NEW RECLAMATION ERA

VOL. 22. NO. 1 JANUARY, 1931

LYMAN LAKE AND HANGING GLACIERS, LAKE CHELAN, WASHINGTON

Reclamation

Comparative Statistics

THE magnitude of the engineering work accomplished in reclaiming the arid lands of the West can only be conceived when a figurative comparison is used. In creating its 39,970 irrigated farms, peopled with 157,088 inhabitants, this bureau has indirectly brought about the development of 214 cities and towns, the population of which when added to the project inhabitants equals more than the entire population of the District of Columbia. ¶ To accomplish this there has been excavation of enough material to have created a ditch across the continent with a 50-foot width and a 10-foot depth. Riprap placed by this bureau to date would create a pyramid nearly equal in size to the Cheops—the largest pyramid of Egypt. Concrete placed to date would have paved the shortest direct route from New York to Los Angeles with a 6-inch paving on a 16-foot highway. Telephone and power transmission lines used by this bureau on its various projects aggregate enough in distance to parallel the above phantom highway throughout its length with a mileage of telephone line sufficient to have created a crossline from Chicago to New Orleans. ¶ The Bureau of Reclamation has a remarkable backing of experience for the building of Hoover Dam.

Extract from Annual Report of Secretary of the Interior
for the fiscal year ended June 30, 1930

NEW 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. 22, No. 1 JANUARY, 1931

Interesting High Lights on the Federal Reclamation Projects

A LARGE number of inquiries are being received monthly concerning settlement opportunities on the Riverton project. Two applicants who had previously visited the project took farm units and made the advance payment for 1931.

THE sugar factory at Sidney, Lower Yellowstone project, is materially assisting in the relief of local unemployment conditions, having handled a total of 112,000 tons of beets this season. In addition to the factory pay roll over $600,000 has been paid out for beets on the project and several thousand more in operating the dumps and similar work.

THE first shipment of turkeys for the season from the Minidoka project was made in November. At Rupert some 5,000 birds, weighing about 60,500 pounds, and at Burley 500, with a total weight of 6,500 pounds, were shipped to market.

THE Klamath Dairymen's Association, the Langell Valley Cheese Factory, and the Malin Cheese Factory on the Klamath project were combined under one general management during the month, although each organization is still maintained as an individual corporation.

THE office of the Vale-Owyhee Government Projects Land Settlement Association was visited during the month by 48 persons who were interested in Vale project lands, and a number of additional inquiries were received by mail. Purchases of 280 acres of land on the project were made by three prospective settlers.

THREE of the new settlers on the Riverton project have made very creditable showings, although they started late in the season and had to overcome the handicap of preparing and working new ground.

THE towns on and adjacent to the Belle Fourche project are cooperating in an exposition at Rapid City, S. Dak., which is featuring Black Hills products with a view to interesting home people in a policy of purchasing home products. The display includes sugar, brick, mill feeds, creamery products, lumber, cement, plaster, cigars, and mining products.

ACTIVE work of construction in the near future of the Federal building at Montrose, Uncompahgre project, is anticipated, clearing of the building site having been completed.

MUCH interest has been aroused by the proposed opening to entry of 30 farm units on the gravity division of the Minidoka project. These tracts are farms whereon the previous entries and water rights have been canceled and which have been resurveyed preparatory to resettlement.

IN response to a special circular mailed out last month about 300 inquiries were received concerning farming opportunities on the Belle Fourche project. Several promising prospects have visited the project and others have requested further information regarding settlement opportunities.

THE market for real estate on the Minidoka project was active during the past month, several sales having been made on the north side. A 40-acre farm near Rupert sold for $6,500; another farm of the same size near Acequia brought $5,000; and an 80-acre tract three miles north of Rupert sold for $10,000.

THE turkey growers on the Boise project sold their Thanksgiving birds in the form of a pool and as usual obtained much better prices than those offered by dealers to individual growers.

FEEDING of alfalfa began in earnest on the Belle Fourche project following the heavy snow of November 18, which covered pastures and beet tops. Lambs continued to make good gains and early shipments were going out from farms where feed supply was low or where lambs were exceptionally heavy. The sheep market ruled firm and was slightly higher than last month.

THE sugar-beet harvest on the Lower Yellowstone project was completed early in the month and no beets were lost on account of cold weather. The sugar factory reports that an average of 12.6 tons per acre was obtained from the harvested acres on the project. This exceeds by over 2 tons per acre the best previous yield.

THE beet harvest on the Belle Fourche project was completed the second week in November, weather conditions having been favorable. Reports of high yields continued to attract attention, particularly on the heavy soils around Newell. August Maass raised beets on an old feed lot that yielded 26½ tons per acre, and many other small patches produced better than 20 tons. The sugar company estimated an average yield of 13 tons on the project, which supplied about 70 per cent of the factory's run.

COL. Wheaton of the construction office, Quartermaster Corps, United States Air Service, and several other officers made a trip to Yuma on the first of December to inspect Fly Field, the Yuma Airport, preparatory to the drawing up of plans for an airways administration building at the field, $5,000 having been appropriated by Congress for this purpose. The building will be erected in the near future and will house a permanent staff of two to four men, including mechanics who will look after Army and Navy planes.

Economic Results of Federal Reclamation

By Dr. Elwood Mead, Commissioner of Reclamation

THE reclamation act was passed in 1902 and 28 years of construction and development work have passed into history. What has been the result? The value of crops grown in 1929 on the 24 Federal projects and private projects receiving water under Warren Act contracts was $160,000,000, which nearly equals the total cost of constructing these projects. The income to the reclamation fund during the fiscal year ended June 30, 1930, was $9,035,508, of which $6,013,672 came from the projects as construction and operation and maintenance repayments, water rental charges, power revenues, and miscellaneous collections. The balance is made up of oil and mineral royalties and receipts from the sale of public lands.

Irrigation is the backbone of agriculture in the arid and semiarid States. The irrigated area of the United States is approximately 20,000,000 acres, of which 10 per cent is embraced in completed reclamation projects which, with future extensions contemplated for construction, as the need arises, will bring the total area up to 3,250,000 acres.

Uncle Sam's venture in the field of irrigation has created 40,000 homes where 160,000 people live. The 214 cities and towns created by and dependent on these projects have a population of 470,000. There are 686 schools, 713 churches, and 130 banks with deposits of $145,000,000. These people are self-supporting. Just where they would be and what they would be doing were there no Government projects is a matter of conjecture, but we do know that they are not farming in the humid sections where the disposal of surplus agricultural products has become a serious problem and they have not joined the great army of unemployed. There are times when the man on the farm may not have much cold cash, but he's not dependent on charity and he always has something to do and plenty to eat. The fundamental idea of the reclamation act was the creation of homes and in that it has been preeminently successful.

CROP VALUES

The average value of crops produced on reclamation projects last year was $60 per acre, two and one-half times the average value for the entire United States. What happened to all this wealth? We know that it did not remain very long in the hands of the man who grew the crops. It was passed on to local merchants, laborers, railroads, and finally reached channels that distributed it to every section of the country.

Crops produced on the projects do not add to the agricultural surplus that has caused so much trouble in recent years. Wheat totals less than one-half of 1 per cent of the production of the entire country. The average consumption of wheat in this country is 5 bushels per capita. Applying this figure to the 630,000 people on Federal projects and the cities and towns directly tributary thereto, it would require 3,150,000 bushels of wheat to supply the needs of these people as compared to a production in 1929 of 3,910,000 bushels. As a matter of fact, consumption per capita on the farm, on account of grain fed to livestock and poultry, would be in excess of 5 bushels, so it is safe to say that Federal reclamation projects do not raise enough wheat to supply their own needs.

Cotton is the most important crop grown on our projects and comprised 21 per cent of the total crop value in 1929, but the surplus cotton produced in this country is the short staple, less than 1 inch in length, and practically all the cotton produced under irrigation is in excess of this length. The quality of the potatoes grown on our Western projects is such that they can be shipped across the continent and compete with the best of the East. Alfalfa, fruits, and sugar beets do not enter the competitive class, while vegetables that reach the early markets furnish a very desirable variety of food at a price that is within the reach of all.

EXISTING PROJECTS TO BE COMPLETED

For the next few years the major operations will be limited to the completion of projects that have already been started and will be confined principally to providing an adequate water supply, constructing subsurface drains for the relief and protection of water-logged areas and supplying gravity water to irrigated areas that are now faced with excessive costs for pumping water for irrigation. Echo Dam and the Weber-Provo diversion canal, comprising the first unit of the Salt Lake Basin project, will be ready for operation in 1931 and will furnish 74,000 acre-feet of stored water as a supplemental supply for 60,000 acres of land in the lower Weber and Ogden Valleys. Three hundred thousand dollars has been appropriated for the construction of the Hyrum Reservoir, with a capacity of 20,000 acre-feet, on the Little Bear River, near Logan, for the purpose of supplying water to 26,000 acres, 4,000 acres of which are new lands and 22,000 acres of land in need of a supplemental water supply in Cache Valley.

The Deadwood Dam, which will add 160,000 acre-feet to the storage capacity of the Boise project in Idaho, has just been completed. Water will be available in 1931 for a portion of the irrigable area of the Vale project in Oregon, while on the Owyhee project, in the same State, good progress is being made on the construction of the Owyhee Dam which will raise the water level 300 feet and store 1,100,000 acre-feet of water which will irrigate about 123,000 acres. About 30,000 acres are now under cultivation in a number of privately operated projects which derive their water supply by pumping from Snake River. For the past two years work has been in progress on the construction of a subsurface drainage system to protect the irrigable lands on the Belle Fourche project in South Dakota and the Lower Yellowstone project in Montana. The Kittitas division of the Yakima project in Washington is nearing completion, water being available for a portion of the irrigable area for the first time this past season. In central Wyoming works have been completed for the irrigation of 40,000 acres of the Riverton project, Wyoming, which is now opened to homestead entry and where the canal system will be extended to cover an ultimate area of 100,000 acres as the need arises. The Willwood division of the Shoshone project, in northern Wyoming, has a number of good farms available for homestead entry with additional lands to be placed on the market in the near future. On the Sun River project in Montana, Gibson Dam has just been completed at a cost of $2,381,313, which insures a full water supply to lands that have been dependent on a flood-water right for the past 10 years.

HOOVER DAM CONSTRUCTION A GIGANTIC TASK

The greatest engineering job ahead of the Bureau of Reclamation is the construction of Hoover Dam and power plant and the All-American canal under the Boulder Canyon project. This dam, which will be about 727 feet above foundation rock and with the power plant will cost about $110,000,000, will pay for itself with its own falling water. The estimated cost of the All-American canal is $38,500,000. Advertisements calling for proposals for the construction of the dam

have been issued. In the 28 years that the bureau has been carrying on construction work, it has placed in dams and other structures a total of 4,392,000 cubic yards of concrete. The preliminary estimate of quantities in Hoover Dam, power plant and appurtenant works, calls for 4,500,000 cubic yards of concrete.

CHANGING CONDITIONS UNDER RECLAMATION

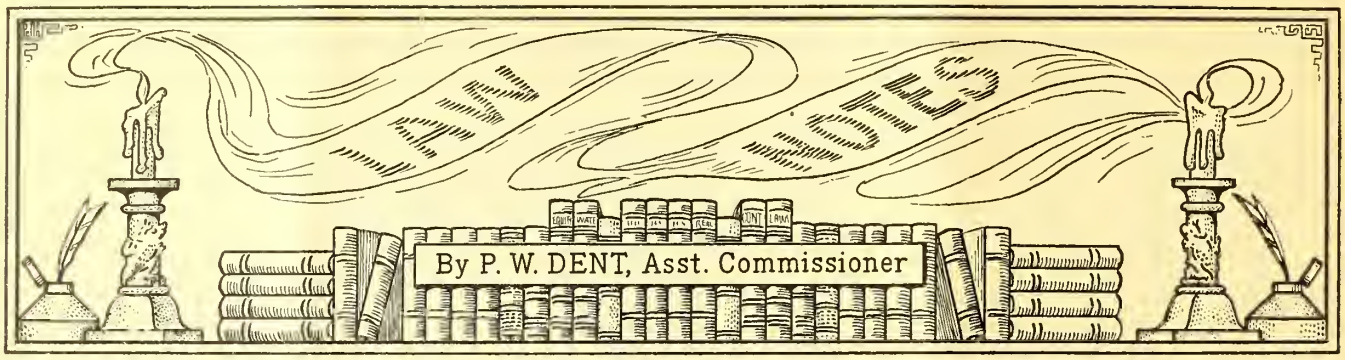
Reclamation is continually confronted with changing conditions. The easily constructed projects have been built, those remaining are too costly and difficult to be attractive to private capital With increasing costs per acre, greater care must be exercised in making investigations to determine the feasibility of a project, and particular attention must be given to settlement and economic development, for on that rests the return of the expenditures. The Federal Government should not be the sole agency for directing the development program. The arid States are vitally interested in the success of irrigation and should accept their full share of responsibility in bringing about rapid settlement and development, working in cooperation with local civic organizations to accomplish the desired result.

Viewed from whatever angle you will the reclamation policy of this country, inaugurated by President Roosevelt 28 years ago last June, has been a wise and statesmanlike move. Comfortable homes have been established, cities and towns have sprung up on land that was once a desert. The benefits have spread to adjoining territory and thence to every section of the country. No policy or expenditure of the Federal Government has been more beneficial or resulted in the creation of greater wealth, and this has been accomplished without burden to the taxpayers of the country as the money used for this purpose comes from the natural resources of the area directly benefited and in time is returned to the Treasury.

Since water was first available in 1906, the cumulative value of crops grown on land irrigated from Government works amounted to $1,642,267,680.

CROP yields in general on the Riverton project are improving each successive year, and the project now promises a real future to settlers.

Harvesting potatoes on the Kittitas Division of the Yakima Project, Washington



Award or Rejection of Bids—Modification

PARAGRAPH 16 of the standard Government instructions to bidders (construction and supplies), standard form No. 22, provides in part:

"16. *Award or rejection of bids.*—The contract will be awarded to the lowest responsible bidder complying with conditions of the invitation for bids, provided his bid is reasonable and it is to the interest of the United States to accept it. * * * The United States, however, reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in the interest of the United States. * * *"

while paragraph 5 of the same form provides:

"5. *Alternative bids.*—Alternative bids will not be considered unless called for."

On June 4, 1929, bids were opened in the Denver office of the Bureau of Reclamation under specifications No. 454–D for steel pipe for Little Valley siphons, Vale project, Oregon. The bid of the Thompson Manufacturing Co. was the lowest complying with the conditions of the invitation for bids, with a delivered cost of $11,607.97. The Western Pipe & Steel Co. submitted a bid with a lower delivered cost of $11,014.82, but there appeared on the bid a notation reading:

"Steel plates will be furnished in accordance with the United States Government Master Specifications No. 352 if inspection is made in accordance with standard practice, as required by A. S. T. M. Specifications A9–24."

One of the conditions of the invitation for bids (specifications) was that the plates should be in accordance with Government Master Specifications No. 352a and with Government General Specifications for Materials No. 339.

Comparison of the A. S. T. M. Specifications A9–24 with Government Master Specifications No. 352a indicated that in many respects they were the same, although somewhat differently arranged, the main differences being:

(*a*) The percentages of phosphorus and sulphur were different for both structural steel and rivet steel.

(*b*) For tension and bend tests, the Government Master Specifications No. 352a required two tests for each melt and, presumably, both tests were required to be satisfactory. The A. S. T. M. Specifications No. A9–24 called for one tension and bend test of each melt, with the provision that "If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted."

As this was thought to be a probable difference from the specifications, within the meaning of paragraphs 5 and 16 of the standard Government instructions to bidders, the awarding officer inquired of the Western Pipe & Steel Co. whether it would withdraw the exception noted on its bid and furnish the material at the price bid but in accordance with the specifications, if it were found that the bid as thus amended could be considered, which the company consented to do; but, before award was made, the Thompson Manufacturing Co., the lowest bidder complying with the conditions of the invitation for bids, protested consideration of the bid of the Western Pipe & Steel Co., whereupon the Comptroller General was asked for an advance decision as to whether (*a*) award should be made to the Thompson Manufacturing Co.; (*b*) readvertisement was necessary under the facts stated and the Comptroller General's decision dated February 9, 1927 (A–17146), shown at 6 Comp. Gen. 514; or (*c*) award should be made to the Western Pipe & Steel Co. under its amended bid, to which the Comptroller General, in his decision dated July 24, 1929 (A–27950), shown at 9 Comp. Gen. 24, replied:

"A bidder who has submitted an alternative proposal when none has been requested, or has submitted a proposal not in accordance with the specifications of the advertisement, may not be permitted—after the bids are opened—to, in effect, withdraw its proposal and submit one in accordance with the specifications or agree to such modifications of its proposal as will make it responsive without variation from the specifications. Therefore, the proposal of the Western Pipe & Steel Co. may not be accepted on the basis of the modifications subsequently proposed.

"The only serious question in the case is whether all of the proposals should be rejected and readvertisement had for the material, it having come to the information of the Government that it is possible to secure the steel for the sum of $593.15 less than that of the low proposal meeting the specifications. See 6 Comp. Gen. 514, referred to in the submission. Unquestionably, the proposal of the Thompson Manufacturing Co. was, at the time of the opening of the bids, the lowest one meeting the specifications and the fact that the Government has subsequently obtained information that the steel could be purchased for $593.15 less than this low bid on a quantity of steel in excess of $11,000, is not sufficient to justify rejection of all bids and readvertisement. If the difference were greater, the public interest might require the procedure stated in 6 Comp. Gen. 514 to be followed, but the loss to the Government through readvertising and considering the bids in the instant matter, as well as the postponement of the availability of the steel for use would doubtless be in excess of the difference of $593.15.

"Answering your question specifically, you are advised that on the basis of the facts submitted, the proposal of the Western Pipe & Steel Co. may properly be disregarded in making the award."

As a part of this general subject there may properly be considered the question whether the contracting officer may, after the opening of bids, enter into negotiations with the lowest bidder complying with the conditions of the invitation for bids, looking to the submission by such bidder of a price for material or supplies to be furnished or work to be performed under conditions differing from those contemplated by the invitation for bids, and, if so, whether all bidders submitting bids under the invitation for bids must be given an equal opportunity to modify their bids.

The Comptroller General, in his decision dated January 11, 1926 (A–12608), shown at 5 Comp. Gen. 470, stated that

"transactions with bidders after proposal which may affect conditions must be carefully guarded so as not to involve any question with other bidders."

In decision dated August 9, 1926 (A–15241), not published, the Comptroller General said:

"The apparent probability that the low bidder on the work originally contemplated will be the low bidder under the changed conditions and that it has submitted bids therefor is not controlling of the matter as to whether the provision of section 3709, Revised Statutes, are for application. Whether the low bidder on the original project can do the work at less expense to the Government under the changed conditions than can any of the other bidders is possible of definite determination only by soliciting competitive bids as contemplated under said section.

"Obviously the acceptance of alternate proposals with the elimination of items or the changing thereof or substitution of items named in the specifications and negotiating the price therefor with one bidder is neither proper from the standpoint of the United States nor of other bidders and amounts to nothing more or less than a complete disregard of the purposes to be gained by the requirement for advertising and the awarding of the contract to the lowest responsible bidder—that is, in the most advantageous interests of the Government."

Again, in decision dated June 20, 1928 (A–23336), not published, the Comptroller General ruled that "a bidder may not qualify his proposal after same has been submitted and without opportunity being given to all other bidders to submit qualifications."

The Comptroller General, in his decision dated July 12, 1928 (A–23150), not published, said: "As has been held by this office repeatedly if, after bids are requested, it develops that the specifications or delivery points should be changed in the interests of the Government, there should be readvertising, so that all bidders will have an equal opportunity to furnish the materials or supplies required, * * *."—*Armand Offutt, District Counsel.*

THREE farms on the Milk River project were disposed of during the month to farmers from adjacent dry lands. All of the farms have either been entirely uncultivated or only partially tilled in past years and the purchasers expect to develop the places as rapidly as possible. Twelve project farms have been transferred to new settlers within three months, and these settlers will start the immediate improvement of their farms.

Recently Enacted Legislation

DISPOSAL OF VACANT PUBLIC LAND

"*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, hereinafter styled the Secretary, is authorized in connection with Federal irrigation projects to dispose of vacant public lands designated under the act of May 25, 1926, as temporarily unproductive or permanently unproductive to resident farm owners and resident entrymen on Federal irrigation projects, in accordance with the provisions of this act.

"SEC. 2. That the Secretary is authorized to sell such lands to resident farm owners or resident entrymen, on the project upon which such land is located, at prices not less than that fixed by independent appraisal approved by the Secretary, and upon such terms and at private sale or at public auction as he may prescribe: *Provided,* That no such resident farm owner or resident entryman shall be permitted to purchase under this act more than one hundred and sixty acres of such land, or an area which, together with land already owned on such Federal irrigation project, shall exceed three hundred and twenty acres: *And provided further,* That the authority given hereunder shall apply not only to tracts wholly classified as temporarily or permanently unproductive, but also to all tracts of public lands within Federal irrigation projects which by reason of the inclusion of lands classified as temporarily or permanently unproductive are found by the Secretary to be insufficient to support a family and to pay water charges.

"SEC. 3. All "permanently unproductive" and "temporarily unproductive" land now or hereafter designated under the act of May 25, 1926, shall, when sold, remain subject to sections 41 and 43 of the said act. The exchange provisions of section 44 of said act of May 25, 1926, shall not be applicable to the land purchased under this act.

"SEC. 4. After the purchaser has paid to the United States all amounts due on the purchase price of said land, a patent shall issue which shall recite that the lands so patented have been classified in whole or in part as temporarily or permanently unproductive, as the case may be, under the adjustment act of May 25, 1926. Such patents shall also contain a reservation of a lien for water charges when deemed appropriate by the Secretary and reservations of coal or other mineral rights to the same extent as patents issued under the homestead laws.

"SEC. 5. In the absence of a contrary requirement in the contracts between the United States and the water users organization or district assuming liability for the payment of project construction charges, all sums collected hereunder from the sale of lands, from the payment of project construction charges on 'temporarily unproductive' or 'permanently unproductive' lands so sold, and (except as stated in this section) from water rentals, shall inure to the reclamation fund as a credit to the construction charge now payable by the water users under their present contracts, to the extent of the additional expense, if any, incurred by such water users in furnishing water to the unproductive area, while still in that status, as approved by the Commissioner of Reclamation and the balance as a credit to the sums heretofore written off in accordance with said act of May 25, 1926. Where water rental collections hereunder are in excess of the current operation and maintenance charges, the excess as determined by the Secretary, shall, in the absence of such contrary contract provision, inure to the reclamation fund as above provided, but in all other cases the water rentals collected under this act shall be turned over to or retained by the operating district or association, where the project or part of the project from which the water rentals were collected is being operated and maintained by an irrigation district or water users association under contract with the United States.

"SEC. 6. The Secretary of the Interior is authorized to perform any and all acts and to make all rules and regulations necessary and proper for carrying out the purposes of this act."

Approved, May 16, 1930.

Regulations are being drafted to put the law into effect.

COMPLETE returns from the 1930 beet crop on the Milk River project show that from 3,219 acres harvested 39,584 tons were produced, or an average of 12.29 tons per acre. Although the acreage harvested was 877 acres less than that of 1929, approximately 4,000 tons more were produced. This results from the elimination of poor areas and better preparation, tillage, and irrigation of the remaining acreage. A total of 42,850 tons were sliced by the factory this season which exceeds the tonnage of any past season. The average sugar content was 16.46 per cent, which is slightly above the average for all Utah-Idaho sugar factories.

AT the close of November the percentage of completion at Echo dam, Salt Lake Basin project, was 92.2.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division

Drilling and Blasting Operations, Milner-Gooding Canal, Idaho

By E. B. Darlington, Superintendent, Minidoka Project, Idaho

THE use of explosives in large quantities is not unusual in construction work, but blasting on the Milner-Gooding main canal, Gooding division, Minidoka project, is of interest because of the large number of charges fired simultaneously and the methods used in detonating the blast. In general, the rock cuts on canal work are not of great depth and satisfactory breakage must be obtained by close spacing of drill holes and correct loading practices.

On the Milner-Gooding Canal, the rock is all basaltic lava. Most of it has the typical columnar structure of the more recent lava flows and it normally breaks to natural fracture planes. As excavation is handled largely by power shovels or drag lines, it is often found that a finer breakage is desirable than that which results from loosening of the blocks naturally formed by shrinkage or otherwise. The blasted material must be of such texture that it can be loaded efficiently into the excavator buckets. Large fragments can be swung out by means of a "choker," attached to the drag-line boom, but this usually causes delay in the excavating operations.

BLASTING BY WHOLESALE

Experimentation by the contractors on the Gooding Canal has demonstrated that on shallow work drill holes spaced 4 feet on centers and shot without chambering, result generally in a satisfactory breakage, especially if a large number of charges are exploded simultaneously. On the work included in the contracts of Mittry Bros. Construction Co. of Los Angeles, involving nearly 27 miles of the main canal, as many as 3,140 loaded holes have been fired in one blast. The illustration (fig. 1) shows 1,600 charges being exploded at the same time. Detonation is accomplished electrically, through connection with a power line used to transmit current to a large drag line and stationary compressor plant. Wiring was done on the graded series system, the number of holes per series varying from 10 to 50. This plan distributes the resistance so that the charges on a short series are detonated slightly in advance of those on the longer series.

An unusually large blast in a deep rock cut was recently made on the Mittry work. Methods different from those used for the shallower cuts were adopted in this case. The contractor decided to attempt breaking the rock all in one lift. The maximum cut in a reach of five stations was 37 feet, and the minimum 24 feet. The canal prism, as designed, has a base width of 26 feet, with side slopes of one-fourth to 1 foot. The volume of rock requiring excavation was approximately 23,000 cubic yards. The number of holes drilled for this shot was 175 and they were spaced on 12-foot centers. These holes were chambered by springing two to three times and loaded with a total of 57,000 pounds of 40 per cent blasting gelatin, or almost two carloads in the 500-foot reach of canal.

Wiring connections were of the series in parallel type, with 30 holes in each series. No. 6 electric blasting caps were used in firing the charges. Electric current from a transmission line was applied through a special transformer regulated to supply about 1.5 amperes per series.

The blast just after explosion is shown in Figure 2. The material was in general reduced to a size which could be easily excavated by the contractor's 175–B Bucyrus drag line, which has a 125-foot boom and is equipped with a 6-yard bucket. There was considerable overbreakage of the slopes, but the canal section below the water line appears to be in fairly sound rock.

DRILLING EQUIPMENT USED

On the Mittry Bros. contracts some unusual types of drilling equipment are being used, especially in connection with rock drilling. This company entered into two contracts, covering about 27 miles of the canal. The terrain through which the canal runs is rough and broken and was formed by lava flows, and large quantities of rock are encountered.

Confronted by the necessity of excavating long reaches in the volcanic formation, ways and means were sought by the contractors to expedite drilling, preparatory to blasting. One of the devices worked out by Mittry Bros consists of a fabricated steel truss spanning the canal and carrying three air drills. This drilling bridge is 82 feet long and 6 feet in width. It is carried on standard car trucks running on 24-inch gage industrial track. The bridge is moved along the canal by means of a hand windlass at each end, temporary anchors for the draw cables being made by driving bars into the ground. The truss carries three drilling machines mounted in leads hung from a carriage, so that the drills can be moved by hand and holes drilled across the canal on any spacing desired. The drilling machines are handled in the leads by Little Tugger air hoists. The bridge also carries a Kohler lighting plant and three air receivers. Drifter drills of 1½ inch diameter steel, shanked with bits for starting 3¼ inch holes, are used with this outfit. They are operated at about 80 pounds air pressure.

The contractor was well pleased with the performance of the steel drilling bridge, and a second truss was built of scrap lumber. In this bridge, tension on the lower chord is partially taken by steel cables. The traveling and drilling equipment are the same as for the steel truss, except that special quarry drills are used instead of drifters. The two bridges are illustrated in Figures 3 and 4.

Air for operating each of these drilling rigs is supplied by three 310-cubic-foot capacity portable compressors hooked together. Three-inch iron pipe is used for the air lines. A run of about 600 feet is welded together at the joints and moved by means of a caterpillar tractor. It has been found cheaper and more effective from the standpoint of air tightness to weld the joints rather than to connect them with threaded couplings.

USE OF CATERPILLAR TRACTOR

Another item of drilling equipment in use by the same contractor consists of a

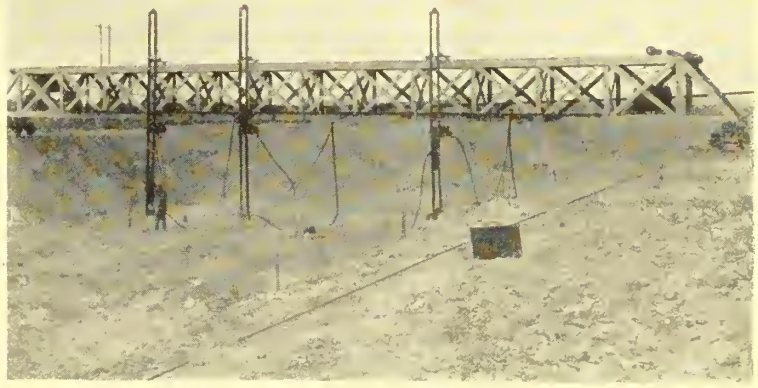
GOODING DIVISION
MINIDOKA IRRIGATION PROJECT
IDAHO

1

2

3

4



5

MILNER-GOODING CANAL

1.
1600-HOLE BLAST ON MILNER-GOODING CANAL

2.
TWO CARLOADS OF DYNAMITE IN THIS SHOT

3.
STEEL TRUSS DRILLING BRIDGE SPANNING CANAL

4.
WOODEN TRUSS DRILLING BRIDGE, MADE BY CONTRACTOR

5.
DRILLING UNIT MOUNTED ON CATERPILLAR TRACTOR

frame and three leads mounted on a 30-Best caterpillar tractor. (See fig. 5.) Leyner type drills are operated in the leads, which are spaced 4 feet on centers. The drills are raised and lowered by means of Little Tugger hoists. Air is supplied by a 750-cubic-foot capacity 2-stage electrically driven stationary compressor, through a 3-inch air line about 6,000 feet long.

This makes a mobile drilling unit which can be utilized under practically any condition of rock topography and width of canal section. On sloping ground the tractor is jacked up into an approximately level position and blocked there. It is moved very quickly on its own power. As in the case of the equipment carried on the trusses, an operator is required for each of the three drills.

