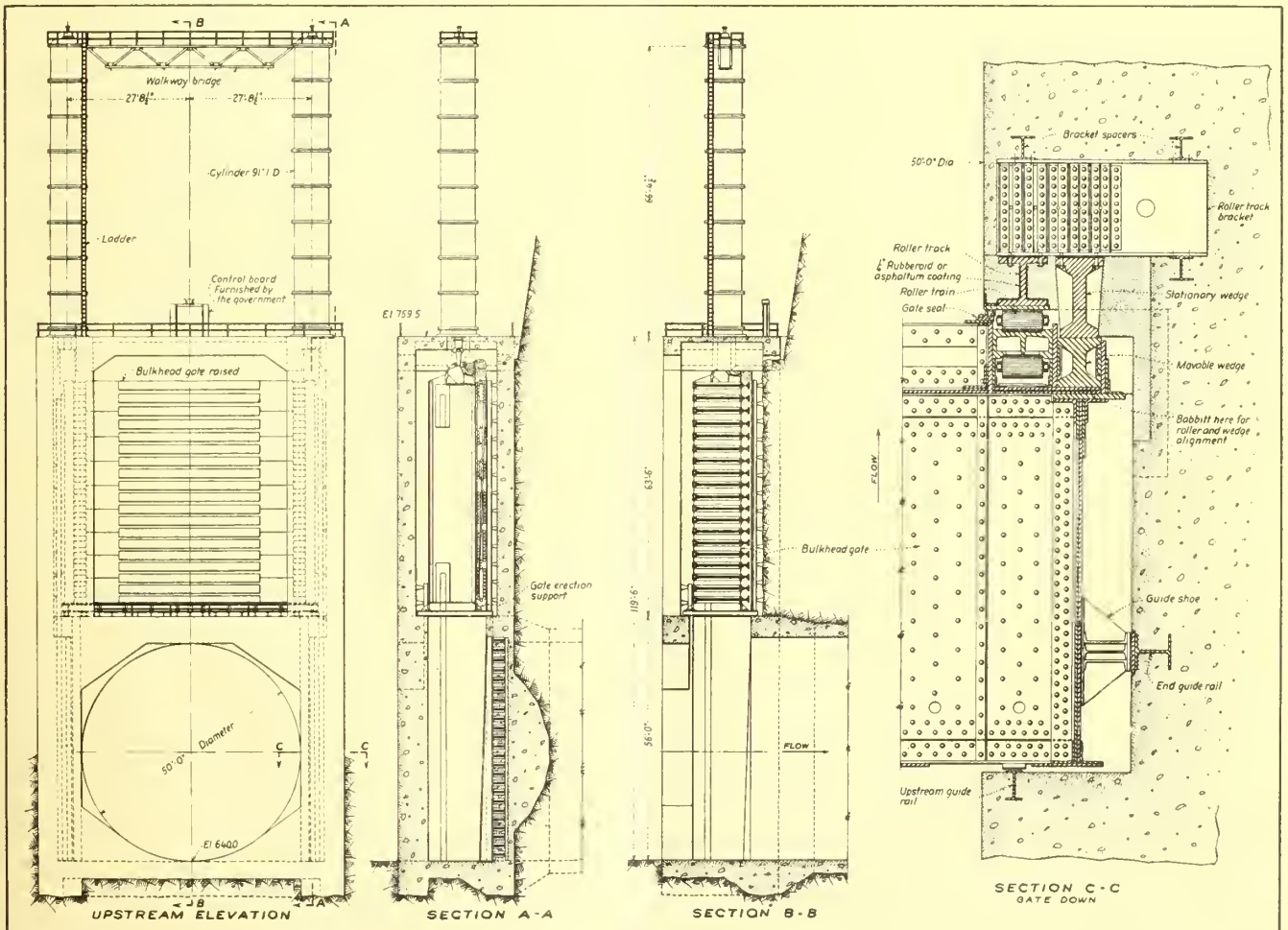
Each bulkhead gate consists of 19 horizontal structural steel girders connected to a vertical girder on each side. The horizontal cross girders are 55 feet 3 inches long and 12 feet 6½ inches wide, and the vertical girders are 50 feet 5½ inches long and 10 feet 6½ inches wide. Connections to the stems of hydraulic cylinders, which control the gate operations, are obtained by extensions of the web plates of vertical girders.

On the upstream side of the gate is a cover plate unit 47 feet wide and 50 feet 6 inches high of 1-inch thick plates riveted to cross girders, and on the exterior face of this unit are nineteen ⅞-inch plates, one for each cross girder. Skin plate units of 1¼-inch thickness are placed between cross girders at a location 10 feet 7½ inches from the upstream face of gate.

The concrete structure for the gate is 119 feet high and contains structural steel guides, brackets, roller tracks embedded in the gate recesses, and cast-steel stationary wedges fastened to the embedded brackets. An assembly recess is located above the tunnel entrance, reaching from 56 feet to 119 feet above the tunnel invert, and a foundation and platform is provided above the assembly recess for two large hydraulic cylinders and a control board for gate operations.

CLOSURE OF BULKHEAD GATES

The gate is erected in raised position in the assembly recess and supported there by steel I beams until time for closure, when the means of support is shifted to lock nuts at the upper ends of hydraulic cylinder stems. When the gate is to be lowered, water will be introduced in the cylinders, the lock nuts will be removed, and by means of a suitable arrangement of piping and valves, the water will be released gradually from the under sides of the pistons by an automatic equalizing device lowering the gate slowly into the closed position.



HOOVER DAM, 50 X 50 BULKHEAD GATE, GENERAL INSTALLATION ASSEMBLY

The hydraulic cylinders are constructed of steel castings, are 69 feet in height and 7 feet 7 inches inside diameter. The pistons and cylinder heads are cast steel and the piston rings are of cast manganese bronze. Maximum piston stroke is 62 feet 5 inches. Each piston stem is a 19-inch outside diameter tube with 1⅞-inch thickness of walls. The cylinders have been designed to withstand a pressure of 290 pounds per square inch.

Six roller trains of caterpillar type are installed on each side of the gate to reduce the operating friction. The carriages are attached to cross girders and the rollers travel upon a high carbon steel seat plate set in the concrete structure. The rollers are 14½ inches long by 8 inches diameter cylinders of Meehanite (a chilled cast-iron alloy) and their axles are of 1½-inch diameter rolled manganese bronze pins.

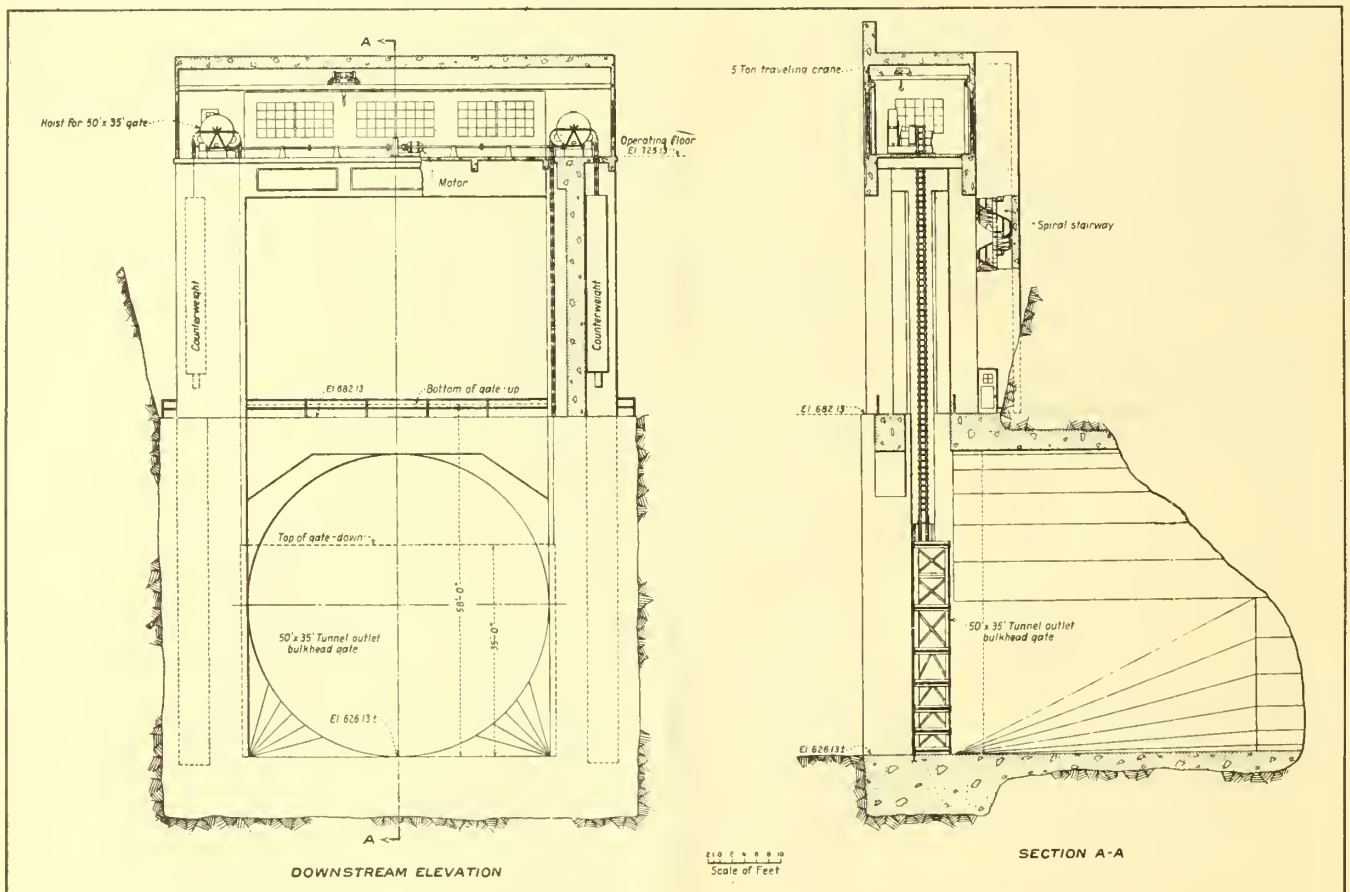
To insure tight closure of the gate and to transmit water pressure directly to the gate structure, freeing the rollers, a movable wedge is provided on each side of the gate for its full height, contacting with the stationary wedge fastened to the gate frame. The stems of the hydraulic cylinders are connected to toggle mechanisms operating the movable wedges so that over travel of the stems, obtained by introduction of water pressure on the top of the cylinders, causes the toggles to force the wedges downward. Both stationary and movable wedges are constructed of cast steel and have a taper of three-eighths inch in 1 foot. Nickel steel was used for the parts of the wedge mechanism.

A corner filler is placed in each lower corner of each gate recess to keep rocks or other obstructions from accumulating in the recess, thus preventing complete closure of the gate. This filler consists essentially of three reinforced concrete slabs laid on a filling of clean sand. The slabs are locked in position and at the time of gate closure will be removed by releasing the locks and pulling the slabs upward and outward from their seats by wire ropes fastened to the slabs. The sand will be jetted from the recess by two jet pipe layouts.

Cooling sprays are provided to reduce the temperature of the metal in the gate, before lowering, to a value as near that of the river water as is practicable. The spray systems consist of three 1¼-inch diameter pipe lines; one placed horizontally above the gate with jets set to spray on the tunnel side of the gate; and the other two lines running vertically within the gate between the upstream cover plate and the skin plate.

Sprays and jets will be operated at a pressure of 100 pounds per square inch. This same force is available for seating wedges and the cylinders can be filled under 220 pounds per square inch pressure. It is estimated that the total amount of water required for lowering each gate will be approximately 98,000 gallons and that the maximum quantity required at one time will be 660 gallons per minute. The cylinders can be filled in 75 minutes and the gate lowered in 45 minutes.

The gate will be sealed in position by a rubber and a bronze seal at the downstream sides and top of the gate and a babbitted seal at the base. The bronze seal is attached by retainers to the cross girders, extends the full height of the gate at its sides and around the top, and is held against the gate frame by a series of coil springs which bear against the seal retainer.



HOOVER DAM, 50 X 35 STONEY GATE, GENERAL INSTALLATION

WEIGHTS AND COSTS

Each of the bulkhead gates weighs 2,180,000 pounds and the weight of the

(Continued on p. 37)

Boulder Canyon Project Notes

Penstock tunnel No. 7 (Nevada) was holed through into the canyon from the No. 2 (Nevada) diversion tunnel on January 14 and No. 5 on January 15. These tunnels are excavated to 21 feet diameter and will be lined with 18 inches of concrete. They will carry 13-foot diameter plate-steel penstock pipes to the power plant turbines. Temporarily the tunnels will be used by trucks to carry out muck from the excavation for the dam foundation.

The Library of Congress, Washington, D. C., has made a loan of 3,000 books to Boulder City as the nucleus for a library. The loan is for an indefinite period, and a room in the municipal building has been made available for library purposes, to be opened late afternoons and evenings. Although primarily for the school children, the books may also be taken out by adults.

During the month of January the project had 7,758 visitors entering the reservation in 3,385 automobiles.

Two 4-yard concrete mixers were received at Boulder City on January 25 for the "hilevel" concrete mixing plant at the dam site. The cost of this plant will exceed $300,000.

Fred C. Snell, of Las Vegas, has been awarded a contract to build 19 houses varying in size from 3 to 6 rooms, for Babcock & Wilcox, the contractors for furnishing and installing the plate-steel outlet pipes. They are being erected in block 14 of Boulder City. Eleven more residences are also to be built in block 28.

On January 24 the swing shift at work on excavation for the foundation of the dam accomplished the record day's work to date. The output for the 8 hours was 1,841 truck loads of muck taken from the river bed, loaded into cars, hauled, and dumped at Williamsville. The trucks used vary from 7-yard Internationals to 16-yard Macks.

Six Companies has moved its suspension bridge from its former location at the upper diversion tunnel portals to a site at the outlets of tunnels Nos. 1 and 2.

On February 1 construction was started on a men's dormitory for employees of the Babcock & Wilcox Co., contractors for fabricating the plate-steel outlet pipes. The dormitory is located on South Cherry Street in block 28 and will contain 79 rooms. It is a 2-story building and is being built by Anderson Bros.

Hi-scaler a Human Pendulum

Louis Fagan, 23-year-old resident of room 2, dormitory No. 2, formerly of Jonesboro, Ark., daily propels his 191-pound body as a pendulum over a 300-foot sheer drop to the floor of the canyon, carrying his fellow workmen, as they are unable to get around a projection on the cliff.

Hanging as he does on a 200-foot rope, he manages to transfer the whole crew working under Shifter Guy "Bulldog" Bray when they come out at lunch time around a particular projection on the perpendicular wall on the Arizona side near the new power-house site.

This feat is accomplished by a face-to-face position in which the man who is being transferred by this human skip locks his legs around the waist of Fagan. Both men get a good grip on the rope and Fagan begins his dare-deviltry by kicking off at a tangent which swings the human pendulum 100 feet out into space and around the projection of the cliff to where they make the high-line cable coming up from the lower portals.

He has been performing this feat of transferring men, according to his declaration, for about three weeks. He is considered by his fellow workmen as a high sealer par excellence. In addition to transporting men after this fashion this fearless hi-scaler carries the dynamite which comes down on the skip to various points where it is loaded into holes.

When footing gets too tough for many another this human fly makes his contribution to the progress of Hoover Dam.—*Las Vegas Age, January 25, 1932.*

The city of Los Angeles has notified Secretary Wilbur, in accordance with provisions of the lease of the Hoover Dam power privilege, that the number of generating units required for the first year of operation will be four. The maximum number ultimately required, in event the States of Arizona and Nevada do not use any of their allotment of power, will be 11. In event the States use all of their allotment, the number of generating units ultimately required will be 13. The above requirements are based on the size of rated capacity of the units being 66,000 kilowatts at the power-plant switchboard operating under a head of 420 feet and that the rated capacity of the electric generators themselves shall be 82,500 kilowatts at unity power factor, or 82,500 kilovolt-amperes.

Boulder City now has a 9-hole golf course. The Black Canyon Country Club has been organized with the following officers: John C. Page, president; H. L. Tucker, vice president; C. M. Voyen, secretary; Gerald Crowe, treasurer; Ralph Lowry, H. L. Tucker, J. F. Reis, W. W. Weed, John C. Page, Gerald Crowe, directors; W. W. Weed, chairman of greens committee; and J. R. Alexander, chairman of handicap committee. The course was in readiness for players on February 5.

On February 8 work was under way in 29 tunnels and adits other then the four 50-foot diversion tunnels with a total footage of 4,389 feet. They include the 8 Nevada penstock tunnels, the 6 Nevada outlets to the valve house, the 6 Arizona outlets to the valve house, and various adits.

Steel Gates in Place

(Continued from p. 36)

gate, hydraulic cylinders, wedges, and steel frame amounts to 3,065,000 pounds. More steel is used in this gate than is ordinarily required for erection of a 12-story office building. Forty-two railroad cars were required for transporting each gate to the project; one girder was loaded to a car, and as the girders extended beyond the length of the cars, empty flat cars had to be inserted between alternate girders. The average weight of a horizontal or vertical girder was 66,000 pounds.

Bolts and rivets required for field erection of a bulkhead gate weighed 29 tons and included 35,300 pounds of 1-inch diameter rivets. Construction of the two cylinders for each gate required 15 tons of stud bolts, each bolt weighing 35.4 pounds.

Exclusive of erection charges, the cost of the two Stoney gates, frames, and hoists was approximately $64,000, and of the two bulkhead gates, frames, and hydraulic hoists approximately $266,000.

Inquiries by mail and in person continue to be received on the Sun River project from prospective settlers.

Notes for Contractors

Owyhee project.—Eighteen firms submitted bids for furnishing gate hoists, stems, gear sets, and shafting, as called for under specifications No. 583–D, at the opening on January 20 at Denver. The following were the low bidders f. o. b. factory: Item 1—8:1 gate hoists and shafting John W. Beam, Denver, Colo., $960; item 2—radial gate hoists and shafting, Marion Machine Foundry & Supply Co., Scottdale, Pa., $931.50; item 3—miter-gear sets and bevel-gear transmission, Marion Machine Foundry & Supply Co., $449.90.

Palo Verde irrigation district.—At the opening of bids under specifications No. 584–D at Yuma, Ariz., on January 30, Geo. Herz Co., Platt Building. San Bernardino, Calif., submitted low bid of $17,430 or $0.083 per cubic yard for the raising of about 11 miles of Colorado River levee, involving 210,000 cubic yards of earthwork. Seven bids were received.

Boulder Canyon project.—Twenty-two companies submitted bids for furnishing cylinder gates and entrance liners for the intake towers at Hoover Dam (specifications No. 541) at the opening at Denver on January 27. The low bid under item 1 covering entrance liners, bulkhead gate seats, and gate sills was submitted by the Goslin-Birmingham Mfg. Co., of Birmingham, Ala., $56,000. Under item 2 for furnishing upper and lower cylinder gates, nose and throat liners, and other appurtenances the Westinghouse Electric & Manufacturing Co., of East Pittsburgh, Pa., submitted the low bid of $334,737. Both of these bids were f. o. b. factory. The bids under item 1 varied from $56,000 to $154,400 and under item 2 from $334,737 to $592,600. In considering items of evaluation and figuring the lowest delivered cost to the Government, it was found that the bids of Goslin-Birmingham and Westinghouse were low, and on February 9 the secretary approved award of contracts to these two concerns.

A preliminary draft of specifications for the main power house and machine-shop cranes (300-ton and 100-ton) has been completed and copies have been forwarded to the major crane manufacturers, electrical manufacturers, and other interested parties for comment. A preliminary draft of specifications for the first group of generators for the power plant has also been completed and sent to interested parties for comment. Work is in progress on detail drawings for 120-inch and 168-inch butterfly valves and hydraulic operating mechanism; also on detail drawings of the 100-foot by 16-foot drum gates for the spillways.

The date for receiving bids under specifications No. 540, Hydraulic Apparatus for Hoover Power Plant, was extended from February 3 to March 1. This change in the opening date was made at the request of the Bureau of Power and Light of the City of Los Angeles in order to afford the city time to make final decision whether the generating equipment to be installed for the city will be designed for both 50 and 60 cycle operation or for 50-cycle operation only.

Minidoka project.—Specifications No. 585–D have been issued, and bids have been invited on furnishing one vertical motor-driven pumping unit having a capacity of 5 second-feet under a maximum static head of 10 feet, for the McLean drainage pumping plant. Bids will be received at the Denver office until March 3.

Yuma project.—On March 3 bids will be received at Denver, Colo., for furnishing at the factory shipping point one ditch-cleaning machine of the caterpillar-crawler traction type to be used in cleaning canals and laterals. The specifications are numbered 586–D.

Huge Traveling Cranes Installed by Babcock & Wilcox

Two huge traveling cranes, among the largest in the world, with an 85-foot span, arrived in Boulder City yesterday and are being installed by Babcock & Wilcox in the steel fabrication plant being erected at Bechtel siding. Two sister cranes (huge machines), each of which can lift 112 tons of steel and transport the weight from any point in the 670-foot steel plant, are but one part of the expensive equipment to be installed in the plant where the big sections of penstock tunnel piping will be rolled.

With four electric motors on each crane, to operate crane and lifts, the cranes will move on two heavy steel runways which are being built along either side of the steel-framed building, high above the floor. The carriages will support the 85-foot span of steel structure, and moving along on the span will be lift machinery to control leads. Thus there will be possible motion the long way of the plant, the entire cranes moving on the runways, motion across the plant and motion up and down.

Among other equipment soon to arrive are air compressor and switching gear for the transforming station. These are expected to arrive on the scene some time next week for installation.

The framework of the plant has been finished and the building is well along toward completion. The power lines and transformers from the substation to the fabrication plant will be completed some time next week, it is expected.

The capacity of each of the cranes which arrived yesterday is rated at 75 tons, but they can carry overload, bringing the total to 112½ tons, it is explained. (Las Vegas Evening Review-Journal, January 21, 1932.)

Articles on Irrigation and Related Subjects

Butler, Millard A.:
Irrigation in Persia by Kanats, illus., Civil Engineering, February, 1933, v. 3, No. 2, pp. 69–73.