Notes for Contractors

Boulder Canyon project.—Bids for construction of the Hoover Dam, power plant, and appurtenant works will be opened at the office of the Bureau of Reclamation, Wilda Building, 1441 Welton Street, Denver, Colo., at 10 o'clock a. m., March 4, 1931. The work includes the 730-foot dam, the four 50-foot diameter diversion tunnels, coffer dams, power plant (except installation of machinery), spillways, outlet works, highway, inclined freight elevator, and spur track. The principal items of work and the estimated quantities involved are as follows: 1,800,000 cubic yards of all classes of open cut excavation; 1,900,000 cubic yards of tunnel and shaft excavation; 1,200,000 cubic yards of earth and rock fill in coffer dams and river channel protection; 4,400,000 cubic yards of concrete; 228,000 cubic feet of grout; drilling 190,000 linear feet of grout and drainage holes; placing 5,500,000 pounds of reinforcement bars; installing 1,900,000 pounds of small metal pipe and fittings; installing 32,500,000 pounds of large metal conduits; installing 10,600,000 pounds of structural steel; installing 20,000,000 pounds of gates, hoists and other metal work. Copies of specifications and plans will be available for distribution about January 10, and a charge of $5 will be made.

Plans and specifications are being prepared and will soon be issued covering the construction of the waterworks and sewerage systems for the Government town of Boulder City near the Hoover Dam. Plans for streets and the sidewalk system are also being prepared. The plans and specifications for the first group of cottages for Government employees are also being prepared and will be issued as soon as possible. These will be followed by other groups, including the administration and buildings of a public nature.

Minidoka project.—Under specifications No. 494–D for furnishing two ¾-yard drag-line excavators, the Osgood Co., of Marion, Ohio, has been awarded the contract, with a net price of $17,289 and a delivered cost of $19,111.39. There were 10 companies submitting bids.

Owyhee project.—Plans and specifications are being prepared for the purchase of the ring gates for the Owyhee Dam.

Yakima project.—Plans and specifications have been prepared covering the furnishing and installation of two penstocks for the Kennewick Highlands pumping plant. The total length of 34-inch diameter continuous wood-stave pipe which will be required is approximately 6,700 feet.

Cle Elum Dam Approved for Construction

On December 11, 1930, Secretary Wilbur sent the following communication to President Hoover:

"The acts of Congress of March 7, 1928 (45 Stat. 200, 228), and March 4, 1929 (45 Stat. 1562, 1592), make appropriations of $500,000 and $1,000,000, respectively, for the construction of Cle Elum Dam, Yakima project. By the act of May 14, 1930 (46 Stat. 279, 308), the unexpended balances of these appropriations were made available during the fiscal year 1931.

"Section 4 of the act of June 25, 1910, provides in effect that after the date of that act no irrigation project to be constructed under the act of June 17, 1902 (32 Stat. 388), and amendatory acts shall be undertaken until the project shall have been recommended by the Secretary of the Interior and approved by the direct order of the President.

"Subsection B, section 4, of the act of December 5, 1924 (43 Stat. 702), provides as follows:

" 'That no new project or new division of a project shall be approved for construction or estimates submitted therefor by the Secretary until information in detail shall be secured by him concerning the water supply, the engineering features, the cost of construction, land prices, and the probable cost of development, and he shall have made a finding in writing that it is feasible, that it is adaptable for actual settlement and farm homes, and that it will probably return the cost thereof to the United States.'

"As the sixth and last of a series of dams for regulating and storing the waters of the Yakima River and tributaries, it is proposed to construct an earth and gravel fill storage dam located on the Cle Elum River, a tributary of the Yakima River. This dam is to have a maximum height of about 125 feet, a crest length of 700 feet, and a volume of about 450,000 cubic yards of material, forming a reservoir with an area of 4,680 acres for storage of 435,000 acre-feet of water for the irrigation of lands under the Yakima project. The cost of the storage dam is estimated at $2,800,000, of the reservoir right of way $300,000, and of flowage rights and contingencies, $400,000, making the total estimated cost $3,500,000. This constitutes a part of the storage system of the project, the total actual and estimated cost of which is $11,558,000. Of this amount the return of $6,996,000 is guaranteed under existing contracts, leaving a balance of $4,562,000, the repayment of which will be provided for as follows: Five hundred and eighty thousand dollars is to be repaid by the Wapato Indian Reservation, $1,000,000 by rentals from the Sunnyside division of the Yakima project, and the remainder by the Roza and Kennewick divisions of the project.

"The development is believed to be feasible, the project is adaptable for actual settlement and farm homes, and the cost of construction of the dam will in all probability be returned to the United States.

"It is recommended that this work be approved, and that the necessary authority be issued to this department to make contracts for the construction of the dam and to proceed with the work."

President Hoover gave his approval on December 11.

THE Mini-Cassia Dairy Herd Improvement Association on the Minidoka project reported 37 cows with a yield of 40 pounds or more of butterfat each. High cow, owned by Haven Leigh, had a record of 82.6 pounds of butterfat and 2,430 pounds of milk. Mr. Leigh was also the owner of the high herd of 10 to 20 cows, the average yield being 35.6 pounds of butterfat and 1,071 pounds of milk.

ON the Tule Lake division of the Klamath project 24 public land farm units were recently opened to entry, as a result of which 162 applications were received from qualified applicants. Questionnaires were sent to all references, 121 of whom appeared before the local examining board.

Lloyd Irrigation Project Ready in 1932

THE Lloyd barrage and canals project in the Province of Sind, Bombay Presidency, India, now under construction, will irrigate over twice as much land as the combined area of all the Federal irrigation projects. An interesting report on this project by Sir M. Visvesvaraya, K. C. I. E., M. I. C. E., and Nawab Ali Nawaz Jung Bahadur, F. C. H., was recently received at the Washington office. There being some misgivings in the public mind as to the soundness of the undertaking, the Government of Bombay authorized an investigation and report by the two engineers named. Sir M. Visvesvaraya was a visitor in Washington in February, 1927.

LARGEST IRRIGATION PROJECT

The Lloyd project is not only the largest single irrigation scheme undertaken in any part of India, but also the largest in the world, exceeding in size both the Assuan project in Egypt and the proposed Boulder Canyon project on the Colorado River. It will assure an ample supply of water to 1,800,000 acres in the province now receiving an inadequate supply from inundation canals, and ultimately increase the irrigated area in the barrage zone to 5,200,000 acres. Work on the barrage across the Indus River at Sukkur was commenced in July, 1923.

The Province of Sind has a cultivable area of 13,750,000 acres. The population is about 33,000,000, of which 5,000,000 is urban. In the greater part of the Province the rainfall is negligible, the average being 5.9 inches, and in the barrage zone 5.5 inches. Only 10 per cent of the cultivated area is dependent on the rainfall. On the remainder of the lands there can be no crops grown without an irrigation supply obtained from the river.

The discharge of the Indus River rarely falls below 22,000 cubic feet per second, while the average is about 110,000. The maximum flow of record was 959,000 cubic feet per second in 1914. The barrage is designed for a maximum discharge of 1,500,000 cubic feet per second. As a general rule the river is in deltaic formation, flowing along an elevated ridge of soil alluvially formed by its own deposits. The Indian system of irrigation by inundation canals, which has been in use since the British occupation of Sind in 1843, takes advantage of this physical peculiarity of the river. The device is primitive, a cut being made at right angles to the river, and, after a short distance, the canal takes a course parallel to the river serving low-lying lands away from the marginal ridge.

DESCRIPTION OF BARRAGE

The Lloyd Barrage, or Sukkur Barrage as it is often called to distinguish if from the Lloyd Dam at Bhatgar, rests on a wide masonry floor founded on the sand of the river bed, protected by aprons of concrete blocks and rock paving and by steel sheet piling cut-offs. Resting on this floor are piers of stone masonry 60 feet apart, with 66 gate openings, of which 7 toward the left bank and 5 toward the right bank will serve as scouring sluices. The piers carry two separate arches of reinforced concrete. Two bridges at different levels cross the structure, one carrying the machinery for operating the gates and the other roadway and footpaths. The over-all length of the barrage between abutments will be 4,725 feet, and the total width of waterway provided will be 3,960 feet. Joined to it on either bank a masonry river wall will be taken upstream, in which are to be placed the head regulators of the various canals. The barrage foundations were not works that could be completed in a single season, and the construction of substantial cofferdams each season, dismantling same and recovering piles before the close of each season presented exceptional difficulties. The floor is constructed in the dry within large cofferdams formed by interlocking sheet piling 40 to 50 feet long, inclosing a section of the river bed and supported on the inside by sand banks. The barrage is over half finished, and it is expected that it will be completed by June, 1932.

CANAL SYSTEM

Excluding feeders or sublaterals, the canal system as now planned will comprise 650 miles of main canals, 990 miles of branch canals, and 4,260 miles of laterals. These main canals are veritable small rivers, the Rohri Canal having a bottom width of 250 feet and a depth of 12 feet, the Rice western being 243 feet wide on the bottom and 11¾ feet deep, and the eastern Nara Canal will have a bottom width of 380 feet and a depth of 11½ feet. In length these canals are 209, 82, and 531 miles, respectively. The designed discharge of these three canals is 13,389, 10,215, and 10,191 cubic feet per second, respectively. For a comparison as to size the All-American Canal on the Boulder Canyon project will be 75 miles long with a bottom width of 134 feet and depth of 20 feet, and a designed initial capacity of 15,000 cubic feet per second. The quantity of earth to be excavated in building the Lloyd project canal system amounts to the vast total of 209,000,000 cubic yards. In comparison to this figure, the Bureau of Reclamation has excavated about 280,000,000 cubic yards to date, and on July 1, 1914, when the Panama Canal was opened, the total canal excavation was 160,000,000 cubic yards.

In the design of the canal system, the duties adopted at diversion are 43½ acres per second-foot for rice, 87 acres for inundation crops, and 174 acres for winter crops. Allowance for percolation and evaporation is made at 8 second-feet per million square feet of wetted perimeter. Nonsilting channel sections are provided wherever possible. The limit for distributary slopes is 1 in 10,000.

The volume of earthwork involved in canal construction is so large that it would have meant an immense organization to do the work by manual labor. The regular working season is only four months, and is liable to be interrupted at any time by epidemics. It was considered inadvisable to rely solely upon hand labor, and so it was decided to also use drag lines, of which 46 of various makes have been purchased. The largest amount of excavation accomplished in any one month has been 5,800,000 cubic yards. Excavation is about evenly divided between machines and manual labor, and to date is approximately 60 per cent completed. Machines have moved an average of 1,850,000 cubic yards a month, while 1,100,000 cubic yards is the average for hand labor.

CONSTRUCTION EQUIPMENT

At the barrage it is necessary to make a liberal use of machines and mechanical power. Electric power generated in a central station of 3,071 horsepower capacity by Diesel engines is principally used. The stone crushers are driven by oil engines, and steam is used for transport, dredging, and pile driving. In the floating plant equipment are two 20-inch suction dredges, steam tugs, cranes, barges, motor launches, and numerous other water craft. There are in use on the works 42 miles of standard gage railway and the rolling stock consists of 10 locomotives and 570 cars. There is also a narrow-gage railway 17 miles in length, with rolling stock comprising 8

locomotives and 650 cars. The rate of haulage is from 8 to 12 cents per ton-mile.

Of the 46 drag-line excavators, the larger machines are 6 English (300 Ruston) and 3 American (300 Bucyrus). The medium and small sized machines are 5 English and 32 American, with bucket capacities varying from 4 yards to three-fourths yard. All are oil Diesel engine driven, with the exception of two Diesel electric excavators. The excavators are all full-circle, single-bucket type, which could be readily converted into shovels, but owing to the large radius of working and depth of cut, shovel types would not have been suitable. The total weight of the machines is over 300 tons, and is said to be the largest fleet ever employed on any one construction job. For a large machine the maximum monthly output has been 120,000 cubic yards. At the start of the work American engineers were used to operate the excavator and instruct Indian operators.

DISPOSITION OF LANDS

It is understood that a start will be made to use the barrage from the beginning of the "inundation" season in 1932. In the barrage zone there is an area of about 1,700,000 acres of uncultivated irrigable land belonging to the Government. Of this area it is proposed to set apart 50,000 acres toward peasant grants, and about 350,000 acres toward grants at concession rates to Zamindars, who are now the principal irrigators. The balance of 1,300,000 acres will probably be sold at public auction. Payments for land will be spread over 20 years.

The principal crop in Sind is rice, which is grown on 25 per cent of the total cropped area. In the case of salt land, they have to grow rice or nothing else. In what is known as the Central Rice Canal tract the same land has been growing rice for from 30 to 40 years, and it has undergone no noticeable deterioration. Cotton and wheat should be the principal crops in future development.

ENGINEER'S REPORT FAVORABLE

In their report Sir M. Visvesvaraya and his associate found that the site for the barrage is a favorable one, and that the engineering designs, with a few minor exceptions, are suitable and satisfactory. Judging from the difficult work already accomplished in the river bed, they are of the opinion that construction work is proceeding satisfactorily, and the successful completion of the barrage is assured. It is estimated that the agricultural production in the ultimate stage of the project may amount to $125,000,000 annually, as against $29,000,000 obtained at present from irrigation works of all classes in

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Activities at Hoover Dam

Construction work at the dam site will soon be under way, as the construction of the dam, diversion tunnels, outlet works, and power plant (but not including installation of machinery) has been advertised and bids will be opened at the Chief Engineer's office in Denver, Colo., at 10 a. m., on March 4, 1931. The printed specifications and plans will be available for distribution about January 10, and will contain about 80 pages of text and 76 drawings. A price of $5 per copy will be charged for the plans and specifications. The bid bond will be $2,000,000 and the performance bond $5,000,000. The period for completion of the whole contract is 2,565 days, making the date of completion about May 1, 1937. An appropriation of approximately $109,000,000 is authorized for this feature of Boulder Canyon project. This amount includes material and labor furnished by the contractor, material furnished by the Government, and overhead, but not interest during construction.

Hoover Dam

The present dam which will rise up through the lava walls of Black Canyon near here is but one in a series of such structures scattered throughout the United States. Each has been an achievement of man, a company or a community; each is outstanding in its influence on its neighborhood. Each seems to have reality, even personality, to those who see it. The placid waters above the turbulent falls below appeal to nearly all of us and tug at some deep but common emotion. Each is entitled to some recognition. We have fastened to some of them the names of the great of our Nation. We have the Roosevelt Dam, the Wilson Dam, the Coolidge Dam, and to-day as Secretary of the Interior and acting in accordance with many requests I have the honor and privilege of giving a name to this new structure. I choose that of the great engineer whose vision and persistence, first as chairman of the Colorado River Commission in 1922, and on many occasions since, has done much to make it possible and declare that the dam to be built by the Reclamation Service of the Department of the Interior in Black Canyon under the Boulder Canyon project act shall be called the "Hoover Dam."

President Hoover is but one in a galaxy of public servants and private individuals who has struggled to bring together the forces in our country to make this project a success. Senator Hiram Johnson, Congressman Swing, Senators Pittman and Oddie rendered never-failing and vigilant service. Their names and those of others too numerous to mention will ever be associated with the work we begin here to-day. We believe that for each of those who have struggled and worked for the Hoover Dam it will be said: "He builded better than he knew."

Excerpt from Secretary Ray Lyman Wilbur's speech naming Hoover Dam at the spike-driving ceremony at Las Vegas, Nev., in connection with commencement of construction of Boulder Canyon project, September 17, 1930.

Bids for construction of the Boulder City-Hoover Dam highway, 7 miles in length from the town site to the dam site will be opened at Las Vegas, Nev., on January 7, 1931. The highway will be gravel surfaced and oil treated and alternate bids are being asked on 22 and 30 foot widths. About 260,000 cubic yards of rock excavation would be required in building the 30-foot highway. The time allowed for completion of the contract is 140 days.

On January 12, 1931, bids will be opened at Las Vegas, Nev., for constructing the United States section of the branch railroad from Bracken Junction to the dam site. This section is about 10¼ miles in length, and will extend from the end of the Los Angeles & Salt Lake Railroad Co. section near the summit to the dam site. It is planned to have this railroad completed in 200 days. Provision is made for the construction of the main-line track only, and the contractor for the dam will be required to build necessary spur and side tracks.

The Los Angeles & Salt Lake (Union Pacific) section of the construction railroad is scheduled for completion by January 15, 1931. This portion of the construction railroad will be operated and maintained by the railroad company as a branch of its main line. The Southern Sierras Power Co., of Riverside, Calif., is rushing work on the 132,000-volt single-circuit transmission line to bring in power for construction purposes and the 235-mile from San Bernardino, Calif., should be completed and power made available by June 1, 1931.

Mr. S. R. DeBoer, city planner and landscape architect, has submitted a plan for the new town of Boulder City. The location is at the upper end of Hemenway Wash about 6 miles southwest of the dam site. The elevation of the town site is 2,500, and it is situated on a divide with a view to the north overlooking the reservoir behind the Hoover Dam. The site is 4 miles from the reservoir shore line and 26 miles from Las Vegas. It will be a model town in every respect, with living conditions for Government employees

made as near ideal as is possible. Bids will soon be asked for the erection of about 12 of the 3 and 4 room cottages. Plans are being prepared for the administration and other buildings for the use of the Government forces. Certain blocks will be set aside for the use of the contractor as sites for the erection of office and headquarters buildings, warehouses, mercantile stores, hospital, boarding and lodging houses, and homes for the contractor's employees. Water supply for Boulder City will be obtained by pumping from the Colorado River, with an intake on the Nevada side about 3,500 feet downstream from the dam site. The bureau has purchased a 2,000,000-gallon storage tank to be installed at Boulder City, and plans are being drawn for filter plant and chemical treating plant, to be built at the town, and the pumping plant and desilting tank at the intake.

Township surveys in the vicinity of Black Canyon recently completed by the General Land Office, locate the dam site in sec. 29, T. 22 S., R. 65 E., M. D. M., Nevada, and sec. 3, T. 30 N., R. 23 W., G. and S. R. M., Arizona. Boulder City will occupy the SW. ¼ of sec. 4, T. 23 S., R. 64 E., Nevada. Bracken Junction, where the Hoover Dam branch leaves the main line, is 7 miles below Las Vegas, 327 miles from Los Angeles and 457 miles from Salt Lake City.

The Colorado River Board of consulting engineers and geologists, of which Maj. Gen. William L. Sibert is chairman, convened at the Denver office on December 1 for a final review of the plans and specifications. The board gave its approval to the plans and specifications for the diversion works and other features which must be completed during the early stages of construction.

A representative of the United States Bureau of Public Roads, after making an inspection of the highway situation, has announced that the Nevada State highway department would immediately award a contract for the first 10 miles of highway from Las Vegas to Boulder City.

The United States employment service of the Department of Labor has established a public employment service on the Boulder Canyon project, with an office at Las Vegas, Nev. Mr. Leonard L. Blood is superintendent in charge. This office will not only direct men to employment, but will supply the country with information concerning progress of work on the project and the demand for workmen.

There will be a combined meeting of the Hoover Dam consulting board and the concrete research board at Las Vegas, Nev., on January 12 to consider concrete problems in connection with construction of the dam and appurtenant works. After the Las Vegas meeting the two boards will convene in Denver for further deliberations. The consulting engineers are Andrew J. Wiley, Louis C. Hill, and David C. Henny. On the board of concrete specialists are P. H. Bates, United States Bureau of Standards; Prof. Raymond E. Davis, University of California; Prof. Herbert J. Gilkey, University of Colorado; Franklin R. McMillan, Portland Cement Association, Chicago, Ill.; and Prof. William K. Hatt, Purdue University.

Mr. Burton Lowther has presented his report covering a sewerage system for Boulder City and plans and specifications are being worked up in the Denver office.

The Southern Sierras Power Co. of Riverside, California, now building the 235-mile transmission line from San Bernardino, Calif., to the site of Hoover Dam, has ordered 5,000,000 pounds of fabricated steel pole line structures for the work. This material is to be delivered at Torrance, Calif., between December 15 and March 15. An order was also placed for 45,000 suspension type insulator units. The power will be delivered at 2,300 volts, 3-phase, 60 cycles, at a substation near the dam site.

Lloyd Irrigation Project

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Sind. The engineers call attention to the difficulties that may arise from shoaling in the river bed, silting of canals and waterlogging over large tracts of the irrigated area, and say that these problems should be kept under scientific observation and timely remedies applied.

The soil of Sind drains with difficulty and facilities for drainage are poor or nonexistent. Within the area affected by the barrage scheme the river continues its course in a single channel, and there are no branches to act as separate outfalls. Evaporation is excessive and water as it evaporates leaves behind injurious salts on the surface. Water logging of the irrigated lands is threatened. In the Punjab it has already become a very serious problem, owing to the intensity of cultivation.

Work in progress during the 1930 working season included the completion of 27 of the 39 spans of the barrage, and for this purpose a huge cofferdam covering 46½ acres, the largest ever constructed in India, was completed. About 1,900 miles of canals out of a total length of 5,900 miles had been finished on January 1, 1930. It is now estimated that the cost of the entire project will be about $90,000,000, including interest.

Hoover Dam Contract Interests Contractors

Among the many firms of general contractors who are looking into the "big job" at Black Canyon are the following: Winston Bros., Minneapolis, Minn.; Atkinson-Spicer Co., Los Angeles, Calif.: Utah Construction Co., Ogden, Utah; The Arundel Corporation, Baltimore, Md.; General Construction Co., Seattle, Wash.; Merritt, Chapman & Scott, New York City; The Foundation Co., New York City; Bates & Rogers Construction Co., Chicago, Ill.; Rosoff Subway Construction Co., New York City; McDonald & Kahn (Inc.), Los Angeles, Calif.; The Carleton Co. (Inc.), New York City; A. Guthrie & Co., Portland, Oreg.; T. E. Connolly, San Francisco, Calif.; J. F. Shea Co., Portland, Oreg.; Mittry Bros. Construction Co., Los Angeles, Calif.; Bent Bros., Los Angeles, Calif.

Secondary Projects

The All-American Canal report by H. J. Gault is scheduled for completion early in January. The report on the Upper Gila River investigations, Arizona-New Mexico, by O. C. Smith, was received in the Washington office on November 18. On the Salt Lake Basin project, Utah, investigations are being made in the Ogden River and Provo River divisions. A land classification and economic report of the Moon Lake area will probably be completed early in January. Field work has been terminated on the central California water resources investigations and the report is being prepared in the Washington office by C. A. Bissell. Some work is being done in the Denver office on the determination of effect on water supply for the Rio Grande project through the operations of the Middle Rio Grande conservancy district. Under a copoerative agreement with the State of Wyoming a land classification and economic report of the Greybull district has been made by W. W. Johnston, and an engineering investigation of water supply and geological examination of the Greybull River reservoir site have also been made. Field work on the Saratoga project, Wyoming, is finished and preparation of the report in the Denver office is nearing completion.

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Settlement Results and Recommendations for Future, Lower Yellowstone Project, Montana-North Dakota

PRELIMINARY WORK

ONE of the provisions in the irrigation district contracts of 1926 was that at least 8,000 acres be placed under option of sale by the Government, upon terms and at prices satisfactory to the Secretary. Options were obtained in 1926 on 77 farms. Material had been prepared for a booklet describing the opportunities for farm ownership on the project and listing the farms under option, giving a brief description of the improvements and the purchase price of each. This booklet was issued early in 1927.

In order to enlist the support of the various interested agencies and to coordinate the efforts of each, an organization known as the Lower Yellowstone Development Association was formed for the purpose of promoting settlement. F. L. Cooper, colonization field man, who was engaged to canvass the irrigated sections of Northern Colorado, spent several months on this work. Following are some extracts from his report:

"After a trip to the Lower Yellowstone Valley in February, 1927, I was employed to do the field work for the Lower Yellowstone Development Association. The work was to be carried on under the direction of H. E. Meisenbach, of Sidney, Mont., the secretary of the association.

"The initial work was to be follow-up work by farm visits to prospects that had answered advertisements being carried in several farm papers throughout the country. These advertisements were being carried by both the Northern Pacific and Great Northern railroads. The information concerning the prospects was furnished by the railroads through the secretary of the association. A trip was made to nearly all of these prospects who were located in Colorado. Only a few prospects were uncovered in this work.

"In April I was called to Montana to attend a joint meeting of representatives of the United States Reclamation Service and the Lower Yellowstone Development Association. At this meeting it was decided to carry all advertisements in farm papers that had a wide circulation in the irrigated districts of Colorado only. The papers selected were the Great Divide and the Western Farm Life. The field work was to consist of farm visits in the irrigated districts of Colorado. Work in other States was not to be attempted. Government bulletins on the valley were to be distributed along with those of the railroads that gave information relative to the project. Reports were to be sent in on all prospects interviewed. Reduced rates were to be obtained by the railroads if possible, so as to encourage the visiting of the project by prospects. It was also recommended that articles be written for the Western Farm Life that could be run as news items on the settlement plan of the Government.

"The initial work was necessarily of a missionary nature. This was due to the fact that no one there had heard of the Lower Yellowstone Valley. As it was far distant and north they were hard to interest. This was particularly true as I was trying to interest the best type of men; those with some money and who had made good in farming. The fact that those with funds were hard to find and harder to interest slowed up progress. Those without capital were easy to interest but not to be considered prospects. Loss in past feeding operations and a general financial depression in farming circles made it difficult to interest those most desired. Practically no land had changed hands here for some time. The great distance from here, the cost of transportation and time required for the trip were the biggest handicaps. No reduced rates were obtainable except from Billings to Sidney and return. Due to pressure of farm work here and the variance in early crop progress, it was not considered practical to send men up before June 15 to July 15.

"There is a large supply of experienced farmers here who practice the same system of farming as is recommended for the Lower Yellowstone Valley. No great exodus can be expected from here at any one time, but with one year more of work one should have a considerable number of farmers going up to the valley each year, which will produce a desirable farm population and influence the farm practices of the whole territory. This depends upon the success of the men who settle there first. Their reports and successes will influence others whom they know here and others to whom we will refer them.

"I highly recommend that some means be found to place buildings on some good farms. Some finance scheme which would let buildings be put up and be a lien on the land to be paid on the same terms as the land would be under the Government option contract.

"No one seems to be interested in land without buildings. For this reason, I recommend that something be done to get option on land for rent. Also that a building program of some kind be considered, if possible. I know of nothing better that could be done to assist the work of building up the farm population and increasing the prosperity of the valley."

SUMMARY OF RESULTS—SEASON OF 1927

Total of farm visits	1, 240
Total of prospects turned in	137
Farmers who were induced to visit the valley	10
Farmers who bought land	3
Acres purchased	354
Value of listings in Government bulletin	$23, 400
Farmers who say they will go next year	27
Possible additional men who may go	20

As a continuation of the work started by Mr. Cooper in Colorado, the bureau employed a man for about two and one-half months in 1928. He made some excellent contacts, but succeeded only in actually closing with two farmers.

One of the most encouraging points brought out in all of this effort is that there are hundreds of first-class farmers

who are intensely interest in the Lower Yellowstone project, and by constant hammering some of them are going to be moved sooner or later.

The following is quoted from an official of one of the agencies participating in this work:

"We are all of us, however, convinced that is takes some time to incubate in any one territory a movement of settlers in any considerable proporations to some distant agricultural region. At best, people move slowly, and, when it comes to moving them north, against the current as it were, it is still more difficult. The work so far has no doubt lodged in the minds of many people a desire ultimately to come and look over Lower Yellowstone and its opportunities. It would seem as though we should be on the point of crystallizing much of this sentiment into action."

OPERATIONS IN 1929 AND 1930

The lower Yellowstone Development Association had such faith in the probability of securing additional settlers that arrangements were made to finance a representative during parts of 1929 and 1930. It was during these two years that real results were first obtained. By the early part of 1930 sixteen Colorado families had been moved to the project and were operating the farms of their choice. Eleven families, comprising 55 people, came in one caravan, their household goods, farm machinery, and livestock being shipped by train. These people are proving to be excellent farmers and esteemed citizens. A picture on page 100 of the May, 1930, ERA shows this group about to leave Colorado. The accompanying picture shows a settler arriving on the project with his household goods via truck. His livestock and machinery were shipped by rail.

Several good families were obtained from Wyoming and a few from the Middle West. Some have not purchased land yet, preferring to rent for a year or two in order to be certain they are satisfied with local conditions, or to improve their finances. A few farms were sold to local people who had been renting or who resided on the dry-farmed area adjoining the project.

RESULTS TO DATE

Of the 79 farms held under option, 27 have been sold. The original options have expired but 17 of the owners of unsold farms have renewed. These sales do not represent the total results on the project as at least 20 farms have been sold which were not listed with the Government, and the activity put fourth by the bureau and the Lower Yellowstone Development Association has doubtless been responsible for the sale of many of these additional farms. It is reasonably certain that 15 or 20 Colorado families who have inspected the land this year will move here before the beginning of another crop year.

Arrival of new settler from Colorado on Lower Yellowstone Project

DIFFICULTIES ENCOUNTERED

One of the most insurmountable difficulties encountered is to induce a settler to purchase a farm that is without adequate buildings and presents a run-down and dilapidated appearance. These are farms that ought to be sold first, and therein lies the failure of all our settlement work to produce the results most needed to put the project on a sound basis.

Then, too, the personal side enters in as is illustrated by the following incident which happened recently:

A substantial farmer from the defunct Williston project became interested in our lands. He was very careful, and the superintendent spent two days with him looking over available opportunities. Finally he decided on a farm that suited him and was very enthusiastic about it. He returned home with the intention of returning a few days later with his wife. Instead of a settler, we received a letter saying that as he and his wife were about to get into the car to come back, the lady broke into tears and felt so badly about leaving her old home and associations that he finally decided to throw up the deal.

This is the same situation we find in Colorado. The man can be moved, but in many cases the family can not.

COSTS INCURRED

The irrigation district contracts authorize an expenditure of $50,000 for economic investigations, colonization, and development of lands. To date there has been expended about $6,739, which includes the cost of preparing and printing the booklet. The expense incurred by the Development Association is in addition to this.

RECOMMENDATIONS FOR THE FUTURE

The prosperity of the project and its ability to meet future repayments depends on getting all tillable land in a state of maximum production. There is room for 100 more families and to get these will require continued work by everyone. This can only be accomplished by personal interviews. So far as known, not a single settler has been induced to locate on the project during the last three years by correspondence alone. Numerous inquiries are received through the mails, but if it were not a matter of courtesy to answer them, they might as well be thrown in the waste basket unless followed up by something more than correspondence.

Such an excellent foundation has been laid in Colorado that it would not be good business to let these people forget about the Lower Yellowstone. Satisfied settlers are the best possible advertisement, and it is believed that settlers are satisfied here. Many calls are received from the new settlers for literature to send to their friends, which indicates that the settlement movement is gaining help from within.

Finding farms with suitable buildings or with any buildings at all, is becoming increasingly difficult. Congressional action should be taken that would furnish

(Continued on p. 17)

Agricultural Credit In France

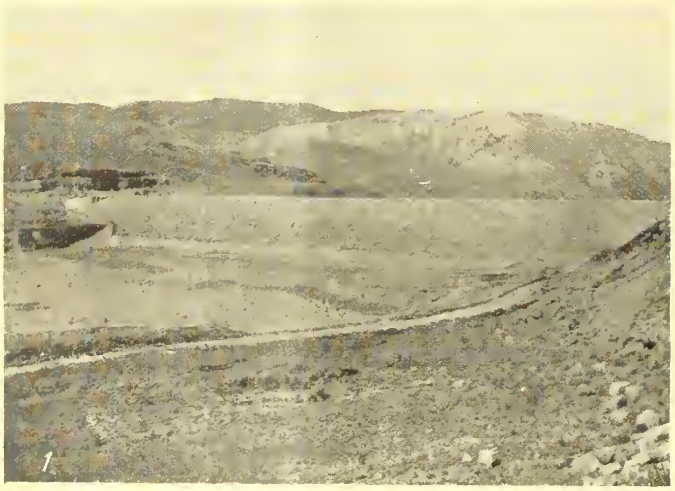
Agricultural credit in France is based essentially on three classes of organizations: Local banks, regional banks, and the National Bank of Agricultural Credit, according to an article in a recent issue of the International Review of Agriculture, issued by the International Institute of Agriculture. Such credit is throughout regulated by the principle of the distribution of credit by means of agricultural associations and cooperative societies, which are regarded as the bodies most suitable for guaranteeing the proper utilization of the loans.

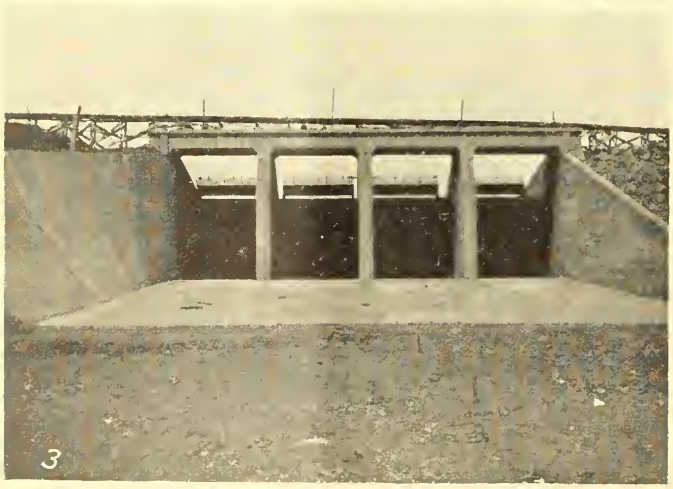
The sole object of the local banks is to facilitate and guarantee operations relating to agricultural production effected by members, whether individuals or associations. The bank capital is formed by contributions paid by such individuals or associations or debentures assigned by name and not transferable except by grant with the approval of the bank. Banks can not be constituted until one-fourth of the owned capital has been paid up; their area of operations is limited, including one or more communes. These banks are made responsible by law for examining the loan applications made by the farmers with full power of acceptance or refusal, and are empowered to make loans either on short or long terms or of medium duration.

Three types of loans are contemplated by the French legislation on the subject: Short, medium, and long term. The borrowers may be individuals or associations.

Short-term loans provide the farm with working capital for the purchase of seed, fertilizers, fungicides, etc. The amount of these loans is left to the judgment of the different local banks. The duration varies in general from nine months to one year. The rate of interest may also vary according to the banks, under a limitation which fixes a minimum for this rate—namely, the rate of interest paid on the bank debentures—and a maximum, which must not exceed by more than 1 per cent the rate of the advances made on securities by the Bank of France. The guarantee is constituted by bills, warrants, deposit of securities, etc.

Loans for a medium period are more especially intended to render possible for agriculturists the operations which, from their nature or extent, require a certain time of amortization of capital invested. Under this heading are included minor farm improvements, enlargement or repair of farm buildings, land improvements, purchases of stock or machines, etc. Loans under this heading are of considerable social interest, since in this way farm workers can obtain the necessary capital to farm themselves and to cultivate a small holding. Such loans are made for a period of not more than 10 years. The rate of interest is regulated in the same way as that for short-term loans.





ECHO DAM, SALT LAKE BASIN PROJECT, UTAH

1. Upstream face of dam; 2. Downstream side of radial gates; 3. Intake to spillway; 4. Outlet basin and spillway channel.

Long-term loans to individuals are intended to facilitate the purchase, improvement, transformation, or reconstitution of small holdings which the borrowers must undertake to cultivate themselves or with the help of their family. The opportunity is thus afforded to the farm worker of becoming owner of a small farm large enough to insure him a livelihood, and to the cultivator who already owns a piece of land to enlarge his holding, or to construct on it the necessary buildings. These loans are also used to facilitate the purchase and construction of houses for farm workers with a view to checking the rural exodus and relieving the housing situation in the rural centers. These loans can not be made for a period longer than 25 years, their maximum amount is 60,000 francs (about $2,400), and the interest is at present fixed at 3 per cent for ordinary borrowers and at 1 per cent for persons in receipt of war pensions.

Opportunities on Lower Yellowstone Project

(Continued from p. 15)

aid for the development of the project lands by placing buildings and other improvements thereon and, if possible, authorize loans to worthy settlers to handle the situation that ought to be taken care of by the Federal Land Banks, but which for some reason the banks do not fulfill.

Local effort should not be diminished, and the bureau should continue to cooperate to the fullest extent with the development association.

THE November livestock feeding on the Milk River project, especially upon beet tops, was being conducted upon a large scale and the stock thus fed was in excellent condition and gaining rapidly. Sufficient feed on the project to abundantly supply the stock demand of the community was anticipated.

Rearrangement of Airplane Legends

On page 231 of the December issue of the NEW RECLAMATION ERA the legends under the group of airplane and related views were incorrectly numbered. It is suggested that the following correct list be clipped and pasted over the old list in personal and reference copies of the ERA:

BUILDERS OF HOOVER DAM

Left to right: Elwood Mead, Commissioner of Reclamation; R. F. Walter, Chief Engineer, Bureau of Reclamation; Walker R. Young, Construction Engineer, Boulder Canyon Project; John C. Page, Office Engineer, Boulder Canyon Project; Ralph Lowry, Principal Assistant to Construction Engineer, Boulder Canyon Project.

Washington Office Christmas Fund Society

The Reclamation Christmas Fund Society was organized about 14 years ago by employees of the Washington office of the Bureau of Reclamation for the purpose of establishing a convenient form of saving of a fund with which to make Christmas purchases. The fiscal year of the society runs from December 1 to November 30. Shares are subscribed at the beginning of the fiscal year, each share representing an amount of $1 per month to be paid into the fund. Payments are made semimonthly on each pay day, and the entire fund with earnings matures on November 30 of each year. In addition to the savings feature of the society it has another important advantage in loaning money to its members during the year. Members are permitted to borrow approximately one and one-half times the amount they will pay in during the year, each loan being secured by the indorsement of two members of the society. Delinquencies in payments on shares are penalized 1 cent per share per day of delinquency after three days of grace.

During the year ending November 30, 1930, the 28 members paid in a total of $3,422 in shares. The earnings during the year amounted to $93.52, made up of interest at 6 per cent on loans to members, interest from the bank at 5 per cent on savings certificates and at 4 per cent on savings balance, and penalties on delinquencies. Earnings amounted to nearly 6 per cent on payments made to the society. The average interest on Christmas savings accounts in Washington, D. C., is approximately 3 per cent. At the close of the year $600 was outstanding in loans which was wiped out by amounts due the borrowers.

For the fiscal year 1931 the society has a substantial increase in membership and also a large increase in the number of shares subscribed.

The affairs of the society are administered by a treasurer, which position changes hands every few years in order to distribute the work. In recognition of the work the treasurer is required to perform, a deduction is made of 25 per cent from the gross earnings as salary.—*Mrs. Margaret G. Young, Treasurer.*

1. Hangar at Municipal Airport, El Paso, Rio Grande project, New Mexico-Texas. 2. Yuma's modern airport, Yuma project, Arizona-California. 3. McAllister Flying Service, Yakima, Yakima project, Washington. 4. Swan Island Airport, Portland, Oreg. 5. Denver Municipal Airport, with 7 passenger all-metal "Flamingo" plane. 6. Carlsbad Travelair passenger plane, Carlsbad project, New Mexico. 7. Grand Junction Municipal Airport, Grand Valley project, Colorado. 8. Mid-Continent Air Express plane operating out of Denver.

Miss Mae A. Schnurr, assistant to the commissioner, is now in the West in attendance upon the annual meetings of the Washington Irrigation Institute at Ellensburg, Wash., December 19–20, 1930, and the Land Reclamation Division, American Society of Agricultural Engineers, at San Francisco, Calif., January 6–7, 1931. In Ellensburg Miss Schnurr addressed the meeting on the subject West versus East on Federal Reclamation Policy, as given on this page. At the San Francisco meeting Miss Schnurr will give an address on the Boulder Canyon Project and its Effect on Future Development, the text of which will be printed in the February issue of the ERA. During the course of her trip Miss Schnurr will visit a number of the projects, including Yakima, Yuma, Rio Grande, and Boulder Canyon.

West Versus East on Federal Reclamation Policy

RECLAMATION by irrigation has been a Federal policy for nearly 29 years.

The United States Government encouraged and made possible the peopling of this wonderful western country of ours by giving free land to the hardy pioneers who were willing to endure the hardships necessary in the early days to wrest a living from the land and develop our latent agricultural wealth. Of a total of 1,441,436,000 acres of public land we have 178,979,000 acres remaining. Of this balance, 920,584 acres are in this State.

Out of the realization that crops could not be grown without the artificial application of water, and irrigation works could not be financed by individuals or even groups of them, was born the idea of having the Nation sponsor this colossal enterprise of reclamation by irrigation.

On June 17, 1902, President Roosevelt signed the bill that made possible this venture by the United States Government. It had the effect of wiping out the arid frontier. Development was progressively successful and moved over the Continental Divide and didn't stop until it reached the Pacific Ocean.

By the building of irrigation works 1,922,330 acres have been made susceptible of irrigation, and when projects under construction have been completed that acreage will be increased to more than 3,000,000.

ESTABLISHMENT OF RECLAMATION FUND

The organic act prescribed the setting up of a fund the income to which would be derived from the sale of public lands; later there were added proceeds from mineral and oil leases and taxes for power. This is a revolving fund. The cost of irrigation works is repaid by the water users directly benefited, in annual installments over a period of years. These payments are added to the fund and are thus spent over and over again for irrigation works.

ACHIEVEMENTS

Agricultural development brought with it transportation facilities until now we have a network of railroads all over the country making every portion of it readily accessible.

Towns sprang up wherever reclamation projects were established and now we have 214 towns mainly dependent for existence on Federal reclamation projects. Washington State has 26 towns in this class, with a population of 49,000. The City of Yakima is the center of 105,000 people supported by irrigation.

To June 30, 1930, the Federal Government spent $196,000,000 for irrigation works in the United States. Of this $27,435,167.43 was spent in the State of Washington. It has two Federal projects—Okanogan and Yakima. Washington's total contribution to the reclamation fund to June 30, 1930, from sources set up in the reclamation act was $7,416,855.95, or about one-fourth the amount spent on irrigation works.

BENEFITS TO THE EAST

The type of crops grown under irrigation in many instances can not be grown successfully outside of irrigated territory in the United States, such as sugar beets and long staple cotton. As compared to the value of crops grown in the United States as a whole, Federal reclamation's contribution is only 1.7 per cent of the total.

The taxable property set up by this development is approximately $1,000,000,000. Direct return in taxes is made to the States and to the National Government as a result of the creation of taxable values by Federal reclamation. A purchasing power is developed that vitally affects the East. The factories of the East work directly or indirectly for the farmers of the West. Mail-order houses could not exist without the business that comes to them from the rural communities and of this business a large share is contributed by the Federal reclamation projects.

In spite of this dependency of one on the other, the West and the East hold diametrically opposed ideas as to the value of our Federal reclamation policy and any future program as to the undeveloped agricultural resources of the West. Those of you who have heard debates of the Senate and House of Representatives at Washington know that these ideas are voiced every time the subject of Federal reclamation is presented, particularly when it involves the authorization of the expenditure of funds.

In answer to the question whether reclamation should be continued, the Secretary of the Interior in his last annual report emphatically replies "Yes, as long as development is carried along sound economic lines." This is precisely the view of Commissioner Mead, and is the yardstick by which the feasibility of any proposed project is now measured.

On the other hand the Secretary of Agriculture, a western man with a typically eastern view, proclaims there is a nation-wide surplus which is being added to by the further development of Federal reclamation which should therefore be curtailed or entirely abandoned as a Federal policy.

It is the eastern view that the western resources are national assets and are de-

veloped at the expense of the National Government. This view is based on no foundation of fact. While it is true that Federal reclamation projects benefit mainly the States in which they are located, it must be remembered that this development is not carried on at the expense of the Government or the taxpayers of the country. Government projects are only aided through not requiring the repayment of interest on the cost of construction works.

The Bureau of Reclamation is continually striving to conceive and adopt policies that mean the upbuilding of the structure of Federal reclamation, not for to-day alone but for posterity. It is only by the adoption of far-seeing policies that Federal projects can be made assets to any community. It is reflected in the condition of the banks, business houses, character of homes, schools, churches, clubs and all cultural development.

Washington stands first among the States in potential water power and is followed by California, Oregon, and New York.

Your water resources are being developed in an orderly manner. The waters of the Yakima River have made possible a wonderful reclamation project, and we can justly be proud of it and the new division—Kittitas. The people in and around Ellensburg can now see the fruits of their labors with the delivery of water for the first time last spring to 13,000 acres from the new canals.

We are earnestly endeavoring to get at the facts that will show where a start might be made that will not only lay the foundation for another reclamation project, but one that from present indications should be outstandingly successful.

The experience of the past year has shown more than ever the worth of Federal reclamation projects. During the period of drought these projects stood out like oases in the desert. Lands lying out of reach of the water supply were parched and in vivid contrast to the farms being watered by artificial methods.

The Washington Irrigation Institute has a rather enviable record of achievement. The well-being of the irrigation development in this State reflects some of its work of which you can justly be proud. The Secretary of the Interior and the Commissioner of Reclamation find its officials always willing to cooperate in any forward movement affecting reclamation as a whole or this State in particular. A profound sense of appreciation is felt by all officials of the Government who contact your representatives for the spirit of cooperation and helpfulness always in evidence.

Those of you who have visited Washington have found the open-door policy throughout our department. No one is inaccessible, from the Secretary of the Interior down. This policy, started in the administration of Secretary Work, has been continued because of its friendliness and opportunity for further service.

PROGRAM OF WASHINGTON IRRIGATION INSTITUTE

FRIDAY, DECEMBER 19, 1930

MORNING

9.30 Registration.
10.00 Call to order.
10.05 Address of welcome, Mayor Charles Anderson, Ellensburg.
10.15 Response, Senator W. L. Dimmick, Yakima.
10.25 Annual address, President A. L. B. Davies, Ellensburg.
10.45 Report of treasurer, Guy Finley, Yakima.
10.55 Appointment of resolutions committee. Election of nominations committee.
11.00 Report of committee on cooperation with irrigation experiment station, F. A. Norton, chairman, Grandview.
11.20 Developments in Experimental Work at Irrigation Experiment Station, Superintendent H. P. Singleton, Prosser.
11.40 General discussion.
12.00 Luncheon.

AFTERNOON

1.30 Report of committee on reorganization and rehabilitation of certain irrigation districts, E. F. Benson, chairman, Seattle.
2.00 General discussion.
2.30 Why the Sunnyside Project is Asked to Purchase More Storage Water, B. E. Stoutemyer, district counsel, Bureau of Reclamation, Portland.
3.00 Opening discussion, R. B. Williamson, counsel for Sunnyside irrigation district, Yakima.
6.30 Banquet. Elks Temple.
What the Rock Island Dam Means in Irrigation and Power Development, Leslie R. Coffin, manager, Puget Sound Power & Light Co., Seattle.
West versus East on Federal Reclamation Policy, Miss M. A. Sehnurr, assistant to Commissioner of Reclamation, Washington, D. C.
High Lights on the Kittitas Project, F. A. Kern, secretary, Kittitas reclamation district, Ellensburg.

SATURDAY, DECEMBER 20, 1930

MORNING

9.30 History and Present Status of Columbia Basin Project, J. A. Swalwell, president, Columbia Basin Irrigation League, Seattle.
9.55 Columbia Basin, H. W. Bashore, engineer, United States Bureau of Reclamation, Spokane.
10.00 The Adjudication and Distribution of Water, Charles J. Bartholet, supervisor of hydraulics, Olympia.
10.30 Additional Water for the Kennewick Project, M. M. Moulton, Kennewick.
10.40 Status of the Roza Project, H. Lloyd Miller, Sunnyside.
10.50 Irrigation in Western Washington, J. C. Scott, Puget Sound Power & Light Co., Seattle.
11.00 Report of resolutions committee. Election of officers.
12.00 Luncheon.

AFTERNOON

1.30 Trip of inspection of irrigation tunnel under Yakima River.
Adjournment.

A RADIO broadcasting station has been installed in Grand Junction, on the Grand Valley project, Colorado. This station was formerly located in Edgewater, Colo.

Settlement Opportunities on Shoshone Project

On the Willwood division of the Shoshone Federal irrigation project, Wyoming, only 13 desirable units remain unentered. Inquiries concerning the settlement opportunities afforded on this project should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C., or to the Superintendent, Shoshone Project, Powell, Wyo. Descriptive literature is available in both offices.

Modern Quarantine Station Erected on Yuma Project

Work was completed the latter part of November on the new quarantine inspection station and California Highway Association guest house immediately across the river from the city of Yuma. This is a very modern station of Spanish style architecture and is to be used as a model for other permanent quarantine stations to be erected by the California State Quarantine Service and State Highway Association at various points along the eastern boundary of the State. This building, which will house State quarantine and highway officers, has facilities for the inspection of 24 cars at a time. This inspection service, inaugurated several years ago, is for the protection of the California agriculturists against the bringing into that State of pests of all kinds such as boll weevil, fruit flies, and different diseased fruit of various types.

THE Montana State Seed Show was held at Great Falls November 14–17. A booth, fixed up to represent the Sun River project, attracted much favorable comment. The project received first place in rosin rye, first and third in Trebi barley, and first in northern beans. The project also made a commendable showing in alfalfa seed, sweet clover seed, red clover seed, seed peas, tame mustard, and potatoes.

BEET farmers on the North Platte project have made a good profit this year and are improving their farm buildings and equipment.

DEPRESSED crop prices and a rather short water supply on the Boise project have not noticeably affected the morale of the settlers, as there is continued interest in farms to sell and rent.

Reclamation Organization Activities and Project Visitors

R. F. Walter, chief engineer of the Bureau of Reclamation, and Walker R. Young, construction engineer of the Boulder Canyon project, were in the Washington office during the month in connection with Boulder Canyon project matters.

R. F. Walter, chief engineer, J. L. Savage, chief designing engineer, and A. J. Wiley and F. L. Ransome, consulting engineers, spent part of the month of December in the Canal Zone, Panama, on consulting work for the Panama Canal in connection with construction of the proposed Madden Dam.

B. P. Fleming, manager, and L. G. Mayfield, president, of the Elephant Butte Irrigation District, and Roland Harwell, manager, and R. F. Burges, attorney, of the El Paso County Water Irrigation District No. 1, Rio Grande project, were in the Washington office during the month on project matters.

W. D. Buchholz, secretary of the Belle Fourche Irrigation District, and F. C. Youngblutt, project superintendent, were in the Washington office during the week beginning December 8 in conference with officials in regard to the project construction repayment rates. Under the existing contract the heavy soils and undeveloped farms carry burdensome charges and on the better farms the rates are comparatively low. More equitable adjustment of repayment terms is under consideration.

W. J. Burke, district counsel, was on the Riverton project on November 7 and 25 and on the Belle Fourche project on November 29 and 30 in connection with legal matters.

F. F. Smith, construction engineer on the Salt Lake Basin project, was on November 22 granted leave without pay for a period of three months to accept a temporary assignment as consultant for the J. G. White Engineering Corporation in Mexico. During his absence T. R. Smith has been designated acting construction engineer of the Salt Lake Basin project.

L. M. Lawson, American commissioner, and other members of the International Water Commission visited the Yuma project during the month.

J. R. Alexander, district counsel at Las Vegas, Nev., visited the Grand Valley project on November 25 on matters relating to the proposed Orchard Mesa repayment contract.

Charles A. DeKay, engineering draftsman on the Belle Fourche project, was transferred on November 5 to the Rio Grande project.

At the International Stock Exposition at Chicago, November 28–December 5, Keith Jones, a Yakima project boy, won honors as junior champion husbandman of the United States, in competition against champions from 32 States. Keith was qualified for entry in this contest as section champion of the Western States, when he secured the award of a prize trip to the National 4–H club Congress and the International Livestock Exposition.

B. E. Stoutemyer, district counsel, visited the Vale project office early in November.

I. E. Houk, engineer in the Denver office, attended a meeting in San Francisco on November 13 of the committee on mass concrete of the American Concrete Institute. Mr. Houk also attended a meeting of the special committee on irrigation hydraulics of the American Society of Civil Engineers, returning to Denver on the 18th.

Porter J. Preston, superintendent of the Yakima project, spent a portion of the month in an investigation of water supply conditions on the Deschutes River near Bend, Oregon.

A. G. Cooke, hydraulic engineer in the public works department of the Federated Malay States, stationed at Negri Sembilan, visited the Yakima project the latter part of the month in the interest of drainage problems and lateral construction.

THREE farms on the Lower Yellowstone project were sold during the month by the colonization agent of the Lower Yellowstone Development Association. The purchasers were from Colorado.

H. A. Parker, superintendent of the Lower Yellowstone project, and Mrs. Parker and son spent the Christmas holidays in Maine. En route they stopped in Washington and paid a brief call on their friends at Reclamation headquarters.

Fred Foster, representative of the Bureau of Fisheries of Salt Lake City, visited the Carlsbad project the latter part of the month for the purpose of examining possible hatchery sites.

G. F. Loughlin, assistant chief geologist of the Geological Survey, was in Denver on November 10 arranging for a geological examination of the Sunshine reservoir in Wyoming.

At the request of the State of California J. L. Savage, chief designing engineer of the Denver office, was at Los Angeles on the Pine Canyon Dam consulting board until November 10, when he returned to his post of duty.

Bernard D. Glaha, senior engineering draftsman on the Riverton project, and Walter A. Sanford, chief of field party at Deadwood Dam, were transferred to the Owyhee Dam in November.

W. F. Kemp, engineer on the Riverton project, was transferred to the Denver office effective November 11.

H. C. Stetson, engineer in the Denver office, was in Cheyenne, Wyo., on November 10, where he appeared as a witness for the Federal grand jury in connection with interference on transmission lines on the North Platte project.

L. A. Hauser, C. P. Mahoney, Ed. F. Williams, and George W. Scott, a committee representing the Palo Verde Irrigation District of California, were in Washington during the month for the purpose of obtaining from the Government assistance in the matter of flood protection for about 80,000 acres of irrigable lands located on the west side of the Colorado River.

J. R. Iakisch, engineer, and W. W. Johnston, economist, were on the Shoshone project from November 1 to 19, inclusive, conducting investigations of the proposed Sunshine reservoir site.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

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

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kuback, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Dehler, Hydrographic Eng.; L. N. McClellan, 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 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	Berkeley, Calif.
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. Lilliugston	do	Do.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Las Vegas, Nev.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	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	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	E. Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	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	J. C. Avery	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	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 [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Lás Vegas, Nev
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph [5]	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and powers system.
[5] Acting.
[6] Storage, main, and Tule Lake divisions.
[7] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. 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	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay 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, Wis	A. B. Reeves	do	Mrs. Nelle 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	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	W. R. Young and C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin	Spokane, Wash	H. W. Bashore	

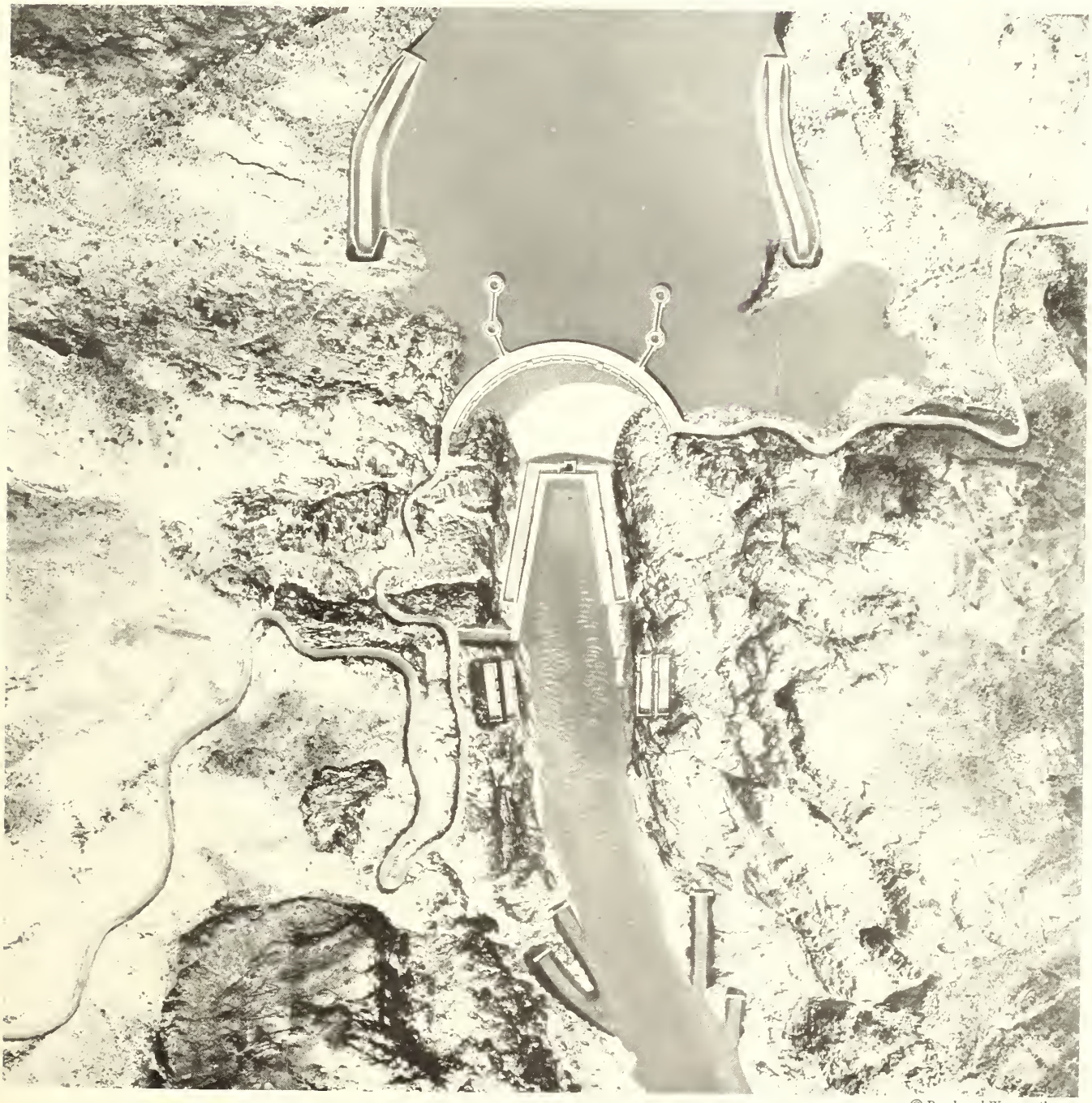
Registered Holstein cows and farm buildings of Peter M. Andersen, one-half mile west of Sidney, Montana, Lower Yellowstone Project

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22. NO. 2

FEBRUARY, 1931



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AIR VIEW OF HOOVER DAM AND RELATED WORKS AS THEY WILL APPEAR WHEN COMPLETED

Secretary Wilbur says . . .

THE GREATEST ENGINEERING JOB ahead of this department is the construction of Hoover Dam in the Colorado River. This structure will raise the water level 582 feet, generate 1,200,000 horsepower of electricity, cost, with its power plant, over $100,000,000, and will pay for itself by its own falling water. The result will be flood protection to Arizona and California lands, reclamation of deserts, improvement of navigation, and the bringing of needed water for domestic supply to the coastal plain of Southern California. Power sale contracts were successfully negotiated which will reimburse the United States for the cost of the dam and power plant if the rates set in these contracts continue to be maintained when the readjustment periods prescribed by the law are reached.

Next to the control of the Mississippi, this is the greatest attempt at solution of a whole region's water problem that the country has before it. The necessity for flood control and the thirst for water have made it necessary and possible to erect this structure in the middle of a desert, transport its power 250 miles, and sell it over an oil and gas field in order that the falling waters of the Colorado may earn the cost of their own capture. The engineering is in the hands of an organization which has built over 100 of the world's great dams without a failure. They will successfully divert the river through four great tunnels, each 50 feet in diameter, together capable of carrying the Mississippi's flow at St. Louis; will build this dam, and will go on to other big jobs for this Nation, all in their stride. It will be a monument to the engineering genius of many men, headed by Dr. Elwood Mead, Raymond F. Walter, John L. Savage, Walker R. Young, and their predecessors, Arthur P. Davis and Frank E. Weymouth.

Extract from the Annual Report of the Secretary of the Interior for the fiscal year ended June 30, 1930.

NEW 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. 22, No. 2 FEBRUARY, 1931

Interesting High Lights on the Federal Reclamation Projects

COLONIZATION work on the Lower Yellowstone project is being continued by the Lower Yellowstone Development Association, several prospective settlers having been shown over the project during the month.

SHIPMENTS of dressed turkeys from the Orland project for the Christmas trade were active during the holidays. Nine cars were shipped by rail and one produce house forwarded 63,000 pounds by truck.

EARLY in the month a general meeting of water users on the Sun River project was held in Fairfield for the purpose of informing the settlers of work accomplished during the year, financial condition of the irrigation district, and plans for the coming year. The meeting was well attended and much constructive interest was shown in all matters pertaining to the welfare of the project.

THE new radio broadcasting station on the Grand Valley project started operating the latter part of the month.

MORE extensive feeding to livestock of beet pulp on the Belle Fourche project is very noticeable, and dairymen generally are coming to realize the value of this pulp in rations that include hay, molasses, and grain.

THE sugar beet campaigns have been completed on the North Platte project with the exception of the factories at Torrington, Wyo., and Gering, Nebr. Final figures for the project place the average yield at 14.5 tons, and the total payments for beets at $4,024,000.

THE Great Western Sugar Co.'s factory at Lovell, Shoshone project, closed a very successful campaign on December 31.

THE Minidoka project reports the sale of rural property during the month as follows: One 40-acre farm 2 miles southeast of Rupert at $4,000; one 80-acre farm near the Paul sugar factory at $10,000; one 10-acre farm 1½ miles south of Burley at $6,000; one 40-acre farm 4 miles south of Rupert at $4,200; a highly improved farm of 50 acres 1½ miles northwest of Rupert at $10,000.