Dana, Marshall N., president:
Federal reclamation projects. (Statement introduced by Hon. Frederick Steiwer), Cong. Record, Jan. 28, 1933, v. 76, No. 43, pp. 2907–2909. (Issued in mimeographed form.)

Davis, Calvin V.:
Water conservation the key to national development, illus. Sci. Am., February, 1933, pp. 92–95.

Eng. News-Record:
Turning the Colorado (editorial), Eng. News-Record, Feb. 2, 1933, v. 110, p. 139.

Glaha, B. D.:
Communal growth of home city of dam builders (Boulder City), U. S. Daily, Jan. 16, 1933, v. 7, p. 8 (p. 1996).

Kniffen, Fred B.:
The natural landscape of the Colorado Delta, illus., Univ. of Calif. Press Bulletin, 1932, pp. 149–220.

Mitchell, L. H.:
Items of heavy expenditure in farm budget. U. S. Daily, Feb. 6, 1933, v. 7, No. 263, p. 8 (p. 2118).

Power:
Air conditioning for Hoover Dam concrete tests, chart, Power, February, 1933, v. 77, p. 69.

Ridgway, Robert:
A contributor to construction progress, Biography on resignation. Contractors and Engineers Monthly, January, 1933, v. 26, No. 1, p. 35.

Walter, R. F.:
U. S. Bureau of Reclamation projects (Progress in 1932), illus. Western Cons. News, Jan. 10, 1933, v. 8, No. 1, pp. 23–24.

Wilbur, Ray Lyman:
Caution in taxation advised to prevent burden on homes. U. S. Daily, Jan. 27, 1933, v. 7, No. 257, pp. 1 and 4 (pp. 2061 and 2064).

A Cow on Every Farm[1]

By L. H. Mitchell, Assistant Director of Reclamation Economics

ON ALL of the Federal reclamation projects there are settlers who have no livestock, and presumably they are convinced that milk cows are out of place on their farms. Some of the reasons often given for this conviction are (1) the climate is not favorable; that is, it is either too hot in some localities, or it is too cold in others; (2) the flies and mosquitoes during certain periods of the year molest the milk cows so that they can not secure the greater part of their feed from pastures; (3) it is cheaper to buy milk from the local dairymen or to use canned milk than to feed and take care of a cow; (4) milk cows are a bother and interfere with the important duties of a farm.

There are few, if any, localities in the United States where the climate is at all times ideal for keeping cows. The difficulties resulting from extreme heat or cold can be overcome or at least ameliorated if inexpensive sheds or barns are provided. In some localities during that period of the day when such pests are most active, the same shelter used for extreme cold or hot weather will likewise be valuable for protection against these pests. When we realize that cows in some of the most famous dairy herds in the country are never allowed to roam or feed from a pasture, it would appear to be practicable for a farmer to keep one or two cows in the stable for the brief period called "the mosquito season."

Generally, farmers most opposed to looking after dairy cows are those who are operating large farms, that is, tractor farmers, who as a rule are the ones contributing most to the so-called surplus. They work long hours during the planting and harvesting seasons, usually three to five months a year, and take life easy the rest of the time. What manufacturing or business establishment can operate successfully by letting such establishment take care of itself more than half of each year?

If the farmer considers the time consumed in the care of his cow as valuable as the time consumed in major farming operations, then he may prove that milk for the family table is cheaper when purchased from dairymen. On the other hand, if he will value that time the same as he would time occupied in shaving, repairing the family car, and similar duties that are a part of the day's work, he will find that a cow or two on his place would be a splendid investment.

We may compare the time spent in taking care of the cow to the time consumed by a business man in walking to his work. In days of prosperity the business man rode to work. Now, however, many are walking. We must adjust our standards of living to the times, so it seems fitting to suggest that now is the time for the farmer to get his dairy supplies from his own cow.

Unquestionably the welfare of the various sections of the country is interdependent; however, when considering the fact that in 1931 two carloads of canned milk were received in one of our project towns of less than 1,500 population surrounded by farms, we wonder if there is not something wrong with the economic set-up.

THE OTHER SIDE OF THE PICTURE

The most contented settlers— the home builders—invariably consider the cow just as essential as the plow, the cultivator, or the automobile. Some of the benefits resulting from having a few milk cows on a farm or a farm laborers' allotment are: (1) The cow furnishes fresh milk, from which are derived cream, butter, and cheese, which are very essential to the health and happiness of all, especially the children; (2) the by-products, such as skim milk and buttermilk supply some of the necessary food for a pig, which will in time be converted into fresh pork; for a calf that with very little extra care will soon grow to be converted into cash; and for a few hens to furnish the family table with fresh eggs and poultry meat. Experiments have been made which indicate that two gallons of skim milk equal a pound of meat scraps in the poultry ration.

It is true that it takes time to properly care for a calf, a pig, or chickens. However, if the farm is a home, as it should be, and if the farmer produces most of his living on the farm, then he is both a consumer and a manufacturer. Let us picture a farm home where each member of the family has a chore to perform. This farm plays a part in the general welfare of the Nation that is comparable to a modern automobile-assembling plant. Can one conceive of any place where the home life would be more congenial or more conducive to greater happiness and contentment than this?

It may be argued that one or two cows are a nuisance and that the farmer should have five or six, or possibly a dozen or more in order to have some dairy products for sale. In answering the question, How many cows should there be on a farm? it is necessary to know the size of the family, the number of irrigable acres and the various classes of land on the farm, and the distance from town and market for dairy products.

For a family of six, two good cows should be sufficient to supply the family table with dairy products. When a farmer has more cows than are needed for supplying the family table, a little bookkeeping is necessary to determine the number required for the most efficient operation. Probably no item for a successful dairy business is as important as a good pasture and the number of acres in a tame pasture is largely governed by the irrigable area of the farm and the type of farming to be followed. As a final answer to the question, How many cows should there be on the farm? it is suggested the farmer answer this by growing and not by going into the dairy business. He should keep books and let

[1] See illustrations on front and back cover pages.

the ledger be the answer to this question. Pay as you go. Interest on borrowed capital has ruined many a happy home. In conversing on this subject with a project dairyman, his answer to this question was "Many small dairymen who are located several miles from market, with no neighboring dairymen with whom they can cooperate in marketing their products, are operating at a loss. The principal item of expense is the cost of operating the truck used in transporting the dairy products from the farm to market. Some farmers like an excuse that will call them to town often and incidentally they take a little butterfat with them. During these times they are doing so at a loss."

There is another factor that plays an important part in determining the practicability of keeping cows on a farm, and that is the determination of the kind of cow best suited to the family or market needs. Milk cows are "machines" for converting hay, grain, etc., into milk. Like any mechanical device, to secure the best results the cow must be efficient and well taken care of. The dairy farmer, like the business man, has keen competition, therefore he should strive to reduce production costs. This means acquiring cheap feed and keeping good cows. Keeping a cow or two does not mean one must be a dairyman.

In times like the present the cow is the economic shock absorber. At the prevailing market price of feed and butterfat, it is evident that a good cow will give the owner something for his investment and labors. The following tabulation has been prepared from various sources, and the writer will be glad to receive comments as to its correctness:

Cost per year of keeping a good cow (not a prize winner):	
4 tons of alfalfa at $4.85 per ton (average all projects)	$19. 40
1 ton of grain at 70 cents per hundredweight (average all projects)	14. 00
Tame pasture—1 acre for 3 cows at $5.55 per acre (average all projects)	1. 85
Salt and miscellaneous items	2. 00
Total cost of feed	37. 25
Other items of cost:	
Interest on investment,[1] taxes, insurance, depreciation, etc.	12. 25
Grand total cost	49. 50
Returns from 1 cow:	
300 pounds of butterfat at 15 cents	45. 00
6,000 pounds of skim milk at ¼ cent	15. 00
Total	60. 00
Allowance for labor	10 50

In closing, the readers of this article may be interested to know that milk, eggs, and other home products are as healthful and appetizing now as when war prices prevailed.

[1] All investments at present are not paying interest.

Value of Scrub Cow to the Lazy Farmer

1. She consumes a lot of cheap feed so that I need not haul it to market.
2. She reduces my taxes as her value is low.
3. If she dies I do not lose very much.
4. It takes very little time to milk her.
5. She is dry a large part of the year and doesn't require any care.
6. She never yields much milk and does just about as well on corn and fodder as she does on balanced rations.
7. It makes little difference whether or not I milk her on Sunday.
8. I am never pestered by neighbors who want to buy her.
9. She keeps down the surplus of dairy products and in this way is no small economic force in the agriculture of the Nation.
10. I never have to sit up nights worrying what to do with all the money I get from my cream check.—*Extension Service.*

A recent report from the Sun River project states that the Montana Wool Growers Association which held its annual convention at Great Falls, Mont., expressed confidence in the industry, optimism for the future, and the "fighting spirit of '65." These were the dominant factors most evident at the convention.

Advertising Brings Results on the Kittitas Division

The advertising campaign which is being conducted by the Chamber of Commerce at Ellensburg, Wash., in cooperation with the land departments of the Northern Pacific and Milwaukee, St. Paul & Pacific Railroads, is accomplishing satisfactory results. A recent report from Ellensburg states that an average of 77 inquiries per day were received in January. The campaign was launched the latter part of November, and in early January 1,741 inquiries had been received.

A large number of the inquirers were sufficiently interested to follow their first letters with requests for additional information, and many of them sent in lists of other persons desiring literature relating to the valley and its opportunities. More than 98 per cent of those writing a second time have spent the greater part of their lives on farms, and the majority claim to have some cash as well as farming equipment and livestock.

Personal visits to the project have also been made, and on February 1 four Hollanders and their families, with 65 head of Guernsey cattle and 30 head of heifers, moved in.

The campaign promises to be a highly successful one.

Is Cow Testing Valuable?

Here are the official figures on Montana dairy herd improvement associations as compiled by the Bureau of Dairying for the 1930–31 season:

There were 7 associations with 1,239 cows being tested for the 12-month period.

These cows produced an average of 8,352 pounds of milk containing 321 pounds of butterfat valued at $123.

The average feed cost was $71 and the average income over feed cost $52 per cow.

These cows represent only 1 per cent of the total number in the State, yet, they produced over 10,000,000 pounds of milk containing 397,114 pounds of butterfat, valued at more than $150,000.

They furnished a market for about $88,000 worth of feed and returned $64,000 over feed costs.—*Sidney (Mont.) Herald.*

Relief to Reclamation Areas

The following resolution relating to reclamation was unanimously adopted at the fourteenth annual convention of the Associated General Contractors of America at Detroit, Mich., on January 18, 1933:

"Whereas economic conditions make it impossible for settlers in certain reclamation areas to meet their obligations; and

"Whereas it appears necessary that Congress grant a moratorium on such obligations; and

"Whereas such moratorium will deplete the reclamation revolving fund used to continue additional improvements now under way in these areas; and

"Whereas a stoppage of these works in their present stage of completion would be uneconomic and would create an unemployment problem in these sparsely settled regions: Therefore

"*Be it resolved by the Associated General Contractors of America in convention assembled at Detroit, January 18, 1933,* That Congress be urged to authorize loans to this reclamation fund in order that works now under construction can be carried to completion to serve a useful purpose, preserve the investments already made, and provide employment for the settlers."

☆

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
Northcutt Ely, Charles A. Dobbel, and **William Atherton DuPuy,** Executive Assistants

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walter R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent		F. C. Bohlson	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Sotutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. constr. engr.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	H. A. Parker	do		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

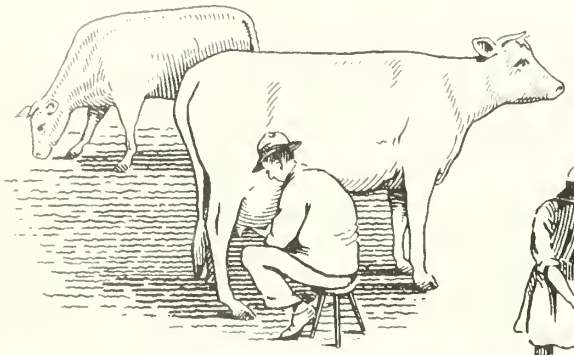
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont		Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	D. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg		Reservoir supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah	D. D. Harris	Manager	D. D. Harris	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	F. G. Hart	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver, Wyo.

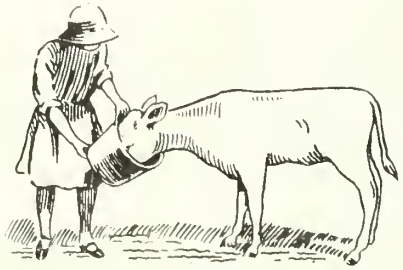
Important investigations in progress

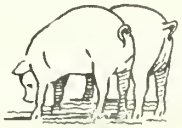
Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Federal Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Winnemucca, Nev	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	Denver, Colo., Customhouse	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Idaho Falls, Idaho	F. F. Smith	None.

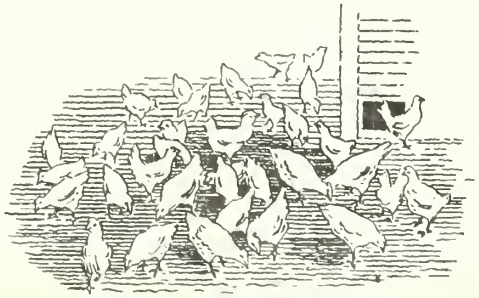
SALLIE A. B. COE, *Editor.*

TWO GOOD COWS WILL PRODUCE ENOUGH SKIM-MILK TO FEED





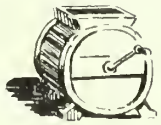


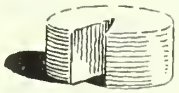


1 Calf — 2 Pigs — 50 Hens

AND

Dairy Products for the Family Table





E. A. DACEY

SEE FRONT COVER AND PAGE 39

U. S. GOVERNMENT PRINTING OFFICE 1933

I 27.5

THE RECLAMATION ERA

VOL. 24, NO. 4 APRIL, 1933

CLEMSON COLLEGE LIBRARY
GOVERMENT PUBLICATIONS

CLEMSON COLLEGE LIBRARY
GOVERMENT PUBLICATIONS

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

The Value of a Home

THE goal of personal ambition, the center of our social structure, the foundation of our commerce and industry, is the home. By the number and stability of our homes will we measure our social and economic progress. Home ownership is fundamental to permanency of our State and Nation.

Through the movement of our surplus population to new homes on the frontier we have "come up" from previous depressions. The West again offers that frontier in its unmeasured acres of potentially irrigable lands upon which can eventually be founded an agricultural empire comparable to that in the central Mississippi Valley. The outstanding advantage of this frontier is its elasticity and susceptibility to controlled expansion as the need arises.

The issues are clouded today as they have been during previous and similar periods of our history. Similar expansion has been opposed in the past and we are confronted with opposition today. The fears that prompted that opposition were groundless as history has proved and will prove again.

—From the Report of the "Montanans, Incorporated,"
Committee on Irrigation.

THE
RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 24, No. 4

APRIL, 1933

Harold L. Ickes
Secretary of the Interior

HAROLD L. ICKES, who became Secretary of the Interior on March 4, 1933, under appointment of President Roosevelt, is of a family that has been Pennsylvanian on both his mother's and father's side for close to 300 years.

The Ickes, who founded the line from which the new Secretary has sprung, was one of those who came to America with William Penn on one of his voyages. He settled in the Perkiomen Creek region in Montgomery County, near Philadelphia. Mr. Ickes' great-grandfather, Nicholas Ickes, became a soldier in the Revolutionary War at the age of 16, and after the war took up land in Perry County. The town of Ickesburg in that county is located on what was the original farm of Nicholas Ickes, who, with his wife, is buried in the cemetery there.

John Loy Ickes, son of Nicholas Ickes, and grandfather of Harold L. Ickes, moved farther west to Blair County, where he located with his family in Altoona. Mr. Ickes' father was Jesse B. W. Ickes, who at the time of his death a decade ago was comptroller of Altoona.

Mr. Ickes' mother was Martha Ann McCune. Her family was Scotch on both sides, the original spelling of the name being McEwen. The McCune family, with other Scotch Presbyterians, had penetrated to the foothills of the Allegheny Mountains before the Revolutionary War and was one of the oldest families in that section. Mr. Ickes' maternal great-grandfather, Joseph McCune, served as a judge for Huntington County before Blair County was cut out of Huntington County, for a period of 36 years.

Harold Ickes was born March 15, 1874, on the farm of his maternal grandfather, Seth R. McCune, in Frankstown Township, Blair County, near Hollidaysburg. He was 16 years old when, upon the death of his mother, he went to Chicago to live with a maternal aunt. There he entered the Englewood High School, where he completed a 4-year course in three years, following which he matriculated at the then new University of Chicago, through which he worked his way, mainly by teaching in the public night schools, graduating in 1897 with an A. B. degree.

After finishing college, Mr. Ickes went to work as a cub reporter on the old Chicago Record, the morning paper of the late Victor F. Lawson. He became assistant sporting editor on that paper and later, when a vacancy occurred in the political department, he applied for the job and got it. Malcolm McDowell, who until recently was Secretary of the Board of Indian Commissioners in the Department of the Interior, and who recently returned to the newspaper game, was Mr. Ickes' chief in the political department. Frederick William Wile, the well-known news broadcaster in Washington, was a fellow cub reporter with Ickes. The latter also worked on the Chicago Tribune and Chronicle. As one of the political staff of the Record, he helped to cover the Republican National Convention in 1900 in Philadelphia, and the Democratic National Convention in Kansas City, Mo.

But Ickes' ambition had always been to be a lawyer, and after working as a reporter and participating in one or two political reform movements for a short time, he went back to the University of Chicago, where he entered the law school, from which he graduated *cum laude*, with the degree of J. D., in 1907, being admitted to the bar immediately thereafter.

Mr. Ickes was a senior in the university when he took part in his first political campaign in the spring of 1897. Chicago was tremendously stirred, and has been many times during the years since, over a public-utility question. Charles T. Yerkes was reaching out for power and attempting to obtain franchise grants that many of the citizens felt were against the public interest. John Maynard Harlan, son of the late Mr. Justice John Marshall Harlan, at that time serving as a member of the city council, decided to run as an independent Republican for mayor against the political machines. His headquarters sent out an appeal for volunteers and Ickes dropped his academic pursuits and reported at headquarters for the balance of the campaign. He supported Harlan actively in two or three subsequent campaigns.

In 1911, Ickes suggested to Prof. Charles E. Merriam, of the University of Chicago, that he, Merriam, run for the Republican nomination for mayor. Merriam agreed to do this if Ickes would manage his campaign. There followed one of the most spectacular campaigns ever conducted in Chicago, the result of which was to register at the hands of a volunteer organization, a smashing defeat of the Republican machine, all along the line. Merriam was nominated against the will of the politicians, with the result that the Republican organization knifed him at the polls, and Carter H. Harrison was elected for his fifth and last term.

When the Progressive movement came along in 1912, the volunteer organization that had been built up by Ickes as manager of the Merriam campaign, was ready to function. This organization constituted the local shock troops in the 1912 fight. In that campaign, Joseph M. Dixon, then Senator from Montana, was Roosevelt's national manager, and Ickes was chairman of the Cook County organization, in charge of the campaign in that county. When Mr. Ickes came to Washington 21 years later, he found Dixon functioning as First Assistant Secretary of the Interior. In the 1912 election, Theodore Roosevelt carried Cook County by a majority of 27,000 although he failed to win in the State as a whole.

Ickes continued to be active in the Progressive ranks. He became State chairman, national committeeman, and a member of the national executive committee, occuying the three last-named offices at the same time. He wanted the Progressive Party to fight the thing through, in the belief that if it only stuck it out for one or two elections, it would

become one of the major parties of the country. He was a delegate at large to the Progressive National Convention that was held in Chicago in 1916, and was one of those who opposed George W. Perkins in his effort to prevent the Progressive convention from making any nomination until after the Republicans had nominated. It will be remembered that both the Republican and the Progressive conventions were being held simultaneously in Chicago, the former at the Coliseum, and the latter in the Auditorium Theater.

After Theodore Roosevelt refused to run as the Progressive Party's candidate, Mr. Ickes joined with those who favored the candidacy of Charles E. Hughes. Instead of permitting the Republican National Committee to conduct his campaign, Mr. Hughes set up a campaign committee consisting of nine regular Republicans and six Progressives. Mr. Ickes was one of the Progressives designated by Mr. Hughes on this campaign committee. He was connected actively with western headquarters at Chicago during the campaign and was intrusted with the particular duty of working with the former Progressives. But the old-line Republicans successfully blocked every effort of Ickes effectively to organize the Progressives. Ten days before the election Ickes wrote an analysis of the situation in the West, State by State, which he sent to the national chairman, the western chairman, and to George W. Perkins. This analysis showed that Hughes would in all probability lose. He set down as the reason for this the contemptuous and high-handed treatment that regular Republicans were according the Progressives everywhere.

In 1920, Mr. Ickes was a delegate-at-large from Illinois to the Republican National Convention. He supported Frank O. Lowden until the latter withdrew and then, on the final ballot, voted for Hiram W. Johnson. After Senator Harding was nominated, he was one of the handful who voted "no" on the motion to make the nomination unanimous. Ickes believed that the nomination of Harding violated every principle for which the Progressives had stood ever since 1912, and he particularly resented the slur that Harding had cast upon Theodore Roosevelt. He concluded that he could not conscientiously support the Republican candidate. Accordingly, he wrote a statement in support of the Democratic candidates, Cox and Roosevelt, which was circulated by the Democratic National Committee as a campaign document.

In this connection it is interesting that in advance of the Democratic Convention, Ickes strongly urged upon George E. Brennan, the Illinois Democratic leader, that the best man who could be named for Vice President on the Democratic ticket was Franklin D. Roosevelt, of New York, and it will be remembered that Mr. Brennan supported and worked for Mr. Roosevelt in the convention for that office.

In 1924 Mr. Ickes was in charge in Illinois of Hiram W. Johnson's candidacy for the Republican nomination. Despite the fact that Senator Johnson was running against Calvin Coolidge, who was President at the time, and notwithstanding the lack of funds and organization, Johnson ran up a tremendous vote in Illinois, and actually elected five delegates. Later, when the Frank L. Smith-Samuel Insull scandal broke, Mr. Ickes urged Hugh S. Magill, a former State Senator, to run as an Independent candidate for the United States Senate and he managed Magill's campaign.