This Era Features Boulder Canyon Project

It seems especially appropriate that, following the calling for bids for the construction of Hoover Dam and appurtenant works on the Boulder Canyon project, more space should be given in this issue of the New Reclamation Era to this great work which will have such an important bearing on the economic and industrial development of the Southwest. Our readers will accordingly find this issue of the Era devoted largely to the Boulder Canyon project, bringing up to date various aspects of the work from the legal, engineering, economic, and accounting viewpoints, with a resume of the whole in Doctor Mead's address before the Massachusetts Institute of Technology.

Each subsequent issue of the Era will carry current information of general interest concerning the progress of construction on the project works.

DURING November the Mini-Cassia Dairymen's Association on the Minidoka project purchased 40,461 pounds of milk butterfat at 39 cents a pound, and 17,588 pounds of cream butterfat at 32 cents, a total of $21,408. About 64 per cent of the butterfat was marketed at Burley and the remainder at Rupert.

A LARGE number of inquiries concerning settlement opportunities on the Riverton project were received at the project office during the month.

ON the Lower Yellowstone project the completion of the advance crop report showed an excellent condition. About 28,681 acres were irrigated, producing crops valued at $957,756, or $33.39 per acre. An additional 6,268 acres were dry-farmed, producing crops valued at $28,106, or $4.48 per acre. The total crop value was $958,862. This is the largest gross value ever produced on the project. The outstanding crops were: Sugar beets, $86.92 per acre; beans, $24.58 per acre; and alfalfa, $17.04 per acre.

THE efforts of the Malta agencies to secure settlement of the Milk River project continued. Three additional 2-year options were obtained to farms embodying fair prices and very reasonable terms of payment. A number of applications from dry farmers for project farms have been received and it is expected that several more will be located before spring.

THE erection of a new school building on the Shoshone project is anticipated, the building to comprise a gymnasium, junior high school, and agricultural and farm shop at a total approximate cost of $70,000.

THE annual meeting of the Phillips County Farm Bureau on the Milk River project was held and officers for 1931 elected. This organization indorsed the plan of the Malta Irrigation District and Commercial Club in attempting to settle the project with good bench-land farmers who had contemplated leaving the country.

MEETINGS of stockmen on the Sun River project were held at which it was proposed to form organizations of water users to lease all available pasture lands from the United States and administer them for the benefit of the local water users.

Hoover Dam, the World's Largest Irrigation Structure

Address by Dr. Elwood Mead, Commissioner, Bureau of Reclamation, before the Massachusetts Institute of Technology, Cambridge, Mass., January 9, 1931

THE first impression of the Boulder Canyon project is size. About every dimension is a superlative. The dam will be 730 feet high, nearly twice the height of any dam yet built. It will be 650 feet thick at the base. The All American Canal, which will carry the stored water to irrigators in Imperial Valley will be 200 feet wide, 22 feet deep, and carry 15,000 cubic feet of water per second. This canal has to pass through a windswept ridge of shifting sand where the excavation will be more than 200 feet deep. The aqueduct that is to carry water to Los Angeles and surrounding cities will be over 200 miles long, and will carry 1,500 cubic feet of water per second, which will have to be lifted 1,200 feet in order to cross the Sierra Divide. It will cost over $200,000,000.

GREATEST ARTIFICIAL RESERVOIR

The lake above the dam will be 115 miles long, 582 feet deep, and will hold 30,500,000 acre-feet of water, enough to cover the State of New York to the depth of one foot. It will be the largest artificial reservoir in the world, more than 11 times the capacity of the Elephant Butte Reservoir in New Mexico, and 12 times that of Assuan in Egypt.

These structures are given heroic proportions because a turbulent river has to be controlled and because the water needs of the Southwest are great and urgent. The reservoir must be large enough to hold the greatest flood. The flow below the dam must be regulated. No floods to break the levees and menace the homes, but always water enough to irrigate 2,000,000 acres of land and meet the requirements of many millions in cities. This dam is the basis of a civilization under which unnumbered generations will live. With it there is no known limit to growth and wealth, without it people must be notified to go elsewhere; the latter to Los Angeles is unthinkable.

Into this reservoir there will be dropped each year 100,000 acre-feet of mud. It has been made large enough to hold this deposit for two centuries without interference with its capacity as a regulator.

It is an enterprise which carries a challenge to the engineer, no matter where he lives. The specifications just issued have therefore been awaited with intense interest by both the profession and by contractors. The manner in which they deal with the obstacles of climate, of location, of size and stresses, were an acid test of the ability of the Reclamation Bureau to carry out monumental undertakings in its field. One verdict has been rendered. It is a statement in the Engineering News-Record of December 25, which says: "It is the most advanced, the boldest and most thoroughly studied hydraulic enterprise in engineering history." Let me quote further from the News editorial: "With 5,000,000 cubic yards of concrete, 30,000 tons of structural steel, and over 70 miles of grouting holes, with rock tunnels ranging from 50 to 70 feet in diameter, and 2,000 tons of needle valves, the structure that is to be set in the path of the turbulent Colorado in a sheer walled narrow gorge at the bottom of an inaccessible desert canyon in the remotest region of the United States constitutes a work ranking with the greatest ever attempted by human hands." The designing engineer is known to his associates as Jack Savage. He has in succession designed the four highest dams in the world; Hoover Dam is simply another step in his progress.

The canyon walls at the water level of the river are only 300 feet apart. The velocity of the river's flow through this bottleneck is about 20 feet a second. The upper cofferdam which turns the river into the tunnels will be 80 feet high, and when the river is diverted 7,000,000 cubic yards of mud and gravel will have to be taken out of the space between the two coffers to uncover the rock on which the dam will rest.

INTENSE HEAT TO BE OVERCOME

This project, like Panama, has a climate. The summer wind which sweeps over the gorge from the desert feels like a blast from a furnace. How to overcome this and provide for the health of workers has had much attention. At the rim of the gorge, where much of the work must be done, there is neither soil, grass, nor trees. The sun beats down on a broken surface of lava rocks. At midday they can not be touched with the naked hand. It is bad enough as a place for men at work. It is no place for a boarding house or a sleeping porch. Comfortable living conditions had to be found elsewhere, and these are found on the summit of the Divide, 5 miles from the dam. Here there is fertile soil; here winds have an unimpeded sweep from every direction; here there is also an inspiring view of deserts and lonely gorges and lofty mountain peaks. When the dam is completed and a marvelous lake fills the foreground, the view from Boulder City will be so inspiring and wonderful as to be worth traveling around the world to see. The water supply for the city has to be brought from the river by a vertical pumping lift of 2,000 feet. The 10-mile railroad from the city to the dam is a marvel of skillful location, as is the paved highway which connects Boulder City and the dam. It is expected that another highway will soon be built on the east side of the river to connect the dam with Kingman, Ariz.

POWER TO BE CARRIED 225 MILES

Power for construction is to be furnished by the Southern Sierras Power Co., which will carry it 225 miles. This power equipment will be built for permanent service. When the power wheels have been installed at the dam, current from them at a much higher voltage will be carried on this line in the opposite direction.

WORKERS TO BE HOUSED IN MODEL TOWN

The town planner of Boulder City is S. R. De Boer, who has a high reputation as a city planner in the mid-west. The houses and offices of the bureau staff have been designed by a southern California architect and will follow the general lines of those in the Panama Canal Zone. Generous provision has been made for lawns and trees for shade and windbreaks, but planting of these will have to wait for the spring of 1932. Water for irrigation can not be provided early enough in 1931. In all, the bureau will spend $2,000,000 creating comfortable living conditions for workers. None of the money will be wasted. It means health and vigor of workers. The specifications require contractors to house 80 per cent of their workers in the town. It will be administered much like the national parks; it will be entirely a Federal city with three commissioners, one of whom will be a representative of the contractor of the dam. Lots for residences and business purposes will be leased with rigid restrictions as to use. It will be a temperance town. The number of stores, shops, and moving-picture theaters will be restricted; otherwise every business would be overdone. The money received from leases will help pay operating expenses.

The heat under which concrete will be mixed and put in place, added to its chemical heat in setting, has led to provisions for inserting small pipes in the concrete as it is placed which will be filled with a freezing mixture. Later on these pipes will be filled with concrete.

CONSTRUCTION COSTS TO BE REPAID

Let us now consider how the money that is to go into this enterprise is to be repaid. This had careful attention from Congress. The law requires the Secretary of the Inte-

rior to enter into contracts which in the Secretary's opinion will return all the money spent on the dam with 4 per cent interest within 50 years, and all the money spent on the All-American Canal in 40 years without interest. Contracts approved by the Attorney General have been made for repayment of the money spent on the dam. It will come from the water supplied cities and towns, and from power already contracted.

The power plant will generate 660,000 firm horsepower with an uncertain but large amount of seasonal power to be sold during the period of high water in the river. The price of firm power is 1.63 mills a kilowatt-hour, and 0.05 of a mill for each kilowatt-hour of seasonal power. The power and water income from the contracts already signed will in 40 years bring an income of $373,500,000. Of this, the United States will receive $228,260,000 to repay money advanced, with interest. Arizona and Nevada will each receive $31,235,000. Operation and maintenance will absorb $16,120,000, and there will be a surplus of $66,650,000 which will be the net profit of the Government for going into this enterprise, to be disposed of as Congress may hereafter direct.

OPERATION OF COLORADO RIVER COMPACT

In the Southwest water is gold. These great sums of money have caused the arid States to recognize the value of flowing water. It is giving rise to a political and economic struggle over its control. States, communities, and individuals have a changing conception of the nature of property rights in water. The first reaction of the upper States to this enterprise was to oppose it. They said that the Government dam and reservoir would create vested rights that would enable users of this water to interfere with later development of irrigation on the upper part of the river. To overcome that objection representatives of each of the seven States and of the United States met and under the guidance of President Hoover, then Secretary of Commerce, formed a compact which created a new water law for the arid region. The compact divides the stream into two sections, and allots 7,500,000 acre-feet a year to each section; 1,000,000 acre-feet is left for subsequent distribution. That deals with 16,000,000 acre-feet, which is the average annual flow of the river. Later on the 7,500,000 acre-feet allocated to the lower section was divided between Nevada, California, and Arizona, and representatives of the four upper States are working on a division of their 7,500,000 acre-feet share. These rights so allocated are perpetual. They set aside the doctrine of riparian rights and the doctrine of prior appropriation which had hitherto governed the division and use of streams. Six of the seven States and the United States ratified the compact. Arizona has not done so, but has brought suit in the United States Supreme Court, claiming an ownership in the river which if recognized would make it a dictator over all future development. It is not believed that this claim will be recognized.

DAM TO BE COMPLETED IN SIX AND ONE-HALF YEARS

Notwithstanding the suit in the United States Supreme Court, work is going steadily forward. Congress in 1930 appropriated $10,660,000 and the present appropriation bill carries an additional $15,000,000. The contract for the dam and tunnels will involve close to $50,000,000 and will be one of the largest ever let in this country. The tunnels are to be finished in two years, the dam in six and one-half years. Considering its magnitude it has very few elements of uncertainty for the contractor. The Government is to buy and furnish cement and structural steel; the contractor therefore assumes no risk from fluctuations of prices. The four tunnels which will carry the river past the dam during its construction have been so thoroughly prospected by means of diamond drill cores that contractors know the kind of material to be removed. The cofferdam is the one hazardous feature of the project. It is to be built according to plans provided by the Reclamation Bureau, and when so built all subsequent hazards of its failure or being overtopped by floods are assumed by the Government. The power machinery is to be provided by the contractors for power. Owing to its size it will be something of a problem to install it, but some of the contractors have for a year been studying the situation and have already designed their equipment. It will have the highest towers of any work ever undertaken and the overhead cables will lift 30 to 40 tons.

BUILDING progress in the city of Yakima, Yakima project, has been on a steady increase for several years, and permits issued during 1930 amounted to $1,651,215. This figure is $407,670 above that for 1929.

ON the Vale project 127 inquiries relative to project lands were received during the month by the representative of the Vale-Owyhee Government Projects Land Settlement Association. Twenty-one interested persons called at the representative's office during the month, 200 acres were sold, and 2 new settlers arrived on the project to establish homes.

Reclamation

The following statement was approved by the land reclamation division of the American Society of Agricultural Engineers at its meeting in San Francisco, Calif., January 7, 1931:

The reclamation of lands for agricultural production has been and will continue to be a vital factor contributing to national wealth and stability. The urge for such development is chiefly economic, thus receiving greatest public support during periods of greatest national prosperity. This public tendency contributed in the past to urgent and often hasty preliminary studies of tentative projects which later led to unwise development, resulting in subsequent embarrassment to the projects in meeting their financial obligations.

The land reclamation division of the American Society of Agricultural Engineers believes in the soundness of Federal support and supervisory development of agricultural areas by reclamation where these are economically feasible. We desire to direct attention to the necessary lapse of time which occurs between the inception of a project and the time it comes into maximum fruition. This period may be as long as 25 years.

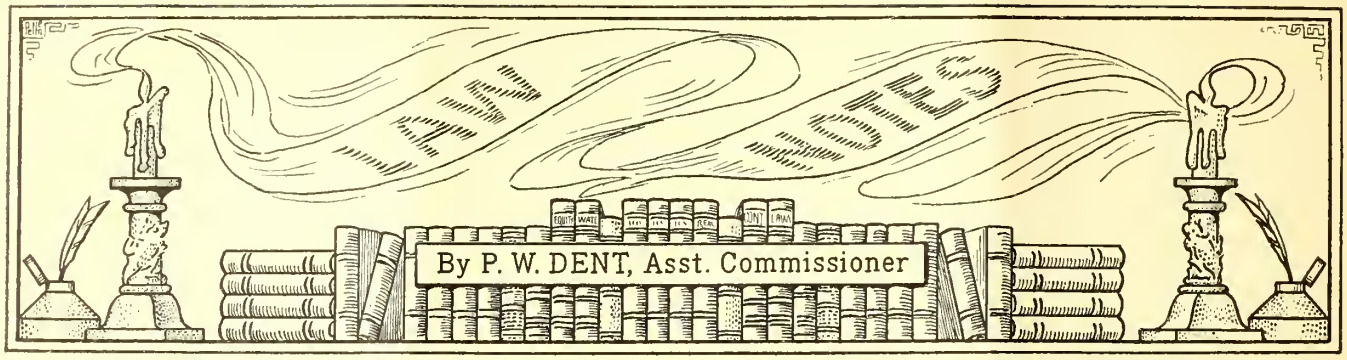
Accordingly we urge that the Federal Government maintain and adequately support the proper agencies to make and develop long-time engineering and economic studies of probable reclamation projects in order that such projects as may be approved will be undertaken at times when their period of development may fit into national economic progress.

The land reclamation division wishes to commend the Federal and State Governments for their splendid services to reclamation development and we pledge our support to these agencies in carrying out the responsibilities outlined in this statement.

Public Land Opening Vale Project, Oregon

The Secretary of the Interior has announced the opening to entry on February 9, 1931 of a small tract of public land comprising 5 farm units on the Bully Creek West Bench Division of the Vale Federal irrigation project, Oregon. The farm units have an irrigable area ranging from 44 to 72 acres.

At this opening ex-service men who have served in the United States Army or Navy in any war will be granted a preference right of entry of 90 days.



Federal Condemnation of State Property

IN State of Missouri *v.* Union Electric Light & Power Co., 42 Fed. (2d) 692, decided July 18, 1930, the Federal District Court of Missouri had before it a situation which is of interest to the Bureau of Reclamation, particularly as concerns the Federal power to acquire by purchase or condemnation property held by one of the States and devoted to a public use. In many respects, as will be seen, the facts are similar to those connected with the Boulder Canyon project development.

The following is taken from the opinion of the court dismissing the complainant's bill, which was brought by the State of Missouri seeking to enjoin the construction of a project under the Federal water power act:

This is an action to enjoin the construction of a dam across the Osage River, near Bagnell, in Miller County, Mo. It is alleged by complainants that the object of said construction is to secure power for a hydroelectric plant, and that said plant is to be operated by the defendant Union Electric Light & Power Co. solely for the purpose of generating electricity for profit. Although complainants assert that the Osage River and many of its tributaries are navigable in fact and in law, yet they say that the construction of said dam would not serve to promote navigation thereon, but would impede same; that the size of said dam, as now contemplated, would inevitably create an immense reservoir and cause the inundation of vast tracts and bodies of land, the submergence of many public highways and school districts, and the permanent overflow of the village of Linn Creek in Camden County, which is now the county seat of said county; and that the courthouse and other public property situated in said Linn Creek would be flooded and rendered useless.

It is further alleged that said dam is not intended as a public improvement and in fact would not be for the public interest, but is wholly designed as a private enterprise for the generation of electricity to be disposed of commercially, and on account of the lake formed thereby a condition deleterious to the public health would be created.

The defendants, on their part, admit the proposed and intended construction of said dam. They assert, however, that it would be an aid and benefit to navigation. The defendants, and particularly the Union Electric Light & Power Co., plead the legal right to construct said dam, which, it says, is vested by virtue of Federal license project 459, Missouri, granted by the Federal Power Commission, pursuant to the provisions of the Federal water power act of June 10, 1920, being chapter 12, title 16 of the United States Code (16 U. S. C. A. secs. 791–823). The authority of the Federal Power Commission, it is asserted, arises from clause 3, section 8, of article 1 of the Constitution of the United States, whereby power is vested in the Congress, "to regulate commerce with foreign nations, and among the several States."

The defendants, and particularly the Union Electric Light & Power Co., plead compliance with said water power act and assert the right not only to construct said dam but to acquire by condemnation, if necessary, all property of a private or public nature, situated within the proposed reservoir or in any manner affected by said project.

* * * * *

The evidence, on the part of the complainants, tended to show that navigation on the Osage River and its tributaries had been carried on uninterruptedly for many years, but that the volume of business had been so far reduced that it was practically negligible at the present time. Such navigation was seasonal and dependent in a large measure upon the stage of the rivers affected, which in turn were largely dependent upon uncertain rainfalls.

The evidence was undisputed that the dam, as proposed by the defendant Union Electric Light & Power Co., would have the effect to accumulate a vast body of water in a huge reservoir, and that the entire region within the valley of the Osage River and the valleys of its tributaries, for a distance of more than 100 miles, would be overflowed. This would result in submerging both public and private property, including the courthouse and jail in the village of Linn Creek, a large number of school districts, and at sundry points inundate the public highways. It was undisputed that Camden County would be divided in three parts by the lake to be formed, and that each part would be rendered inaccessible to the other parts.

It further appeared beyond question that a large portion of the more fertile bodies of land in Camden County, lying along and in close proximity to the Osage River and its tributaries would be inundated, so that the county, so far as agriculture is concerned, would be permenently deprived of its most valuable productive areas. There was evidence as to the necessary withdrawal of such lands from State and local taxation and the serious effect that would follow upon the revenues of Camden County. There was evidence that insanitary conditions would be created by the exposure of large areas covered with mud and bog due to the recessions of the lake.

The evidence on the part of the defendants showed that navigation on the Osage and its tributaries had been so greatly reduced in recent years that it was now negligible. It was admitted that valuable properties, both public and private, would be inundated. The testimony of the defendants, however, showed that no unhealthy conditions would result from the construction of said dam and reservoir, but that, on the contrary, the areas covered by mud and bog would be greatly reduced by reason of said construction.

The Osage River and its tributaries are subject to frequent and extensive overflow in their natural state. Much of the area to be taken as part of the proposed reservoir is now subject to overflow. Following such overflows, deposits are left similar to that which would follow the withdrawal of waters in the reservoir and are far more extensive.

The evidence, on the part of the defendants, tended to show that navigation would be materially benefited by the construction of said dam; that the Osage River would be rendered navigable for heavy draft boats between Warsaw in Benton County and Bagnell in Miller County; and that this would comprehend a distance of approximately 100 miles and would connect with railroad carriers at both of these points.

The evidence was that for many years there has not been continuous navigation, but that freight was ordinarily taken from the river at Bagnell and thereafter carried by railroad. There was much evidence that the release of water from the reservoir would much more evenly distribute the flow on the Osage River below the dam, and that navigation would experience a dependable and adequate flow of water. Moreover, the Missouri River would be affected somewhat favorably for navigation at periods of low water.

* * * * *

1. At the outset the court is concerned with the fundamental and jurisdictional question as to whether the project is one of Federal judicial cognizance. As a postulate to a further consideration of the case, it must be acknowledged, and the parties so concede, that the National Government, under the power "to regulate commerce with foreign nations and among the several States," has full and complete jurisdiction over all matters affecting navigation. (Addyston Pipe & Steel Co. *v.* United States, 175 U. S. 211,

20 S. Ct. 96, 44 L. Ed. 136; Gibbons *v.* Ogden, 9 Wheat. 1, loc. cit. 229, 6 L. Ed. 23; Alabama Power Co. *v.* Gulf Power Co. (D. C.) 283 F. 606, loc. cit. 613.) Moreover, this power and authority extends just as fully and completely to navigation upon the navigable waters wholly within a State.

In Sewell *v.* Arundel Corporation, 20 F. (2d) 503 loc. cit. 504, the Court of Appeals for the Fifth Circuit, said: "It is well settled that Congress has complete dominion over the navigable waters of the United States, whether wholly within the boundaries of a State or otherwise, and has authority to undertake and prosecute such work as may be thought necessary to improve their navigability. This authority includes the power to obstruct, and when Congress gives consent to the creation of an obstruction to navigation it ceases to be a nuisance and the courts are powerless to interfere. (Wisconsin *v.* Duluth, 96 U. S. 379, 24 L. Ed. 668; Pennsylvania *v.* Wheeling & Belmont Bridge Co., 18 How. 421, 15 L. Ed. 435.)"

* * * * *

Complainants are correct in their contention that, if the construction and maintenance of the dam is for the prime and sole purpose of generating electricity for commercial purposes, and not for its influence upon navigation, then the subject matter would not be within the power of the Congress or within the jurisdiction of this court. (Addyston Pipe & Steel Co. *v.* United States, supra.)

* * * * *

8. By section 21 of the water power act (16 U. S. C. A. sec. 814) it is expressly provided that: "When any licensee can not acquire by contract or pledges an unimproved dam site or the right to use or damage the lands or property of others necessary to the construction, maintenance, or operation of any dam, reservoir, diversion structure, or the works appurtenant or accessory thereto, in conjunction with an improvement which in the judgment of the commission is desirable and justified in the public interest for the purpose of improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, it may acquire the same by the exercise of the right of eminent domain in the district court of the United States for the district in which such land or other property may be located, or in the State courts."

The licensee has been granted the power to acquire property by the exercise of eminent domain in express terms. Concededly this right may be exercised as against private property.

"Public lands," as used in the act, refers only to lands owned by the United States. The only question, therefore, that is here presented is whether the right of eminent domain may be exercised against property already dedicated to a public use when situated within the proposed reservoir and to be affected by the improvement.

9. While it is well settled that the legislature may authorize the taking of property already devoted to a public use, it is equally well established that a general delegation of the power of eminent domain does not authorize the taking of property already devoted to a public use, "*unless it can clearly be inferred from the nature of the improvements authorized or from the impracticability of constructing them without encroaching upon such property that the legislature intended to authorize such a taking.*" (10 R. C. L., sec. 169; Western Union Telegraph Co. *v.* Pennsylvania R. R. Co. et al, 195 U. S. 540, 25 S. Ct. 133, 49 L. Ed. 312, 1 Ann. Cas. 517.) In this connection it can not be questioned but that Congress had the power to confer the right of eminent domain upon the defendant Union Electric Light & Power Co. (10 R. C. L. sec. 167.)

In the instant case the Congress must have contemplated this identical situation; hence the requirement of notice. Moreover, the proposed improvements could not be accomplished except through the exercise, if necessary, of eminent domain against property already dedicated to public use. To deny the right of eminent domain as against this public property would not only defeat the functions of the National Government, but would run contrary to the obvious intent of the Congress as expressed in the water power act. (Stockton, Attorney General, *v.* Baltimore & New York R. R. Co. (C. C.) 32 F. 9; 20 C. J. sec. 90, P. 602; Vermont Hydro-Electric Corporation *v.* Dunn et al., 95 Vt. 144, 112 A. 223, 12 A. L. R. 1495; Imperial Irrigation Co. *v.* Jayne, 104 Tex. 395, 138 S. W. 575, Ann. Cas. 1914B, 322.)

* * * * *

12. This court can take no cognizance of the enforced removal of the county seat of Camden County. The Congress acting under its power to regulate commerce is supreme, and its authority must be upheld and executed, even though it involves the removal of the county seat of Camden County. Even a county seat could not endure as an obstruction and barrier to the free exercise of governmental authority.

* * * * *

NOTE.—The States can not condemn Federal property. (Utah Power & Light Co. *v.* United States, 243 U. S. 389), but in Nahant *v.* United States (136 Fed. 273), and Bedford *v.* United States (23 Fed. (2d) 453) the Federal condemnation of State property has been permitted. The foregoing case is in line with the Nahant and Bedford cases.

WATER SUPPLY CONDITIONS

December was characterized by slightly subnormal temperatures and a marked deficiency in precipitation. In many localities only a negligible amount occurred during the month.

While it is yet early for predictions concerning the 1931 water supply, with most of the runoff producing snowfall normally occurring after December 31, the present extremely low snow cover on the watersheds indicates small runoffs for the ensuing year.

For reservoirs with concurrent records available, the storage contents on December 31, 1930, were 3,819,000 acre-feet, compared with 4,531,000 acre-feet for the same date in 1929.

Recently Enacted Legislation

CHINOOK DIVISION MILK RIVER PROJECT

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act of May 25, 1926 (Forty-fourth Statutes at Large, page 636), be and the same is hereby, amended by adding after section 20 of said act sections 20–A and 20–B, as follows:

"SEC. 20–A. There shall be deducted from the total cost chargeable to the Chinook division of this project the following sum:

"(1) Twenty-one thousand six hundred and eighty-four dollars and fifty-eight cents, or such amount as represents the construction cost as found by the Secretary of the Interior against the following lands:

"(a) One thousand seven hundred and seventy and seventeen one-hundredths acres permanently unproductive because of nonagricultural character.

"SEC. 20–B. All payments upon construction charges shall be suspended against the following lands in the Chinook division:

"(a) Twelve thousand six hundred and seventeen and sixty-four one-hundredths acres temporarily unproductive because of heavy soil and seepage; (b) eleven thousand three hundred and seven acres for which no canal system has been constructed, all as shown by the land classification of the Chinook division made under the direction of the Secretary of the Interior and approved by him under date of January —, 1930. The Secretary of the Interior, as a condition precedent to the allowance of the benefits offered under sections 20–A and 20–B, shall require each irrigation district within the Chinook division to execute a contract providing for repayment of the construction charges as hereby adjusted within forty years and upon a schedule satisfactory to said Secretary; and no water from the Saint Mary River watershed shall be furnished for the irrigation of lands within any district after the irrigation season of 1930 until the required contract has been duly executed."

SEC. 2. All contracts with the Government touching the project shall be uniform as to time of payment and charge for the construction of the Saint Mary diversion.

Approved, July 3, 1930.

Settlement and Development of the Boulder Canyon Project

FOR the benefit of those who see in the Boulder Canyon project only another large area of land to be brought into cultivation in the near future for the production of crops to compete with agricultural products of the East and Middle West, let it be said at the outset that, as has been the case with other statements, it is perfectly all right except that in the first place there will be little or no such competition, and in the second place it will be seven or eight years before water will be available for growing crops on the withdrawn public land.

What our economic condition may be at that time no one can foretell with any degree of accuracy. It seems reasonably safe to assume, however, that what has been true in the past concerning the local absorption of the products of Federal irrigated agriculture will be equally true of the agricultural development under the Boulder Canyon project, and that these future products of Federal irrigation will be readily absorbed by the growing demands of the Southwest whose population and industrial development are confidently expected to respond in a marked degree to the stimulus of the construction of Hoover Dam.

The anticipated influx of capital and population to this region as a result of the vast power development at the dam and the assurance to Los Angeles and a score of smaller cities of an adequate supply of water for domestic purposes, thus insuring their continued phenomenal growth, must be met by an increased food supply. The arid areas irrigable from Hoover Dam will help to supply this need.

SETTLEMENT OPPORTUNITIES ON COMPLETION OF WORKS

At present all public land susceptible of irrigation from Hoover Dam has been withdrawn from entry and will not be opened to settlement until water for irrigation is available. That means not until after the Hoover Dam is completed and canals and laterals constructed to bring the water to the land, or from seven to eight years hence.

When water is available for irrigation and the land is opened to entry, ex-service men will have a preference right of three months to enter such land before citizens without a military or naval background are allowed to make application. The land will doubtless be opened in units of a few thousand acres at a time as water becomes available for a particular area and in order that there may not be too great a lag between completion of construction and full settlement.

TITLES TO ILLUSTRATIONS ON OPPOSITE PAGE

Upper: Commencement of construction of Hoover Dam. Left to right: Senator Key Pittman of Nevada; Governor Fred B. Balzar of Nevada; Carl R. Gray, president of Union Pacific System; Hon. Ray Lyman Wilbur, Secretary of the Interior; Senator Tasker L. Oddie of Nevada.

Lower: Government engineers in charge of construction. Left to right: Dr. Elwood Mead, Commissioner of Reclamation; Raymond F. Walter, chief engineer; Walker R. Young, construction engineer; John C. Page, office engineer; Ralph Lowry, assistant construction engineer.

CROPS ADAPTED TO PROJECT

It is not anticipated that much, if any, difficulty will be experienced in settling these lands as they become available. This region has been aptly called America's Valley of the Nile, where a potentially fertile soil and abundant sunshine, coupled with an adequate water supply and intelligent farming methods, will work wonders in transforming an arid waste into a garden spot. Here will be duplicated the crops of the Salt River Valley and the Yuma project in Arizona, and those of the Imperial Valley in California. A wide variety of crops is possible, including alfalfa, cotton, winter vegetables, cantaloupes, lettuce, pecans, citrus fruits, figs, dates, and many other crops normally grown in the temperate and subtropical zones.

It is believed that, as in the case with land opened to entry on the Tule Lake division of the Klamath project, Oregon-California, the demand for these Boulder Canyon project lands will exceed the supply, and that as a result a miniature agricultural empire will in time be gradually developed here to meet the needs of population increase and industrial expansion in the nearby cities and towns of the Southwest.

Every effort will be made by the Bureau of Reclamation to see to it that the land opened to entry is economically feasible of producing crops of a character and in sufficient quantities to provide a living for the farmers and repay the charges to the Government. Careful land classifications and soil analyses will be made to determine this essential factor. In addition the men who take up the public land will be required to demonstrate to an examining board that they have the necessary qualifications for success, particularly experience in farming and a reasonable amount of capital. The combination of the right man with adequate capital, a fertile soil, an adequate water supply, and nearby markets should eliminate most of the hazards of changing raw land into producing farms. Every means will be used by the bureau to bring about this happy combination in the settlement and development of the Boulder Canyon project.

AT the end of the month a milk producers' association was in process of organization on the Klamath project. Thirty to 35 dairymen are expected to join the association, the members of which will be under contract to market their products through the Klamath Dairymen's Association.