In the 1928 campaign, Mr. Ickes was inactive, but he voted for Alfred E. Smith.

In the recent campaign Mr. Ickes was chairman of the western Progressive headquarters, and worked actively for the Democratic national ticket in the Western States.

In addition to his national political activities, Mr. Ickes has always been particularly interested in local and State politics. He has opposed William Hale Thompson consistently. When Judge William E. Dever was nominated for mayor by the Democrats and subsequently elected, Mr. Ickes organized a group of Independent Republicans and carried on an active campaign in his support. He repeated this at the end of Mayor Dever's term, and he also supported the late Anton Cermak for mayor.

From 1897 on, when Mr. Ickes first became interested in municipal politics, he has fought for municipal reform and has taken a positive stand on all public utility issues. In 1930 when Samuel Insull was seeking a perpetual street railway franchise which Mr. Ickes regarded as particularly iniquitous, he became president of the Peoples' Traction League and waged a vigorous battle against Insull and what he represented in the political and social life of Chicago and Illinois. At this time, Insull was at the height of his power, and only a bare handful of men and women could be found who had sufficient courage and vision to oppose him. Mr. Ickes helped to organize and has served as a director of the Utility Consumers' and Investors' League of Illinois, which is engaged in a fight for fair utility rates.

In 1920 an attempt was made to give Illinois a new constitution of an extra conservative type. Mr. Ickes helped to organize a group of which he became chairman to oppose this proposed constitution. It was beaten at the polls by a majority of three-quarters of a million votes.

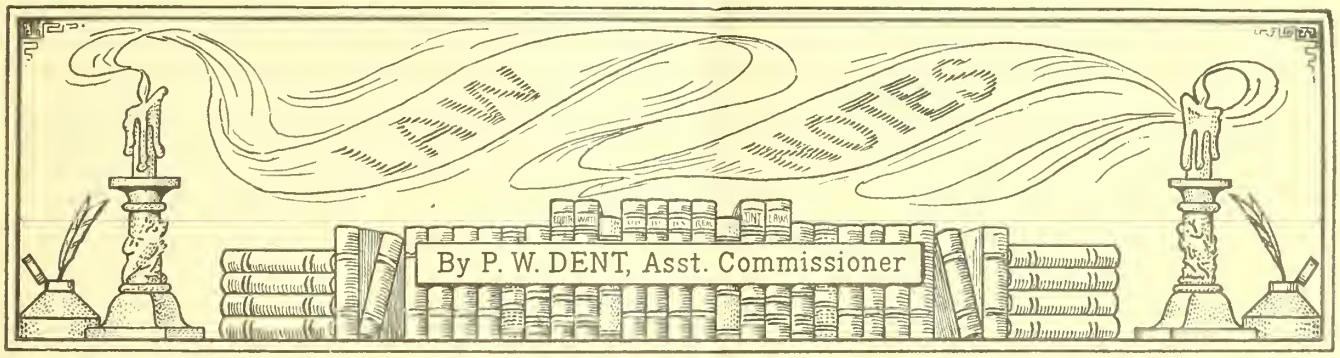
Shortly after the World War broke out, Mr. Ickes was put in charge of patriotic propaganda, which was one of the principal subdivisions of the Illinois State Council of Defense. But he was anxious to get abroad. He was offered an Army commission and an assignment to the War Department in Washington but declined, and accepted instead, a chance to go overseas for the Y. M. C. A. In France he was attached to the Thirty-fifth Division, with which he served in Alsace-Lorraine and in the final drive in the Argonne. At the head of the Y. M. C. A. unit attached to the Thirty-fifth Division was former Senator Henry J. Allen, of Kansas. Mr. Ickes was next in line to Senator Allen and was in full charge during a long and serious illness of his chief.

Although over age and a married man with a family, Mr. Ickes wanted to get into active service and at the time of the armistice he was in Paris on his way to General Headquarters with a recommendation from the general in command of the Thirty-fifth Division that he be given a commission as captain and sent back to the division for service in the commissary department. The armistice changed the situation and shortly thereafter Mr. Ickes returned to Chicago.

In 1911 Mr. Ickes was married to Anna Wilmarth Thompson and they have four children, three sons and a daughter. Wilmarth, the eldest son, is married and has three children. The daughter, Mrs. Requa Bryant, is also married and lives in Evanston, Ill. The two younger sons are Raymond, a sophomore at the University of Chicago, and Robert, a freshman at Lake Forest College. The family home is at Winnetka, Ill. Mrs. Ickes is a Republican member of the Illinois State Legislature from her district, serving her third term.

Mr. Ickes is a member of the National Roosevelt Memorial Association, was president of the Roosevelt Memorial Association of Greater Chicago, is a former president of the Chicago Forum Council, and belongs to the American Bar Association, and Phi Delta Theta and Phi Delta Phi fraternities. He is a member of the University Club of Chicago, the Congressional Country Club, Indian Hill Club, and Shawnee Country Club.

He does not play golf. Tennis has always been his game but insistence of his doctors has forced him to give it over. Gardening has long been his hobby and he knows much of the choice and cultivation of plants and shrubs. For a number of years he has specialized in the cultivation of dahlias. In fact he was one of the first to go in for dahlias on an extensive basis in the Chicago region. He has originated a number of varieties of his own, one of which, Anna W. Ickes, has received a certificate of merit from the American Dahlia Society and has been patented under the new law. Influenced by his son, Raymond, he some years ago became interested in stamp collecting and has added many specimens to his son's collection.



Act of February 17, 1933, Making Appropriations for Bureau

[*Public No. 361—72d Congress*]

AN ACT Making appropriations for the Department of the Interior for the fiscal year ending June 30, 1934, 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 following sums are appropriated, out of any money in the Treasury not otherwise appropriated for the Department of the Interior for the fiscal year ending June 30, 1934, namely:

Office of the Secretary

SALARIES

Salaries: For the Secretary of the Interior, First Assistant Secretary, Assistant Secretary, and other personal services in the District of Columbia, $372,420: *Provided,* That in expending appropriations or portions of appropriations, contained in this act, for the payment for personal services in the District of Columbia in accordance with the classification act of 1923, as amended, with the exception of the First Assistant Secretary and the Assistant Secretary the average of the salaries of the total number of persons under any grade in any bureau, office, or other appropriation unit shall not at any time exceed the average of the compensation rates specified for the grade by such act, as amended: *Provided,* That this restriction shall not apply (1) to grades 1, 2, 3, and 4 of the clerical-mechanical service, or (2) to require the reduction in salary of any person whose compensation was fixed, as of July 1, 1924, in accordance with the rules of section 6 of such act, (3) to require the reduction in salary of any person who is transferred from one position to another position in the same or different grade in the same or a different bureau, office, or other appropriation unit, (4) to prevent the payment of a salary under any grade at a rate higher than the maximum rate of the grade when such higher rate is permitted by the classification act of 1923, as amended, and is specifically authorized by other law, or (5) to reduce the compensation of any person in a grade in which only one position is allocated.

CONTINGENT EXPENSES, DEPARTMENT OF THE INTERIOR

(Appropriations are then made for certain departmental contingent expenses) and other absolutely necessary expenses not hereinbefore provided for, $85,000; and, in addition thereto, sums amounting to $34,000, for stationery supplies shall be deducted from other appropriations made for the fiscal year 1934, as follows: General Land Office, $4,500; Geological Survey, $5,500; Freedman's Hospital, $1,000; St. Elizabeths Hospital, $2,900; National Park Service, $8,100; Bureau of Reclamation, $12,000, any unexpended portion of which shall revert and be credited to the reclamation fund; and said sums so deducted shall be credited to and constitute, together with the first-named sum of $85,000, the total appropriation for contingent expenses for the department and its several bureaus and offices for the fiscal year 1934.

For the purchase or exchange of professional and scientific books, law and medical books to complete broken sets, periodicals, directories, and other books of reference relating to the business of the department, $500, and in addition there is hereby made available from any appropriations made for any bureau or office of the department not to exceed the following respective sums: Indian Service, $500; Office of Education, $1,800; Bureau of Reclamation, $2,000; Geological Survey, $3,000; National Park Service, $1,500; General Land Office, $500.

PRINTING AND BINDING

For printing and binding for the Department of the Interior, including all of its bureaus, offices, institutions, and services in the District of Columbia and elsewhere, except the Alaska Railroad, the Geological Survey, and the Bureau of Reclamation, $135,000, of which $35,000 shall be for the National Park Service, and $40,000 for the Office of Education, no part of which shall be available for correspondence instruction.

* * * * *

Bureau of Indian Affairs

IRRIGATION AND DRAINAGE

For payment of annual installment of reclamation charges against Paiute Indian lands within the Newlands reclamation project, Nevada, $5,381; and for payment in advance, as provided by district law, of operation and maintenance assessments, including assessments for the operation of drains to the Truckee-Carson irrigation district, which district, under contract, is operating the Newlands reclamation project, $10,443, to be immediately available; in all, $15,824.

* * * * *

Appropriations herein for irrigation and drainage of Indian lands shall be available only for expenditure by and under the direction of the Commissioner of Indian Affairs, except for such engineering and economic studies and construction work as the Secretary of the Interior decides may be more advantageously performed by the Bureau of Reclamation.

* * * * *

Bureau of Reclamation

The following sums are appropriated out of the special fund in the Treasury of the United States created by the Act of June 17, 1902, and therein designated "the reclamation fund," to be available immediately:

Salaries: For the Commissioner of Reclamation and other personal services

in the District of Columbia, $126,700; for office expenses in the District of Columbia, $20,000; in all, $146,700.

Administrative provisions and limitations: For all expenditures authorized by the Act of June 17, 1902 (32 Stat., p. 388), and Acts amendatory thereof or supplementary thereto, known as the reclamation law, and all other Acts under which expenditures from said fund are authorized, including not to exceed $156,000 for personal services and $15,000 for other expenses in the office of the chief engineer, $20,000 for telegraph, telephone, and other communication service, $5,000 for photographing and making photographic prints, $41,250 for personal services, and $10,000 for other expenses in the field legal offices; examination of estimates for appropriations in the field; refunds of overcollections and deposits for other purposes; not to exceed $18,000 for lithographing, engraving, printing, and binding; purchase of ice; purchase of rubber boots for official use by employees; maintenance and operation of horse-drawn and motor-propelled passenger-carrying vehicles; not to exceed $35,000 for purchase and exchange of horse-drawn and motor-propelled passenger-carrying vehicles; packing, crating, and transportation (including drayage) of personal effects of employees upon permanent change of station, under regulations to be prescribed by the Secretary of the Interior; payment of damages caused to the owners of lands or other private property of any kind by reason of the operations of the United States, its officers or employees, in the survey, construction, operation, or maintenance of irrigation works, and which may be compromised by agreement between the claimant and the Secretary of the Interior, or such officers as he may designate; payment for official telephone service in the field hereafter incurred in case of official telephones installed in private houses when authorized under regulations established by the Secretary of the Interior; not to exceed $1,000 for expenses, except membership fees, of attendance, when authorized by the Secretary, upon meetings of technical and professional societies required in connection with official work of the bureau; payment of rewards, when specifically authorized by the Secretary of the Interior, for information leading to the apprehension and conviction of persons found guilty of the theft, damage, or destruction of public property: *Provided*, That no part of said appropriations may be used for maintenance of headquarters for the Bureau of Reclamation outside the District of Columbia except for an office for the chief engineer and staff and for certain field officers of the division of reclamation economics: *Provided further*, That the Secretary of the Interior in his administration of the Bureau of Reclamation is authorized to contract for medical attention and service for employees and to make necessary pay-roll deductions agreed to by the employees therefor: *Provided further*, That no part of any sum provided for in this Act for operation and maintenance of any project or division of a project by the Bureau of Reclamation shall be used for the irrigation of any lands within the boundaries of an irrigation district which has contracted with the Bureau of Reclamation and which is in arrears for more than 12 months in the payment of any charges due the United States, and no part of any sum provided for in this Act for such purpose shall be used for the irrigation of any lands which have contracted with the Bureau of Reclamation and which are in arrears for more than 12 months in the payment of any charges due from said lands to the United States;

Examination and inspection of projects: For examination of accounts and inspection of the works of various projects and divisions of projects operated and maintained by irrigation districts or water users' associations, and bookkeeping, accounting, clerical, legal, and other expenses incurred in accordance with contract provisions for the repayment of such expenses by the districts or associations, the unexpended balance of the appropriation for this purpose for the fiscal year 1933 is continued available for the same purpose for the fiscal year 1934;

Operation and maintenance of reserved works: For operation and maintenance of the reserved works of a project or division of a project when irrigation districts, water-users' associations, or Warren Act contractors have contracted to pay in advance but have failed to pay their proportionate share of the cost of such operation and maintenance, to be expended under regulations to be prescribed by the Secretary of the Interior, the unexpended balance of the appropriation for this purpose for the fiscal year 1933 is continued available for the same purpose for the fiscal year 1934;

Yuma project, Arizona-California: For operation and maintenance, $47,500; for continuation of construction of drainage, $19,000; in all, $66,500: *Provided*, That not to exceed $25,000 from the power revenues shall be available during the fiscal year 1934 for the operation and maintenance of the commercial system;

Orland project, California: For operation and maintenance, $35,200;

Boise project, Idaho: For operation and maintenance, Payette division, $28,300: *Provided*, That the unexpended balance of the appropriation for continuation of construction, Arrowrock division, fiscal year 1933, shall remain available for the same purpose during the fiscal year 1934;

Minidoka project, Idaho: For operation and maintenance, reserved works, $12,300; for continuation of construction gravity extension unit, the unexpended balance of the appropriation for this purpose for the fiscal year 1933 is continued available for the fiscal year 1934: *Provided*, That not to exceed $50,000 from the power revenues shall be available during the fiscal year 1934 for the operation of the commercial system; and not to exceed $125,000 from power revenues shall be available during the fiscal year 1934 for continuation of construction, south side division;

(To be continued in May issue).

"Boulder Canyon Project Federal Reservation" in the Federal Courts

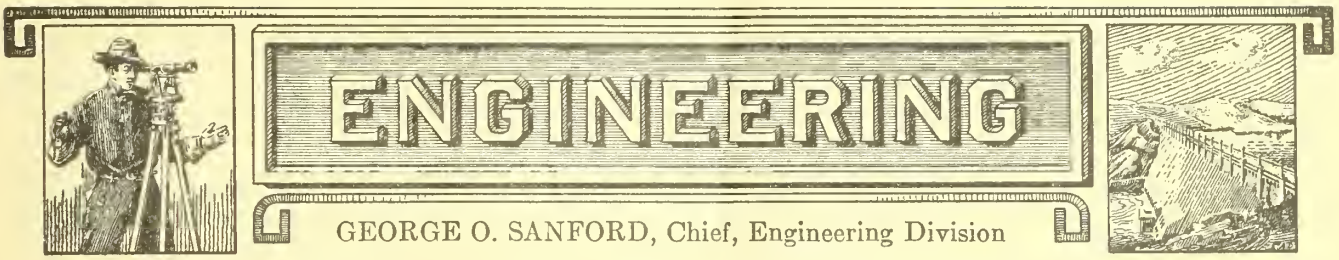
By Nevada Compiled Laws, 1929, secs. 2895–2898, the State of Nevada gave its consent to the acquisition by the United States of exclusive Federal jurisdiction over any land in "this State which has been or may hereafter be acquired for sites for customhouses, courthouses, post offices, arsenals, or other public buildings whatever, or for any other purpose of the Government." The act provides for the filing with the Governor of a plat of such lands "verified by the oath of some officer of the General Government having knowledge of the facts."

On May 26, 1931 there was filed with the Governor of Nevada such a plat of the "Boulder Canyon Project Federal Reservation in Nevada," about 115 miles square, embracing the proposed Hoover Dam and the construction camp in connection therewith, as well as Boulder City, the village that has resulted from the construction activities. The plat was verified by the affidavit of the Secretary of the Interior.

Nevada did not concede the validity of the cession, and proceeded to tax the property in the reservation including the property of the Six Companies (Inc.), the contractor engaged in the construction of the dam. The Six Companies (Inc.), brought a suit in the Nevada Federal Court for an injunction to restrain the assessor from taxing its property.

District Judge Norcross, in decision of February 15, 1933 (not yet published), denied the prayer for an injunction and dismissed the complaint. The grounds

(Continued on p. 52)



GEORGE O. SANFORD, Chief, Engineering Division

Construction of Diversion Cofferdams

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

THE construction of diversion works, to leave dry the river channel where the main structure of Hoover Dam will be built, is rapidly nearing completion. The four 50-foot diameter tunnels that carry the water around the damsite have been excavated and soon will be completely lined for their aggregate length of more than three miles. A temporary dam was thrown across the river downstream from the inlets of the diversion tunnels, and on November 14, 1932, the entire flow of the river was turned through the two tunnels on the Arizona side. Two-thirds of a million yards of earth and rock fill were placed in the upstream cofferdam during the months of November, December, and January, and work is now concentrated on the construction of a similar structure downstream from the dam site.

DESIGN

The cofferdams have been designed of sufficient mass and height to turn a river flow of 200,000 cubic feet per second, the probable maximum discharge of the river during construction of the project. The flow of the Colorado River at Black Canyon usually ranges between 3,500 and 150,000 second feet, although a discharge of 200,000 cubic feet per second may occur in unusual years. The four 50-foot diameter diversion tunnels have a fall of 14 feet from the inlet to outlet and will carry 200,000 cubic feet per second with a water surface elevation of 707 at the inlets, 17 feet above the tunnel roofs, and at elevation 683 at the outlets, 7 feet above the tunnels. The crest elevation of the upper cofferdam was therefore established at 720, giving a minimum freeboard of 13 feet; and the lower cofferdam at 690, or 7 feet above the maximum water surface. The axis of the upper cofferdam is approximately 600 feet downstream from the inlets of the diversion tunnels and 850 feet upstream from the axis of Hoover Dam; the lower cofferdam is 800 feet upstream from tunnel outlets and 1,340 feet downstream from the axis of the dam.

The principal mass of the upper cofferdam is composed of a central section of earth fill 98 feet in height, with a crest width of 70 feet and slopes of 3 to 1, containing over one-half million cubic yards of material. The slopes are protected by a rock blanket and the upstream face is paved with a 6-inch thickness of reinforced concrete. The dam is 480 feet wide, 98 feet in height, and 750 feet thick.

Percolation of water through the upper cofferdam is prevented by the face paving, a steel piling cut-off driven generally to bedrock across the upstream toe, three concrete cut-offs on each canyon wall reaching from base to crest, and rubber fabric seals on both sides and the lower edge of the face paving.

The lower cofferdam is also an earth fill structure which has its upstream face protected by a rock blanket. The dam will be approximately 360 feet wide, 500 feet thick, and 66 feet high. The crest width will be 50 feet, the downstream slope 5 to 1, and the upstream slope 2 to 1. The dam will contain approximately 230,000 cubic yards of earth and 63,000 cubic yards of rock. Two concrete cut-offs from base to crest are to be placed at each canyon wall to lessen percolation between dam and cliffs. The downstream face is not covered by a protective surfacing, since a barrier of 127,000 cubic yards of rock placed downstream from the cofferdam, will act as a buffer against eddy action from the backwash of the river.

PROGRESS OF CONSTRUCTION

To prevent flooding of partially completed work and consequent repetition of construction, it is necessary to build the cofferdams during a single season of low river flow and, as construction of the dams involves the placing of over a million cubic yards of earth and rock, with flash floods causing possible delays, commencement of construction was advisable at the earliest date. Therefore, when the river flow diminished following the flood of early September, construction operations were immediately instituted. A fill of tunnel muck was advanced from the Nevada side of the canyon to the center of the stream, downstream, and back to the Nevada side inclosing half of the upper cofferdam site and forcing the river toward the Arizona side. The inclosed area was pumped dry, a 5-cubic yard electric drag line was brought down from the Arizona gravel deposit, three 3½-cubic yard electric shovels and a fleet of trucks were moved to the site and removal of the silt and sand was started to uncover a consolidated formation suitable for the dam foundation. This formation was discovered at elevation 622, or 18 feet below the river bed and 98 feet below the crest of the dam.

A pile trestle bridge was built across the river immediately downstream from the inlets of diversion tunnels and as soon as tunnel No. 4 was opened for river flow, trucks commenced hauling rock and dumping into the river on both sides of the bridge. Within 30 hours after initial diversion, the temporary dam thus constructed had risen sufficiently high so that all water was flowing through the Arizona diversion tunnels except a small amount of seepage through the hastily constructed fill. To cut off the seepage and to prevent flooding the cofferdam site by possible flood, the temporary dam was then heightened and widened, using muck from the cofferdam excavation.

Soon after the temporary dam was completed above the upper cofferdam, a similar fill was finished immediately upstream from the outlets of the diversion tunnels. The water in the river channel, thus inclosed, was pumped out and excavation of the upper cofferdam extended to the Arizona wall. The excavated material was hauled by 8 and 10 yard trucks to the railroad and used for widening the railroad bench along the river, or unloaded at a dump ground near the mouth of Hemenway Wash. The excavation for the upper cofferdam was started on September 25 and finished on December 5, 1932. Approximately 212,872 cubic yards of sand and gravel were removed at an average rate of 5,200 cubic yards a day.

HANDLING OF MATERIALS

Desirable material for the earth fills had been located by test holes in Hemenway Wash. Pits were opened with 3½-cubic

yard electric shovels, railroad track laid to the pits from the Black Canyon line of Six Companies Inc., and the material loaded into side dump cars for transportation to the cofferdams. Arriving at the unloading site, the earth was dumped from a trestle, reloaded into trucks by 3½-cubic yard shovels and hauled to the cofferdam fill. Here it was dumped by the trucks, spread by the bull-dozers installed on 30-horsepower caterpillar tractors, the correct amount of water was sprinkled on the material, and the mixture then rolled by 6-ton Rohl rollers pulled by 30-horsepower tractors.

Approximately 510,000 cubic yards of material were placed from October 31, 1932, to completion of the fill on January 1, 1933. More than 420,000 cubic yards of earth were deposited in the fill during December, 18,000 cubic yards or 4,000 truck loads of material being placed in many 24-hour periods of that month. Three 3½-cubic yard electric shovels were used at the pit for loading the trains and two or three shovels of the same capacity for loading the fleet of 35 trucks at the trestle near the cofferdam. For hours at a time each shovel was loading, swinging, and dumping a shovelful in less than 30 seconds.

STRUCTURAL DETAILS

Steel sheet piling at the upstream toe of the upper cofferdam was driven by air hammers, except near the Nevada canyon wall where an unusual number of large bowlders were encountered. A trench was excavated at this location and the piling placed on a concrete footing resting on bedrock. The 5-cubic yard dragline with its 80-foot boom was used to set sheet piling in position and for holding the air hammer when the piling was driven. Each pile is of the arch-web type, 16 feet wide and 40 to 55 feet long.

The concrete cut-offs at the canyon walls near the center of the dam were formed and poured as the earth fill progressed upward. The concrete was hauled from the mixing plant in 4-cubic yard agitators, and the agitators were lifted from trucks to the pouring site by the 5-cubic yard dragline.

The rock blankets on the slopes were placed after the earth fill was nearly finished. The rock was secured from the stripping operations or excavations on canyon walls, requiring 151,000 cubic yards for the slope facings.

The reinforced concrete paving on the upstream slope is poured in 16-foot sections running from a concrete curb at the sheet piling cut-off to the crest of the dam. This work was started on December 20, 1932, and was completed in February, 1933. The paving contains 3,500 cubic yards of concrete and almost 4 miles of ⅝-inch reinforcement steel bars.

Construction of the lower cofferdam has been delayed by stripping of canyon walls and the excavations at the sites of the outlet works. The earth fill for the dam is obtained from Hemenway Wash. The railroad has been extended downstream, and ends at a trestle erected near the dam site, where the material is dumped, reloaded, and hauled to the cofferdam site and the fill constructed in manner similar to that for the upper cofferdam. The rock barrier, downstream from the lower cofferdam has a thickness of 210 feet, a height of 54 feet, and contains approximately 127,000 cubic yards of rock.

All four diversion tunnels will be completely lined and both cofferdams are expected to be completed before the high water of the spring and summer of 1933. The low stage of the river from October to January and the respite from flash floods have materially aided the uninterrupted progress of construction.

The cofferdams are only to serve a temporary purpose until Hoover Dam is built above the entrances to outlet tunnels at the bases of intake towers; then the bulkhead gates will be closed at the inlets of the outer diversion tunnels, the flow of the river temporarily controlled by slide gates installed in the inner diversion tunnels, and the upper cofferdam will be overtopped and inundated by the reservoir back of Hoover Dam. The lower cofferdam and rock barrier will then be removed from the river channel to clear the tail race for efficient operation of the power plant.

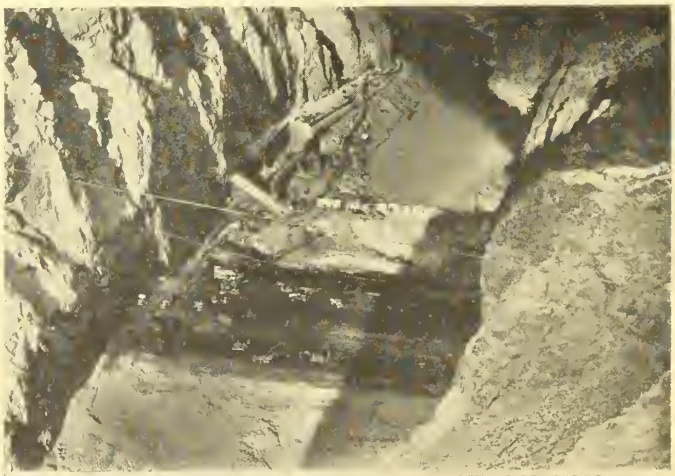
Notes for Contractors

Boulder Canyon project.—Bids were opened at Denver, Colo., at 10 o'clock a. m., on March 10, for furnishing hydraulic apparatus for the Hoover power plant (specifications No. 540) comprising five 115,000-horsepower and two 55,000-horsepower vertical-shaft hydraulic turbines, with governors and with or without butterfly-type shutoff valves. Four bids on turbines and governors were received from the following companies: Newport News Shipbuilding & Dry Dock Co., New York City; S. Morgan Smith Co., York, Pa.; Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; Pelton Water Wheel Co., San Francisco, Calif. The Woodward Governor Co., of Rockford, Ill., and the Lombard Governor Co., of Ashland, Mass., also submitted bids on governors.

Specifications No. 589-D have been issued covering the purchase of eight 57-inch diameter butterfly valves with operating mechanisms, eight 24-inch internal differential control valves, and cast-iron pipe, fittings, manholes, and trash-bar spacers to be installed in the Nevada and Arizona spillways at Hoover Dam in connection with the operation of the drum gates on the crests of the spillways. Bids were opened on March 30, 1933.

Current work in the Denver office includes the preparation of specifications for purchase of the initial group of generators, station service units, and high-

OPERATIONS AT THE UPPER COFFERDAM AFTER THE RIVER WAS DIVERTED



CONSTRUCTION OF UPPER COFFERDAM SHOWING ALL DETAILS OF LOADING, HAULING AND PLACING EARTH FILL

voltage oil circuit breakers for the power plant.

Minidoka project.—Specifications No. 588–D were issued on March 6, 1933, covering the purchase of one 667 kilovolt-amperes transformer, one 75 kilovolt-amperes transformer, two 370 kilovolt-amperes autotransformers, and two 800/5 ampere current transformers for South Side Pumping Station No. 3 on the Minidoka project. Bids were opened on March 24, 1933.

Bids under specifications No. 585–D were opened on March 3, 1933, for furnishing a vertical motor-driven pumping unit having a capacity of five second-feet for installation in the McLean drainage pumping plant. Seven bids were received, the low bid being submitted by Hendrie & Bolthoff Manufacturing and Supply Co., of Denver, Colo., whose price was $545.

Yuma project.—Bids under specifications No. 586–D were opened on March 3, 1933, for furnishing a ditch-cleaning machine for the Yuma project. Two bids were received, the low bid being submitted by the Standard Steel Works, of Los Angeles, Calif., whose bid was $7,950.

Boulder Canyon Project Notes

Six Companies Inc. is using 223 trucks for construction purposes. Some of these are equipped with duralumin bodies and have a capacity of 12 cubic yards or 16 tons. Sixty of the trucks are covered and fitted with cushioned seats and transport men to and from the canyon, the capacity of each of these lorries being 48 men. The expenditures incurred for truck operations include an average of $43,000 monthly for gasoline and $15,000 for tires.

Judge Frank Norcross handed down a decision in the Federal Court on February 15, denying the plea of Six Companies Inc. for a permanent injunction against the State of Nevada from collecting taxes in the Federal Reservation. In another decision, he granted an injunction against the State from enforcing Nevada mining laws in the area. In the decision concerning the collection of taxes, Judge Norcross held that the State statute of 1921, under which the reservation was established, applied only to permanent structures and that the Federal Reservation was created only for temporary purposes. With regard to enforcement of mining laws, the decision stated that the construction operations did not pertain to mining and therefore the mining laws were not applicable.

A meeting of representatives of the various cement companies in California, Utah, Colorado, and Idaho was held at the Biltmore Hotel in Los Angeles on March 15 at the invitation of Chief Engineer Walter to discuss the new cement specifications for the Hoover Dam work. Prof. Raymond E. Davis of the University of California and Byram W. Steele of the Denver office represented the bureau at the meeting.

The Palo Verde Irrigation District's board of directors has authorized the signing of a contract with the Secretary of the Interior whereby the district will be granted storage at the Hoover Dam for water to irrigate 104,000 acres.

The new "Hi-Mix" concrete plant of the Six Companies Inc. started operations on March 2, mixing concrete for lining the Nevada spillway; also for the foundation of the hoist house for the Government cableway.

Six Companies Inc. has constructed at the lower toe of the dam, for drainage purposes, a shaft down to elevation 486 or about 150 feet below the river bed, with an adit from the Nevada inner diversion tunnel to the shaft and a drainage drift from the shaft to a point within 12½ feet of the line of center of the dam. The bureau has now requested the contractors to construct a drift for exploration purposes, about 5 feet by 7 feet in size, and at approximately 500 feet elevation, from the end of the present drainage drift into the Arizona side of the canyon, with a cross drift extending upstream. The drifts will be used for experimental strain gage measurements.

The Denver office is making studies of a freight-car transfer cradle for taking loaded freight cars from the United States construction railroad on the canyon rim down into the canyon by means of the 150-ton capacity cableway. From the cableway landing a railroad will extend into the power plant.

The Reconstruction Finance Corporation has authorized a loan of $22,800,000 to the Bureau of Power and Light, City of Los Angeles, for the construction of a transmission line from the dam site to Los Angeles, a distance of 271 miles. Transmission voltage will be 275,000 volts, the highest in the United States. It is estimated that an average of 4,600 men will be given employment for 2½ years.

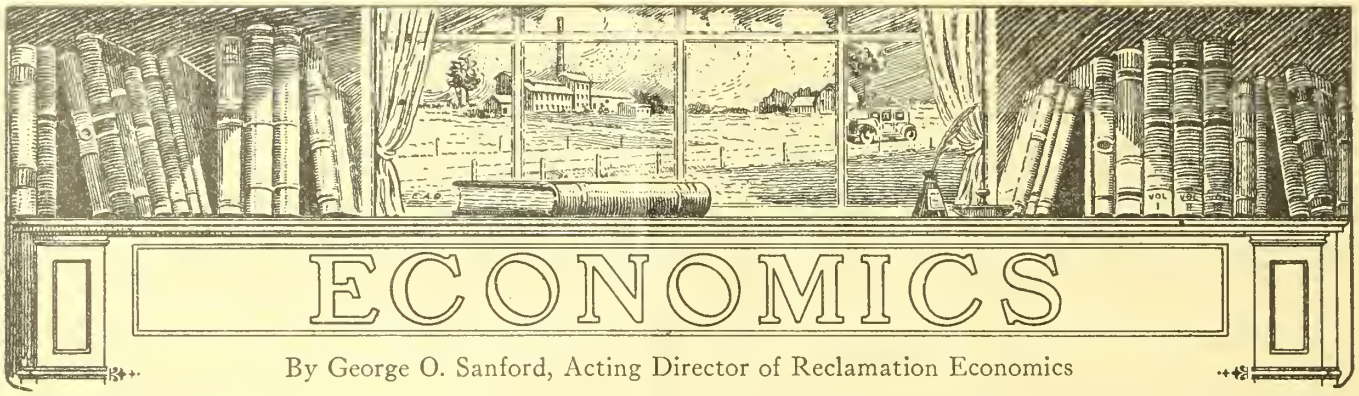
Babcock & Wilcox Co., contractors for the outlet pipes, completed its office building at Bechtel and moved in March 1. At the fabricating plant, two 75-ton cranes were placed in operation February 12. Installation of machinery in progress comprises a 50-foot planer, boring and finishing machine, and rolling and bending mills.

Eighty-four contracts representing 164 tracts of land in the reservoir site had been executed by the landowners and the Government at the end of February. Payments amounting to $463,758.56 have been made to 81 owners for 160 tracts. The Government has acquired 6,808.73 acres of land in the transactions.

A record minimum temperature of 12° for the Boulder Canyon project was established on February 12. The temperature in Black Canyon was 32° or below for five days during the month of February.

Approximately 4,452 persons were employed on the project on March 1, distributed as follows: Bureau of Reclamation, 237; Six Companies Inc., 3,678; Boulder City Co., 111; Anderson Bros. Supply Co., 131; Babcock & Wilcox Co., 9; Fred C. Snell Co., 80; Consolidated Steel Co., 6; permittees (estimated) 200.

The canyon of the Colorado about the Hoover Dam is brilliantly illuminated at night by thousands of electric lights which are ably backed up by a great brigade of dishpans. It appears that these lamps are subjected to a variety of hard experiences and to keep them supplied with reflectors which are ordinarily made use of for this purpose would be a very expensive proposition by reason of the frequent breakage. A bright new dishpan was experimented with for this service and the results were found to be so satisfactory that they were adopted all over the site. Ten thousand dishpans were ordered for this purpose.



By George O. Sanford, Acting Director of Reclamation Economics

Adjustments Required to Balance Production

By L. H. Mitchell, Assistant Director of Reclamation Economics

THE February 15, 1933, News Bulletin of the University of Nevada Agricultural Experiment Station has an article by F. B. Bradley on the subject of "Alfalfa Hay on the Newlands Project—Adjustments Required to Balance Production." This has many valuable suggestions applicable to all Federal reclamation projects.

The bulletin states that the article "is preliminary and subject to revision later when the final summarization is made for formal publication." As the time for planning the spring program is at hand this article is very timely, especially so when carefully considering the suggestions pertaining to imports of feed and the plowing up of alfalfa once in 6 to 10 years, the harvesting of grain with turkeys, and maintaining the fertility of the soil without shipping in fertilizer are applicable to practically every irrigated locality. The additional income from the sale of veal and cull cows, and feeding the skimmed milk to turkeys, chickens, and hogs often represents the difference between success and failure.

In any adjustment program to balance production consideration should be given to the possible saving by using horses in place of tractors.

The following is quoted from Mr. Bradley's article:

"The project begins the year 1933 with a carry-over of hay on hand and the largest total alfalfa acreage in the history of the project. It is clear that if a normal yield is obtained this year and the acreage is not reduced, either additional markets must be developed or the number of livestock fed within the project must be greater than ever before. Since there are no indications at the present time that the outside market can be materially expanded, it becomes necessary for the project to bring its production and consumption of hay into balance.

"Alfalfa hay is the most important crop on the Newlands project. It is in reality the project's main source of wealth. It covers 85 per cent of the cultivated area and directly or indirectly brings to the project more income than all other crops combined.

"Before the invasion of the alfalfa weevil the hay not used by farm and range stock was sold for cash, chiefly outside the State. Now alfalfa is no longer an exportable crop, except for the small amount that can be shipped out in the form of meal. The main body of the crop must therefore be consumed locally by livestock. In case the production greatly exceeds the demand, prices will drop so low as to force a part of the alfalfa out of production until a proper balance is reached between price and cost of production.

ALFALFA HAY ACREAGE SHOULD BE RESTRICTED

"At the present time serious overproduction in 1933 is threatened unless yield is restricted by some natural cause. To prevent an oversupply of alfalfa hay with resulting low prices, project farmers can voluntarily act to bring about a better balance between supply and demand. There are two ways to do this, (1) substitute other needed crops for some of the alfalfa acreage and (2) increase the farm livestock to a point where the amount of hay consumed by project livestock will not leave more on hand than can be easily fed to range cattle and sheep. The number of farm livestock should be sufficient to keep the supply of hay available for sale to feeders so low that it will always be cleaned up. It is probably too late to adopt measures that will be effective this year, although a few individual farmers may be able to make some adjustments.

"This is not a time to urge general expansion of the dairy industry in the United States, but on the Newlands project expansion may be justified for the reason that it is needed to balance the alfalfa output which can not be disposed of to so good an advantage in any other way. Even at the present low price of butterfat dairy cows provide a better cash market for the hay than can be obtained by selling the hay to feeders. Selling the hay through dairy cows provides a continuous cash market throughout the year. An increase of the dairy cow population by 1,000 head, together with the young stock required to maintain this number, would provide an annual market for about 8,000 tons of hay. At 1932 prices this amount of hay would bring in $40,000 if sold to feeders, but if fed to cows and marketed as butterfat it would bring in $40,000 for the butterfat alone, with an additional income for the sale of veal and cull cows, together with the saving in income derived from the feeding of skim milk to turkeys, chickens, and hogs.

"It is not likely that all the surplus hay can be disposed of by increasing the farm livestock. A part of the surplus must be taken care of by reducing the alfalfa acreage and planting to other crops which can either be sold for cash or used on the farm as feed.

"Unfortunately there are no cash crops which can be recommended in view of the present outlook. There are crops, however, which can be grown for feed. The Newlands project imports each year about 100 carloads of feed consisting of wheat, barley, corn, and mixed feeds. The cost to project farmers is at least $5 per ton more than market price. Not many of the small farmers can grow grain profitably for market because of the expense of harvesting and threshing small lots, but there are conditions in the management of small farms where it may be advisable to grow some grain each year.

CROP ROTATION

"The general productivity of the farms can usually be maintained at a higher level by providing a rotation that will require the plowing up and reseeding of alfalfa once in 6 to 10 years. In some sections

of the State alfalfa must be reseeded oftener than this, but on the Newlands project alfalfa is long-lived. The intermediate crop after alfalfa is plowed up is usually grain, but sometimes corn or potatoes are used. Grain, even when produced at a loss, may in the end be profitable when used to renovate unsatisfactory stands of alfalfa. The intermediate crop can be fertilized and the general productivity of the land increased. When grain is used in a rotation in this manner, the net earnings of the farm may be increased even though the grain crop itself does not pay all expenses. An unseen and unmeasurable benefit comes from increased yields of alfalfa after it is reseeded, and any replacement of alfalfa with grain or other crops tends toward a more even distribution of labor.

"But it is not always necessary to grow grain at a loss, even on small farms. There is an increasing practice among turkey growers, of saving labor and expense of harvesting and threshing wheat by letting turkeys harvest it standing. Again, some poultrymen harvest their grain and feed it to the chickens in bundles, thus saving the cost of threshing. When produced and used in this manner, grain may be raised with little cash cost resulting in a material saving in cash outlay for feed.

"*Summary.*—The indications are that there will be a surplus production of alfalfa hay on the Newlands project in 1933 and later years unless adjustments are made to prevent it. More hay can be used on the project and the project cash income increased, by increasing the number of dairy cows. The area in alfalfa can be reduced by bringing grain crops into rotation with alfalfa in such a way as to improve the fertility of the soil and to supply additional grain feed which is now purchased outside at an unnecessary cash cost to the project."

Back to the Soil

O. W. Hoffman, secretary of the Sunnyside irrigation district in the Yakima Valley, reports an active movement back to the land. "Every piece of land in the district will be leased, and there is not enough land to provide for all applications." Many unable to make a living in the cities are trekking back to the soil.

Mr. Hoffman reports another significant trend—toward smaller tracts than in the past, due to a prevailing purpose to make a living through the depression, and not take a chance on losses through larger production.

Another new aspect is the return of owners who have been renting their land and now are returning from towns and cities.—*Spokane Spokesman-Review.*

Need of Kittitas Division for Competent Farmers

By A. A. Whitmore, Acting Construction Engineer, Ellensburg, Washington

The Kittitas Division of the Yakima project is practically completed, and the district is assuming the entire cost of operation and maintenance. The problem now is to obtain competent farmers to settle upon the lands of the project, and the local officials are gratified that the community is making excellent progress toward a solution.

Late in the month of November, 1932, the Ellensburg Chamber of Commerce, cooperating with the Kittitas Irrigation District, started a classified advertising campaign in farm papers and daily newspapers published in irrigation districts of the States of Washington, Oregon, Idaho, California, Colorado, Utah, Wyoming, Nebraska, and Montana, calling attention to the opportunities on the newly completed Kittitas Division of the Yakima project in central Washington. The amount of money expended in the campaign was comparatively small, but by the middle of February, 3,050 inquires had been received. To each inquirer were sent several pamphlets on the Kittitas Valley, and the irrigation district; also a questionnaire covering the inquirer's farm experience, capital, type of farming, whether interested in a lease or purchase, type of farm desired, number in family, and amount of livestock and equipment, together with a list of 30 or more typical farms for sale.

More than 700 of these inquirers have written a second time, returning the questionnaire and these people have sent the names of more than 650 additional farmers who are interested in a possible location on the project. Thirty-five of these men have already visited the project during the winter months to look for a location. Nine have actually purchased or leased land. These have brought or will bring 190 head of dairy cattle, as well as other livestock and equipment.

During the month of January and early February inquiries came in at the rate of more than 50 a day, and many of these were followed by second letters which came in at the rate of 17 a day. This demonstrates the interest that is being taken in this project and the importance of its development. The majority of the inquirers are between 25 and 35 years of age, sons of farmers, married and looking for an irrigated farm home. A total in excess of 4,000 inquiries will no doubt be the result of a small classified advertising campaign, and it is believed that within 18 months after the project is completed the entire division will be settled by a high type of experienced farmers. This development establishes the fact that irrigation work not only employs men during the construction period, but that the normal growth of a project is spread over many years, and that there are thousands of experienced farmers, anxious to get off of marginal lands onto an irrigated farm in a proven district.

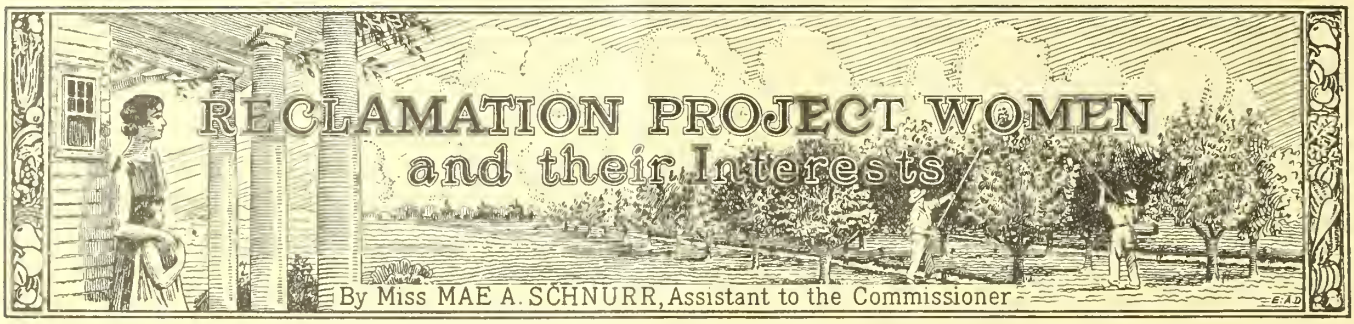
The Kittitas division is not a project whereby 72,000 acres of sagebrush desert have been brought into cultivation, but one on which approximately 30,000 acres which were already fully developed and settled, lacked an adequate water supply and until this condition was relieved the farmers were at a standstill.