Government Plans Model Town at Boulder City, Nevada

ON December 18 Secretary Wilbur approved the plans for Boulder City, Nev., the new town to be constructed by the Government on the Boulder Canyon project, about 6 miles west of the site of the Hoover Dam. For several months S. R. De Boer, city planner and landscape architect, of Denver, Colo., has been at work on plans for this town, which has resulted in a layout that will probably serve as a model in town planning for years to come. The employees of the Government and of the contractors, together with those who wish to engage in business, or to follow their trades or practice their professions, will find in Boulder City all the conveniences and comforts which the Government is able to provide. In southern Nevada there is an annual temperature range from 20° to 120°, with a mean temperature in December of 52° and of 94° in July. The summers are hot and dry, while the winter climate is quite agreeable. Trees, green grass, and flowers are missing in the vicinity of the town site, and instead are found sandy soil, bare rocks, and occasional desert shrubs. But a transformation will be worked in this particular instance, and here the "desert will blossom like a rose." Boulder City will truly be an oasis in the desert, a resting place for the weary traveler. The workers on the project who live in this "model town" will have comfortable living quarters specially designed for the prevailing climatic conditions, and the town will lack nothing to be found in the average progressive community elsewhere in the country.

There will be expended by the Bureau of Reclamation in the construction of Boulder City about $2,000,000, and it is expected that about 3,000 people will have residence there during the construction period. The size of the population after the dam and power plant are completed is problematical, but it seems very likely that it will be a sizable tourist town. With a main transcontinental highway as projected from Kingman, Ariz., on the east, and crossing over the top of the dam, thousands of tourists will use this route on their way to the Pacific coast. The 730-foot dam and 115-mile lake will compete with the National Parks as scenic attractions. A maintenance force will also be needed at the dam and power plant.

GENERAL PLANS FOR CITY

The city plan contemplates that the construction contractor's camp, the Government camp, and various business establishments to care for the needs of these people will be assembled in the city under Government administration. The streets, business section, residence section, and parks will be laid out as shown on the accompanying plan. Streets will be graded and oil surfaced, concrete curbings and sidewalks constructed, and street lighting system installed. The Government will construct a town hall, school, garage, dormitory and guest house, auditorium, administration building, and 75 cottages for its employees comprising five 6-room, nineteen 5-room, twenty-six 4-room, and twenty-five 3-room cottages; also 50 small garages, a swimming pool, and playground. About $600,000 will be expended on these features.

The proposed water system will have sufficient capacity for the needs of 3,000 people, together with incidental city uses. The water will first be pumped from the Colorado River to a mechanical presedimentation plant and then pumped in two lifts to a chemical treating plant, sand filter, and storage system at the city, with a total lift of about 2,000 feet. Sufficient distribution system is to be installed by the Government to make water available to each lot. The water system will cost upwards of $400,000. A sewage system to cost about $150,000 will also be constructed, to consist of city distribution, with service connections to Government buildings and a disposal plant located about three-fourths mile from the city.

A transmission line from the substation of the Southern Sierras Power Co. at the dam site, substations at the water-supply pumping plant and at the city, and the city distribution and lighting system, are included in the bureau's construction plans. Sufficient capacity will be installed to handle all cooking and refrigeration uses as well as other requirements, making Boulder City an electric community. An ornamental street-lighting system is planned for the business section. Landscaping is also provided for in the Government estimates.

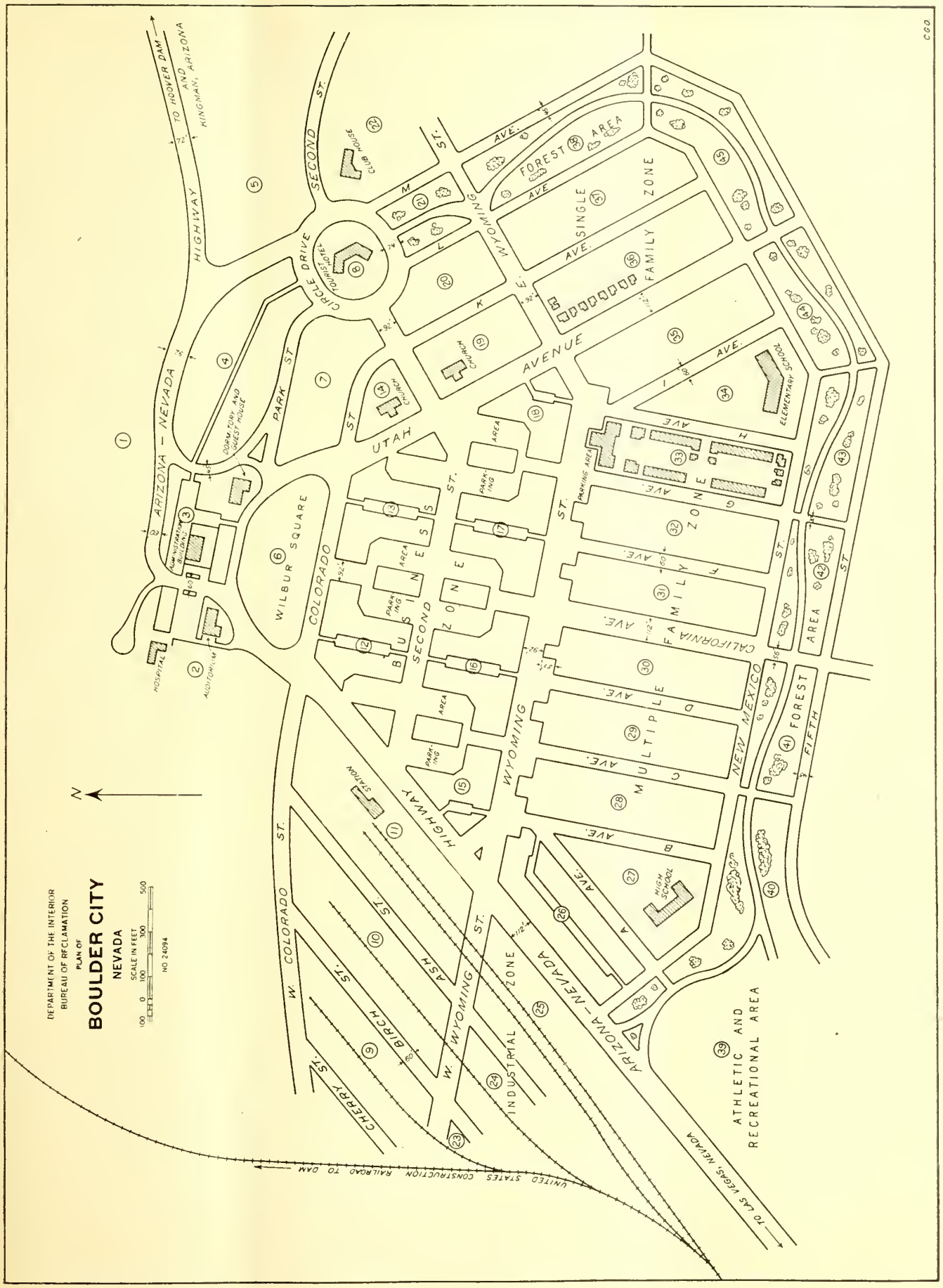
TOWN GOVERNMENT

The administration of the town government will be in the hands of a commission of three, one of whom will probably be a representative of the contractor for the dam. A city manager will have direct charge under supervision of the commission, with United States deputy marshals appointed as police officers. All operation and maintenance of water, sewer, and electric systems, streets, parks (with a combined area of about 10 acres), and other municipal works will be under the direction of the city manager. The duties of police judge will be taken care of by a United States commissioner and there will be a superintendent of public works with the usual city maintenance force.

The contractor for the Hoover Dam, power plant, and appurtenant works will have a section of the town set aside for his construction camp, in which he may erect an office building, warehouses, garages, commissary, hospital, dormitories, boarding houses, homes for employees, and other necessary buildings. These buildings are required to have a neat attractive appearance and the plans for same are subject to the approval of the Government. For the use of the land set aside for the contractor, and for the municipal services and facilities made available, he will be charged $5,000 per month during the construction period, together with additional charges for water and electricity. After acceptance by the Government of the dam, power plant, and related works, the contractor will have the right to lease the land occupied by his camp at the regular established rates. The specifications covering construction work at the dam site include a provision requiring the contractor to house not less than 80 per cent of his employees in Boulder City. There will necessarily be a few isolated camps, at places such as the Arizona gravel pits, and also boarding and lodging facilities which will be needed at the dam site.

SUMMIT SITE SELECTED

Due to the inaccessibility of the work, the magnitude of the operations, and the severe weather conditions during the hot summer months, and having in mind the health, comfort, and general welfare of those engaged on the work, the town has been located at the "summit" on a saddle of the divide between the river area and Las Vegas. The elevation is 2,500 feet, which is about 1,000 feet higher than the top of the canyon at the dam site. The location is about 6 miles west of the dam site and 23 miles southeast of Las Vegas, Nev., on a branch line (now under construction) of the Los Angeles & Salt Lake Railroad, a part of the Union Pacific system. A main highway will connect Boulder City with Las Vegas and the dam, and will probably join with a highway from Kingman, Ariz., and the east, in the near future. This summit site has an average temperature 6° lower than that of any of the other sites under consideration. It is at the top of the divide with a rather steep descent to the north, and a uniform 3 per cent slope to the south, with hills both to the east and west. There is an unusually beautiful view to the north overlooking the proposed 145,000-acre


DEPARTMENT OF THE INTERIOR
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HIGHWAY
ARIZONA - NEVADA
CIRCLE DRIVE
SECOND ST.
TOWNSITE OFFICE
CLUB HOUSE
DORMITORY AND GUEST HOUSE
PARK ST
WILBUR SQUARE
COLORADO
UTAH
CHURCH
WYOMING
AVENUE
FOREST AREA
SINGLE FAMILY ZONE
ELEMENTARY SCHOOL
PARKING AREA
BUSINESS ZONE
PARKING AREA
MULTIPLE FAMILY ZONE
CALIFORNIA
NEW MEXICO
FIFTH
HOSPITAL
AUDITORIUM
STATION
HIGH SCHOOL
INDUSTRIAL ZONE
ATHLETIC AND RECREATIONAL AREA
W. COLORADO ST.
W. WYOMING ST.
CHERRY ST.
BIRCH ST.
ASH ST.
ARIZONA - NEVADA
TO LAS VEGAS, NEVADA
UNITED STATES CONSTRUCTION RAILROAD TO DAM

reservoir 4 miles away. This lake will have an area 20 per cent larger than Lake Tahoe in California-Nevada.

The main axis of the town has been placed at a slight variation with the compass to give a more equal exposure of sunlight for all building walls. There will be no automobile parking allowed on streets, but provision will be made for parking on specially created open plazas in the downtown business blocks. In the business district the blocks have been provided with alleys, the interior part of which will be 46 feet in width, thus providing a loading and unloading space for trucks. Main through-arteries will be separate from business and residential streets. Street widths contemplated are as follows: Main highways 112 feet, roadway 56 feet, with possible extension to 76 feet; business streets 92 feet, roadway 56 feet; residential streets 60 feet, roadway 30 feet. All buildings in the town will be in harmony as to design. Different types of stores and business establishments will be given definite locations. Residential blocks have great length in the more densely populated districts, as much as 900 feet, with an average width of about 260 feet. In the design of these residential blocks provision has been made for open plazas in the block interiors to provide small parks and playground facilities.

STREET LAYOUT

Three main arterial highways are the basis of the street plan, the center one of the three being the axis of the city, and all three highways centering on the Government administration building located on a saddle overlooking the reservoir to the north. The west boulevard (Arizona-Nevada Highway) connects with the highway to Las Vegas and passes the railroad station, following the railroad on the west side of the city. The central boulevard (California Avenue) will pass through the center of the business district, with the administration building facing squarely on it, at the upper end of the street grade. The third arterial boulevard (Utah Avenue) on the east is of residential character.

At right angles to the arterial boulevards is the main business street (Second Street) with the railroad station at the west end. All the other streets connecting the radial boulevards are to be parallel to this main street. Residential streets are all planned to parallel the three radial boulevards and generally run in a southerly direction. The blocks south of the business district will have the greatest density of population, while the eastern part of the city has been set aside as a residential district of a more open character and less density. The higher part of this residential district to the north and directly east of the Government group of buildings is proposed for residences of the Government employees.

PRINCIPAL BUILDINGS

The office building of the Bureau of Reclamation has been made the central feature of the city. It will front on a central park (Wilbur Square) and have auto parking areas on both sides. To the southeast and close by will be the dormitory and guest house, while the auditorium and garage will be located in block 2 adjoining on the west.

The business section (blocks 12, 13, 15, 16, 17, and 18) has been designed around open plazas partly closed on the ends, with the central one the most important. With the provision of parking space in the plazas, and the elimination of parking in the streets, the business frontage is shifted from street to plaza. These plazas, with grass plots and trees through the center to provide open vistas, have parking space for over 1,400 automobiles and trucks. This capacity is independent of parking facilities provided for Government buildings, railroad station, and other public buildings. It is planned to design all stores with arcades over the sidewalks.

The city hall and post office are to be located in the two end buildings on the north end of the central business plaza. It is proposed to group together the stores that logically belong together and assign definite types of buildings to the various plazas. Stores for wearing apparel, notions, books, etc., would be located in the south half of the plaza with grocery, hardware, and furniture stores in the north half. Directly on the main street on the four corners of the intersection of the main street with the plaza would be the drug stores. Hotels and lodging houses will be in the business district fronting on Wilbur Square, while a large tourist hotel is proposed at the east end of the main street (Second Street) on a small hill, where a 4-acre tract is set aside for this purpose.

RESIDENTIAL SECTION

Sites for apartment houses are located just south of the business section, and in this area there are small parking spaces at every corner. These apartment houses will face on the open courts of the residential blocks to the south, giving an unusual amount of air and light. Several blocks south of the apartment house area (blocks 26, 28, 29, 30, 31, 32, 33, and 35) are designed for multiple dwellings, with interior courts 100 feet in width, in which will be playground apparatus, and the remainder will be made into lawn. Between the buildings and court is a space from 20 to 30 feet wide set aside for private yards. These dwellings will be set back from the curb about 20 feet, with garages in pairs made a part of the building design instead of being independent structures.

In the eastern part of the city a district (blocks 36 and 37) has been set aside for single family dwellings, with more space allowed for individual gardens and less community space. The Government residential area in the northeast section will have probably the most desirable location in Boulder City. Parks and playgrounds are plentifully provided in the proposed plans. The central park facing the Government administration building will serve as a civic center. North of the Government buildings the ground drops away rapidly and there is a valley between some small hills which can be used advantageously for a swimming pool. An industrial zone is planned to the southwest of the railroad station. On the Arizona-Nevada Highway entering the city from Las Vegas will be placed garages, filling stations, repair shops and business establishments of a similar nature. A forest belt will encircle the southern and eastern part of the city as a protective shelter from the desert beyond. In this belt can be located play areas such as football fields and tennis courts, the larger part of block 39 being planned for an athletic and recreational area. Facing the forest area in block 27 is a site for a high-school building. A driveway, bridle path, and walking path can be placed through the trees. In the eastern section of the forest area (block 8) will be located the tourist hotel with a golf course. A second forest belt farther out from the town is designed for a future time, in which will be located a municipal airport and municipal golf course. There will also be a district set aside for truck gardening and orchards, for which the second forest belt will provide a protection

PLAYGROUNDS AND PARKS

With the creation of courts in the residential blocks, there will be a small playground in the interior of every block which can be equipped with apparatus for the small children and also croquet lawn and horseshoe pitching court for elderly people. With these playgrounds it will not be necessary to have play facilities for small children in schoolgrounds and parks, but the latter can be used rather for older boys and girls, young men and women, and be equipped with football and baseball fields, tennis courts, etc. Two triangular blocks (27 and 34) are set aside for school grounds. These blocks are away from the main traffic lines, but still conveniently located, and face the forest area. Grouping of church buildings is proposed at the east end of Second Street in blocks 14, 19, 7, and 20. In the naming of streets, the names of States in the Colorado River Basin are used for the main thoroughfares. A careful study is

(Continued on p. 41)

Diversified Farming on Riverton Project

By A. G. Keys, Pavillion, Wyo.

The December issue of the ERA carried an article on the production and marketing of irrigated crops in the lower Yakima Valley which is of interest to settlers in other irrigated sections and has called forth the following statement from a farmer on the Riverton project, Wyoming:

Although the crops adapted to the Yakima Valley would bring poor returns on the Riverton project, the diversified plan could be carried out with the idea of producing the maximum amount of forage from new land, in addition to two or three cash crops which would allow the farmer to meet his water charges, taxes, payments on implements, and provide for his family with the surplus.

In the absence of cheap transportation Riverton is handicapped in the production of bulky crops which must be trucked to the railroad. At the present time it takes about 25 per cent of the crop to cover this charge. To overcome this disadvantage many farmers have seeded their places down to alfalfa and sweet clover to be fed to livestock so that the finished product can be marketed with reduced transportation charges.

This year's crops proved beyond a doubt that exceptional returns may be expected from Riverton soil, but more thought should be given to the individual who must succeed from the start if the project is to go forward. With the experience gained on older projects a program covering a 10-year period might be worked out that would serve as a guide to a man who is not familiar with local conditions. Too many men depend on oats or wheat for the first year's crop, with disappointing results as a rule. Others seed their land to alfalfa and sweet clover when they have no prospect of getting the money to fence the clover off for pasture or of supplying winter feeding for their sheep or cattle. They pass up the sidelines of chickens, turkeys, and a good truck patch which would mean a living for their familes.

With a small amount of commercial fertilizer there is an increased yield in potatoes, corn, beans, millet, and small grains. Raw land will produce potatoes for seed, flax, cabbage, stock carrots, tomatoes, and other vegetables which would find a ready sale in an outside market. The man who wishes to specialize in dairy stock, beef cattle, sheep, hogs, or poultry can not be bound by any set rule, but these men will be in the minority and any program should fit the needs of the fellow who depends on the soil alone to get his start.

A suggested program is given in the accompanying sketch. After the settler has arranged his fields according to the lay of the land and the location of head ditches he will probably have a good idea of the crops to be grown. This will enable the county agent to advise him intelligently, but without a definite plan ahead and little knowledge of what can be expected from any particular crop the new settler, as well as some of the older ones, is bound to fail if he is depending on hay or grain alone to carry him along.

Examples of the success of men who practice diversified farming should be hammered home at every opportunity in order that their experiences may prove profitable to new settlers.

SUGGESTED ROTATION PROGRAM FOR 80-ACRE FARM UNIT

RIVERTON PROJECT, WYOMING

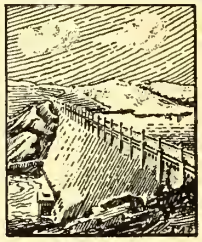
1ST. YEAR		2ND. YEAR		3RD. YEAR		4TH. YEAR		5TH. YEAR	
BLDGS. AND GARDEN	OATS OR RYE WITH SWEET CLOVER FOR PASTURE OR HAY	BLDGS. AND GARDEN	HARROW IN BROME, ORCHARD, AND BLUE GRASSES FOR PERMANENT PASTURE	BLDGS. AND GARDEN	PASTURE	BLDGS. AND GARDEN	PASTURE	BLDGS. AND GARDEN	PASTURE
OATS WITH ALFALFA	BEANS, CORN, POTATOES	ALFALFA	OATS WITH ALFALFA	ALFALFA	ALFALFA	BEETS, POTATOES, CORN, OR PEAS	ALFALFA	BEETS, BEANS, BARLEY, OR PEAS	POTATOES OR CORN
BEANS AND FLAX OR FALLOW	FALL PLOW	BEANS, CORN, POTATOES	FLAX OR WHEAT WITH CLOVER	GRAIN WITH ALFALFA	BEANS OR CORN AND POTATOES	ALFALFA	OATS WITH CLOVER	ALFALFA	BEANS OR PEAS

6TH. YEAR		7TH. YEAR		8TH. YEAR		9TH. YEAR		10TH. YEAR	
BLDGS. AND GARDEN	BEETS, POTATOES, CORN, OR PEAS	BLDGS. AND GARDEN	BEETS, PEAS, BEANS, OR CORN	BLDGS. AND GARDEN	OATS WITH SWEET CLOVER	BLDGS. AND GARDEN	PASTURE MIXTURE IN CLOVER	BLDGS. AND GARDEN	PASTURE
OATS OR RYE WITH SWEET CLOVER FOR PASTURE	BEETS OR BEANS	PASTURE	BEETS OR BARLEY	PASTURE	OATS WITH ALFALFA	POTATOES OR CORN	ALFALFA	BEETS	ALFALFA
ALFALFA	GRAIN WITH ALFALFA	POTATOES OR CORN	ALFALFA	BEETS, BARLEY, OR BEANS	ALFALFA	BEETS OR BEANS	ALFALFA	GRAINS WITH CLOVER OR ALFALFA	POTATOES OR CORN

1ST. YEAR-50 HENS-1 COW-1 SOW-6 TURKEY HENS AND 1 GOBLER.
2ND. YEAR-100 HENS-2 COWS-1 SOW-15 EWES OR SOME "BUM" LAMBS-10 TURKEY HENS.
3RD. YEAR-INCREASE POULTRY AND LIVESTOCK AS FINANCES WILL PERMIT.
PLANT A FEW NATIVE TREES AND SHRUBS EACH YEAR AND FILL IN WITH NURSERY STOCK LATER. START A FEW STRAWBERRIES AND RASPBERRIES FIRST YEAR IF POSSIBLE.
EXCHANGE WORK AND FARM TOOLS WITH YOUR NEIGHBOR. SAVE YOUR MONEY TO INVEST IN POULTRY AND LIVESTOCK. PLANT A GOOD GARDEN EACH YEAR. SUBSTITUTE SEED CROPS ON NEW LAND AS LOCAL MARKET DEVELOPS.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Specifications and Plans Available for Work at Hoover Dam

THE most important construction job ever undertaken by the Bureau of Reclamation, and the largest Government project since the Panama Canal is now being advertised, and bids are to be publicly opened at the Denver, Colo., office at 10 o'clock a. m. on March 4, 1931. In one contract there will be included the Hoover Dam, power plant, and appurtenant works estimated to cost about $108,000,000, which amount includes both labor and materials. Specifications and plans have been printed and were available for distribution on January 10 at the Washington, Denver, and Las Vegas offices. The specifications contain about 100 pages of text and 76 drawings and sell for $5 a copy. A bid bond in the amount of $2,000,000 must be submitted with each bid, and the successful bidder who is awarded the contract will be required to furnish a performance bond of $5,000,000. The Colorado River board of engineers and geologists, of which Maj. Gen. William H. Sibert is chairman, has approved the designs for the diversion works and other features which must be completed during the early stages of construction. Final approval of plans for the section of the dam and spillways is deferred, awaiting the results of further analyses and of tests on models of these features.

DIVERSION WORKS

The works for diversion of the river during construction, which will be built first, consist of upper and lower cofferdams and four tunnels, and are described in the specifications as follows: The upstream cofferdam will be of the earth and rock-fill type, the upstream earth-fill slope being protected by a 3-foot rock blanket covered with 6 inches of reinforced concrete paving. Steel sheet piling will be driven in a trench at the upstream toe to form a water-tight cut-off wall in the river bed. The downstream cofferdam will also be of the earth and rock-fill type, the downstream slope being protected from eddy action by a rock barrier. This rock barrier will be placed downstream from the downstream cofferdam and will consist of a massive embankment of 127,000 cubic yards of dumped rock. These cofferdams are sizable structures in themselves, the upper dam being about 80 feet in height with a top width of 70 feet. In the two cofferdams will be placed 798,000 cubic yards of earth and 227,000 cubic yards of rock.

There will be four diversion tunnels, two on each side of the river, circular in section, lined with a minimum of 2 feet of concrete and measuring 50 feet in diameter inside of the lining. In length the four tunnels average about 4,000 feet. They will require 1,563,000 cubic yards of tunnel excavation, as well as an additional 400,000 cubic yards of open-cut rock excavation, and the placing of 337,000 cubic yards of concrete in the inlet and outlet structures and linings. Plugs in the tunnels will require 121,000 cubic yards of concrete.

After the downstream cofferdam and rock barrier have served their purpose they will be removed from the river channel by the contractor.

HOOVER DAM

The dam will be of the massive concrete arch-gravity type. It will be about 1,180 feet long on the crest and about 730 feet in height above the lowest point of foundation bedrock. The radius of curvature of the axis will be about 500 feet. About 3,400,000 cubic yards of concrete will be placed in the dam out of a 4,400,000 total for all the works. A cut-off trench will be excavated in the foundation rock along the upstream toe. The foundation and abutment rock are to be drilled and pressure grouted, the holes being located at 5-foot intervals in one line in the trench. Grout holes will vary in depth up to a maximum of about 150 feet. The dam will contain a very complete drainage system, with a main drainage gallery parallel to the axis of the dam, connecting with radial drainage conduits discharging at the downstream toe of the dam. To provide for expansion and contraction the concrete will be built up in sections or columns. The setting heat of the concrete will be dissipated by means of a refrigeration plant supplying and forcing cooled water through pipes imbedded in the concrete. In addition to the drainage galleries there will be a number of inspection galleries. Two elevator shafts will connect the two wings of the power house with the top of the dam. The contractor must take out 857,000 cubic yards of common excavation for foundations of dam, power house, and cofferdams; and 400,000 cubic yards of rock for the dam foundation.

SPILLWAYS

Two spillways will be constructed, one on each side of the river. Each of these will consist, in downstream order, of a 50-foot by 50-foot Stoney gate, a concrete ogee overflow crest about 700 feet long, a reinforced concrete-lined open channel, a 50-foot diameter concrete-lined inclined tunnel, through which the water will pass into the outer diversion tunnel. This outer tunnel, after having served its purpose as a diversion tunnel, will be plugged with concrete immediately upstream from its junction with the inclined spillway tunnel, and the downstream portion will then become a part of the spillway system. It is estimated that the spillways will require 1,012,000 cubic yards of open-cut excavation and 144,000 cubic yards of excavation in the inclined tunnels.

OUTLET WORKS

The outlet works on each side of the river will consist of two separate systems, each being regulated by a cylinder gate in the bottom of an intake tower, the two towers being about 185 feet apart in a direction parallel with the river. The system regulated from the upstream intake tower will consist, in downstream order, of the tower with a cylinder gate 31 feet in diameter, discharging into a 30-foot diameter inclined tunnel connecting with the inner diversion tunnel; the upstream tunnel plug in the diversion tunnel with temporary slide gates; the inner diversion tunnel below the upstream tunnel plug; the downstream lower and upper canyon-wall outlet gates and needle valves; the downstream tunnel plug with outlet gates and needle valves installed therein; and the 50-foot by 50-foot Stoney gates at the outlet end of the inner diversion tunnels.

The system regulated from the downstream intake tower will consist of the

tower with its cylinder gate 31 feet in diameter discharging into a 30-foot diameter horizontal penstock tunnel, leading to the upstream lower and upper canyon-wall outlet gates and needle valves. Power penstocks divert from each system. The lower and upper canyon-wall outlet gates and needle valves on each side of the river are housed in separate buildings, and in each of the four buildings there will be eight 72-inch needle valves for discharge control. The canyon-wall valve houses will require 255,000 cubic yards of excavation, and the placing of 51,000 cubic yards of concrete, while 108,000 cubic yards of concrete are specified for the intake towers, foundations, and superstructures.

POWER PLANT

The power plant will be located immediately downstream from the dam. It will be a U-shaped structure of concrete and structural steel with one wing on each side of the river, with the connection portion constructed across the downstream toe of the dam. Each wing of the building will be built sufficiently large to accommodate at least six, and possibly eight, main power generating units, together with transformers, switching and control equipment, and auxiliary apparatus. The length of the river face of each wing will be about 500 feet, the depth to the excavated canyon wall about 66 feet, and the height from the generator floor to the top of the roof will be about 85 feet. Construction of the power house is covered by the specifications, but the hydraulic and electrical machinery, equipment, and wiring will be installed by the Government. The power house will require the placing of 143,000 cubic yards of concrete.

INCLINED FREIGHT ELEVATOR

The inclined freight elevator guide structure will be located on the slope of the canyon wall immediately downstream from the power house on the Nevada side of the river. The top of the structure will be about elevation 1,261 and the bottom elevation about 667. It will consist of a channel excavated in the rock wall and lined with concrete, in which track rails, structural guides and other metal work will be installed to guide the elevator car. This guide structure will be connected to the power house by a spur track constructed in a concrete foundation. After the construction of the dam, power plant, and appurtenant works is completed, the inclined freight elevator and spur track will be used by the Government for general operation and maintenance purposes. The distance between upper and lower landings will be 594 feet, the speed of the transfer car 60 feet per minute, and the size of the car platform 12 feet by 50 feet. The elevator may be used by the contractor during the construction period for transporting labor, materials, equipment, and supplies. If the contractor desires this, the Government will, upon request, proceed with the purchase and installation of the elevator equipment. The elevator would then be operated and maintained by the contractor during the construction period.

PREFERENCE IN EMPLOYMENT

The contractor and his subcontractors will be required to give preference at the time of employment, so far as practicable; first, to qualified ex-service men, and second, to qualified citizens of the United States. Preference for ex-service men is a requirement of the Boulder Canyon project act, and the citizens' preference was recommended by Secretary Wilbur and approved by President Hoover on December 17, 1930.

CONSTRUCTION PROGRAM

It is expected that the successful contractor will receive notice to proceed about April 15, 1931, and will begin work within 30 days after that date. The program outlined calls for completion of the four diversion tunnels by October 1, 1933, and the cofferdams by May 1, 1934. It is thought that placing of mass concrete in the dam will start not later than December 1, 1934. The program contemplates that all concrete, the construction of all necessary features for the beginning of storage of water by June 15, 1936, and of all other necessary features for the generation of power by September 1, 1936, with the storage of water to elevation 935, will be completed by the required dates.

All that portion of the two wings of the power house sufficient to permit installation of the six upstream power units on each side of the river; the portion of the building connecting the two wings; the substructure of the power house, for installation of two additional power units on each side of the river immediately downstream from the other power units, up to elevation 660; and all other portions of the power plant and other works which must be completed before the necessary power machinery and other equipment to be installed by the Government for the operation of power units N1, N3, N5, A1, A3, and A5 can be placed, are to be completed within 1,600 calendar days (about October 1, 1935).