Demand for Kittitas Farms

On March 4 an opening of a tract of public land comprising 47 units, including 9 farm laborers' allotments, was thrown open to settlement on the Kittitas Division of the Yakima Federal irrigation project, Washington. On March 14 the acting construction engineer reported that 385 inquires had been received and 54 formal applications had been filed on 33 units. The interest seemed to be ever increasing, with a constant stream of persons making first-hand inspections of the lands.

Some Comparative Figures

Area irrigated, entire United States, 1929 (rice areas excluded) ----------acres--	18, 871, 993
Area State of Maine ----------acres--	21, 145, 600
Area cropped, 1929, all Federal reclamation projects------acres--	1, 512, 250
Area State of Delaware ----------acres--	1, 716, 800
Area all lakes in State of Maine--------acres--	1, 912, 800
Value all crops in United States, 1929---------	$8, 088, 494, 000
Value all crops from Federal reclamation projects, 1929----------	$88, 459, 390
Relation of crop values Federal reclamation projects to entire United States-------- ----------per cent--	1. 1



Boulder City Kindergarten

By Mrs. Gladys Mary Sanford, In Charge of Boulder City Kindergarten

BOULDER CITY is a construction camp established and operated to facilitate the building of the Boulder Canyon Project. It is therefore a community of temporary homes for people, most of whom are temporarily employed. The social structure is unique. Yet the child who lives here has the same claim to development as has the child who lives in a typical community, with the advantages of a school where children work and play together laying the groundwork upon which all society is based, the technique of working and playing together. The experiences and influences effected and the habits formed during early childhood, more than at any other period of life, determine whether this technique shall be developed or stunted. The kindergarten curriculum adapts itself to this purpose.

GROUP SINGING PERIOD

BOYS AT WORK BENCH DURING FREE PERIOD

PHOTOS. BY B. O. GLAHA

Since the budget for Boulder City chools did not include a kindergarten, it remained to be proved by experiment whether this service could be rendered through private enterprise. The success of the experiment depends largely upon the attitude of the parents. Does the average parent value this development of the pre-school child to the extent that he will support a kindergarten operated on a tuition basis?

At the suggestion of Sims Ely, city manager, who is also directly in charge of the Boulder City school system, the undertaking was begun. At the same time several mothers showed active interest in the project. Some 80 or 90 parents were nterviewed and without exception they showed a most encouraging attitude toward a Boulder City kindergarten. However, the happy business of establishing their new homes, linked with the less pleasant but ever present adjustment to the unstable economic conditions, has applied the acid test to the parents' enthusiasm. Lack of means has forced many parents to forego the benefits of the kindergarten for their children. In the light of the conditions just noted, we feel that the apparent results indicate more than a modest success.

Walker R. Young, the Government construction engineer, and Mr. Ely both showed a very kindly interest toward this community service. They provided for comfortable and convenient housing in the basement of the municipal building, and arranged for the loan of some unused equipment. Thus we were placed in pleasant surroundings.

Having in mind the established relationship between kindergarten methods and life in general, our curriculum has been developed around the interests of the Boulder City child. Home life is his first interest. Therefore we center activities and play around the doll and house furnishings.

NATURAL INTERESTS CONSIDERED

Songs and stories of home and home activities play an important part at this age. An interest in community activities, usually more manifest two or three years later, has been surprisingly apparent in the group. This is doubtless due to much discussion at home of the various phases of the construction work.

There must be opportunity for free movement and exercise of the large muscles, so we have a work bench with hammers, nails, saws, and wood. Here again the home interest is the inspiration and we have tables and chairs—at least so they have been named by the juvenile creators, and who has a better right to say.

Nearly every child in kindergarten has a pet of his or her own, usually a dog or a cat. These, of course, take an important place in our nature study conversations. Furthermore our local environment offers a singular and interesting program, as new to the teacher as to the children. A few of the lizards and insects are painfully and sometimes even dangerously poisonous. For this reason it is necessary for the child to be informed so that he may use sensible precaution independently. Otherwise many lizards and insects are harmless subjects for interesting study. Of the desert flora with its many odd plants, probably the most interesting to the children are the various cacti.

Certain skills can be mastered in kindergarten such as the recognition of the written or printed names of the members of the group, and even the reading of a few sentences. For instance, our pictures are filed under simple classified headings that are read by the children. This incidental reading combined with our kindergarten program of stories and conversation affords the child a motive for learning to read when he enters first grade next year. Likewise, counting, as far as is of practical use, is employed. For example we count scissors, tools, et cetera, as they are put away.

Music, though freely interspersed throughout the day, claims a period of its own. The children listen, sing, take part in the toy orchestra, respond to various rhythms (such as walking, flying, hopping, skipping, and swaying) and express or interpret moods. Our first month of singing amounted to little more than a "chanting" of the words of the song while the melody was played or sung by the teacher. Now the children not only sing pleasingly in groups but many also sing solo melodies sweetly and with assurance.

We believe that, if we can place the young child in an environment of good music, art, and literature, we will cultivate in him an appreciation (not to be confused with formal instruction in the arts) which will serve as a criterion for his own choice of amusement, affording him a worthy use of leisure time. Many expressions result from these stimuli-attempts at original music, dramatization of stories and poems, the pure joy of reciting poems and Mother Goose rhymes and the entertainment and development of personality through story telling.

DEVELOPING ORIGINALITY

One of the most valuable and interesting parts of a day at kindergarten is the free period when each child chooses and does what he pleases. For these activities we attempt to place a variety of material at the disposal of the children. Our supplies for this period include such things as wooden boxes, nails, cartons, sewing materials, colored paper, wrapping paper, blocks, wooden beads and string, scissors, crayolas, clay, and paste. All of these articles are inexpensive. In fact, some are little more than waste material but will challenge the ingenuity of the young artist or craftsman and prove far more valuable in developing his originality than many of the costly toys on the market.

Some children show marked aptitude and even talent as a result of free choice of medium, acquiring skill and developing individuality and initiative. Others play with toys and play apparatus in the room, learning self-control, courtesy to others, and cooperation in helping and receiving help. As the child approaches first-grade ability, he becomes more and more interested in reading, and it isn't uncommon

GROUP OF GIRLS WITH DOLLS

PHOTOS BY B. D. GLAHN

BIRTHDAY PARTY

during this hour to find a child on the rug, or at the table, "reading" to a group of other children.

Some of the visible results of our free period show peculiar local color. Quite generally a cactus (of the accepted or of an original form) is included in a drawing. The Black Canyon has often been portrayed, especially following Christmas Day when the entire job was thrown open to the public. The awe-inspiring tunnels were drawn; the most effective conception showed a large purple spot on a black background. Less representative of local environment is the incident that took place in our play store when a pineapple was purchased for five cents and an orange for twenty dollars!

Many experiences, though definitely a part of the kindergarten program, are treated incidentally as they come up. Thus we are learning throughout the day, as the need arises, how to cross streets, friendly greetings, use of tools, planning and criticism of work, caring for group properties and for individual belongings (imagine our joy one morning recently at finding a compartment cupboard in our room) proper health attitudes and practices, care of one's person, and so on.

Then there are also the unexpected thrills and surprises, the occasional walk, a party or birthday cake. A program for our mothers or a special day celebration requires much preparation and planning and demands cooperation and a sense of responsibility all of which help make the child a social being.

Though our enrollment has been small, the spirit of cooperation and sympathetic understanding has been so manifest in the parents represented that we know there is an appreciation of the work being done. It has been interesting to see this educational institution called kindergarten, which has been so long advocated in educational circles, truly appreciated by the parents. We hope that some day pioneering will have served its purpose and that every Boulder City child will have an opportunity to attend kindergarten before entering the first grade.

Boulder Canyon Reserve

(Continued from p. 44)

of the decision were: (*a*) That the terms of the State act of cession did not extend to a reservation such as the Boulder Canyon Project Federal Reservation, the act permitting a cession of State jurisdiction only where the United States acquired property by purchase, condemnation, or otherwise, for the specific Federal purpose, whereas in this case the lands in the reservation were public lands of the United States acquired in 1848 by treaty with Mexico; (*b*) that the State act of cession did not authorize the creation of a temporary reservation, such as the court considered this would be for at least the greater part of its area, since in six or seven years when the work is completed it would be necessary (the court inferred) to abandon the part of the reservation not embraced in the dam nor needed for operation, maintenance or administrative purposes; and (*c*) that the acts of Congress did not authorize the Secretary of the Interior to claim the benefit of the State act of cession.

It is understood that the Six Companies Inc. will probably appeal the case.

A 40-acre farm east of Heyburn, Minidoka project, was recently sold for $3,000.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, spent a busy day in Pittsburgh on March 14. Arriving in the morning he had a conference with press men. At noon he broadcast over KDKA, and in the evening was the guest of a select group of engineers of the Pittsburgh district at a dinner, following which he gave an illustrated lecture on the Boulder Canyon project before the Pittsburgh branch of the American Institute of Electrical Engineers, with an attendance of 1,160.

R. F. Walter, chief engineer, has returned to Denver from Los Angeles, where he, in company with L. N. McClellan, chief electrical engineer, spent several weeks with representatives of the Bureau of Power & Light of the City of Los Angeles, in connection with Boulder Canyon power plant matters.

L. R. Smith, chief clerk of the Denver office, and Ronald E. Rudolph, chief clerk of the Kittitas Division, Yakima project, have completed their assignment in Los Angeles in connection with the audit of the accounts under the Charles and George K. Thompson contract, Yakima pressure tunnel, Kittitas Division, and returned to their respective headquarters. C. A. Lyman, field representative, who was also engaged on this work, went from Los Angeles to the Yuma project.

F. W. Haversack, assistant engineer, recently left Denver for Pittsburgh, Pa., for the purpose of inspecting the manufacture by the Westinghouse Electric & Manufacturing Co. of cylinder gates for the intake towers on the Boulder Canyon project, under specifications No. 541. Most of Mr. Haversack's time during the next year will be spent in Pittsburgh and vicinity.

Dr. Wales A. Haas, chief surgeon of Six Companies Inc., died from an attack of acute appendicitis on March 6. Masonic funeral services were held in the Legion Hall in Boulder City on March 8, and interment was in Oakland, Calif.

Doctor Haas was a prominent member of the Boulder City Lodge of Masons and of the American Legion. He was medical examiner for the Veterans' Bureau and Boulder City health officer.

W. J. Chiesman, superintendent of the Grand Valley project, returned to duty on March 20, having recovered from an operation for appendicitis followed by penumonia.

The following assignments to the Boulder Canyon project have been authorized: Fred H. Nichols, assistant engineer, and Charles S. Hoag, junior engineer, by transfer from the Humboldt River secondary investigations, Nevada; William E. Wheeler, Rodney H. Harris, and Carl A. Schuppenies, rodmen, from the Minidoka project; John W. Dodson, inspector, by reinstatement; Edgar M. Kitchen, levelman, Wendell T. Mulkey, inspector, and Lloyd J. Hudlow, rodman, from the Yakima project; Guy R. Reynolds and John H. Gibson, inspectors, and Albert O. Rankin, rodman, from the Kittitas Division, Yakima project; Joseph M. Barrett, junior engineer, from Colorado River Basin investigations, Salt Lake City Utah; Gustavus A. Warning, inspector, from the Grand Valley project; Forrest B. Greene, junior engineer, and James Owen Reeves, inspector, from upper Snake River storage investigations, Idaho.

H. H. Plumb, engineer, has returned to the Denver office, having supervised the completion and acceptance tests on the Grand Valley power plant.

L. H. Mitchell, assistant director of reclamation economics, left Washington on March 20 to visit the Denver office and the Grand Valley, Uncompahgre, Strawberry Valley, Newlands, Orland, Klamath, Yakima, Owyhee, Vale, and Minidoka projects. The purpose of Mr. Mitchell's trip is to meet and discuss with the officials and water users the problems that confront their respective projects. His itinerary will cover approximately five weeks.

☆

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Joseph M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **Nathan R. Margold,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
William Atherton DuPuy, Executive Assistant

WASHINGTON, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under Construction or Operated in Whole or in Part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif.	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg	F. A. Banks	Constr. engr			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	William F. Sha	William F. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent		F. C. Bohlson	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Yonngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr	C. B. Funk	do	do	Do.
Yakima, Kittitas Div	Ellensburg, Wash	A. A. Whitmore	Act. constr. engr.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	H. A. Parker	do		Denver office	do	Do.

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems.
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

Completed Projects or Divisions Constructed by the Bureau of Reclamation and Operated by Water-users' Organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phœnix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phœnix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Val. W. U. A	Montrose, Colo	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	G. J. Hagens	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	H. W. Genger	Superinteudent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont	Axel Persson	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	Superintendent	D. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nellie Armitage.	Torrington Wyo.
Northport division	Northport irrigation district	Northport, Nebr	Paul G. Gebauer	President	Mabel J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg		Reservoir supt	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	Manager	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	F. E Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W. U. A	Ogden, Utah	D. D. Harris	Manager	D. D. Harris	Ogden, Utah.
Strawberry Valley	Strawberry W. U. A	Payson, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo	Clarence Peterson	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver, Wyo.

Important Investigations in Progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo., Customhouse	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Federal Bldg	E. O. Larson	State of Utah.
Humboldt River, Nev	Denver, Colo., Customhouse	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	do	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg	H. W. Bashore	State of California.
Upper Snake River Storage	Denver, Colo., Customhouse	F. F. Smith	None.

SALLIE A. B. COE, *Editor.*

Photo B. D. Glaha

BOULDER CANYON PROJECT, LOOKING UPSTREAM THROUGH BLACK CANYON, SHOWING COFFERDAM CONSTRUCTION AND POWER HOUSE EXCAVATION. OUTLET PORTALS OF TUNNELS NOS. 2 AND 3 ARE SEEN

I 27.5
CLEMSON COLLEGE LIBRARY
GOVERNMENT PUBLICATIONS

THE RECLAMATION ERA

VOL. 24, NO. 5 MAY 1933

AN APPLE ORCHARD IN BLOOM
ON THE KITTITAS DIVISION
YAKIMA IRRIGATION PROJECT
WASHINGTON

© Underwood & Underwood

NATHAN R. MARGOLD, SOLICITOR OF THE INTERIOR DEPARTMENT

THE
RECLAMATION ERA
Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D.C.
Price 75 cents a year
HAROLD L. ICKES
Secretary of the Interior
ELWOOD MEAD
Commissioner, Bureau of Reclamation
Vol. 24, No. 5
MAY 1933

Nathan R. Margold, Solicitor of the Interior Department

Nathan R. Margold, of New York, who was on March 23 appointed by Secretary Ickes to the office of Solicitor of the Interior Department, was born on July 21, 1899. His early education was received in the elementary and high schools of New York City. He graduated from high school in June 1916, and was awarded a Regents scholarship.

Mr. Margold entered the College of the City of New York in September 1916, and received his A.B. degree in June 1919. In September 1920, he entered the Harvard Law School and received the degree of LL.B., *cum laude*, in June 1923, at the age of 24. After graduation from law school Mr. Margold worked from August 1923 to April 1925 in the law office of Cook, Nathan & Lehman, of New York City. He severed his connection with this firm to accept an appointment as assistant United States attorney for the Southern District of New York. This appointment was without regard to political considerations. During this assignment Mr. Margold served under United States Attorneys Emory R. Buckner and Charles H. Tuttle until 1927, and during this period personally conducted many appeals in the Circuit Court of Appeals without the loss of any contested case in his charge.

From September 1927 to June 1928 he was an instructor of law at the Harvard Law School, and during the year also edited, jointly with Prof. Joseph H. Beale, the fifth edition of Beale's Cases on Criminal Law.

Upon his return to New York City in July 1923 Mr. Margold was appointed a special counsel to the New York Transit Commission in the Interborough Rapid Transit fare litigation and related controversies. In that capacity he worked extensively on various phases of the litigation both in its legal and factual aspects. In the New York Appellate Division and Court of Appeals stages of the litigation he also served as "of counsel" to the City of New York, writing the portions of the city's brief dealing with the substantive or nonprocedural issues.

In March 1930 he was retained by the Institute for Government Research as its legal adviser on Indian affairs, etc. Since July 1928 he has also been engaged in general practice of law in New York City, predominantly in the capacity of consultant or special counsel in difficult and important cases. Thus, for example, he was retained by William D. Guthrie to assist him in *Tremaine* v. *Ward*, popularly known as the Budget Controversy between Governor Roosevelt and the New York Legislature. Similarly, in 1930, he was privately retained to write a memorandum concerning the constitutionality of certain proposed amendments to the New York Public Service Commission Law. He also was retained, in an important litigation involving a claim of many millions against the estate of the founder of the Scripps-Howard chain of newspapers (*Scripps* v. *Scripps*, U.S. Circ. Ct. of App., 6th Circ.), to write the briefs and frame the arguments orally presented to the court by Chief Justice Hughes shortly before his elevation to the Supreme Bench.

Mr. Margold is an active member of the following bars: New York State, United States Supreme Court, United States Circuit Court of Appeals for the Second Circuit, United States District Court for the Southern District of New York, United States Customs Court, and United States Court of Customs and Patent Appeals. He is a member of the American Bar Association, Association of the Bar of the City of New York, and New York County Lawyers Association. He was a director of the American Indian Defense Association and chairman of the Indian Civil Liberties Committee of the American Civil Liberties Union.

Retained as legal adviser in Indian affairs by the Institute for Government Research, Mr. Margold carried out the first complete study of the important and vexed subject of Indian claims against the Government. In 1930 he succeeded, as a volunteer, the late Louis Marshall as counsellor to the Pueblo Indian tribes, primarily in the matters connected with the large controversy involving the Pueblos from Isleta to Cochiti and the Middle Rio Grande Conservancy District. The settlement for which Mr. Marshall, succeeded by Mr. Margold, had contended, was made effective in May 1930, and under it the conservancy development has gone forward successfully, to the satisfaction of Indians and whites alike. The first self-liquidating enterprise to receive cash from the R.F.C. was the Middle Rio Grande Conservancy District.

Thereafter, still as a volunteer and at his own expense, Mr. Margold became associate counsel of the attorneys for the Pueblo tribes (Hanna and Wilson, of Albuquerque, and Barker and Fahy, of Santa Fe) who were handling the land-title litigations and the litigations involving compensation to the tribes for lands lost pursuant to the Pueblo Lands Act of 1924.

At present Mr. Margold is completing a necessarily elaborate study of the project of tribal incorporation, probably the keystone project in the needed reorganization of Indian property management and the needed emancipation of Indian cultural and institutional powers.

Mr. Margold's capacities as a business administrator may be deduced from his record as a negotiator in business law. Those acquainted with his record and his personality believe he is especially fitted to deal with social and economic questions arising out of the conservation and use of western water supplies, the protection of the public range and the mineral resources of the public land. They have entire confidence in his political and administrative adequacy. His readiness to make very large material sacrifices for the Indian cause is self-evident, inasmuch as his legal practice is important and remunerative and his career in law, had it not been interrupted as he is willing to interrupt it, would have been of outstanding eminence.

Research Work of the Bureau of Reclamation

By Dr. Elwood Mead, Commissioner, Bureau of Reclamation

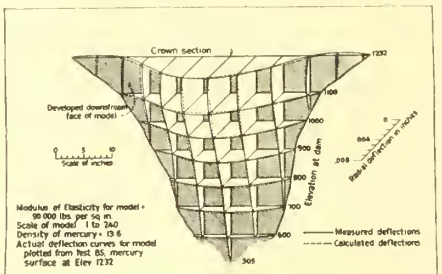
NEARLY all of the dimensions of Hoover Dam and its appurtenant works are of unusual magnitude, presenting many unusual problems that must be solved in the design, construction, and operation of the project. Great caution must be exercised in applying previous theories and practices to the design and construction of a dam of these unprecedented dimensions. New theories and practices must be developed from fundamental data, and these must be checked, tested, and proved in every possible way to insure that no mistakes are made in their development or application, and that the maximum economy is secured that is consistent with permanence and absolute safety. Recognizing these conditions, and considering the importance of the structure and the enormous expenditure involved, it was deemed imperative that a sufficient research program be undertaken to establish beyond question the suitability and sufficiency of the methods of design and construction to be adopted.

The research program for Hoover Dam is now in progress in nearly all of its features, and while tentative conclusions have been formulated as the progress of construction has demanded, the final results and conclusions are not yet available for publication. It is possible, however, at this time to outline the purposes and scope of the investigations, which involve researches in many branches of science, including mathematics, mechanics, physics, hydraulics, seismology, structural geology, chemistry, and related sciences. New methods and equations for the mathematical analysis of stresses have been developed from fundamental principles. New features of mechanical, structural, and hydraulic design have been adopted. Improved methods and technique in model testing have been worked out. Exhaustive studies have evolved new concepts of the structural and thermal properties of concrete, including the development of new specifications for portland cement, of controlled heat evolution, and many experiments and tests have been made under both laboratory and actual field conditions, to determine physical, structural, and hydraulic properties.

DESIGN OF THE DAM

Hoover Dam will be of the massive arch-gravity type, about 730 feet high and 650 feet thick at the base. The pressure of the water on the upstream face at the base of the dam will be about 45,000 pounds per square foot, and the total pressure on the upstream face will be more than three and one-fourth million tons. This pressure will be transmitted to and supported by the rock of the canyon walls and of the foundation under the dam. Under such conditions the amount and distribution of the stresses in the dam as well as in the abutments and foundations must be known with certainty and the structure must be so proportioned as to support these tremendous loads with maximum safety and economy and with no possibility of destructive stresses being developed.

Although the technical design of the dam is largely a matter of mathematical analysis, supplemented by model testing, it involves at the same time many problems of a research nature. Until recent years no adequate and satisfactory method of analyzing the stresses in massive arch dams was known. The trial load method of analysis, which is now widely accepted as the best available method, has been



ACTUAL DEFLECTIONS OF HOOVER DAM MODEL COMPARED WITH THOSE CALCULATED BY TRIAL LOAD METHOD

gradually evolved by the engineers of the bureau, and this method has recently been brought to a highly satisfactory working state in connection with the design of Hoover Dam. The accuracy and dependability of this method of analysis has been established by field observation and particularly by model tests, which have proved conclusively that the computed arch action takes place in a massive arch-gravity dam of the type selected (fig. 1).

The effect of internal temperature variation, shear, twist, flow under stress, Poisson's ratio, foundation and abutment deformation, radial cantilever sides, uplift pressure at the base, uplift pressure in the pores of the concrete, earthquake shock, spreading of canyon walls due to reservoir water pressure, and similar phenomena, have been analyzed and determined. The magnitude and distribution of stresses in all parts of the foundation and abutments under all conditions of loading have also been determined. The effect of nonlinear distribution of stress in all parts of the structures, in both arch and cantilever elements, has been evaluated. The stress conditions caused by the subcooling of the concrete during the hardening period, by pressure grouting of the construction joints and by other load conditions to be encountered during the construction period, have been investigated. These analyses and determinations have required extensive researches into the fundamental theories of mechanics and elasticity and into the complete field of stress analysis.

The original program of arch dam model testing that was started several years ago in cooperation with the Engineering Foundation Arch Dam Committee has been considerably extended in connection with Hoover Dam. It includes extensive research and investigations to determine the best and most suitable materials for use in models of this kind, including means of load application and methods and technique in measuring and analyzing the resulting stresses and strains. The testing program included the building, testing, and analyzing of a concrete model of the Stevenson Creek test dam, a concrete model of the Gibson Dam, and a plaster of paris and celite model of Hoover Dam. It also includes the construction and testing of a soft rubber model of Hoover Dam.

While these tests and analyses have not as yet been completed in all respects, the results so far accomplished have conclusively shown that arch action will take place as computed, and that the adopted design and dimensions of the dam are economical, adequate, and entirely safe for all conditions of loading to be met.

CEMENT AND CONCRETE RESEARCH

The science and art of concrete design and construction has received a great amount of study by many able scientists and investigators during the past two decades, and much progress and many improvements have been made. These studies have, however, been largely confined to ordinary concrete construction in which the maximum size of aggregate is about 1½ inches in diameter. Massive concrete in large dam construction, where the dimensions of the concrete structure are of the order of several hundred feet, and where the aggregate varies in size from fine sand to cobbles as much as 9 inches in diameter, presents problems in design and construction that have not heretofore been satisfactorily solved. The results of past research in concrete, although valuable, and applicable in vary-

ing degree to all concrete work, do not furnish adequate data for the solution of these new problems. Although many concrete dams have been built regardless of the lack of complete data, the unprecedented magnitude of Hoover Dam and the requirement for absolute safety and permanence on this monumental structure make the solution of these mass concrete problems correspondingly more important than in any dam heretofore constructed. These problems must be thoroughly investigated and any fundamental data, now lacking, that are required for their solution must be secured, which is the main purpose of the program of concrete research.

The major portion of the concrete research program relates to the phenomena of heat generation in concrete during the hardening period, which are the cause of volume changes in the concrete. The control of volume changes is of utmost importance in a massive concrete structure such as Hoover Dam, which will be subjected to enormous water loads, and whose mass must be continuous in order to provide not only for watertightness but also for the proper distribution of stresses throughout the structure. The law of heat dissipation or cooling of masses is that the time required for cooling of similar shapes is proportional to the square of the dimensions. For instance, a concrete structure 50 feet thick will lose 90 percent of its temperature rise in 1½ years, whereas a structure 500 feet thick will require 150 years to lose the same proportion of its temperature rise. If Hoover Dam were built without control of the rate of placing and without special provision for cooling the concrete, the setting heat would probably not be dissipated for several hundred years, during which time destructive volume changes would take place, resulting in undesirable and possibly dangerous open joints or cracks in the mass.

These conditions have necessitated two new and special provisions in the design of the dam: First, circumferential construction joints in addition to the usual radial contraction joints, thus dividing the mass into a series of approximately square columns or blocks; and, second, a complete artificial cooling system consisting of pipes embedded in the concrete through which cold water will be circulated. This system will lower the temperature of the concrete to normal and cause the resulting volume change to take place during the construction period, so that the joints between the columns, which will be opened as the concrete cools and contracts, may be completely and permanently filled with cement grout forced into place under pressure before the structure is placed in service.

In order that these problems may be intelligently studied and efficiently solved, extensive pioneer research pertaining to the thermal properties of cement and concrete is required. All properties of cement, both chemical and physical, must be exhaustively studied in order that a type of cement with controlled and known heat evaluation may be specified. The researches into the properties of cement are being carried on under a cooperative agreement with the University of California at the Engineering Materials Laboratory of the University at Berkeley, where necessary special facilities and trained personnel are available for this work. The principal cement companies of southern California are also cooperating generously in this work.

The cement investigations involve a study of 94 different cements, including tests on more than 15,000 specimens. Of the cements being investigated, 28 are

Testing 24- by 48-inch concrete cylinder for modulus of elasticity and Poisson's ratio in 4,000,000-pound capacity hydraulic testing machine. Denver laboratory.

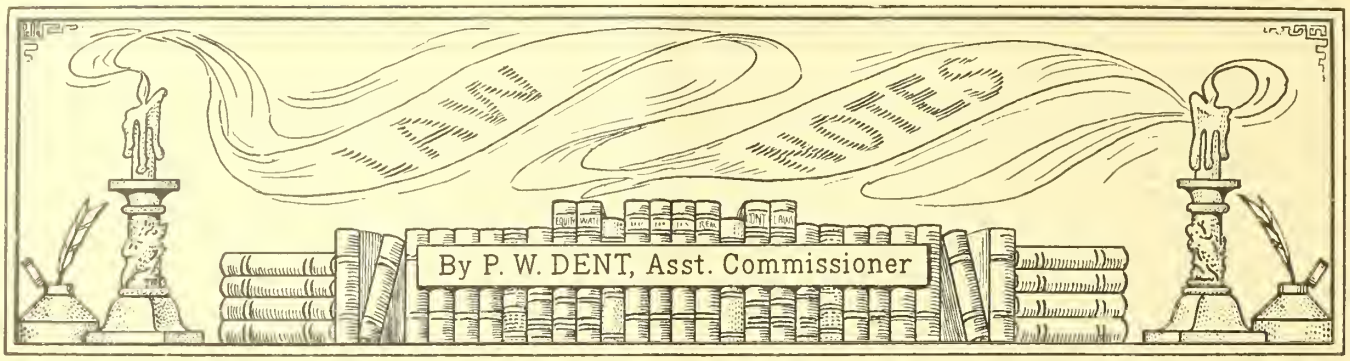
commercially ground; 22 are laboratory ground from commercial clinker; 20, covering an extreme range of chemical composition, are laboratory ground to equal fineness; and 24 are laboratory cements, laboratory ground to varying controlled degrees of fineness, from clinker of different chemical composition and different processes of clinker heat treatment. The investigation includes exhaustive studies of the effect of chemical composition, fineness of grinding, and, to a limited extent, the effect of manufacturing processes upon heat generation, volume changes, strength, and durability. These cement studies were supplemented and concluded, in so far as Hoover Dam is concerned, by a series of tests on mass concrete at the Bureau of Reclamation laboratories in Denver, Colo. The three most promising cements were tested in the bureau's laboratories for temperature rise, volume changes, and elastic and plastic properties. These studies indicated which of the cements tested had the most favorable characteristics and made it possible to prepare tentative specifications for the cement for Hoover Dam. These tentative specifications were considered on April 3 at Denver, Colo., by the Hoover Dam Consulting Board and the board of consulting specialists on concrete. Final specifications were approved and have since been printed and distributed to the various cement manufacturers. They supersede Federal Specifications SS-C-191 for use in the construction of the dam.

Researches being made into the thermal and related properties of concrete include the determination of the values of the thermal properties involved in the design of the cooling system; the practicability and efficiency of the cooling system as a whole; the determination of the rise of temperature that will take place in the interior of the dam; and the amount of heat that must be removed by the cooling system. Theoretical computations and laboratory tests are being supplemented by studies of the available records of heat development and volume changes in concrete dams previously built, and by specially planned field tests on the concrete in Owyhee Dam. These tests were started while the dam was under construction and will be continued throughout the cooling and pressure grouting periods.

Corresponding studies and researches are being made to determine the volume changes that will actually take place in the mass concrete of Hoover Dam. Concrete cores across contraction joints have been drilled in the interior of Gibson Dam, from which the actual joint opening and the efficiency of the pressure grouting could be determined. Special instruments have been developed and installed in the mass concrete of Owyhee Dam to accurately measure the volume changes that take place. Large size laboratory tests are being conducted in Denver to determine the efficiency of pressure grouting in closing contraction joint openings in mass concrete and to determine the desirable size of the joint openings and the properties of the cement grout required for efficient grouting.

Other problems included in the concrete research program are tests of ultimate compressive strength, long time measurements of plastic flow under stress, determinations of modulus of elasticity and Poisson's ratio, tests of sliding friction, strength of bond at horizontal construction joints, comparative strength of test cylinders of different sizes, variation in

(Continued on p. 57)



Act of February 17, 1933, Making Appropriations for Bureau

[*Public No. 361, 72d Congress*]

(Continued from April issue)

BUREAU OF RECLAMATION—Continued

Bitter Root project, Montana: For loaning to the Bitter Root irrigation district for necessary construction, betterment, and repair work, $100,000, as authorized by the act entitled "An act for the rehabilitation of the Bitter Root irrigation project, Montana," approved July 3, 1930 (46 Stat., pp. 852, 853);

Milk River project, Montana: For continuation of construction, $14,200;

Sun River project, Montana: Of the unexpended balance of the appropriation for continuation of construction for the fiscal year 1932, $100,000 is reappropriated and made available for the fiscal year 1934 for construction, Greenfields division;

North Platte project, Nebraska-Wyoming. Not to exceed $120,000 from the power revenues shall be available during the fiscal year 1934 for the operation and maintenance of the commercial system;

Rio Grande project, New Mexico-Texas: For operation and maintenance, $305,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1933 shall remain available for the same purposes for the fiscal year 1934;

Owyhee project, Oregon: For continuation of construction, $1,577,000;

Vale project, Oregon: For operation and maintenance, $19,000: *Provided*, That the unexpended balance of the appropriation for the purchase of right of way, fiscal year 1932, shall be available for the same purpose during the fiscal year 1934;

Klamath project, Oregon-California: For operation and maintenance, $45,500: *Provided*, That revenues received from the lease of marginal lands, Tule Lake division shall be available for refunds to the lessees in such cases where it becomes necessary to make refunds because of flooding or other reasons within the terms of such leases: *Provided further*, That $85,000 of the unexpended balance of the appropriation for continuation of construction, fiscal year 1932, shall be available for continuation of construction during the fiscal year 1934;

Salt Lake Basin project, Utah, second division: The unexpended balance of the appropriation for the fiscal year 1933 shall remain available for the same purposes for the fiscal year 1934, the proviso to said original appropriation for said second division being hereby amended so as to read as follows: "*Provided*, That no part of this sum shall be available for construction work until a contract or contracts shall be made as required by the reclamation laws with an irrigation district or districts or water-users' association or associations for the payment to the United States of the cost of such second division";

Yakima project, Washington: For operation and maintenance, $265,000; for continuation of construction, $355,000; in all, $620,000: *Provided*, That not to exceed $40,000 from power revenues shall be available during the fiscal year 1934 for operation and maintenance of the power system;

Yakima project (Kittitas division), Washington: The unexpended balance of the appropriation for continuation of construction for the fiscal year 1933 shall remain available during the fiscal year 1934;

Riverton project, Wyoming: For operation and maintenance, $21,000: *Provided*, That not to exceed $20,000 from the power revenues shall be available during the fiscal year 1934 for the operation and maintenance of the commercial system;

Shoshone project, Wyoming: For operation and maintenance, Willwood division, $12,300: *Provided*, That the unexpended balance of the appropriation for construction, Willwood division, for the fiscal year 1933, shall remain available for the same purposes for the fiscal year 1934: *Provided further*, That not to exceed $25,000 from power revenues shall be available during the fiscal year 1934 for the operation and maintenance of the commercial system;

Secondary and economic investigations: For cooperative and general investigations, including investigations necessary to determine the economic conditions and financial feasibility of projects and investigations and other activities relating to the reorganization, settlement of lands, and financial adjustments of existing projects, including examination of soils, classification of land, land-settlement activities, including advertising in newspapers and other publications, and obtaining general economic and settlement data, the unexpended balances of the appropriations for these purposes for the fiscal year 1933 shall remain available for the same purposes for the fiscal year 1934: *Provided*, That the expenditures from this appropriation for any reclamation project shall be considered as supplementary to the appropriation for that project and shall be accounted for and returned to the reclamation fund as other expenditures under the Reclamation Act: *Provided further*, That the expenditure of any sums from this appropriation for investigations of any nature requested by States, municipalities, or other interests shall be upon the basis of the State, municipality, or other interest advancing at least 50 per centum of the estimated cost of such investigation;

Giving information to settlers: For the purpose of giving information and advice to settlers on reclamation projects in the selection of lands, equipment, and livestock, the preparation of land for irrigation, the selection of crops, methods of irrigation and agricultural practice, and general farm management, the cost of which shall be charged to the general reclamation fund and shall not be charged as a part of the construction or operation and maintenance cost payable by the water users under the projects the unexpended balance of the appropriation for this purpose for the fiscal year 1933 is continued available for the same purpose for the fiscal year 1934;

Limitation of expenditures: Under the provisions of this act no greater sum shall be expended, nor shall the United States be obligated to expend during the fiscal year 1934, on any reclamation project appropriated for herein, an amount in excess of the sum herein appropriated therefor, nor shall the whole expenditures or obligations incurred for all of such projects for the fiscal year 1934 exceed the whole amount in the "reclamation fund" for the fiscal year;

Interchange of appropriations: Ten per centum of the foregoing amounts shall be available interchangeably for expenditures on the reclamation projects named; but not more than 10 per centum shall be added to the amount appropriated for any one of said projects, except that should existing works or the water supply for lands under cultivation be endangered by floods or other unusual conditions an amount sufficient to make necessary emergency repairs shall become available for expenditure by further transfer of appropriation from any of said projects upon approval of the Secretary of the Interior;

Total from reclamation fund, $3,003,000.

To defray the cost of operating and maintaining the Colorado River front work and levee system adjacent to the Yuma Federal irrigation project in Arizona and California, subject only to section 4 of the act entitled "An act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes", approved January 21, 1927 (44 Stat. p. 1010), $48,000, to be immediately available, together with the unexpended balance of the appropriation for the fiscal year 1933,

Boulder Canyon project: For the continuation of construction of the Hoover Dam and incidental works in the main stream of the Colorado River at Black Canyon, to create a storage reservoir, and of a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from such reservoir; to acquire by proceedings in eminent domain or otherwise, all lands, rights of way, and other property necessary for such purposes; and for incidental operations, as authorized by the Boulder Canyon Project Act, approved December 21, 1928 (U.S.C., Supp. V, title 43, ch. 12A): $8,000,000, to be immediately available and to remain available until advanced to the Colorado River Dam fund, which amount shall be available for personal services in the District of Columbia, and for all other objects of expenditure that are specified for projects included in this Act under the caption "Bureau of Reclamation" without regard to the limitations of amounts therein set forth: *Provided*, That of this fund not to exceed $18,000 shall be available for the erection, operation, and maintenance of necessary school buildings and appurtenances on the Boulder Canyon project Federal reservation, and for the purchase and repair of required desks, furnishings, including maps, globes, stationery, books, schoolroom equipment, and other suitable facilities: *Provided further*, That of this fund not to exceed $50,000, reimbursable, shall be available for investigation and reports as authorized by section 15 of the Boulder Canyon Project Act: *Provided further*, That no part of any appropriation in this act for the Bureau of Reclamation shall be used for investigations to determine the economic and/or financial feasibility of any new reclamation project.

* * * *

Sec. 2. Appropriations herein made for field work under the General Land Office, the Bureau of Indian Affairs, the Bureau of Reclamation, the Geological Survey, and the National Park Service, shall be available for the hire, with or without personal services, of work animals and animal-drawn and motor-propelled vehicles and equipment.

Approved, February 17, 1933.

170423—33——2

Public Land Opening Gooding Division Minidoka Project, Idaho

The Secretary of the Interior has announced the opening to entry on May 17 of 68 public land farm units on the Gooding division of the Minidoka project, Idaho.

For a period of 90 days from the date of opening ex-service men will be eligible to apply for units. At the expiration of that period the remaining units will be open to the general public. Each applicant, including ex-service men, must have a capital of at least $2,000 in cash or its equivalent in farm implements, livestock, etc., deemed by the examining board to be as useful to the settler as cash. He must also have had at least 2 years' farming experience, preferably on irrigated land, his industry and character must be vouched for, and he must be in good health.

Requests for literature, including farm application blanks, should be addressed to the Commissioner, Bureau of Reclamation, Washington, D.C., or the Superintendent, Minidoka Project, Burley, Idaho.

Research Work of Bureau

(Continued from p. 55)

strength with ages and curing temperatures, proper gradation of aggregates through a range of sizes up to cobbles 9 inches in diameter, effect of vibration of fresh concrete, and permeability of concrete.

Failure of 36- by 72-inch concrete cylinder under compressive load. Note lines of conical fracture. Denver laboratory.

The concrete research program has required the establishment of two large, adequately equipped laboratories in Denver (figs. 2 and 3). Test specimens of concrete in great numbers, varying in size from 3 inches in diameter by 3 inches in length to 36 inches in diameter by 72 inches in length, are required to be manufactured and tested. A 4,000,000-pound hydraulic compression testing machine was purchased and installed for this work in cooperation with the Bureau of Standards. The successful development of the many new and ingenious instruments, and special fabricating and handling equipment, together with the technique necessary for carrying out these unprecedented tests, has been an important part of the work, but these details cannot be described in the space allotted for this article.

(To be continued in June issue)

A joint meeting of the Hoover Dam Consulting Board and Concrete Research Board was held in Denver during the week beginning April 3. Those in attendance at this meeting included P. H. Bates, of the Bureau of Standards, and consulting engineers F. R. McMillan, R. E. Davis, W. K. Hatt, H. J. Gilkey, D. C. Henny, W. F. Durand, and L. C. Hill.

Governor Martin, of Washington, has appointed a Columbia Basin Commission consisting of E. F. Banker, Winthrop; H. R. Smith, Neppel; James McGovern, Spokane; A. S. Goss, Seattle; and Rufus Woods, Wenatchee.

ENGINEERING

GEORGE O. SANFORD, Chief, Engineering Division

Cableways at Hoover Dam Site

By W. R. Nelson, Assistant Engineer, Boulder Canyon Project

TRANSPORTING and placing the millions of pounds of concrete, steel pipes, reinforcement steel, gates and valves, powerhouse machinery, and other supplies and equipment for building the dam and accessory structures on the Boulder Canyon project have involved the preparatory construction of many miles of railroads and highways to bring materials to Black Canyon and the installation of numerous cableways for their rapid conveyance to final positions. The equipment and operation of the cableways are known to those who have observed the construction of dams, but a short description of them may prove of interest to others.

GENERAL DESCRIPTION

The load to be transported on the cableway is suspended by a hook, fall blocks, and hoist cables from a carriage which travels between towers on the track cable. The cableways at Black Canyon are of three types, having stationary head and tail towers, traveling self-supporting towers or stationary head tower and traveling tail tower. For the stationary type the track cable is anchored in the canyon walls and supported at desired elevations by the head and tail towers. For the movable type, the track cable is fastened to the towers and the pull of the cable is counteracted by heavy concrete counterweights at the rear of the structures and by trucks on the towers bearing against horizontal rails or inclined front tracks.

Hoist drums, operated by electric motors, are provided for the conveying and hoisting ropes in all cableway installations and for the dump ropes and tower-propelling lines for the 20-ton movable type. All hoists are equipped with band and other service brakes which are released and controlled by compressed air or electrical means.

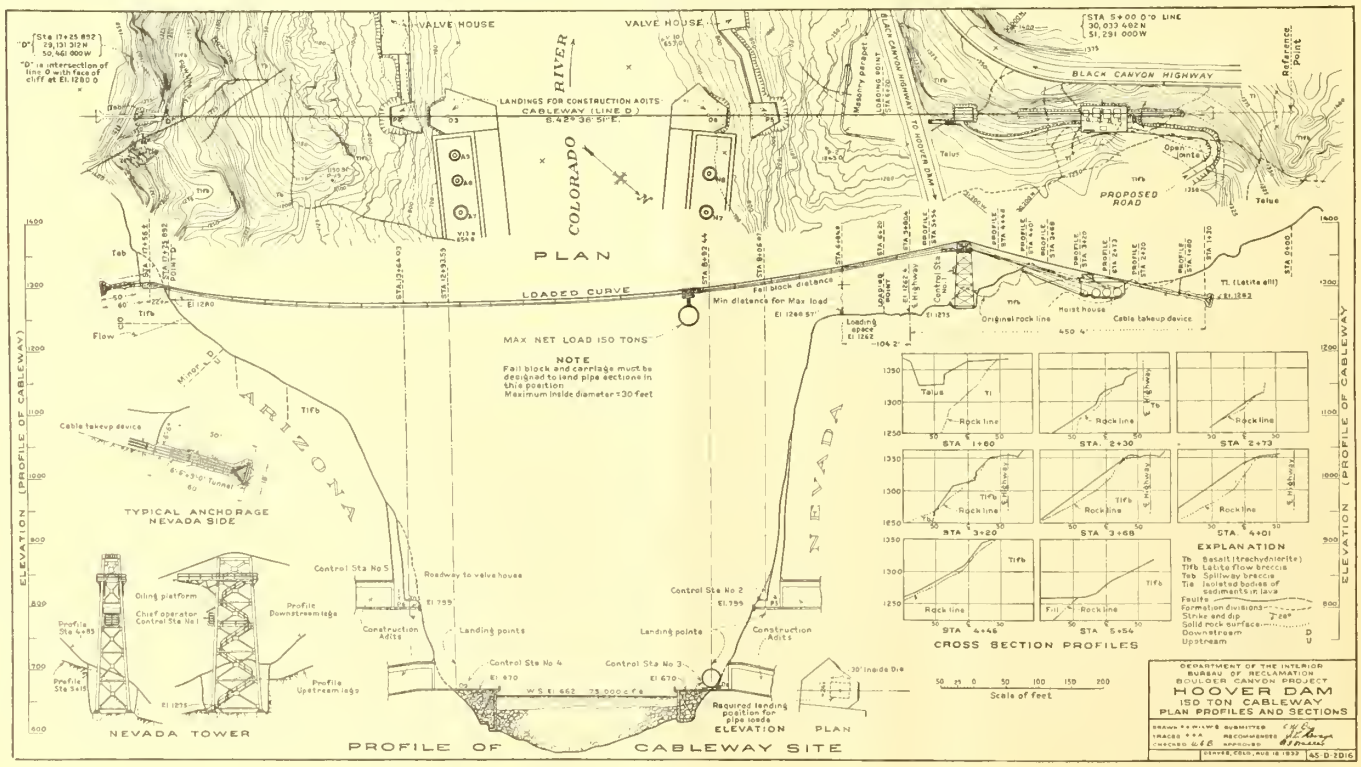
The cableway load is conveyed across the canyon by an endless steel rope that runs from track carriage to two sheaves at the tail tower, returns above all other cables to a sheave in the head tower, passes to and around the drum of the conveyance hoist and thence to a sheave in the top of the head tower and returns to the track carriage.