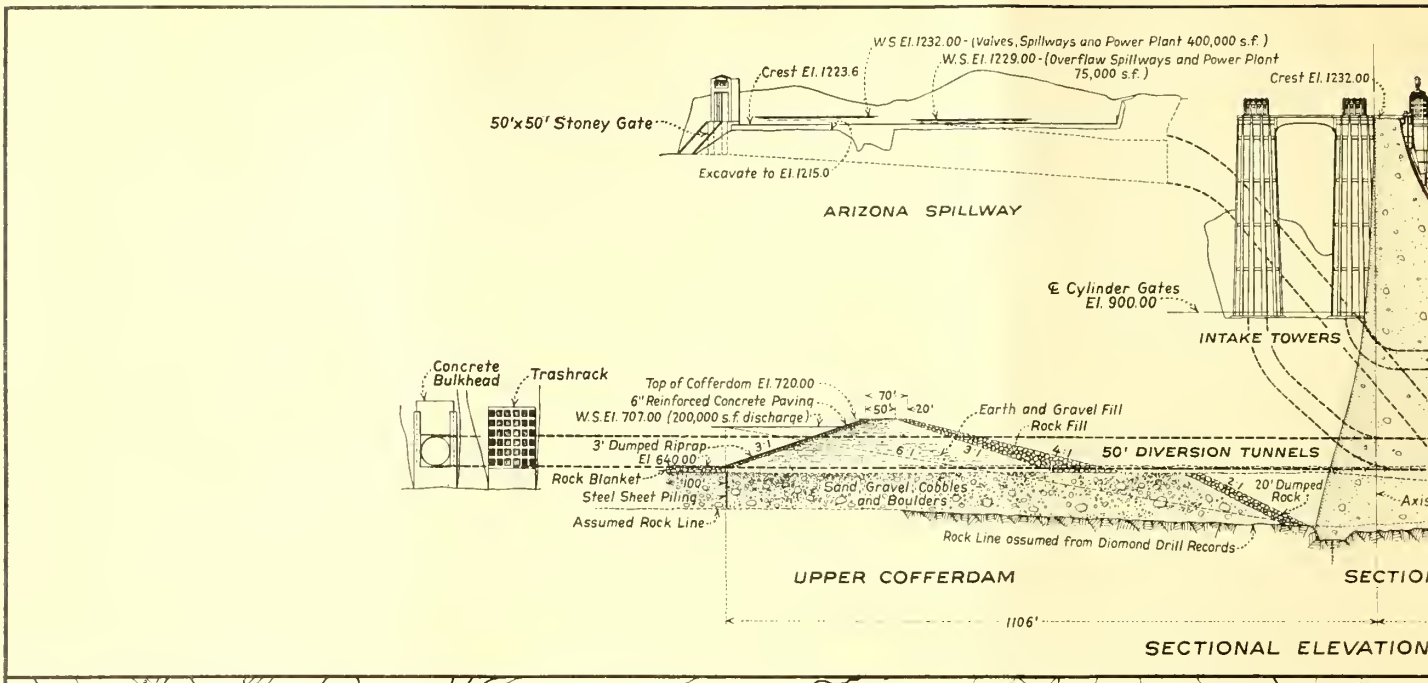
All other portions of the dam, power plant, and appurtenant works which will permit, without damage to any part of the required works, the permanent storage of water up to a maximum elevation of 935, and the operation of power units N1, N3, N5, A1, A3, and A5, are to be completed within 1,965 calendar days (about October 1, 1936). All of the remainder of the work under the schedule, including completion of the power house and power plant for six power units on each side of the river, must be completed within 2,565 days, or 7 years (about May 1, 1938). If the Government gives the contractor notice within 1,600 days that seven or eight power units will be required on each side of the river, instead of six, this additional work must also be completed within the 2,565-day period.

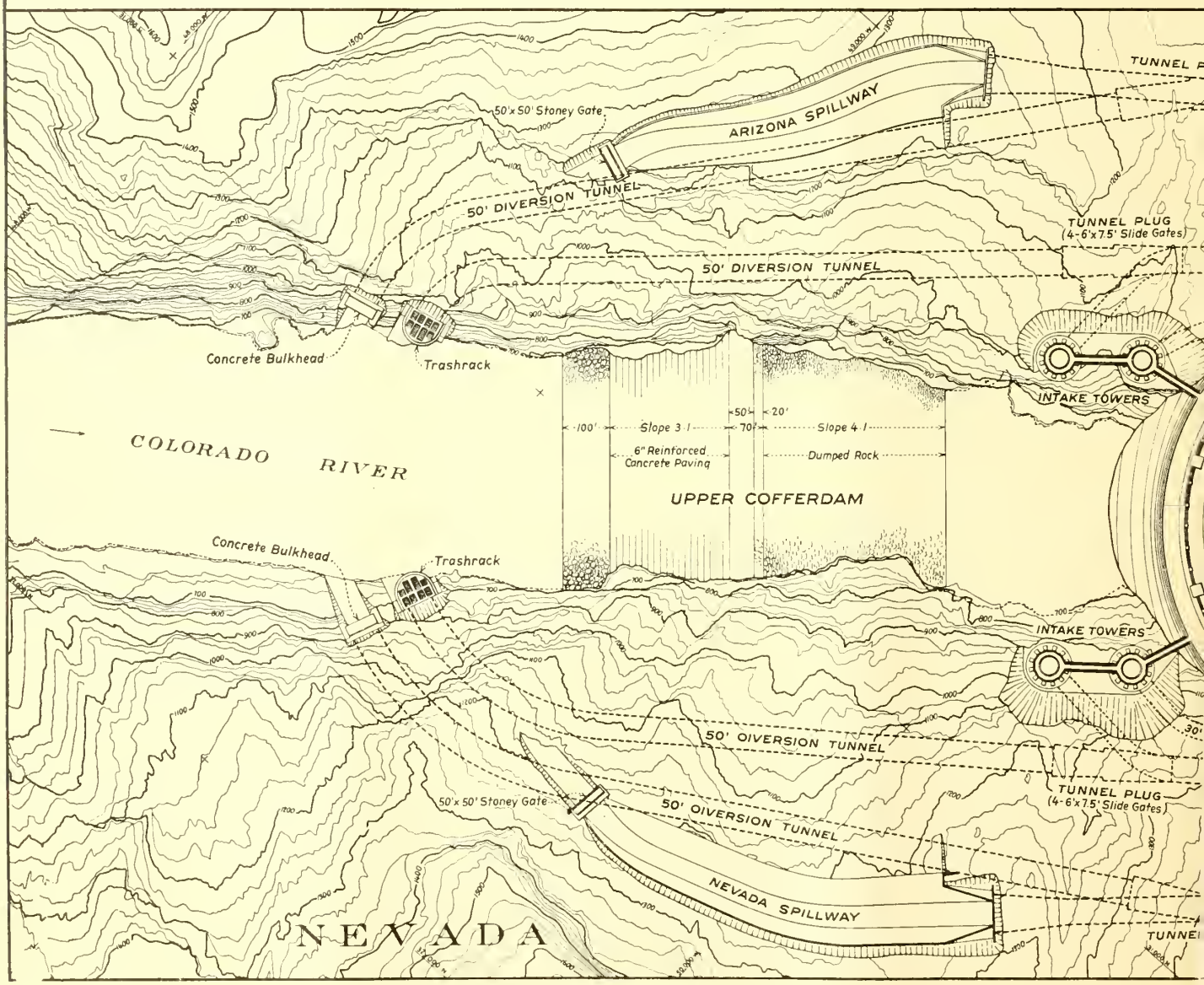
If any part of the work is not completed on or before the date fixed for its completion by the terms of the contract, the contractor shall pay to the Government as fixed, agreed, and liquidated damages the sum of $3,000 per day for each calendar day's delay for each part of the work, as described in the two previous paragraphs.

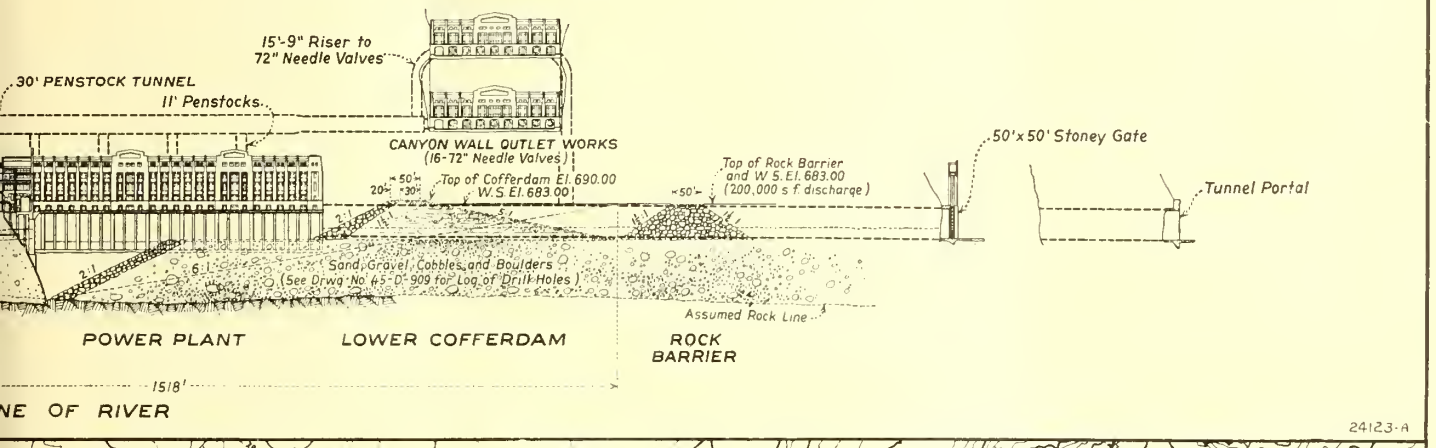
MATERIALS FURNISHED

As a general rule the Government will furnish to the contractor all materials which are to enter into the completed work. These include the more important items of cement, reinforcement steel, pipe and fittings, plate-steel conduit linings, gates and hoists, needle valves, power-house machinery, and structural steel. These materials will be purchased by the Government from time to time during the construction period, as they are needed. The contractor must furnish sand, broken rock or gravel and cobbles for concrete, form materials, and lumber. Sand, gravel, and cobbles will be obtained by the contractor from deposits on Government property, on the Arizona side of the river about 8 miles upstream from the dam site.

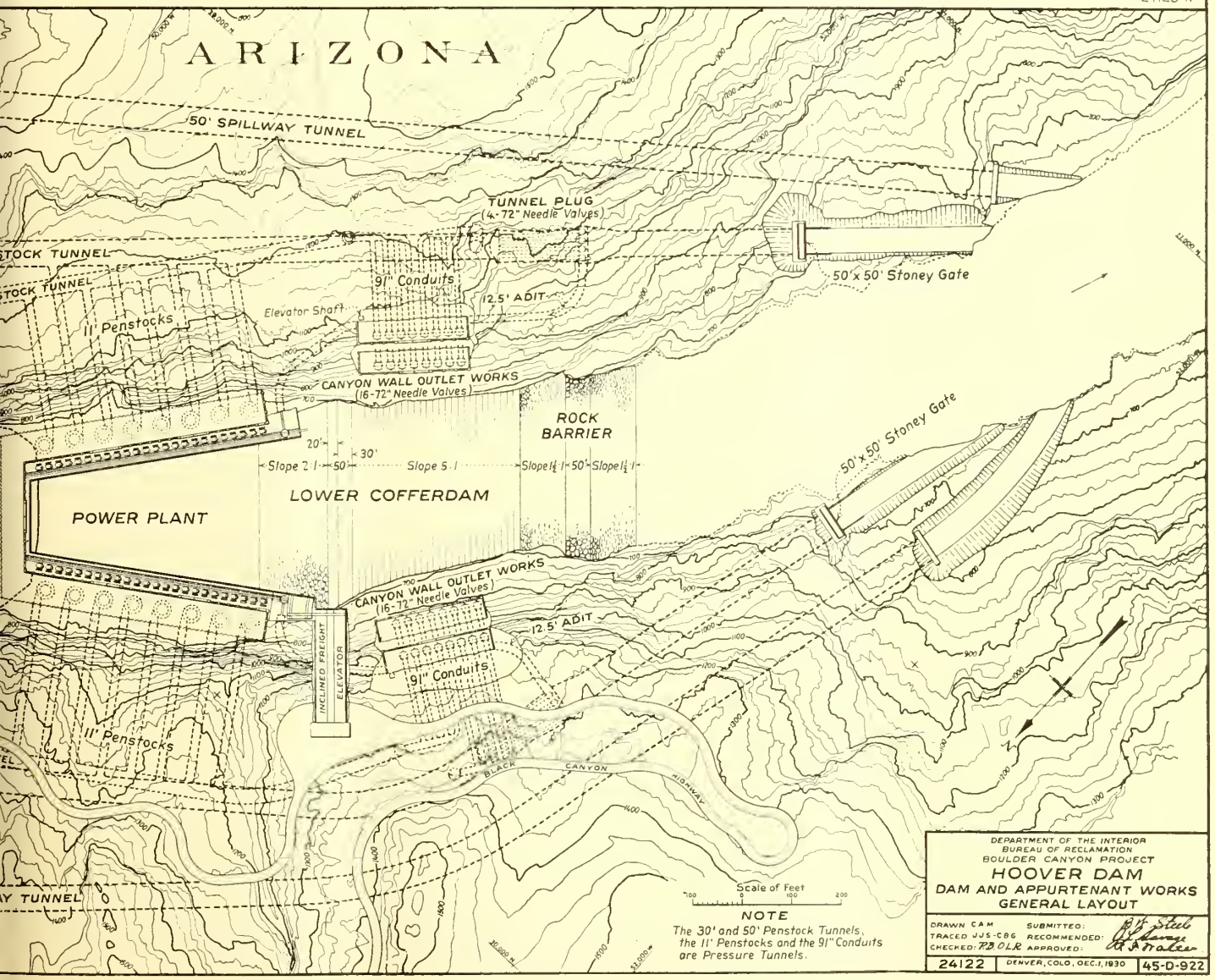
Open-cut excavation	*1,800,000 cubic yards.*
Tunnel and shaft excavation	*1,900,000 cubic yards.*
Earth and rock fill in cofferdams and river channel protection	*1,200,000 cubic yards.*
Concrete	*4,400,000 cubic yards.*
Grout	*228,000 cubic feet.*
Drilling grout and drainage holes	*290,000 linear feet.*
Installing reinforcement bars	*5,500,000 pounds.*
Installing small metal pipe and fittings	*1,900,000 pounds.*
Installing large metal conduits	*32,500,000 pounds.*
Installing structural steel	*10,600,000 pounds.*
Installing gates, hoists, and other metal work	*20,000,000 pounds.*


W.S. El. 1232.00 - (Valves, Spillways and Power Plant 400,000 s.f.)
W.S. El. 1229.00 - (Overflow Spillways and Power Plant 75,000 s.f.)
Crest El. 1223.6
Crest El. 1232.00
50'x50' Stoney Gate
Excavate to El. 1215.0
ARIZONA SPILLWAY
℄ Cylinder Gates El. 900.00
INTAKE TOWERS
Concrete Bulkhead
Trashrack
Top of Cofferdam El. 720.00
6" Reinforced Concrete Paving
W.S. El. 707.00 (200,000 s.f. discharge)
3' Dumped Riprap El. 640.00
Rock Blanket
Steel Sheet Piling
Assumed Rock Line
Earth and Gravel Fill
Rock Fill
50' DIVERSION TUNNELS
Sand, Gravel, Cobbles and Boulders
20' Dumped Rock
Rock Line assumed from Diamond Drill Records
UPPER COFFERDAM
1106'
SECTIONAL ELEVATION


ARIZONA SPILLWAY
50'x50' Stoney Gate
50' DIVERSION TUNNEL
TUNNEL PLUG (4-6'x7.5' Slide Gates)
Concrete Bulkhead
Trashrack
INTAKE TOWERS
COLORADO RIVER
Slope 3:1
Slope 4:1
6" Reinforced Concrete Paving
Dumped Rock
UPPER COFFERDAM
NEVADA SPILLWAY
NEVADA


15'-9" Riser to
72" Needle Valves
30' PENSTOCK TUNNEL
11' Penstocks
CANYON WALL OUTLET WORKS
(16-72" Needle Valves)
Top of Cofferdam El. 690.00
W.S. El. 683.00
Top of Rock Barrier
and W.S. El. 683.00
(200,000 s.f. discharge)
50'x50' Stoney Gate
Tunnel Portal
Sand, Gravel, Cobbles, and Boulders
(See Drwg. No. 45-D-909 for Log of Drill Holes)
Assumed Rock Line
POWER PLANT
LOWER COFFERDAM
ROCK
BARRIER
1518'
NE OF RIVER

24123-A


ARIZONA
50' SPILLWAY TUNNEL
TUNNEL PLUG
(4-72" Needle Valves)
STOCK TUNNEL
STOCK TUNNEL
11' Penstocks
91" Conduits
12.5' ADIT
Elevator Shaft
CANYON WALL OUTLET WORKS
(16-72" Needle Valves)
50'x50' Stoney Gate
ROCK
BARRIER
20'
30'
Slope 2:1
50'
Slope 5:1
Slope 1¼:1
50'
Slope 1¼:1
LOWER COFFERDAM
POWER PLANT
50'x50' Stoney Gate
CANYON WALL OUTLET WORKS
(16-72" Needle Valves)
12.5' ADIT
91" Conduits
INCLINED FREIGHT
ELEVATOR
11' Penstocks
BLACK CANYON HIGHWAY
AY TUNNEL
Scale of Feet
100 0 100 200
NOTE
The 30' and 50' Penstock Tunnels,
the 11' Penstocks and the 91" Conduits
are Pressure Tunnels.
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BOULDER CANYON PROJECT
HOOVER DAM
DAM AND APPURTENANT WORKS
GENERAL LAYOUT
DRAWN C.A.M.
TRACED J.J.S.-C.B.G.
CHECKED: R.B. O.L.R.
SUBMITTED:
RECOMMENDED:
APPROVED:
24122
DENVER, COLO., DEC. 1, 1930
45-D-922

HIGHWAY AND RAILROAD

A highway will connect with the end of the 7-mile construction highway from Boulder City to the dam site, and descend to the crest of the dam on the Nevada side of the river. After crossing over the canyon to the Arizona side on the roadway along the crest of the dam, the highway grade will rise to a terminus above the canyon rim, where it can connect with a contemplated State highway from Kingman. There will be constructed by the contractor about 4,000 feet of highway on the Nevada side and 1,400 feet on the Arizona side.

The construction railroad from Bracken Junction on the Los Angeles & Salt Lake Railroad of the Union Pacific system to the dam site will be completed about September 1, 1931. The United States section of 10¼ miles from the summit, near Boulder City, to the dam site will be turned over to the contractor for the dam, power plant, and appurtenant works, to be operated and maintained by him during the construction period.

ACCEPTANCE OF COFFERDAMS BY GOVERNMENT

After the upstream cofferdam, rock blanket in the river channel, the downstream cofferdam and rock barrier and adjacent rock protection have been completed, in accordance with the specifications, they will be accepted by the Government, provided that the four diversion tunnels have been completed and the river satisfactorily diverted through them. After this acceptance the Government will assume liability for any damage to the accepted works, due to flood or other causes not the fault of the contractor, and for damage resulting thereby to other features of required construction.

EARLY DEVELOPMENT OF POWER

It is expected that four units of the power plant will be placed in operation about 1 year and 8 months prior to the completion of the dam, and two additional units about 1 year later, all of these units to be operated by the downstream in-take towers. In this connection the Government reserves the right to commence the generation of power at any time after water has been stored to elevation 900.

WALLS ALONG CANYON RIM

It will be necessary to construct rubble masonry walls along the canyon rim above the power plant and in-take towers and below the highway on both sides of the canyon, for protection of the permanent works from injury by falling rocks.

GROUT AND DRAINAGE SYSTEM

The contractor will be required to drill 258,000 linear feet of grout holes in tunnels, adits, shafts, and foundations for dam and spillway crests; also 34,000 linear feet of drainage holes in the foundation for the dam. There will be 422,000 cubic feet of pressure grouting required, of which 376,000 cubic feet will be placed in tunnels, adits, and shafts. Grout holes in the foundations will be drilled to varying depths up to a maximum of 150 feet. In the upstream cut-off trench of the dam the grout holes will be drilled at about 5-foot intervals.

CONTRACTION JOINTS IN DAM

Contraction joints in the concrete of the dam will be provided for convenience in construction and to take care of expansion and contraction of the concrete in horizontal directions. These contraction joints will divide the dam into sections. Horizontal keys are to be built into the circumferential joints and vertical keys into the other contraction joints.

CONCRETE

With about 4,400,000 cubic yards of concrete to be placed in the dam, power plant, and appurtenant structures, strict precautions will govern in the mixing and placing of concrete. In general, the proportions shall be such as to produce concrete having an ultimate compressive strength at the age of 28 days, varying from not less than 2,500 pounds per square inch for the mass concrete of the dam, to not less than 3,500 pounds per square inch for slabs, beams, and other thin reinforced members. The accuracy of the weighing equipment shall conform to the requirements of the United States Bureau of Standards. Placing of concrete in the dam must, in general, be done by means of bottom-dump buckets or other methods whereby each complete mixer batch or combination of mixer batches is conveyed in one mass to its location in the dam. The rate of placing concrete in any panel or column of the dam shall be such that not more than 5 feet in depth shall be placed in 72 hours, and not more than 35 feet in depth in 30 days. Methods of conveying concrete to any of the structures, by which the mixed batch or combination of batches is progressively loaded into chutes, belts, or conveyors, or other similar equipment and carried in a thin continuous flow to the forms, will not be permitted, except by permission of the contracting officer, for very limited, isolated sections of the work. The continuous flow methods of conveyance are excluded under the specifications.

COOLING CONCRETE IN DAM

After any portion of the concrete in the dam and tunnel plugs has set for a minimum period of six days it shall be cooled by removing the excess heat above 72° F. The temperature is to be reduced by running cooled water through pipes placed in the concrete. The contractor shall furnish, install, and operate a complete refrigeration plant for removing the excess heat. This plant is to be a 3-unit plant, interconnected so that the units may be used in combination as well as separately, and the plant must have a capacity sufficient to reduce the temperature of a flow of 2,100 gallons of water per minute from 40° to 47°. The average temperature rise due to setting of concrete is approximately 40° F. above placing temperature; and the amount of heat to be removed is approximately 700 B. t. u. per degree per cubic yard of concrete. In the month of July with a mean monthly temperature of 93.8° and the maximum temperature of the concrete 133.8°, it is estimated that cooling water must be applied for 2.4 months to reduce the temperature of the concrete to 71.7°, the average of the mean monthly temperature for the year. It is contemplated that 2-inch standard pipe and fittings, or boiler tubing, will be used and that there will be required the installation of about 800,000 linear feet or 150 miles of pipe, in lines 10 feet apart, and involving the use of 16,000 couplings.

STEEL REQUIREMENTS

The contractor will be required to install 6,435,000 pounds of plate-steel conduit linings for the outlet works and 13,915,000 pounds for the power penstocks. A portion of the metal conduit linings in the upper and lower canyon-wall outlet works, and in the tunnel-plug outlets will be plate-steel pipes embedded in concrete. These linings will have an inside diameter of 7 feet 7 inches, with the plate thickness varying from 1¼ inches to ¾ inch, with welded longitudinal seams and bolted flanged joints.

Power penstocks connecting the turbines with the 30-foot diameter penstock tunnels and the inner 50-foot diameter diversion tunnels will be lined with plate steel varying in thickness from 1½ to 2 inches, and embedded solidly in concrete. The inside diameter of these power penstocks will be 11 feet with the lining varying from ¾ inch to 2 inches. There will also be 9,570,000 pounds of conduit lining castings installed.

In the dam, power plant, and appurtenant works will be placed 35,000,000 pounds of reinforcement bars and rails. There will be required the installation of 6,600,000 pounds of standard steel and cast-iron pipe, fittings and valves. Another item in the schedule calls for installing 17,875,000 pounds of structural steel. The contractor will furnish and erect 3,170,000 pounds of steel ribs, liner plates, and arch ring segmental bars in tunnels, adits, and shafts.

(Continued on p. 38)

Aqueduct 265 Miles Long to Cost $200,000,000

THE Parker route for the proposed 265-mile aqueduct, which will carry water from the Colorado River to the cities and towns of southern California, was approved on December 19, 1930, by the board of review comprising Andrew J. Wiley, Richard E. Lyman, and Thaddeus Merriman. This aqueduct is planned to provide an adequate future domestic supply for Los Angeles and vicinity, and the estimate of cost is $200,000,000. A recommendation in favor of this route had previously been made to the board by Frank E. Weymouth, chief engineer of the Metropolitan Water District of Southern California, formed to build and operate the aqueduct. To provide funds for this construction, it will now be necessary for the district to vote bonds, and it is reported that a proposition to authorize their issuance will be submitted to the voters within the next few months.

Diversion from the Colorado River is planned at a point a few miles above Parker, Ariz., about 150 miles below the Hoover Dam, and a pump lift of 1,523 feet will be required. The route of the aqueduct is via Rice to Hayfield Reservoir; then to Shavers Summit, Whitewater, Portero, Moreno, Perris, and the Puddingstone Reservoir near Pomona. The annual maximum cost of maintaining and operating the aqueduct and delivering 1,500 cubic feet of water per second is estimated by the board at $6,106,000 per annum; but this annual cost does not include either interest on the original investment or annual payments on amortization of bonds. The total carrying charges, including interest, will be $15,606,000, but this maximum will not be reached until about the twentieth year after beginning of construction.

ADVANTAGES OF PARKER ROUTE

Among the reasons given by the board of review for selecting the Parker route in preference to the Bridge Canyon, Black Canyon, Bull's Head, Picacho or All-American routes, are the following: From the viewpoint of geology, it passes through the best terrain; no unusually large tunnels are involved, construction hazards are the smallest, and safety against earthquake damage is the greatest. The route is less expensive in first cost than all others, and comparative estimates show a smaller operating cost because of a lower pump lift. The quantity of power required for pumping, over and above that produced by drops in the aqueduct line itself, is less than on either the Picacho or All-American route. At the Hayfield Reservoir site intermediate storage is available, an advantage not found on any of the other routes. The Parker route for its entire length is in the State of California, thus avoiding the question of taxes or assessments in any other State.

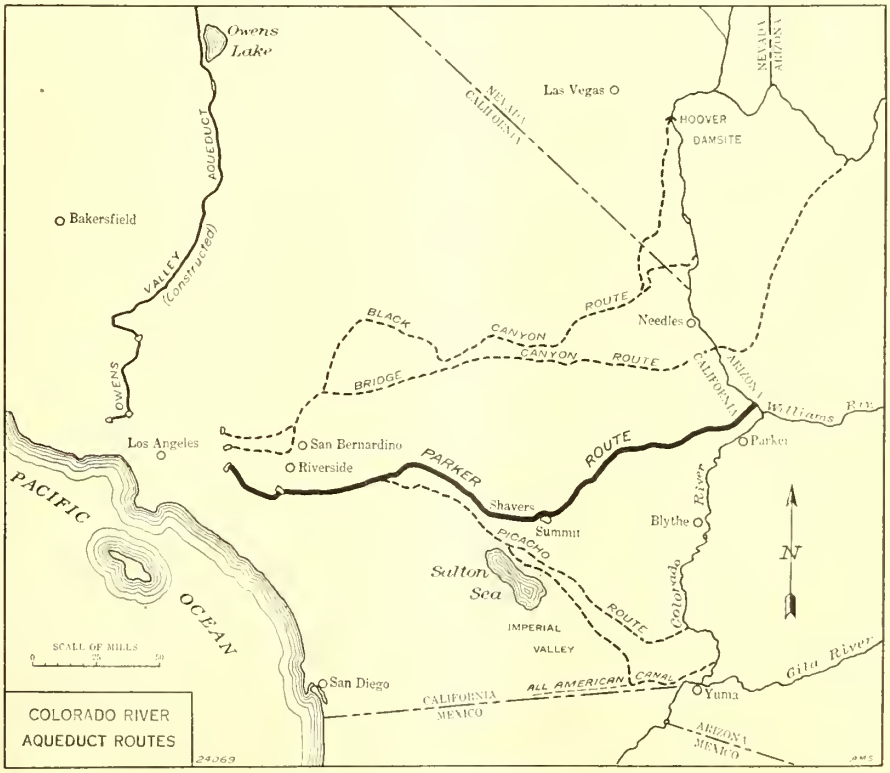
BUILDING OF PARKER DAM TO BE DEFERRED

The board is of the opinion that it is desirable to defer construction of the Parker Dam on the Colorado River for several years after the completion of the Hoover Reservoir. This reservoir will remove silt from the river, and the clear water below will then pick up and remove silt now present in the bed and along the banks, and change and modify the regimen of the stream. Until this readjustment has taken place, the consulting engineers believe that it is best to defer building the Parker Dam. A combined diversion and power dam may later be constructed and it is estimated that enough power can be produced at the site to pay the cost of the dam. Prior to construction of the dam, diversion may be made by pumping directly from the stream, with clarification of the water by basins and mechanical apparatus.

The average diversion from the river will be 1,500 second-feet, and about 10 per cent will be lost by seepage and evaporation. Four pumping plants will be required, with a total lift of 1,523 feet. Electric power required for pumping amounts to 291,040 kilowatts, or about 390,000 horsepower. At the point of diversion 29,100 kilowatts can be produced, and with a power drop beyond the divide at Colton of 406 feet, an additional 38,430 kilowatts will be available. The remainder of the power required will be purchased from the power plant at Hoover Dam. There will be 74.1 miles of open canal (lined or unlined), 80.3 miles of closed surface conduit, 92.6 miles of tunnels, and 18.4 miles of pipe lines. The longest tunnel will be 13 miles, with a 9.7-mile tunnel the next in length.

An initial pump lift of 539 feet is proposed at the river and the aqueduct then enters the 13-mile tunnel through the Whipple Mountains. Near Shavers Summit three pumping plants are required to lift the water to the summit elevation of 1,817 feet. At the base of the last pumping plant is a natural reservoir site (Hayfield) of large capacity. The line west of Shavers Summit is to be principally in tunnel along the face of the San Bernardino Mountains. Crossing the upper end of the Coachella Valley the line will be in open conduit and the San Jacinto Mountains are to be tunneled.

According to the report of the board, six routes for the aqueduct were surveyed and carefully studied, all but one requiring pumping the water over the intervening mountains with total lift ranging from 1,523 feet on the Parker route to 2,051 feet on the Bull's Head route. In length the five pumping routes vary from 234 to 299 miles, while the gravity route from



Bridge Canyon is 315 miles long. The All-American Canal route would have been the cheapest, but would involve joint use of the canal which is planned for irrigation of the Imperial and Coachella Valleys, and the board of review did not believe this to be either desirable or practicable. The Bridge Canyon gravity line would cost $468,000,000 and require two very long tunnels, one 89 miles and the other 75 miles. With a gravity aqueduct it is estimated that the cost per acre-foot of water delivered at terminal reservoirs over a 40-year period would be $51.23, as compared with $26.56 for the adopted Parker route.