Raising or lowering the load is accomplished by means of the hoist rope which is reeved between the hoist fall blocks and track carriage, then travels to a sheave in the head tower and down and around the hoist drum.

On those cableways equipped with dump hoist and lines, the ropes are reeved from drum to track carriage and dump fall blocks in similar manner to the hoist ropes. Dumping is accomplished by lowering the hoist fall blocks and holding the dump fall blocks stationary.

PRELIMINARY SERVICE

During the early stages of construction in Black Canyon, small service cableways were erected near diversion tunnel portals to move heavy equipment across the river, build steel suspension bridges, and carry men to the sites of stripping operations on the canyon walls. Certain of these were



placed above the inlets of the four diversion tunnels and the outlets of two inner tunnels and later aided in erection of the steel bulkheads and trash-rack foundations and the Stoney gates.

After the Black Canyon highway was excavated to the top of the dam site on the Nevada side, another small cableway was installed above the canyon wall valve houses, which had its head tower located in a bay on the highway. This installation provided quick dispatch of men and materials from rim to rim of the canyon and permitted the movement of men and equipment to the sites of valve houses, for the excavation of the valve-house bench and outlet tunnels.

All of the above-mentioned cableways are the stationary tower type which have their hoists or power units on the Nevada side of the canyon, and anchorages for track cables by means of structural steel members concreted in place at the end of anchor tunnels driven in the canyon walls.

CONTRACTOR'S SYSTEM

In order to secure adequate coverage by cableway of the spillways, intake towers and dam, and to convey concrete, steel and other construction materials to these sites in an efficient and rapid manner, the contractor, Six Companies, Inc., has installed five 20-ton cableways which have self-supporting movable towers at head ends of four of the installations and at the tail ends of all five. The cableways are numbered 5 to 9, inclusive; nos. 5 and 6 crossing above the locations for the spillways, intake towers and upstream portion of the dam; 7 and 8 covering the downstream portion of the dam; and no. 9 being placed above the site of the powerhouse wings.

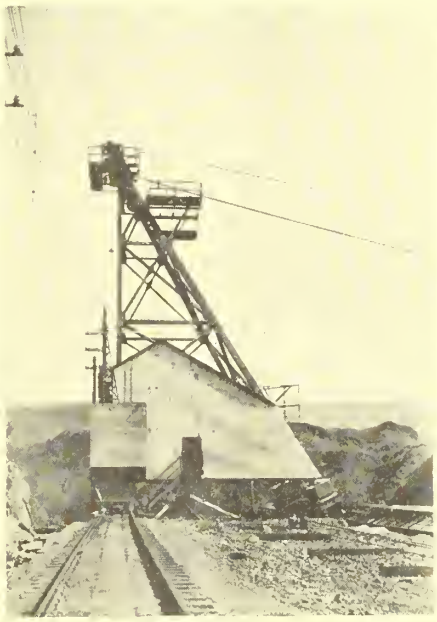
All these towers are of the traveling type except the head structure of no. 9 which is a stationary structural steel A frame 98 feet in height. Cableways nos. 5 and 6 occupy the same tracks as do also nos. 7 and 8. The spans of nos. 5 and 6 are 2,575 feet, of nos. 7 and 8 are 1,405 feet, and of no. 9 is 1,374 feet.

With respect to the elevation of the crest of the dam (elevation 1,232) the lowest point of the track cable when loaded will clear the crest by approximately 57 feet, for cableways nos. 5 and 6, and 88 feet for cableways nos. 7 and 8. The lowest point on the loaded track cable of no. 9 will be about 57 feet below the crest elevation.

The track cable for each installation is a 3-inch diameter lock coil type which has a guaranteed strength against breaking of 450 tons. The endless rope is a 1-inch diameter steel cable and the hoist and dump ropes are ⅞-inch diameter. The cableways have been designed for normal operations with 20-ton loads and infrequent loading up to a maximum of 40 tons. The concrete counterweights have been built to counteract the pull from a 60-ton load.

The movable towers have the form of a right pyramid with back leg vertical and are built of heavy structural steel and partially covered with corrugated iron to form a housing for the operating machinery. In order to eliminate a possible fire hazard, the floors are built of checkered steel plate and no wood is used in the structures. The heights of the towers vary from 17 to 90 feet, their widths from 20 to 46 feet, and lengths along track from 20 to 32 feet. The towers are supported by four to eight trucks, each containing two pairs of 33-inch diameter wheels traveling upon two parallel standard-gage tracks placed from 19 to 45 feet apart.

The vertical component of the pull of the cable on each tower is resisted by a massive block of concrete weighing from



Movable cableway tower operating over Hoover Dam site, showing a typical installation.

400,000 to 1,052,000 pounds, placed above the rear trucks. The horizontal component of the cable pull is counteracted by trucks on the tower bearing against a center rail placed with web horizontal or by elevating the front rail of the front track.

The hoists and power units are installed in the towers on the Nevada side of the canyon, the hoist house for no. 9 being placed at the base and on the riverward side of the A frame. Each cableway is operated by a 500-horsepower 2,200-volt A.C. motor and a 3-drum hoist equipped with band brakes and V-type wood block clutches. The brakes are operated by compressed air, and safety features are provided whereby they will brake automatically in case of power failure, overloading, overspeeding, or incapacity of the operator. The load can be conveyed on the track cable at a rate of 1,200 feet per minute (13.6 miles per hour), or lowered and hoisted at a rate of 300 feet per minute. A tower is moved on its tracks by motor and hoist in the structure, the hoist being attached by a single cable and through sheaves to anchorages at both ends of the track runway. A single electrical circuit operated from the head tower synchronizes the traveling operations of the head and tail towers.

HANDLING OF CONCRETE

The contractor has recently completed the Hi-Mix concrete plant at a location near the no. 9 head tower. According to present plans, this plant will manufacture most of the concrete for spillways, intake towers, valve houses, and upper portions of the dam, completing its work in 1937. The Lo-Mix plant in Black Canyon, 4,000 feet upstream from the dam site, has been in operation since February 28, 1932, and has manufactured approximately a third of a million cubic yards of concrete, most of which has been placed in the linings of diversion tunnels. It is planned that this plant will mix the concrete for the lower portion of the dam and be dismantled in 1935, preceding the storage of water back of the partially completed dam.

A railroad has been partly constructed from the Lo-Mix plant, running downstream beneath cableways nos. 5 to 8, inclusive, and another is planned to be built from the Hi-Mix plant running upstream beneath all cableways. Bottom dump buckets of 8-yard capacity mounted on flat cars will receive the concrete from the plants. The buckets will be transported by rail to a position beneath the designated cableway and then be conveyed by cableway to the pouring site. Each bucket with its load will weigh approximately 20 tons. During the peak of operations the contractor plans to mix and pour 150,000 to 200,000 cubic yards of concrete a month, which will require continuous operation both day and night of six to eight 4-cubic-yard mixers and some or all of the cableways.

The water to be carried from the reservoir past the dam to the turbines of the power plant, or to outlet works, will pass through steel pipes, 4,500 feet of which will be 30-foot diameter penstock headers. Some of these pipes will have a $2\frac{11}{16}$ inch thickness of steel and weigh 135 tons for a 24-foot length and some special pieces will weigh as much as 150 tons. Other steel pipes include 1,800 feet of 25-foot diameter penstock headers, 1,900 feet of $8\frac{1}{2}$-foot diameter outlet pipes, and 5,400 feet of 13-foot diameter penstocks. These pipes are to be furnished and installed by Babcock & Wilcox Co., of Barberton, Ohio, but the Government is required by the contract to transport the pipes from the fabrication plant, 1½ miles

Panorama of canyon rim above Hoover Dam site on the Nevada side. Left to right: Operating tower for 150-ton cableway; Six Companies Hi-Mix concrete mixing plant; cableway operating over dam site; and cableway operating over intake towers and spillways.

west of the dam site, to the portals of construction adits leading to tunnels in which the pipes will be placed.

The mode of transportation from fabrication plant to canyon rim has not been definitely decided. The most feasible manner to convey the pipes from rim to adit portals is by cableway, and one of these, of 150-ton capacity, is now under construction for this work by Government contract with the Lidgerwood Manufacturing Co., of Elizabeth, N.J.

GOVERNMENT CABLEWAY

This cableway, with a capacity more than twice as large as any cableway previously constructed, will be a permanent installation, and in addition to the transportation of the steel pipes, will also be used to transport the turbines, generators, transformers, valves, gates, and other materials for the power plant and outlet works. After the dam is completed it will be used for operation and maintenance of the power plant and outlet works and for installation of additional machinery.

The cableway will be a stationary type, having a 90-foot structural-steel head tower on the Nevada side, a concrete saddle on the Arizona side, and track cables connected to I-bars which have been imbedded in concrete anchorages in each canyon wall. The track will be made up of six 3½-inch Langlay superplow steel cables placed side by side at 18½-inch centers on a catenary curve. Each track cable will have a strength against breaking of 1,070,000 pounds, or 6,420,000 pounds (3,210 tons) for the six cables comprising the track. With a 150-ton load on the cableway, the pull of the track cables will amount to more than 2,000,000 pounds on each anchorage.

Two endless ropes and two hoist cables, each of 1⅛-inch diameter steel, will run from track carriage to hoist drums for conveying the load along the track and for lowering and hoisting operations. The load will be carried by two fall blocks suspended from the track carriage by a reeving of hoist ropes. The track carriage will be equipped with forty-eight 24-inch diameter sheaves for traveling upon the track, eight sheaves for each track cable.

OPERATING 150-TON CABLEWAY

The hoist house located between the steel head tower and the Nevada anchorage will contain two hoist drums, one conveying drum and electrical power and control units. Each hoist drum is to be operated by a 125 horsepower D.C. motor and the conveying drum by a 400 horsepower D.C. motor. Electrical energy will be received at 2,300 volts, 60 cycles, and converted to direct current by a motor generator set, the motor of 300 horsepower rating and the generator of 250 kilowatts and 550 volts. The drum for the conveying hoist will have a diameter of 8 feet, a length of 10½ feet, and each of the 2 hoist drums will have a diameter of 13 feet and a length of 17 feet, allowing sufficient drum area to wind the ropes in a single layer and eliminate overlapping.

Deceleration and braking of the load will be secured by motor control and operation, by band brakes on the hoist drums operated by electric thrustors, and by solenoid brakes on the axles of driving motors. Equipment is provided whereby the load will be automatically decelerated and brakes applied, in the event of overloading, overspeeding, or power failure. Rotation of conveying and hoist drums will be synchronized by electrical means.

The track carriage is to be operated at a speed of 240 feet per minute, the load speed will be approximately 30 feet per minute when raising 40 to 150 tons or lowering 50 to 150 tons, and 120 feet per minute for raising or lowering smaller loads. Provision will also be made for "creeping" speeds when conveying on the track and "inching" speeds when hoisting or lowering.

CONTROL STATIONS

The cableways will be operated and controlled from five control stations. One of these will be placed at each of the four adit portals, while the main station will be located in a lookout on the canyon rim near the head tower. Telephonic communication will be established between all stations, and the main station will be erected at the end of a platform projecting 30 feet from the canyon rim, in order to secure a clear vision of the platforms at all adit portals.

During normal operations, the main station will possess control to move the load on the track cable, but not to lower or hoist above any of the other stations. Each of the stations at the adit portals will be able to lower or hoist above and at its location, but will possess only restricted control of the movement of the load along the track. Transfer of control by the stations will be made with all equipment de-energized and resumption of operation made by means of a definite interlock to the station assuming control. The main station will be able to control all operations when necessary by means of a change-over switch located in the hoist house. Signal lights will be provided at each station showing which station is energized, by means of red and green lights.

Among the principal materials that the Government cableway will be required to handle during the years of construction from 1934 to 1937 are 42,000 tons of steel pipe, four 115,000-horsepower turbines, one 55,000-horsepower turbine, twelve 84-inch and twelve 72-inch needle valves as well as generators, transformers, valves, and fittings for the power plant and outlet works. As the demands for power increase, the cableway will be used to transport the remaining generator units until the ultimate rating for the power plant of 1,835,000 horsepower has been reached.

Boulder Canyon Project Notes

For the month of March, the average number of men employed on the project was 3,704 and the approximate gross pay roll was $550,000.

On April 1, excavation of the following tunnels and adits were completed: The 21-foot diameter Nevada penstock tunnels nos. 1 to 8, inclusive, except no. 2, between diversion tunnel no. 2 and the power house; the six 11 by 11 foot Nevada outlets to the valve house; the upper and lower 26 by 43 foot Nevada construction adits; the 7 by 14 foot pioneer tunnel from diversion tunnel no. 2 to intake tower; upstream wing of no. 8 Arizona penstock tunnel; the six 11 by 11 foot Arizona outlets to the valve house; and the upper 26 by 43 foot Arizona construction adit.

Murl Emory, accompanied by three passengers, piloted his specially designed boat from the dam site in Black Canyon to Hell Diver rapids, 118 miles upstream, and return, the entire trip requiring 4 days. The boat draws less than a foot of water and is propelled by airplane motor and propeller.

Construction operations at the dam site are of considerable interest to engineering students. The latter part of March a party of 50 students from the Agricultural College of Utah, accompanied by Dean Arthur Fife, and on April 7 a party of 50 students from the California Institute of Technology visited the project.

The "Boulder Canyon Wild Life Refuge" was created by Executive order on March 3. It includes lands in 25 townships in Arizona and 38 townships in Nevada, which are set apart for the use of the Department of Agriculture as a refuge and breeding ground for wild birds and animals. Practically all the lands involved have been withdrawn in connection with the Boulder Canyon project for river regulation, improvement of navigation, flood control, irrigation and domestic water supply, and for power development. The reservation of this area as a wild-life refuge is therefore secondary to its use by the Interior Department.

Sims Ely, city manager at Boulder City, states that Six Companies now has 661 cottages for married workers and dormitory accommodations for 1,711 men. This is exclusive of dormitory space at the river for 300 men, which is used in the winter months only. The Babcock & Wilcox Co. has a dormitory with a capacity of 101 and 12 homes for married employees. The Government has 2 dormitories for single men, accommodating 70, and 100 cottages for married employees. In addition to these housing facilities, more than 100 cottages have been constructed by employees of the contractors on ground leased from the Government.

Tourist travel to the Boulder Canyon, which has been increasing during the past few weeks, reached a peak for the year 1933 on April 8, when 798 visitors passed through the reservation gate.

Six Companies now has all four diversion tunnels ready for the spring flood waters of the Colorado. The two Arizona tunnels now carry the river and on 48 hours' notice the two Nevada tubes can be opened. Penstocks from the diversion tunnels to the canyon are temporarily closed by concrete bulkheads.

The twelve 4- to 6-room houses and the 101-man dormitory in Boulder City for employees of Babcock & Wilcox have been completed and are occupied. Installation of all equipment in the fabrication plant at Bechtel, including planer, rolls, facing lathe, stress-relieving furnace, and two 100-ton cranes, was completed in March. The first shipment of steel plates has arrived and the contractors are now ready to start fabrication of pipe.

The rock barrier downstream from the lower cofferdam was completed in April. About 130,000 cubic yards have been placed in this structure. The lower cofferdam was also completed during April. This structure is an earth fill with its upstream face protected by a rock blanket 66 feet in height, and contains approximately 230,000 cubic yards of earth and 63,000 cubic yards of rock.

Steel-Plate Shipments Begin

Shipment of steel plates from the Illinois Steel Co.'s plant at Gary, Ind., to the fabricating plant of the Babcock & Wilcox Co. at Bechtel near the site of Hoover Dam has been started. During the next two years approximately 92,000,000 pounds of plates and shapes will be shipped from Gary and 800,000 pounds of fabricated sections from the Babcock & Wilcox plant at Barberton, Ohio. All equipment has now been installed in the plant and fabrication of pipes has been started.

The shipment of pipe material will require 1,000 cars, and because of unusual dimensions several problems relating to transportation have arisen. The maximum width of plate will be 12 feet and the maximum length for this width will be 41 feet. Other material will vary in width from 5 feet to 11 feet 6 inches, and the maximum length will be 47 feet. A piece of 30-foot diameter pipe, 12 feet long, will be made up of three plates each approximately 12 feet wide, 32 feet long, and 2¾ inches thick, each plate weighing 23 tons (see back cover). Only two of these plates can be shipped on a single car.

Flat cars average in width 9 feet 5 inches and 41 feet in length, and as the 12-foot plates will be loaded lying flat, there would be a clearance of approximately 1 foot, should 12-foot-width material be passing in the opposite direction. For the 47-foot lengths it happens that the Union Pacific has a number of cars 52 feet 8 inches in length which will take these long pieces with space for the required blocking at each end, thus utilizing the entire car length almost to the inch.

The $10,908,000 contract awarded to the Babcock & Wilcox Co. calls for the furnishing, erecting, and painting of 4,700 feet of 30-foot, 1,900 feet of 25-foot, 5,600 feet of 13-foot, and 2,300 feet of 8½-foot diameter plate-steel pipe. The Government will transport the pipes from the fabricating plant at Bechtel to landing platforms at tunnel, while the contractor moves the pipe into the tunnels and erects them in final position. Moving erection sections of the 30-foot diameter pipe, which are made up of two 12-foot lengths, from the fabricating plant to the canyon will necessitate using special trucks or carriages as the weight of each section will be about 140 tons. They will be lowered about 600 feet from the rim to the bottom of the canyon by a 150-ton capacity cableway.

The price of pinto beans made a nice advance in March on the Grand Valley project from $1.90 to $2.75 a hundredweight.

Benefits of Sugar Industry in South Dakota

By W. D. Buchholz, Secretary, Belle Fourche Irrigation District, Newell, S.Dak.

THE sugar-beet crop in the irrigated regions of the Black Hills territory is receiving much consideration, and evidences are plentiful that the 1933 acreage will be increased from 30 to 40 percent over last year.

The directors of the Black Hills Beet Growers' Association made a report some time ago in connection with the hearing which was conducted before the United States Tariff Commission, commencing on February 14. A portion of that report was devoted to the importance to South Dakota of the sugar-beet industry, both as to the growing of sugar beets and the manufacturing of sugar therefrom. This part of the report is now given publicity, since it covers many of the points which the farmers and business men in the beet-growing sections are now discussing among themselves.

BETTER FARMING PRACTICES

Sugar-beet culture strongly promotes better farming practices. It encourages fall plowing, deep plowing, land levelling, frequent cultivation, rotation of crops, diversification of crops, weed eradication, maintaining fertility, suitable irrigation ditches, and careful irrigating. The several farm practices necessary for raising sugar beets create improved conditions for growing the later crops in the rotations. The raising of sugar beets also stimulates the production of maximum crops which is so essential to profitable farming.

On these points A. D. Ellison, county agent of Butte County, says:

> Through the improvement of soil fertility and farm practices, a large percentage of land that is now devoted to the production of surplus crops could be made to support more people in the production of sugar beets, placing them on a self-sufficing basis and assisting in a large measure toward relief of the unemployed.

INCREASED FARM RETURNS

Raising sugar beets increases farm returns. The superintendent of the Belle Fourche project reports that—

> Following the construction of the sugar factory in the Belle Fourche Valley in 1927, the total value of crops raised on the Belle Fourche irrigation project reached about $1,200,000 for the years 1928-30, doubling the value of the years 1922-24, which had an average of $598,000. Comparing returns of sugar-beet farms and others for 1932, the crop census shows the following: Returns per acre, 290 farms growing beets, $19; returns per acre, 560 farms not growing beets, $6.50; returns per acre, 850 farms growing all crops, $12.25.

The importance of the sugar-beet crop in increasing farm returns is seen also in the following project figures furnished by the superintendent:

Year	Beets	Other crops	Total
1928	$609,000	$565,000	$1,174,000
1929	642,000	564,000	1,206,000
1930	631,000	573,000	1,204,000
1931	295,000	390,000	685,000
1932	309,000	292,000	601,000

RETURNS OBTAINED FROM BEET ACREAGE

Because of the extremely low prices received in 1932 for small grains, corn, and hay, these crops did not return the cost of production. The farmer lost money on them and the landlord's rental was negligible. The sugar-beet crop was the only one that broke even or a little better for the grower and the landlord. The rental in 1932 from sugar-beet land was about $10 per acre; nothing to brag about, to be sure, but sufficient to carry the load of taxes, water charges, and interest. As stated by J. B. Hill, county agent of Lawrence County, "There is no argument whatever but that the sugar-beet industry was the greatest sustaining financial factor to the farmers who had land suitable for this production in 1932."

Growing sugar beets contributes to and strongly stimulates the dairy industry and the feeding of cattle and sheep. The by-products of beet tops, pulp, and molasses are valuable supplemental feeds to the grains and hay. The dairying and livestock feeding enterprises have been noticeably advanced since the coming of the local sugar factory. This in turn creates a better market for the grains and hay raised in this region. The superintendent of the United States Experiment Farm at Newell, reports "The beet industry, in combination with livestock, is one of the soundest farm enterprises we have and should be encouraged to the fullest extent possible."

INDUSTRY FURNISHES EMPLOYMENT

In 1932 the Belle Fourche factory ran 75 days; the number of people employed by the sugar company was 140 in the factory and 80 at the receiving stations. In the preceding seasons even more obtained employment from the sugar company. From 800 to 1,000 persons were employed in the beet fields, and Spanish-speaking people are fast giving way to American citizens. The wages earned are of large benefit in buying and paying for merchandise, paying taxes, and otherwise keeping up business in the beet-growing regions. The number of unemployed in this territory and the consequent burden upon public and private relief agencies would be much greater, at this time, were it not for the employment of about 1,200 persons which this industry afforded in 1932.

BEET INDUSTRY AN AID TO FEDERAL RECLAMATION

The United States invested about $5,000,000 to construct the irrigation and drainage system of the Belle Fourche project. Repayment of the debt has been slow and tedious. Based on past and present prices, the proceeds from small grains, corn, and hay, are not promising for the repayment of this debt. This territory needs money returns from concentrated instead of bulky production. Outside of cucumbers and sugar beets, no specialized crops have been found adapted to the soil and climatic conditions which prevail on this project, and cucumbers

each year are wanted only on a few hundred acres. Repayment of the debt to the Government therefore depends largely upon full-capacity development of the sugar-beet industry and the various enterprises which it stimulates.

EXPANSION OF INDUSTRY DESIRABLE

"Buy American." This idea is well founded in what the sugar-beet industry has done and is now doing. It should grow five to six fold because to date it has been a successful farming enterprise. Development of this industry so that the United States is self-supporting in this food is necessary from the standpoint of national security. The country now produces about one sixth of the sugar needed to feed its people; but there are lands suited to the raising of sugar beets to produce sufficient sugar to feed all its people.

A fivefold increase in the beet acreage of the United States would increase by fivefold all the many benefits hereinbefore noted which inure to the farmers, landlords and tenants, laborers, and material men; it would increase fivefold the labor needed in factories and on farms and correspondingly reduce the number of unemployed in the country; it would reduce by about 4,000,000 acres the lands now devoted to the raising of wheat, corn, cotton, and other crops contributing to surplus production in the country, and this would be very practical and successful farm relief; it would bring fulfillment of the earnest hope of the beet growers and laborers that the consumers of the country in their sugar needs may "Buy American."

There is general understanding and agreement that the present development of the beet-sugar industry has been possible only through benefits conferred by a protective tariff on sugar importations. No one believes that the American farmer and laborer can produce beet sugar in even competition with the cane producers in the Philippine Islands and Cuba. Our people believe that the desired expansion of the beet-sugar industry can come only by maintaining an adequate tariff upon sugar coming from foreign countries and by reasonable limitations on importations from our insular possessions. In years past the tariff on sugar has not been excessive; otherwise there would not have been the tremendous development in the cane-sugar industry in Cuba and the Philippine Islands.

Perhaps the tariff has been somewhat too low, otherwise there would now be a much larger acreage in sugar beets and a much larger number of beet-sugar factories. We believe that in order to maintain a healthy growth in the sugar-beet industry and in time bring about national security in this food by the domestic production equaling the domestic demand, there should be a reasonable increase in the tariff rates upon all sugar coming from foreign countries and Cuba, and more stringent restrictions upon sugar coming from the insular possessions of the United States.

GENERAL STATISTICS

Many benefits of the industry are reflected in general industry, the creation of much new wealth, and an unusually wide distribution of money in large figures in this State incident to the raising of sugar beets and manufacturing of sugar.

These benefits are shown in the following statistics:

Cost of materials for erecting factory, largely brick and cement	[1] $75,000
Beet acreage per year	[2] 8,000–10,000
General taxes paid, going to support of schools, local and State governments, building and improvements of roads	$95,000
Sugar beets produced in 6 seasons tons	662,665
Total paid growers	$3,988,293
Total paid to labor in factory and receiving stations	$1,093,416
Total paid to field workers	$1,016,678
Lime rock purchased in South Dakota and used in factory	$54,258
Total paid for fuel (coal and natural gas for 3 years)	$339,594

Figures for 1932 operation are as follows:

Total acreage of beets	8,000
Average yield per acre tons	11.7
Average sugar content per cent	16.62
Bags of sugar manufactured	253,669
Factory run days	75
Men employed in factory	140
Men employed at receiving stations	80
People employed in fields	800
Initial payment for sugar beets, flat rate per ton	$4.25

[1] Bricks made in brick plant at Belle Fourche, cement at State cement plant at Rapid City.

[2] This acreage before coming of the beet industry was devoted to grains and hay, which contributed to country's crop surplus.

Notes for Contractors

Boulder Canyon project.—On March 10, bids were opened at Denver, Colo., for furnishing hydraulic apparatus for the Hoover power plant. Four manufacturers submitted bids on turbines, butterfly valves, and governors—Allis-Chalmers Manufacturing Co., West Allis, Wis.; Newport News Shipbuilding & Dry Dock Co., Newport News, Va.; Pelton Water Wheel Co., San Francisco, Calif.; and S. Morgan Smith Co., York, Pa. On governors alone, the Lombard Governor Co., Ashland, Mass., and Woodward Governor Co., Rockford, Ill., also submitted bids.

The bids, all f.o.b. factory points were as follows: Schedule 1, five 115,000-horsepower turbines, Allis-Chalmers, $1,369,900; Newport News, $1,403,715; Pelton, $1,628,300; Smith, $1,437,845; schedule 2, five 115,000-horsepower turbines, with butterfly valves, Allis-Chalmers, $1,719,300; Newport News, $1,816,144; Pelton, $2,002,000; Smith, $1,779,510; schedule 3, two 55,000-horsepower turbines, Allis-Chalmers, $289,900; Newport News, $249,368; Pelton, $302,000; Smith, $289,180; schedule 4, two 55,000-horsepower turbines with butterfly valves, Allis-Chalmers, $365,000; Newport News, $338,020; Pelton, $381,000; Smith, $385,180; schedule 5, governors for five 115,000-horsepower turbines, Allis-Chalmers, $104,300; Newport News, $66,908; Pelton, $81,630; Smith, $74,350; Lombard, $86,075; Woodward, $60,605; schedule 5, governors for two 55,000-horsepower turbines, Allis-Chalmers, $37,400; Newport News, $20,670; Pelton, $26,630; Smith, $25,500; Lombard, $29,650; Woodward, $20,191; schedule 5, all seven governors, Allis-Chalmers, $112,200; Newport News, $87,578; Pelton, $108,260; Smith, $98,850; Lombard, $115,725; Woodward, $79,526.

The low bidders f.o.b. factory points are Allis-Chalmers Manufacturing Co., 115,000-horsepower turbines; Newport News Shipbuilding & Dry Dock Co., 55,000-horsepower turbines; Woodward Governor Co., governors. In figuring lowest delivered cost to the Government, cost of transportation and erection, efficiency guarantees and other factors were considered. Award of contracts has awaited approval of the city of Los Angeles and the Southern California Edison Co. which will operate the plant and pay for the machinery. The butterfly valves will be readvertised under separate specifications.

Twenty-nine manufacturers submitted bids under specifications No. 589-D for furnishing eight 57-inch butterfly valves with operating mechanisms (item 1), eight 24-inch internal differential control valves (item 3), and cast-iron pipe, fittings, manholes, and trash-bar spacers (item 2), all for installation in the spillways at Hoover Dam. Bids were opened at Denver on March 30. For the butterfly valves, prices received ranged from $1,520.62 to $2,800 for one valve, and Filer & Stowell Co. of Milwaukee, Wis., was low. The bids for the control valves ranged from $496 to $1,225 for each valve, the Johnson City Foundry & Machine Co., Johnson City, Tenn., making the low bid. The Bartlett-Haywood Co., of Baltimore, Md., submitted the low bid of $5,494 for item 2, other bids

ranging up to $15,796. All of these bids were f.o.b. factory. Based on lowest delivered cost to the Government and considering cost of inspection, the Johnson City Foundry & Machine Co., Johnson City, Tenn., was the low bidder for items nos. 1 and 3, with a combination bid of $17,000. The Goslin-Birmingham Manufacturing Co., Birmingham, Ala., was low bidder for item no. 2, with a factory bid of $6,000. Contracts have been awarded to the two low bidders.

Specifications no. 542 are being issued requesting bids on furnishing 120-inch and 168-inch diameter butterfly valves with their operating mechanisms for installation in the Hoover power plant. The valves will be installed by the Government.

Under invitation A-3163-A, bids opened March 6, 1933, the Pacific Coast Steel Corporation, 621 South Hope Street, Los Angeles, Calif., was low bidder on furnishing approximately 760,000 pounds of deformed reinforcing steel. The low bid was $1.31 per hundredweight. Under invitation A-3170-A1, the Iowa Valve Co. and Grinnell Co. were low bidders for furnishing gate valves, pipe and flanges for spillways with bids of $3,060 and $3,665.59, respectively. Under invitation A-3183-A, the Pacific Coast Steel Corporation has been awarded the contract for furnishing steel reinforcing bars for the Arizona spillway at a price of $9,253.39.

A preliminary draft of specifications has been prepared for the two station service units for the power plant and these have been discussed with representatives of Allis-Chalmers, Pelton, and others. Two 4,200-horsepower horizontal impulse type turbines and two 3,000-kilovolt-ampere horizontal generators are under consideration.

Bids were opened at Denver on April 24, under specifications no. 590-D for furnishing 400,000 barrels of Portland cement in bulk under new low-heat cement specifications varying from Federal specifications no. SS-C-191. This is the initial requirement for cement for the mass concrete in the dam. The estimated maximum daily delivery of cement required is 7,000 barrels and the estimated maximum monthly delivery is 175,000 barrels.

Minidoka project.—Hendrie & Bolthoff Manufacturing & Supply Co., Denver, Colo., was low bidder under specifications no. 585-D, bids opened March 3, for furnishing one vertical motor-driven drainage pump, capacity 5 second-feet, for $545. At the opening on March 10, Anderson & Tilly, Jerome, Idaho, submitted low bid of $2,806.15, under specifications no. 587-D, for building lateral system structures on the Gooding division.

Yakima project. — Under invitation A-13664-A, bids were opened at Denver on April 7 for furnishing 11,000 barrels of portland cement in cloth sacks. The Superior Portland Cement Co., of Seattle, Wash., was low with a bid of $1.90 per barrel, f.o.b. Concrete, Wash. Five companies submitted bids.

Reclamation Organization Activities and Project Visitors

Walker R. Young, construction engineer on the Boulder Canyon project, was a recent visitor on the Yuma project.

L. N. McClellan, chief electrical engineer, has returned to Denver from Los Angeles, where he met with officials of the city of Los Angeles and the Southern California Edison Co. and discussed with them the turbine bids for the Boulder Canyon project. On his return trip he spent 1 day in Boulder City.

E. W. Lane, engineer, left Denver recently for Yuma, Ariz., where he initiated silt studies along the Colorado River, the studies being made in connection with the designs for the All-American Canal.

J. L. Savage, chief designing engineer, made a recent brief trip to the Boulder Canyon project.

T. S. Martin, master mechanic in the Denver office, has been temporarily assigned at Madden Dam, Panama Canal. The immediate requirement for this service is in connection with the erection of sluice gates.

The appointments of D. C. Henny and L. C. Hill as consulting engineers in the Bureau of Reclamation were terminated at the close of April 10, in order to permit them to serve as consultants in the War Department. They will be reappointed later on to their former positions.

The many friends of George A. Beyer, chief photographer in the Washington office, will be pleased to learn of his marriage on March 25 to Miss Elizabeth Hall. Mr. and Mrs. Beyer are now at home at 5 Kingsbury Drive, South Woodside Park, Md.

Thomas F. Neely, who was employed in various clerical positions in the Bureau from 1906 to 1929, died on April 9. Mr. Neely was placed on the retired list on January 1, 1930, because of his poor physical condition.

In the interest of economy, with this issue publication of the Reclamation Era will be discontinued until further notice.

Jesse R. Thompson, formerly employed on the Uncompahgre project, has been reinstated as foreman on the Boulder Canyon project.

John R. Iakisch, engineer assigned to Colorado River Basin investigations, sustained severe injuries on April 3. At the time of his accident he was engaged in the inspection of a canal location along a steep rock side hill in the vicinity of Norton landing on the Colorado River, near Cibola, Ariz. A rock ledge upon which he was standing gave way, his left hip and ankle being badly sprained, and in addition he incurred severe bruises and abrasions on his legs, arms, and body.

C. M. Day, mechanical engineer, has returned to Denver from a trip to Barberton, Ohio, Pittsburgh, Pa., and other eastern points, where he was engaged in connection with current contracts.

William G. Weber, associate engineer in the Denver office, has been temporarily assigned to the Boulder Canyon project for the purpose of inspecting the installation of the bulkhead gate hoists.

B. E. Stoutemyer, district counsel at Portland, Oreg., was a recent visitor on the Minidoka project.

W. O. Fleenor, manager of the Gering-Fort Laramie irrigation district; Bert Adams, manager of the Goshen irrigation district; Lloyd Edwards, assistant superintendent of the Mountain States Power Co.; and a delegation of Bayard city officials, recently visited the North Platte project.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **Nathan R. Margold,** Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary, and Budget Officer
William Atherton DuPuy, Executive Assistant

WASHINGTON, D.C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
C. N. McCulloch, Chief Clerk

P. W. Dent, Assistant Commissioner
George O. Sanford, Chief of Engineering Division

George O. Sanford, Acting Director of Reclamation Economics
L. H. Mitchell, Assistant Director of Reclamation Economics

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydraulic Eng.; L. N. McClellan, Chief Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz.	R. M. Priest	Superintendent	J. C. Thrailkill	Jacob T. Davenport.	R. J. Coffey	Los Angeles.
Boulder Canyon	Boulder City, Nev.	Walker R. Young	Constr. engr.	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Boulder City, Nev.
Orland	Orland, Calif.	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Boulder City, Nev.
Boise [1]	Ontario, Oreg.	F. A. Banks	Constr. engr.			B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	Superintendent	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont.	A. W. Walker	do			do	Do.
North Platte [4]	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	A. T. Stimpfig	do	Do.
Carlshad	Carlshad, N. Mex.	L. E. Foster	Superintendent	William F. Sha	William S. Sha	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex.	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg.	C. L. Tice	Reserv. supt.		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	Chas. C. Ketchum	Superintendent		F. C. Bohlson	do	Do.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler	C. J. Ralston	do	Do.
Owyhee	Ontario, Oreg.	F. A. Banks	Constr. engr.	Robert B. Smith	F. C. Bohlson	do	Do.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima [7]	Yakima, Wash.	John S. Moore	do	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Cle Elum Dam	Ronald, Wash.	R. J. Newell	Constr. engr.	C. B. Funk	do	do	Do.
Yakima, Kittitas Div.	Ellensburg, Wash.	A. A. Whitmore	Act. constr. engr.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo.	H. A. Parker	do		Denver office	do	Do

[1] Reserved works, Boise project, supervised by Ontario office.
[2] Jackson Lake and American Falls Reservoirs, power system, and Gooding division.
[3] Malta, Glasgow, and storage divisions.
[4] Pathfinder and Guernsey Reservoirs and power systems
[5] Acting.
[6] Storage, Main, and Tule Lake divisions.
[7] Storage, Sunnyside, Tieton, and Kennewick divisions.
[8] Reservoir, power plant, and Willwood division.

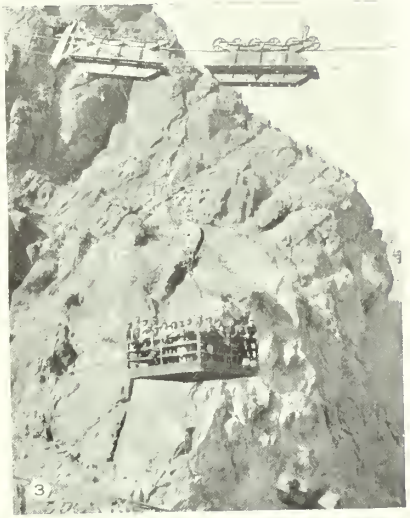
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

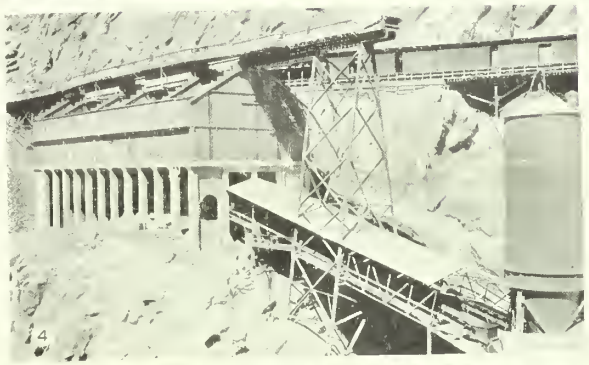
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W.U.A.	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo.	C. W. Tharp	Superintendent	C. J. McCormick	Grand Junction.
Uncompahgre	Uncompahgre Valley W.U.A.	Montrose, Colo.	C. B. Elliott	do	Wm. W. Price	Montrose, Colo.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise, Idaho
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	G. J. Hageus	Irrigation engineer and manager.	Miss Elsie H. Wagner.	Hamilton, Mont.
Huntley	Huntley Project irrigation district.	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont.	A. L. Bentou	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont.	Charles J. Johnson	Superintendent	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Zurich, Mont.	J. F. Overcast	President	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	do	John W. Archer	do	A. H. Dorn	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	Manager	H. P. Wangen	Fairfield, Mont.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Project manager	O. B. Patterson	Sidney, Mont.
North Platte, Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Flora K. Schroeder	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	D. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	B. L. Adams	do	Mrs. Nelle Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	Paul G. Gebauer	President	Mahle J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev.	D. S. Stuver	Project manager	Mrs. L. V. Pinger	Fallon, Nev.
Baker	Lower Powder River irrigation district.	Baker, Oreg.	A. J. Ritter	Manager	F. A. Phillips	Keating, Oreg.
Umatilla, East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	E. D. Martin	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg.	F. E. Thompson	Manager	F. E. Thompson	Bonanza, Oreg.
Do	Horsefly irrigation district	do	John Ross	President	Dorothy Eyers	Do.
Salt Lake Basin (Echo Res.)	Weber River W.U.A.	Ogden, Utah	D. D. Harris	Manager	D. D. Harris	Ogden, Utah.
Strawberry Valley	Strawberry W.U.A.	Payson, Utah			E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan, Wash.
Shoshone, Garland division	Shoshone irrigation district	Powell, Wyo.	Clarence Peterson	President	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver, Wyo.

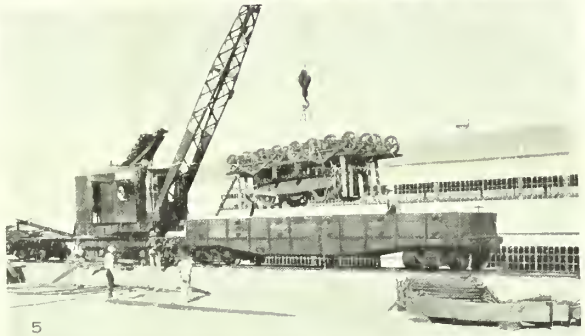
Important investigations in progress

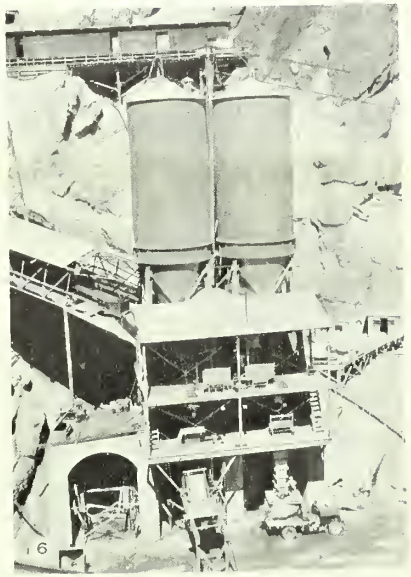
Project	Office	In charge of	Cooperative agency
All-American Canal	Denver, Colo., Customhouse.	Denver office	Imperial and Coachella districts.
Salt Lake Basin, Utah	Salt Lake City, Utah, Federal Bldg.	E. O. Larson	State of Utah.
Humboldt River, Nev.	Denver, Colo., Customhouse	Leo J. Foster	State of Nevada.
Colorado River Basin investigations	do	P. J. Preston	Colo., Wyo., Utah, and N. Mex.
Central California Water Resources	Sacramento, Calif., Public Works Bldg.	H. W. Bashore	State of California.

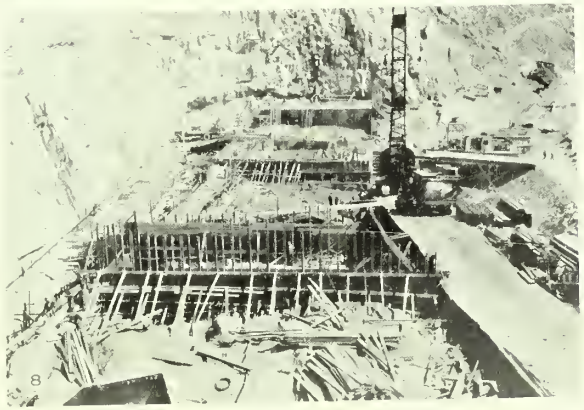
SALLIE A. B. COE, *Editor.*











BOULDER CANYON PROJECT

PROGRESS VIEWS

Photograph by Babcock & Wilcox

1, Thirty-foot diameter plate-steel outlet pipe at Hoover Dam, manufactured by Babcock & Wilcox. Weight 72 tons, thickness 2¾ inches. 2, Head tower and hoist house for 150-ton permanent cableway under construction. 3, Workmen going on shift in skip operated over Six Companies cableway no. 9. 4, Aggregate storage at Six Companies high-level concrete mixing plant. 5, Unloading carriage for 150-ton permanent cableway at Boulder City storage yards. 6, Six Companies high-level concrete mixing plant showing loading, mixing, and control decks with cement storage silos above. 7, View looking upstream through Black Canyon showing downstream cofferdam and rock barrier. Excavation in dam substructure and upstream cofferdam seen in background. Stoney gate structure at outlet portal of diversion tunnel no. 2 seen in lower left. 8, Concreting operations in weir foundation at Nevada spillway.

U. S. GOVERNMENT PRINTING OFFICE: 1933