The Metropolitan Water District is composed at the present time of 12 cities and towns—Anaheim, Beverly Hills, Burbank, Colton, Glendale, Los Angeles, Ontario, Pasadena, San Bernardino, San Marino, Santa Ana, and Santa Monica. These have a combined population of about 1,500,000. A number of other cities and towns have indicated an interest in the plan to obtain a supplemental water supply from the Colorado River, but have not yet made final decision through special elections. A contract has already been made with the United States which provides for the delivery to the district each year from the Boulder Canyon Reservoir, up to and not to exceed 1,050,000 acre-feet of water, which corresponds to an average flow throughout the year of 1,500 cubic feet per second. The district will be charged 25 cents per acre-foot for Boulder Canyon Reservoir water during the project 50-year repayment period. This will mean an annual payment to the Government of about $250,000.

Specifications and Plans Hoover Dam

(Continued from p. 36)

GATES AND OTHER MACHINERY

Four structural steel Stoney gates with their hoists, counterweights, structural steel guides, and other appurtenances, weighing 2,600,000 pounds, will be required. One of these gates will be installed in the upstream end of each spillway structure, and the other two gates at the downstream end of the inner diversion tunnels. Each gate will be 50 feet in height by 54 feet 7½ inches in width, made up of structural-steel plate girders approximately 72 inches in depth, and mounted on caterpillar roller trains, running on heavy structural H-beams attached to the concrete structure.

The hydraulically operated high-pressure gates, 56 in number and weighing 10,340,000 pounds, include emergency gates in the upper and lower canyon-wall outlet works and the slide gates in the upper concrete plugs in the inner diversion tunnels. In each of the 30-foot diameter intake towers a 31-foot diameter by 10-foot cylinder gate will be installed, each gate with hoist weighing about 570 tons. Twelve 8-foot by 10-foot metal shutter gates will be provided for each tower, to be used for closing the water passages for repairs to the cylinder gates. Forty 72-inch needle valves weighing 4,070,000 pounds will be installed, 32 of which are to be in the 4 canyon-wall buildings. Fourteen traveling cranes will be furnished by the Government for use in installing and maintaining gates, hoists, and valves. The 4 cranes in the intake towers will be 15-ton capacity; 36-foot span; in the canyon-wall outlets there will be 4 cranes of 30-ton capacity and 36.5-foot span.

Contractors Request Hoover Dam Specifications

The following contracting firms (not necessarily prospective bidders) have requested plans and specifications for the Hoover Dam from the Washington office: The Arundel Corporation, Baltimore, Md.; Mason-Hanger Co., New York City; Underpinning & Foundation Co. (Inc.), New York City; R. S. Morrow & Son, Omaha, Nebr.; Joseph Miele Construction Co., Maplewood, N. J.; Ward Engineering Co., San Francisco, Calif.; A. Phelps & Sons, Detroit, Mich.; Spencer, White & Prentis (Inc.), New York City; Booth & Flinn Co., Pittsburgh, Pa.; Parker & Graham (Inc.), Slatington, Pa.; The Carleton Co. (Inc.), New York City; Harrison-Wright Co., Charlotte, N. C.; The American Foundation (Inc.), Cincinnati, Ohio; Robert E. McKee, El Paso, Tex.; States Corporation, Chicago, Ill.; Paul J. Moranti (Inc.), New York City; Allied Engineers (Inc.), New York City; W. S. Lee Engineering Corporation, Charlotte, N. C.; Mark R. Hanna Co., Detroit, Mich.; Gauger-Korsmo Construction Co., Memphis, Tenn.; A. Guthrie & Co. (Inc.), Chicago, Ill.; The Hunkin-Conkey Construction Co., Cleveland, Ohio; White & Dart, New York City; M. P. Smith Construction Co., Chattanooga, Tenn.

New Map Available

A new map of the Boise irrigation project, Idaho, has just been received from the lithographer. Four printings have been used to show topography, reservoirs, principal canals, and irrigable areas of the Boise and adjacent projects.

The map is numbered 23900, the scale is 8 miles to an inch, the size is 10½ by 13½ inches, and the price is 10 cents per copy.

Colorado River Commissions and Boards

Colorado River Compact Commission.—The members of the original Colorado River Compact Commission who signed the Colorado River compact Nov. 24, 1922, which was approved for the United States by Hon. Herbert Hoover, then Secretary of Commerce were: W. S. Norvel, of Arizona; W. F. McClure, of California; Delph E. Carpenter, of Colorado; J. G. Scrugham, of Nevada; Stephen B. Davis, jr., of New Mexico; R. E. Caldwell, of Utah; Frank C. Emerson, of Wyoming; and Herbert Hoover, chairman.

The Colorado River compact provides that the chief official of each State charged with the administration of water rights, together with the commissioner of Bureau of Reclamation, and Director of Geological Survey shall cooperate along certain lines. The organization contemplated by the compact has not yet assembled.

Upper basin compact commission.—The upper basin States have organized a compact commission consisting of the following: Delph E. Carpenter, Colorado River commissioner, Colorado; Francis C. Wilson, Colorado River commissioner, New Mexico; W. W. Ray, attorney, member Colorado River Commission, Utah; and John A. Whiting, State engineer, Wyoming.

Colorado River Board.—Under Public Resolution No. 65, dated May 29, 1928, Seventieth Congress, the Secretary of the Interior, on July 6, 1928, appointed a board of engineers and geologists to consider plans and specifications for the Boulder Canyon project comprising Maj. Gen. William L. Sibert, Mobile, Ala., chairman; Prof. Charles P. Berkey, Columbia University, New York; Prof. Daniel W. Mead, University of Wisconsin; Robert Ridgway, 49 Lafayette Street, New York; and Prof. Warren J. Mead, University of Wisconsin, Madison, Wis.

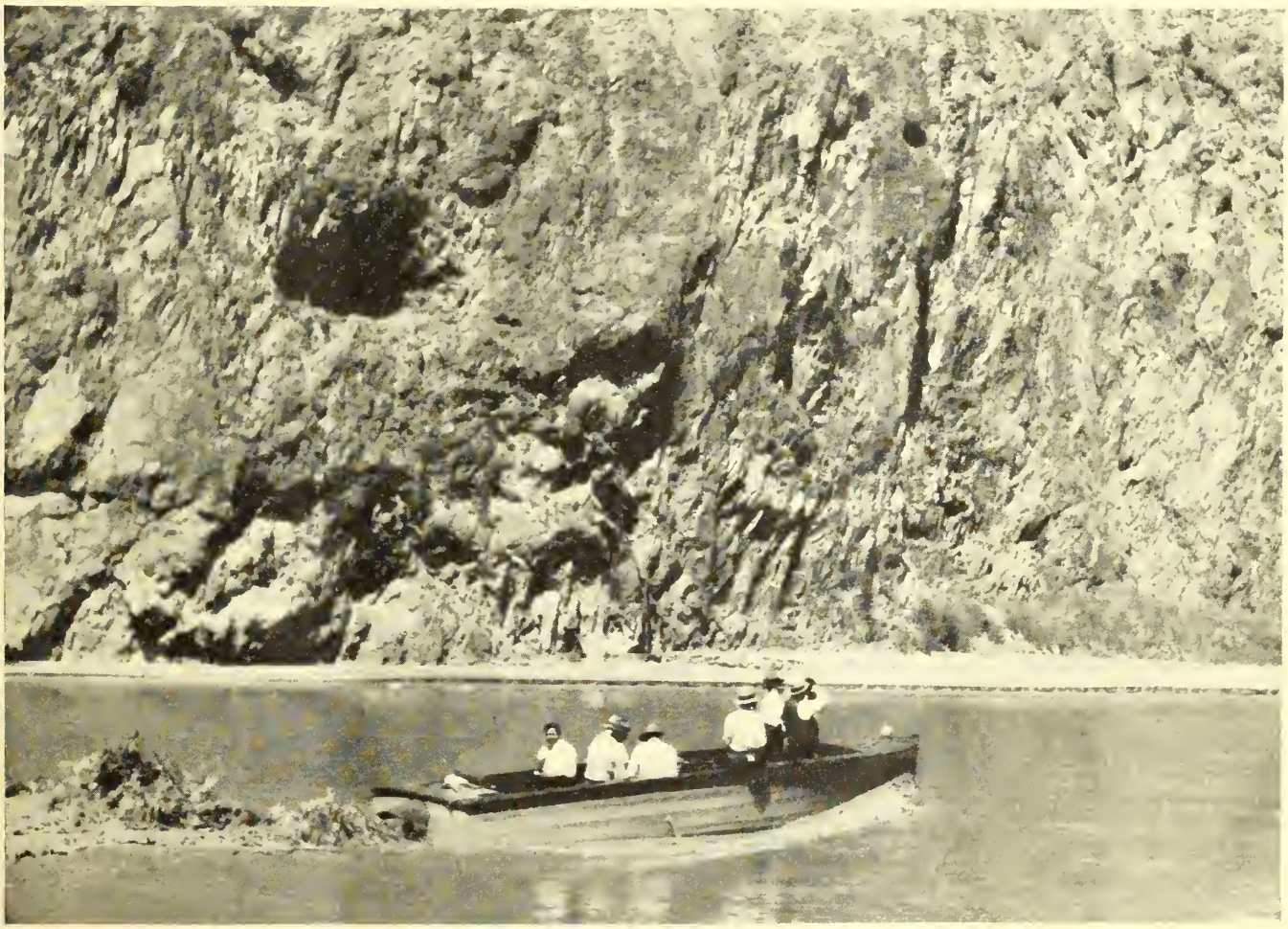
This board has made three reports as follows:

(1) November 24, 1928, House Document 446, Seventieth Congress, Second session, 15 pages. (Summary in Reclamation Era. January 1929, pp. 2–3.)

(2) April 16, 1930, raising height of dam 25 feet, and other matters. (Summary in Reclamation Era, June, 1930, p. 113.)

(3) December 6, 1930, approval given to the designs for diversion works and other features which must be completed during the early stages of construction.

(Continued on p. 41)



GOVERNMENT OFFICIALS AND ENGINEERS INSPECTING BLACK CANYON ON THE COLORADO RIVER, THE SITE OF HOOVER DAM

Hoover Dam as Seen by Engineering News-Record

HERETOFORE the Boulder Canyon Dam, or Hoover Dam, to use the name given it by prenatal christening, has been thought of as excelling chiefly in size. Even the description given in our pages last February seemed to convey little more. Now the bidding plans and specifications reveal it as the most advanced, the boldest and most thoroughly studied hydraulic enterprise in engineering history.

That it proved possible through special effort to put the call for bids ahead six months, and thereby help to bring earlier relief to our lagging productive activities, entitles the engineers and officials of the Reclamation Bureau to thanks and congratulations. But they deserve even greater commendation for the quality of their work. The plans and specifications are of rare perfection. Not only are the arrangement and details of the structure worked out with high originality and painstaking care but the specification of desired results approaches measurably near to that ideal at which the engineer's arbitrary judgment is eliminated. Such preparation goes far toward assuring successful and satisfactory construction.

Hoover Dam is to be nearly twice as high as any dam yet built. But this single fact gives only a fragmentary view of the dimensions of the tasks involved. With 5,000,000 cubic yards of concrete, 30,000 tons of structural steel, and over 70 miles of grouting holes, with rock tunnels ranging from 50 to 70 feet in diameter and 2,000 tons of needle valves, the structure that is to be set in the path of the turbulent Colorado in a sheer-walled narrow gorge at the bottom of an inaccessible desert canyon, in the remotest region of the United States, constitutes a work ranking with the greatest ever attempted by human hands. Size and remoteness aside, however, the project gave rise to broader and more fundamental study of the strength and action of dams than engineering science until now has known. It will doubtless become a new datum point in the record of dam and hydraulic construction.

Two years ago a review board of engineers and geologists answered various doubts about the safety of the projected dam by indorsing the general scheme, with a conservative recommendation as to foundation loads—30 in place of 40 tons per square foot. The same board was then charged with the responsibility of approving the final design before construction. It has done so, and only details remain to be considered—certain construction features of the dam and the discharge works. As now presented to bidders the project is substantially final, and no engineering problems stand in the way of early beginning of work or its successful prosecution through the seven years of construction.

CONTRACTUAL PROBLEMS OVERCOME

Very recently it had been feared that difficulities would arise in the contractual relations between the bidder and the Government because of the size of the work, the risk of loss by floods and the possibility of unforeseeable changes in labor and material costs during the long time involved. Some people believed that the contractor would need to be protected by a special contract to relieve him of undue risk, while others asked that local labor be given a preference, that a prevailing-wage requirement be included, and the like. In short, the contractual relation appeared to be a serious problem. It is highly fortunate, we believe, that a simple and normal contract is now proposed to bidders. Only three unusual clauses appear: (1) The bid bond and the construction surety are set at fixed and moderate amounts ($2,000,000 and $5,000,000 respectively); (2) the Government, after once accepting the cofferdams built to its design, assumes the risk of flood damage to all property except contractor's plant; (3) qualified veterans and citizens have a preference right to employment. These provisions give such protection as is needed and are not likely to cause delay or to limit the contractor's freedom in his effort to get efficient and economical results. It may be noted also that the Government will supply all main materials, except concrete aggregates, but this is not without precedent and should not bear on satisfactory construction relations.

INTENSIVE STUDY OF DAM

Of the structures of the project, the great dam itself commands interest far overshadowing that of the accessories. It was early recognized as presenting a critical problem in respect to determining the stress action, especially because the arched form (suited to the gorge location and the hard rock walls) made it inevitable that much load would be borne laterally by arch action. Intensive study was therefore given to mathematical analysis of the structure in order to determine the precise nature of the interaction between the horizontal arch elements and the vertical beam elements of the dam. As a result, a high degree of certainty has been attained in determining how the dam will resist water pressure. Model tests are to be made in confirmation, but perhaps after all a model 3 or 4 feet high will not be able to bring out as much truth as does the mathematical study. The dead-load stresses and those stresses which exist in the unloaded mass are of course unknown; the construction methods are planned to set limits to these stresses as far as possible.

A more critical question was that of building the dam so as to obtain an integral mass and avoid cracking, which, outside of foundation uncertainties, is the most serious defect in modern concrete dam construction. Both shrinkage (due to moisture change) and thermal action (due to heating of the concrete while it is setting and to subsequent cooling and contraction) are factors here. Shrinkage is dealt with in Hoover Dam by building the structure in blocks or vertical columnar prisms 50 feet square, the joints between which are to be grouted under pressure later on, thereby creating a solid arch. The heating difficulty is dealt with by placing within the concrete a close network of cooling pipes, through which refrigerated water is to be circulated during the setting of the concrete to keep it cool and draw out the heat generated by the chemical action of set. The ideas embodied in these two expedients are closely in harmony with those entertained by leading workers in the field of dams for some time past, but they have never been translated so definitely into practical form. Block construction has been adopted in many dams ever since Schussler's Crystal Springs dam of 40 or more years ago; but as now used, with bitumen-painted sides fully keyed, and subsequent grouting, it is unmistakably a new departure. Far more radical an innovation, however, is the cooling-pipe system, an expedient which perhaps is due in part to the hot summer climate at the site. Its virtues are untried, but on the other hand it can not harm the dam. It is preeminently the most original feature of the dam.

Dry mixtures are to be used in all the concrete work, to obtain high strength and density, and accordingly bucket placing is specified. But it is timely to remark here that many questions relating to the concrete work are still to be considered in detail. A special committee of concrete experts outside the Reclamation Bureau has been appointed for this purpose; its sessions early in January are expected to place the questions of cement and concrete on a final basis. They will contribute to making Hoover Dam a significant milestone in the progress of dam science and construction.

In view of these remarkable studies and design developments, the exceptional site, the deep foundation work, and the thorough grouting of the foundation rock that is proposed, the magnitude and complexity of the associated structures, it is in no way extravagant to conclude that that Boulder Canyon project has been given an engineering stature fully proportionate to its position as a surpassing contribution to the development of the Southwest, and indeed its security. Full appraisal of the service that the control of the Colorado will render to that region must be left to the future, but at the most moderate estimate the service constitutes a challenge to the engineering profession that it support the project with the highest performance within its power. The engineers responsible for the project have done their part.

Colorado River Commissions and Boards

(Continued from p. 38)

Hoover Dam consulting board.—The following board of engineers and geologists has been appointed by Commissioner Elwood Mead as a consulting board on Hoover Dam: Prof. W. F. Durand, Leland Stanford University, Calif.; D. C. Henny, Portland, Oreg.; L. C. Hill, Los Angeles, Calif.; F. L. Ransome, Riverside, Calif.; and A. J. Wiley, Boise, Idaho.

Board of consultant specialists on concrete.—The following have been appointed by the Bureau of Reclamation to consider problems regarding cement and concrete for the Hoover Dam: F. R. McMillan, director of research, Portland Cement Association, Chicago, Ill.; Prof. William K. Hatt, school of civil engineering, Purdue University, Lafayette, Ind.; Prof. Raymond E. Davis, department of civil engineering, University of California; Prof. H. J. Gilkey, University of Colorado, Boulder, Colo.; Dr. P. H. Bates, chief, cement division, Bureau of Standards, Washington, D. C.

Colorado River Planning Commission.—A planning commission (the membership is not quite yet complete) includes the following: Porter J. Preston, for the United States; M. C. Hinderlider, for Colorado; H. W. Yeo, for New Mexico; W. D. Beers and George M. Bacon, for Utah; and John A. Whiting, for Wyoming. Representatives for the other States are to be requested on the commencement of the investigations in those States.

STATE COMMISSIONS

Arizona.—Colorado River Commission includes Governor George W. Hunt, ex officio; Charles B. Ward, chairman; John M. Ross, secretary.

California.—Colorado River Commission includes John M. Bacon, chairman, W. B. Matthews, Earl C. Pound, and F. H. McIver, secretary.

Colorado.—Colorado River Commission, Delph E. Carpenter, commissioner, and the Colorado River Planning Commission; M. C. Hinderlider, State engineer.

Nevada.—Colorado River Development Commission: Governor F. B. Balzar, chairman; George W. Malone, State engineer; and Ed. W. Clark.

New Mexico.—Interstate Water Commissioner Francis C. Wilson; Colorado River Planning Commission, H. W. Yeo, State Engineer.

Utah.—Colorado River Planning Commission, W. R. Wallace, chairman, W. W. Ray and W. D. Beers, Colorado River Planning Commission; W. D. Beers and George M. Bacon, State engineer; Utah Water Storage Commission, William R. Wallace, chairman, George M. Bacon, secretary, Richard R. Lyman, A. F. Doremus, A. P. Bigelow, W. W. Armstrong, William Paterson, J. R. Murdock, John G. M. Barnes, W. O. Creer, Wilford Van Wagenen, S. M. Nielson, and B. O. Colton.

Wyoming.—State Engineer John A. Whiting is representative on all State organizations having to do with interstate stream problems.

Model Town Planned at Boulder City

(Continued from p. 30)

to be made of the planting of trees along the streets as well as in the parks. Along residential streets tree planting will be in groups, thus admitting sunlight and giving shade alternately. In the business blocks at setbacks in the buildings individual trees can be placed.—*P. I. Taylor, Engineer, Bureau of Reclamation.*

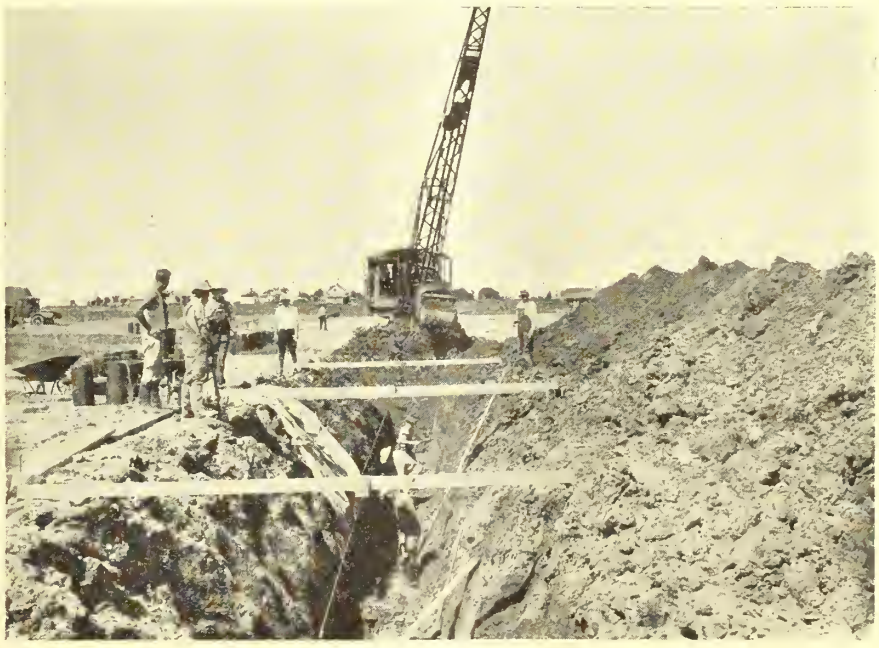
Representative Arentz's Name Omitted

The January issue of the NEW RECLAMATION ERA carried on page 10 an excerpt from the speech of Hon. Ray Lyman Wilbur, Secretary of the Interior, at the celebration in connection with the commencement of construction of the Boulder Canyon project, as quoted from a recent press release by the Department of the Interior.

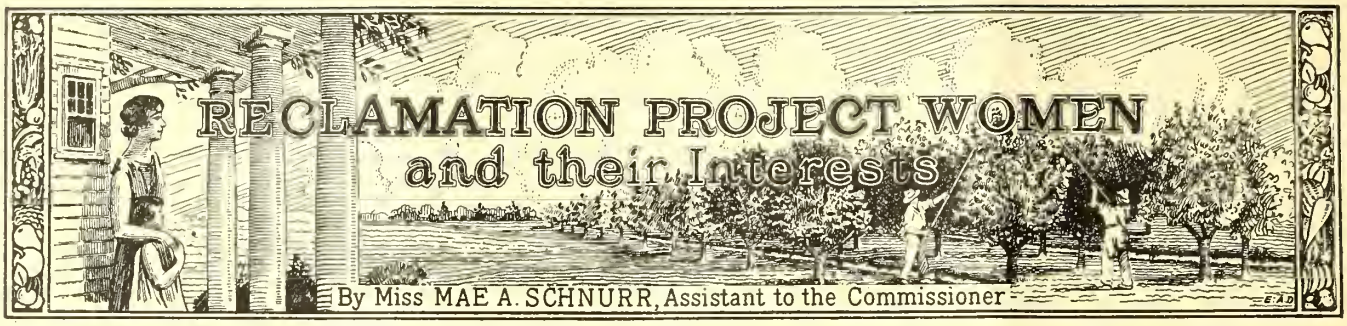
In the original speech Secretary Wilbur gave credit to Hon. Samuel S. Arentz, Member of Congress from Nevada, for participation in the enactment of the Boulder Canyon Project legislation, along with Senators Johnson, Pittman, and Oddie, and Representative Swing, but through an inadvertence Representative Arentz's name was omitted in the news release. The ERA regrets this omission and hastens to make the correction.

In the Imperial Valley of Southern California the silt content of the irrigation water from the Colorado River was 3.55 per cent by volume in the year 1929, as compared with 1.94 per cent in 1928.

The Owyhee Dam on the Owyhee project, Oregon, is 51 per cent completed, and the General Construction Co. is very little behind schedule with the work. Concrete operations slowed down in December, and suspension of this feature was looked for in January. Cold weather necessitated keeping up fires and protecting fresh concrete with canvas as soon as poured. Aggregates and water were heated at the mixer, so that no concrete reached the forms at a temperature lower than 50° F. At this temperature the concrete was protected for 72 hours.



Construction of Newell town-site drain, Belle Fourche project, South Dakota



Boulder Canyon Project and Its Effect on Future Development

Address by Miss Mae A. Schnurr, assistant to the Commissioner, Bureau of Reclamation, at the annual meeting, land reclamation division American Society of Agricultural Engineers, San Francisco, Calif., January 6 and 7, 1931

THE Boulder Canyon project has been in the public eye for many years, and magazines, newspapers, and lecturers have featured this project until it might be thought there would be no phase of its development which had not been covered, but when one tackles the subject of this project's effect on future development it offers an opportunity to discuss evident benefits and stirs the imagination as to probable ones.

The interest of the United States in the Boulder Canyon project is now largely centered upon it as a colossal feat in engineering. This dam will be nearly twice as high as any hitherto attempted, the lake fourteen times the size of the lake at Assuan in Egypt and ten times the size of any existing artificial reservoir for irrigation purposes in the United States. It is a wonderful engineering undertaking to place this huge wedge of concrete in a canyon nearly 2,000 feet deep and where man will have to work under a summer temperature of over 100°.

AFFECTS WATER LAW

The greatest significance is to be found, however, in the social and economic changes which the building of a single structure is destined to bring about. Already it has wrought a significant change in our water laws. California, wedded to the riparian doctrine, will experience a revolutionary change by building a huge aqueduct 265 miles long to carry the Colorado River into another watershed. The Colorado River compact, which dedicates to particular States a perpetual share in this water supply, modified both the riparian doctrine and that of appropriations which have heretofore controlled. But the great change is in the increase in wealth and the improvement in living conditions over a wide area of the Southwest.

REMOVES MENACE TO IMPERIAL VALLEY

The original reason for enlisting the aid of the Federal Government was the plight of the people living in Imperial Valley. Before the water of the Colorado was brought into this basin, it was a hideous desert, but supplied with water it became a center of production that has been benefiting the whole Nation. The thousands of carloads of lettuce which every spring go out of the Imperial Valley to every large eastern city, have changed the diet on their tables, and the thousands of carloads of Imperial Valley cantaloupes have made this a better world to live in from one ocean to the other. But the people who have wrought this transformation have had to do it under a continuous menace, because where the river crosses the boundary into Mexico, it is 100 feet above where their irrigation canal crosses the international boundary, and the lower part of the valley is 300 feet below the river. It is kept out of the valley by a levee 70 miles long and that levee is menaced by every flood. The only way to remove that menace, and give permanence to the lives and fortunes of the 100,000 people in Imperial Valley is by means of a reservoir large enough to hold all the water in times of emergency, and large enough to regulate its flow so that the disastrous floods of the past will be only a memory. That is why Hoover Dam was first thought of. That is why it was designed to have a reservoir large enough to completely regulate the river, and why the one planned will hold all the water that comes down the river for two years.

When this matter was brought to Congress 10 years ago it was seen that without some modification of existing water laws, it would be a menace to the development of the upper section of the stream. It took years to inspire Congress with courage enough to sanction a dam that broke all precedents, and in that time the Southwest was growing as no one had ever dreamed it would grow. Los Angeles, San Diego, and other California cities more than doubled in population while Congress was deliberating on Hoover Dam, and all through this meagerly watered section of the Southwest, more people, more orchards, more factories were creating a demand for water which could not be supplied locally.

When Los Angeles went 250 miles to the Owens River to reinforce its water supply, everyone drew a breath of relief. They said "Now that question is settled. We have water for all time. Not only water enough for the city but enough to irrigate the San Fernando Valley." Secure in that conviction, little attention was paid by the people of that city to what was proposed on the Colorado, but before Congress had passed the act, Los Angeles had become a city of over a million people, and had begun to dream about being the largest city on the continent. To insure that, an adequate supply of pure water had to be provided, as no city can expand larger than its water supply, and the only source was the Colorado, so that now Los Angeles is planning the largest and longest aqueduct in the world, a fit counterpart in its engineering features to the Hoover Dam and the great lake above it.

Public opinion would never have sanctioned approval of the Boulder Canyon Project Act if it could not be shown that the project would pay for itself. It was thus that the development of hydroelectric power entered into the deliberations of Congress and was finally accepted as the instrument to finance this project.

Hoover Dam power means lightening the burden of settlers, the establishment of industries, and the economic development of natural resources. The dam will be located in a mineralized section; as a result its latent resources will very probably be developed.

SCENIC ATTRACTIONS

As water begins to gather behind the dam, forming a huge lake 110 miles long, we will see in the making what is destined to be a wonderful scenic attraction. Hoover Dam will be a connecting link between Arizona and Nevada, and the combination of the dam and the lake will undoubtedly create a Mecca for tourists.

We are planning a model city for 5,000 people, 7 miles from the damsite to be

known as Boulder City. It is reasonable to expect that with natural attractions and good accommodations, tourists may be expected to come in great numbers. Denver is now largely supported by tourist travel to the Rocky Mountains, having formerly depended on its smelters. It is a phase not to be overlooked. Chambers of Commerce recognize its possibilities to foster further development.

In the case of the Boulder Canyon project tourist travel would maintain certain enterprises started during the 7-year period of construction by employees.

I have touched on some of the effects of the Boulder Canyon project on future development; there must be many others.

I appreciate the opportunity to address you. The fact that I was sent to this meeting from Washington indicates an interest in your society and the things you are trying to accomplish. We have a wholesome respect for your organization and the way you go about matters that the society interests itself in. The magazine of the society, The Agricultural Engineer, is an aristocrat in its field.

You will always find us ready and willing to cooperate in any way we can.

Imperial Valley Has 424,000 Acres in Crops

The annual report of the Imperial Irrigation District of California, just received in the Washington office, contains much interesting data concerning this area which is to be greatly benefited by the construction of the Boulder Canyon project. The district includes 605,000 acres (the largest irrigation district in the United States) of which 515,000 acres are irrigable. In this valley situated below sea level there is a population of 60,000 persons. The annual diversion from the Colorado River for the year 1929 amounted to 3,423,511 acre-feet or 20 per cent of the river's discharge at Yuma, Ariz., of which 615,934 acre-feet or 18 per cent were delivered to water users in Mexico. Of this amount 1,173,390 acre-feet were wasted or lost, and the remaining 2,250,121 acre-feet were delivered to the farms, or 3.95 acre-feet to each acre. The net area cropped was 424,145 acres, and the grand area in crops was 675,843 acres, which includes 251,698 acres counted twice. Among the principal crops and their acreages are, alfalfa, 245,775; barley, 117,793; corn, 29,251; cotton, 20,431; lettuce, 77,654; cantaloupes, 64,773; melons, 24,530. In Mexico the principal crops with acreages and percentages were, cotton, 145,452, 88.1 per cent; alfalfa, 16,893, 10.3 per cent; grain, 2,185, 1.3 per cent.

Yakima Project Holds Third Annual Dairy Show

By Maurice D. Scroggs, Irrigation Manager, Sunnyside Division, Yakima Project

The Third Annual Sunnyside Dairy Show was held October 3 and 4, 1930, at which there were 168 entries of registered and grade dairy cattle of the Jersey, Guernsey, and Holstein breeds. Over 60 exhibitors entered and several hundred project men and women attended the 2-day show.

The success of the Sunnyside Dairy Show, which was initiated in 1928 by the Sunnyside Commercial Club, has been made possible by the financial and administrative support of the business men of Sunnyside and the active interest and participation of the farmers of the Sunnyside division.

The purpose of the show is to encourage and stimulate the dairy-cow owner, especially the small farmer with grade cows, for whom, the sponsors of the show realized, success in the dairy industry rested primarily upon production. Although prizes are offered for registered cattle, the larger share of the premiums go to the exhibitors of grade cattle. Every effort is made by special production classes and otherwise to place the emphasis upon breeding and building for production. The scrub bull is taboo and the purebred sire of proven worth encouraged.

One of the most gratifying phases of the show is the participation of the youth of the farm, especially those enrolled in 4-H clubs. This interest has grown each year and it is planned to foster it in every way possible.

The committee for the Sunnyside Commercial Club this year was: A. G. Fleming, chairman; Fred H. Langford, secretary; George R. Gochnour, superintendent; S. H. Harrison, John Heffron, and Maurice D. Scroggs, directors. These had the very active assistance of the Washington State College, the county 4-H leader, the State supervisor of livestock, and the Yakima Dairy Development League; as well as many farmers and business men throughout the Yakima Valley.

The budget for the Dairy Show has approximated $2,000 each year. The chief item of expenditure has been for premiums. The permanent building for housing the exhibits was constructed in 1929 and another is planned for the near future. Permanent grounds near the center of the business district of Sunnyside have been acquired and adequate arrangements have been provided for the watering, care, and exhibiting of the stock. The Sunnyside Dairy Show seems to be on a permanent basis. With the unquestioned possibilities and indeed necessity for dairying in the Yakima Valley, this annual event should be increasingly effective in contributing to the growth and success of the industry. While some prophesy greater things, the sponsors of the Dairy Show are planning conservatively, well content with that all too rare an accomplishment—a community enterprise in which so many are enthusiastically and constructively cooperating.

Yakima

Oh, Yakima we praise thee,
All glory to thy name,
The God of genius' ideas
Made possible thy fame.

There once the coyote traveled,
A seeming worthless plain,
Burned by the sun of summer
And destitute of rain.

'Twas man's imagination,
The work of many years,
That brought about your progress
By skillful engineers.

The water in abundance
Comes from the mountain stream
To decorate your acres,
All with a lovely green.

Your beauty and your grandeur,
Your majesty supreme,
Would mock the boasting artist
Beyond his thought or dream.

There stand the great snow mountains,
Their lofty peaks soar high,
To bless the fields and hamlets
When all is parched and dry.

Your people all are happy,
Contented to remain;
'Tis proof that many blessings
With Reclamation came.

—John S. Gabbard,
R. F. D. 6, Yakima, Wash.

WORK has been started by the State Highway Department of California on the paving of 6 miles of the Los Angeles and San Diego Highway starting at the Colorado River bridge at Yuma. This work includes a relocation of a portion of the highway, erection of several bridges over washes, making of a number of grade changes, and the laying of 6 miles of 20-foot bitulithic paving. The building of this highway, the completion of which is anticipated by June, is expected to relieve to a considerable extent the local unemployment situation.

Notes For Contractors

Boulder Canyon project.—Bids were opened on January 7, 1931, for the construction of the highway between Boulder City and the Hoover Dam (specifications No. 517). Sixteen bids were received, the low bid being that of the General Construction Co. of Seattle, Wash., whose bid on the basis of a 30-foot oiled surface highway was $388,207 and on the basis of a 22-foot oiled surface was $329,916.

On January 12, 1931, bids under specifications No. 518 were opened at Las Vegas, Nev., for constructing about 10¼ miles of the United States construction railroad from the summit to the Hoover Dam site. The low bidder was the Lewis Construction Co. of Los Angeles, Calif., with a bid of $455,510.

Specifications No. 519 covering construction of the Hoover Dam, power plant and appurtenant works are now available at the Denver, Las Vegas, and Washington offices. The price of the plans and specifications is $5 a copy. Bids for this work will be opened at the Denver office at 10 o'clock a. m., March 4, 1931.

Plans and specifications for the various features of the construction of Boulder City are being prepared as rapidly as possible. Bids were opened on January 15 for furnishing two riveted plate-steel tanks for the water-supply system. On January 26 bids were opened at the Denver office, under specifications No. 501–D, for furnishing three deep well pumps, each having a capacity of 550 gallons per minute, when operating under a total effective head of 110 feet; six horizontal, centrifugal pumps, each having a capacity of 450 gallons per minute, when operating under a total effective head of 1,200 feet; and three horizontal, centrifugal pumps, each having a capacity of 550 gallons per minute, when operating under a total effective head of 170 feet. These pumps are for installation in the water-supply system for Boulder City. Specifications have also been issued which cover the construction of twelve 3 and 4 room houses for Government employees.

Other specifications which are being prepared and which will be issued as fast as completed, include the purchase of materials for the water-supply pipe line from the river to the city, construction of the pipe line, purchase of materials for the city water-supply system and the sewer system, including a sewerage disposal plant, the construction of the sewer and water system, purchase of electrical apparatus for transmission lines and substation for the city electrical system, construction of the electrical system, grading streets, construction of sidewalks and curbs, construction of an administration building and garage, and the construction of additional houses.

Vale project.—Bids were opened on December 19, 1930, for earthwork and structures on the Vale main canal between stations 2060+58 and 2450 and the Bully Creek east bench lateral system, under specifications No. 515. The low bidder for schedules Nos. 1, 3, 4, 5, and 6, which included the canal work and lateral excavation, was W. H. Puckett Co., of Boise, Idaho, at $75,323.50. The low bidder for schedule No. 2 was Henry C. Boyer, of Ontario, Oreg., at $5,080 and for schedules 7 to 11, inclusive, covering the construction of lateral structures, Gabbey & McNeil, of Boise, Idaho, were low with a bid of $32,630.45.

Owyhee project.—On December 23, 1930, bids were opened at Denver, Colo., under specifications No. 516, for furnishing three 48-inch internal differential needle valves for the Owyhee Dam. The American Locomotive Co., of Schenectady, N. Y., was low bidder, with net price f. o. b. cars at Dunkirk, N. Y., of $18,831, and delivered cost $19,986.61. The award of contract was approved on January 5.

Bids were opened at the Denver office December 18, 1930, under invitation No. 16205–A for 5,000 barrels of cement in sacks, and 200,000 barrels of bulk cement for the Owyhee project, and proposals were received from five companies. The low bid for the bulk cement was submitted by the Utah-Idaho Cement Co., of Ogden, Utah, for 40,000 barrels of cement only at a price of $1.31 per barrel, which, with the addition of the freight item, would amount to $2.438 per barrel. It is proposed at this time to make an award for only 40,000 barrels and later to make recommendations with respect to the 5,000 barrels of sack cement and the remaining 160,000 barrels of bulk cement.

Low River at Yuma

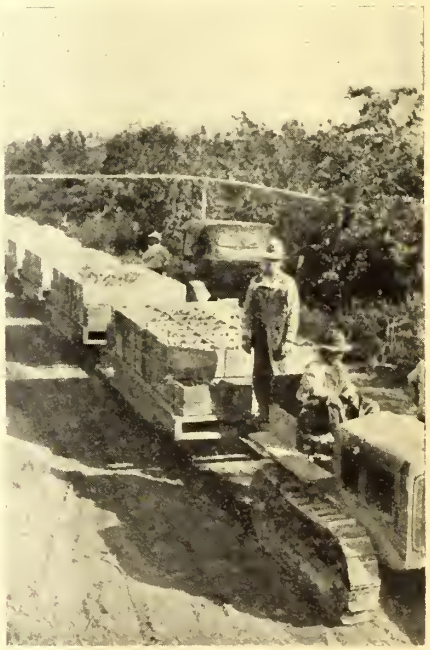
The discharge of the Colorado River at Yuma, Ariz., on December 1, was 5,500 cubic feet per second. During the greater part of the month the flow was stationary at 3,300 to 3,800 cubic feet per second. The last few days of the month the discharge fell off and on the 31st was 2,350 cubic feet per second. Run-off for the month of December was the lowest of record, being only 45 per cent of normal. The run-off for the calendar year 1930 of 10,629,000 acre-feet was the lowest for 26 years, 1904 being the only year of record with a lower run-off. This low river is a convincing argument for the need of storage in the reservoir behind the Hoover Dam, and the resulting regulation of river flow. (LATER.—On January 7 the discharge was 1,740 cubic feet per second.)

DURING the fall months approximately 1,000 acres were planted to new alfalfa on the Vale project.

Columbia Basin Project Yields Abundant Fruit

During Commissioner Mead's visit to the Columbia Basin project last fall he was driven through a 157-acre apple orchard which had produced several varieties of apples, setting a record for a place of that size. The owner of this orchard, Charles Simpson, packed for shipment during the season the following boxes: Jonathans 55,757, Delicious 54,304, Winesaps 25,571, Stayman Winesaps 22,484, Spitzenburg 14, a total of 158,130, or 1,007 boxes per acre.

In another section of the Columbia Basin project—Neppel, Moses Lake—where irrigation is done by pumping, 450 carloads of apples, pears, and other fruit were shipped out during the season. The Milwaukee Railroad, which considers this the brightest spot on its line, received $300,000 in freight from these shipments. The Schnuerlie orchard in this section packed over 1,000 boxes of apples to the acre during the season.



Hauling apples from orchard to packing house, Columbia Basin project, Washington

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Conservation Committee Holds Final Meeting

On January 12, 1931, Chairman James R. Garfield opened the third and final meeting of the members of the Committee on the Conservation and Administration of the Public Domain, at the conclusion of which the report was signed and transmitted to the President.

The act authorizing the appointment of the committee was approved on April 10, 1930, and funds were made available on May 14. The first meeting of the committee, under the enabling act, was held early in June, and the second in November, when a tentative draft of the report was prepared. The January meeting was called by Chairman Garfield for consideration of this tentative draft and such changes as had been suggested by the various members.

The members attending the meeting were as follows: James R. Garfield, chairman; I. M. Brandjord, H. O. Bursum, James P. Goodrich, Perry W. Jenkins, Rudolph Kuchler, George H. Lorimer, George W. Malone, Elwood Mead, Charles J. Moynihan, I. H. Nash, William Peterson, Mrs. Mary Roberts Rinehart, Huntley N. Spaulding, R. K. Tiffany, Wallace Townsend, and Francis C. Wilson. Pressure of other business prevented the attendance of Gardner Cowles, E. C. Van Petten, and W. B. Greeley, but the committee had the benefit of their written expressions of opinion.

The contents of the report had not been released as the ERA goes to press. The general and special recommendations and the text relating to reclamation will be printed in the magazine as soon as available.

Farm, buildings, and registered Holsteins of Vernon Herrigstadt, near Savage, Lower Yellowstone project, Montana-North Dakota

Appropriations for Boulder Canyon Project

Memorandum of Procedure Agreed to by Secretaries of Interior and Treasury

THE Boulder Canyon project act, approved December 21, 1928 (U. S. C., Supp. III, title 33, ch. 15A), authorizes the appropriation of $165,000,000 from the General Treasury. Pursuant to this act, $10,660,000 was appropriated by the second deficiency act, fiscal year 1930, approved July 3, 1930.

2. Section 2 (a) of the Boulder Canyon project act establishes a special fund to be known as the Colorado River dam fund, and directs that all revenues received in carrying out the provisions of the act shall be paid into and expenditures shall be made out of the fund, under direction of the Secretary of the Interior.

3. Section 2 (b) authorizes the Secretary of the Treasury to advance to the fund, from time to time and within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of the act, * * * and that interest at the rate of 4 per cent accruing during the year upon the amounts advanced and remaining unpaid shall be paid annually out of the fund, except as otherwise provided.

4. Section 2 (d) provides that the Secretary of the Treasury shall charge the fund as of June 30 in each year with such amount as may be necessary for the payment of interest on advances made under subdivision (b) at the rate of 4 per cent per annum accrued during the year upon the amounts so advanced and remaining unpaid, except that if the fund is insufficient to meet the payment of interest the Secretary of the Treasury may, in his discretion, defer any part of such payment, and the amount deferred shall bear interest at the rate of 4 per cent until paid.

5. Whether the annual interest is paid out of funds advanced to the Colorado River dam fund, as provided by section 2 (b) or deferred as provided in section 2 (d), the interest charge practically amounts to interest compounded annually.

6. In view of the decision of the Attorney General of the United States that advances on account of the All-American Canal are not interest-bearing, it becomes necessary to account separately for advances on account of the Boulder Canyon project and the All-American Canal. The following accounts will be established on the books of the Treasury:

Appropriation symbol	Title of account
4X510	Advances to Colorado River dam fund, Boulder Canyon project (no year).
4X511	Advances to Colorado River dam fund, All-American Canal (no year).
4S512	Colorado River dam fund, Boulder Canyon project (no year).
4S513	Colorado River dam fund, All-American Canal (no year).

7. Appropriations made by Congress pursuant to the Boulder Canyon project act of December 21, 1928, supra, for advances to the Colorado River dam fund on account of the Boulder Canyon project, and the All-American Canal will be classified as general funds and will be established upon the books of the Treasury by appropriation warrants under the following appropriation symbols and titles:

Appropriation symbol	Title of account
4X510	Advances to Colorado River dam fund, Boulder Canyon project (no year).
4X511	Advances to Colorado River dam fund, All-American Canal (no year).

8. Upon request by letter from the Secretary of the Interior to the Secretary of the Treasury, transfer appropriation warrants will be issued in amounts requested therein, charging account 4X510 or account 4X511, as appropriate, with corresponding credits to account 4S512 or account 4S513. For the purpose of reporting expenditures in the daily statement of the United States Treasury, "expenditures, general fund—general," will be charged when transfer appropriation warrants are issued advancing money to the Colorado River dam fund under section 2, and "special fund expenditures—other," will be credited. Checks against the Colorado River dam fund will be issued under special fund symbol numbers assigned to the special fiscal agents.

9. Interest on advances from the appropriation "4X510—advances to Colorado River dam fund, Boulder Canyon project (no year)," will be computed from the date of appropriation transfer warrant. The actual-day method will be followed in computing interest chargeable on advances to the Colorado River dam fund. In case a greater sum has been advanced to the Colorado River dam fund (4S512 or 4S513) than is necessary to provide for current payments, the excess amount may be transferred back to the advances account (4X510 or 4X511) upon letter from the Secretary of the Interior to the Secretary of the Treasury requesting such action, and interest on the amounts so returned will cease on the date the transfer warrant is issued. Amounts returned to the advances account (4X510 or 4X511) under this procedure will not be considered "repayment of advances" under section 2 (e) of the act of December 21, 1928.

10. In case interest is deferred under section 2 (d) of the act, an appropriate certificate will be issued by the Secretary of the Treasury to the Secretary of the Interior. As there are no means of recording such indebtedness on the accounts of the Treasury relating to receipts, appropriations and expenditures, in order that the indebtedness for deferred interest may be readily reconciled with the accounts of the Interior Department, the Treasury Department will maintain a memorandum account to record the interest so deferred, and the interest on such deferred interest.

11. On June 30, of each year, unless interest is deferred under section 2 (d), a direct settlement will be made against the Colorado River dam fund (4S512) the proceeds of which will be deposited into the

Treasury as "miscellaneous receipts—interest on advances to Colorado River dam fund." In the event there are insufficient funds in the Colorado River dam fund to meet interest due on June 30 of any year the Secretary of the Treasury, upon request of the Secretary of the Interior, may advance to the Colorado River dam fund within the appropriation available therefor, an amount sufficient to cover such interest and such advance will bear interest at the rate of 4 per centum per annum as in the case of other advances made under section 2 (b) of the act. However, the Secretary of the Treasury may, in his discretion, defer any part of such interest under the provision of section 2 (d) of the act as explained in paragraphs 4 and 10 of this memorandum.

12. Advances will be made to fiscal agents of the Department of the Interior only from the Colorado River dam fund (4S512 and 4S513). Deposits by fiscal agents of unexpended balances will be made to the Colorado River dam fund for credit to the accounts 4S512 and 4S513, as appropriate.

13. Although section 2 (a) directs that all revenues received in carrying out the provisions of the act shall be paid into the fund under the direction of the Secretary of the Interior, in order to conform to the standard practice of the Treasury Department, collections by fiscal agents will be deposited temporarily to the credit of "4025—Miscellaneous receipts—revenues, Colorado River dam fund (Boulder Canyon project)" and "4026—Miscellaneous receipts—Revenues, Colorado River dam fund (All-American Canal)." Such collections will not be considered repayments of advances under section 2 (e), but will be transferred monthly by appropriation warrant and credited to the Colorado River dam fund, 4S512 or 4S513, as appropriate.

14. Upon certification of the Secretary of the Interior to the Secretary of the Treasury at the close of each fiscal year of the amount of money in the Colorado River dam funds (4S512 and 4S513) in excess of the funds required for construction, operation and maintenance, and payment of interest, settlement warrant will issue charging the Colorado River dam fund (4S512 or 4S513, as appropriate) and the amount will be deposited into the Treasury as "miscellaneous receipts—repayments of advances to the Colorado River dam fund."

All-American Canal Investigations

The report on the All-American Canal investigations is now being prepared in the Denver office, under the supervision of Homer J. Gault, engineer. This work is being done under a cooperative contract with the Coachella Valley County Water District and the Imperial Irrigation District, both of California. It is thought that the report will be available about the first of February.

The most important structure will be the diversion dam and desilting works at the head of the canal, the plans for which features are well advanced. Studies of this feature have been confined principally to the upper diversion site, but consideration is being given to the Laguna site, and also to a site 1½ miles above the Laguna Dam.

On account of the unusual magnitude of some of the features, the application of unit costs in the estimates becomes important, and especially with regard to excavation from the dam to the west side of the sand hills.

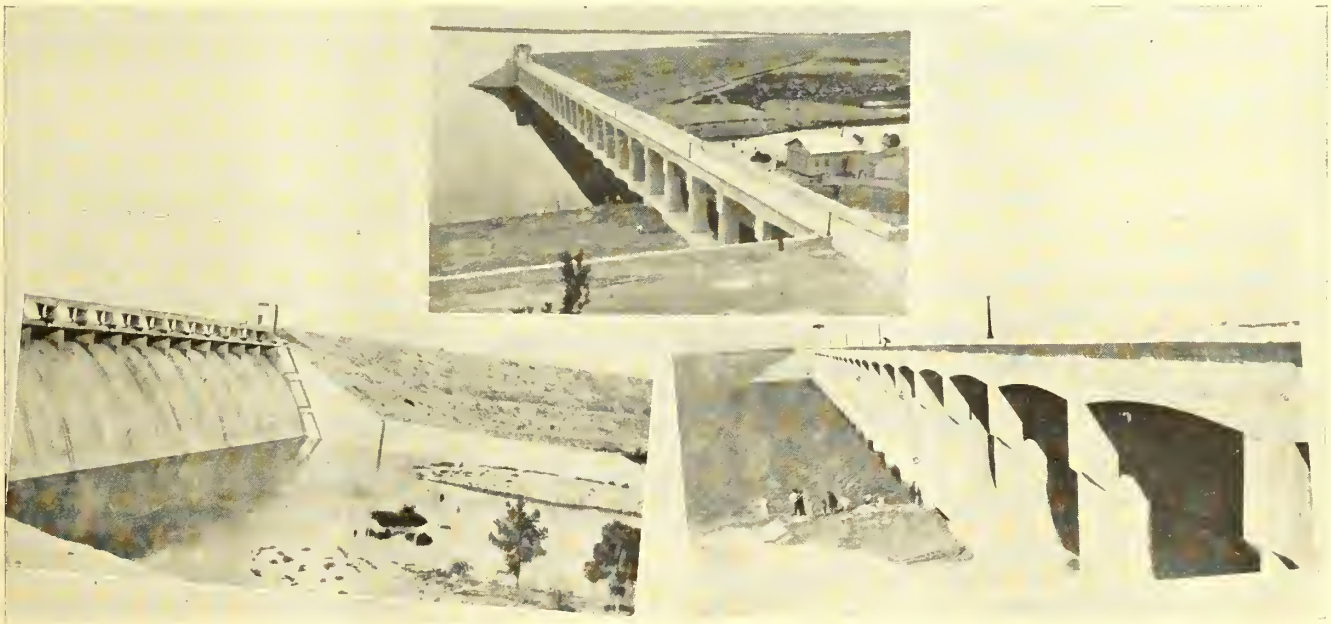
ERICKSON Brothers of Fruitdale, S. Dak., have constructed new pens at the Belle Fourche sugar factory for pulp feeding. This firm, which fattens about 7,000 lambs for market, is also wintering 4,000 ewes for breeding stock.

THE Black Hills sugar plant, South Dakota, closed on December 31 after a run of 94 days, during which 125,000 tons of beets were sliced bringing the contributing farmers $885,000 gross.

PLANTING of cantaloupes and watermelons on the Yuma project started in January, and with favorable spring conditions the crop will be ready to market in May or early June.

ON the Uncompahgre project efforts are still being made to effect a consolidation of the three poultry organizations on the Western Slope into one association.

ON the Yuma auxiliary project 18 cars of grapefruit and 3 cars of oranges were packed and shipped from local groves during December.



DON MARTIN DAM, SALADO RIVER, MEXICO

Upper, Dam and storage reservoir. Lower left, Downstream side of spillway. Lower right, Natives fishing in reservoir.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, gave an illustrated lecture on Hoover Dam before the Massachusetts Institute of Technology at Cambridge, Mass., on January 9. This address was one of a series of Aldred lectures which were founded in 1923 at the institute by John E. Alfred, of New York City.

On January 21, Dr. Mead attended the annual meeting in New York City of the officers and directors of the American Society of Civil Engineers, and on January 22 left for California for a conference at Sacramento with the members of the Hoover-Young Commission on the report on water conservation in central California. While in the West Doctor Mead spoke on Hoover Dam before the Associated General Contractors of America, conferred at Los Angeles with the Imperial and Coachella Valley Irrigation districts relative to all-American canal matters, and visited Hoover dam site.

At Hoover dam site, January, 1931, showing excavation to determine character of abutment for dam. Left to right: Ralph Lowry, assistant construction engineer; Miss Mae A. Schnurr, assistant to Commissioner of Reclamation; Walker R. Young, construction engineer; D. L. Carmody, associate engineer.

J. G. Moody, California deputy real estate commissioner, was a caller at the Orland project during the month.

Miss Mae A. Schnurr, assistant to the commissioner, who was in the field the latter half of December and the first half of January, attending various reclamation meetings and visiting a number of the projects, returned to the Washington office on January 15. As usual, Miss Schnurr made a number of interesting and valuable contacts. Her address in San Francisco at the meeting of the land reclamation division of the American Society of Agricultural Engineers is printed in this issue of the ERA.

R. F. Walter, chief engineer in the Bureau of Reclamation, spent several days in the Washington office in connection with the financial situation of the bureau, returning to Denver on January 22.

Hugh A. Brown, who has been detailed for the past nine months as executive secretary of the Committee on the Conservation and Administration of the Public Domain, has resumed his duties in the Washington office as director of reclamation economics.

Early in the month J. R. W. Davis, chief engineer; Thomas Balmer, Colonel Mears, and C. B. Harding, officials of the Great Northern Railway, conferred with B. E. Hayden, superintendent of the Klamath project, regarding the changed location of the proposed Great Northern Railroad across project lands.

Miss Chloe D. Mantle, who has been a member of the Washington force of the Bureau of Reclamation since its organization in 1902, retired from active service on December 1. Miss Mantle will make her future home in Watertown, N. Y.

Miss Gertrude M. Athey, of the engineering division, has returned to Washington after an interesting trip to various points in Florida.

The headquarters of R. J. Coffey, district counsel, were changed from Berkeley to Los Angeles, Calif., effective January 14.

George O. Sanford, assistant director of reclamation economics in the Washington office, accompanied by Mrs. Sanford, motored to his old home in eastern Massachusetts and spent the Christmas holidays with relatives and friends.

On December 23 the Washington office force enjoyed its second Christmas party sponsored by Mrs. Margaret G. Young, supervisor of the stenographic section, and her several able assistants. Santa Claus made his appearance to the delight of the guests, and Miss Regina C. Watkins, of the chief clerk's division, gave an appropriate recitation. Mrs. P. I. Taylor, wife of a member of the engineering division, contributed a very important part by presenting the ladies with a delicious home-made devil's food cake, duplicating the one which she donated on the occasion of our first Christmas party a year ago.

J. L. Savage, chief designing engineer in the Denver office, was on leave several days during the month during which he served as a member of the Pine Canyon Dam Consulting Board. Mr. Savage later joined Chief Engineer Walter on his trip to Panama. They returned to Denver early in January.

Harold E. Rocker, of the mails and files section of the Washington office, was on leave for several days during the month of December, during which announcement was made of his marriage. The bride, Miss Doris Martin, is a native of England, but has been residing in Washington for several years.

Walker R. Young, construction engineer, Boulder Canyon project, spent one day in Denver en route from Washington to his headquarters at Las Vegas, Nev.

J. R. Iakisch, drainage engineer, was in the Denver office during the month preparing his report on the Saratoga investigations in Wyoming. Mr. Iakisch stopped at the Yuma project office the latter part of the month in order to secure data in connection with his studies of the drainage system on that project.

The Punjab, one of the most populous and prosperous regions of India, takes its name from the "five rivers" which irrigate the area, and is made up of the British Province of Punjab and 34 native States.

U. S. GOVERNMENT PRINTING OFFICE 1931

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver Colo, Wilda Building

R. F. Walter, Chief, Eng; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, 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 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, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Las Vegas, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	J. R. Alexander	Do.
						R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peck	E. A. Peck	J. R. Alexander	Las Vegas, Nev.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	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	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	H. H. Berryhill	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	J. C. Avery	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	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 [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[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] Actiug.
[6] Storage, main, and Tule Lake divisions.
[7] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	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	Minikoka 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. Fout	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay 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. Neile 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	Fallou, 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	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of	Cooperative agency
All-American Canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	W. R. Young and C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin	Spokane, Wash	H. W. Bashore	

HOOVER DAM, POWER PLANT, AND ARIZONA OUTLET WORKS, BOULDER CANYON PROJECT
ARTIST'S CONCEPTION OF WORK UPON COMPLETION

NEW RECLAMATION ERA

VOL. 22. NO. 3 MARCH, 1931

RAKING SAGEBRUSH ON THE KITTITAS DIVISION, YAKIMA PROJECT, WASH.

Independence . . .

The man who owns a reasonable number of acres of fertile land . . .

. . . Making his home on the land

. . . The members of his family doing most of the work in connection with his farming operations

. . . Producing all of his fruits and vegetables for his table twelve months in the year

. . . Canning sufficient supply of his farm products as the food carry-over for the use of his family

. . . Owning at least two cows for his milk and butter supply, also skimmed milk for his poultry and livestock

. . . Hogs to produce his own table meat twelve months in the year

. . . Chickens for eggs, and also meat for his table

. . . A few sheep to keep down weeds and brush

. . . Producing all the other livestock, hay, and grain

. . . Production in excess of family food and livestock feed requirements to sell, either locally or through cooperatives

. . . Is one of the MOST INDEPENDENT citizens in the Nation.

GEORGE R. WHEELER,
Columbia College, Columbia, S. C.

NEW 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. 22, No. 3 MARCH, 1931

Interesting High Lights on the Federal Reclamation Projects

THE 1930 cotton crop on the Yuma project was practically all picked at the close of the month, including snap cotton. Yields this season were approximately a bale per acre, or a normal season's production.

SETTLEMENT and farm development on the Boise project continued active with the same lively demand for farms for rent and occasional sales. An attempt is being made in the State legislature to revise the taxing system and lessen the proportion of burden on farm lands.

THE increasing importance of the dairy industry on the Minidoka project is shown by the annual report of the Mini-Cassia Cooperative Dairymen's Association for 1930. During the year the association handled 789,000 pounds of butterfat, an increase of more than 84,000 pounds over the corresponding amount for 1929. The average price paid last year for cream butterfat was 33.5 cents per pound, and 41.8 cents for milk butterfat. A total of 369,000 pounds of casein was manufactured and sold, of which 259,000 pounds came from the Burley plant and 110,000 pounds from the Rupert plant.

THE Dennis Construction Co., of San Diego, Calif., has started work on its contract with the California Highway Association for the laying of six miles of bitulithic pavement on the Ocean-to-Ocean Highway across the Reservation division, Yuma project. This contract calls for several heavy fills and bridge crossings over washes and relocation of a portion of the present highway. The contract calls for the completion of this work by June 1.

SEVENTEEN cars of grapefruit were packed and shipped during the month from groves on the Yuma auxiliary project.

PRUNING of orchards continued throughout the month on the Orland project. The last of the season's crop of navel oranges was shipped. With the mild temperatures prevailing near the close of the month, almond buds were beginning to swell with indications of early blossoming if the warm weather continues.

Warning to Unemployed

Heedless of urgent warnings, large numbers of applicants have proceeded to Las Vegas, Nev., only to find that opportunities for employment in connection with construction of Hoover Dam will not exist for 90 days or more. In fact the United States Employment Service at Las Vegas has on hand applicotions sufficient to care for possible employment needs for the next six months.

Under existing conditions, none should go to Las Vegas unless he is assured of employment upon arrival, or is equipped with independent means to carry him over a period of several months.

MRS. M. L. BURTON, of Burley, Minidoka project, who has followed the most advanced methods in poultry raising, has demonstrated the possibilities of profitable annual returns from a well-kept flock. The original investment of $50 made by Mrs. Burton in 1925 has increased until the present value of her plant is $7,500. In 1930 she brooded 5,000 baby chicks, from which 2,150 pullets were developed, 1,300 of which were retained and are now yielding a 50 per cent egg production. The balance were sold. Mrs. Burton's flocks, which are accredited, supply the hatcheries in Twin Falls and Paul, Idaho, with eggs, Her business yields a substantial annual income.

CONSIDERABLE activity in settlement matters continues on the Sun River project. The Chicago, Milwaukee, St. Paul & Pacific Railroad has employed a special agent and is advertising the project in many newspapers and periodicals having a wide circulation among prospective settlers. Martin Himler, a Hungarian settlement worker and also connected with the railroad, visited the project the latter part of the month for the purpose of getting first-hand information on project lands. Associate County Agent D. P. Thurber, A. W. Walker, superintendent, and J. E. Young, banker, met at Great Falls to discuss with R. W. Reynolds, commissioner of agricultural development and colonization, settlement plans for the Sun River project.

THE First National Bank of Olathe and the Olathe State Bank, which was a subsidiary of the First National Bank of Montrose, Uncompahgre project, have merged into one institution for the purpose of giving better service to the community. The new bank is known as the First National Bank of Olathe and is controlled by the First National Bank of Montrose. This leaves four banks on the project, all of which are in excellent condition financially.

THE Glasgow Irrigation District and Chamber of Commerce on the Milk River project have started a campaign to secure options to vacant lands in an effort to encourage dry farmers of that vicinity to locate on the project. This plan has brought several new settlers to the Malta division, and should be effective on the Glasgow division also.

THE R. Hardesty Manufacturing Co., makers of culvert pipe, headgates, and all irrigation appliances, are planning the early location of a branch at Sidney, Lower Yellowstone project.

Problems of Western Reclamation[1]

By R. C. E. Weber, Superintendent Orland Irrigation Project, Calif.

IN discussing the subject of "Problems of Western Reclamation," comment will be confined to those difficulties confronting reclamation activities as carried out by the Federal Government through the agency of its Bureau of Reclamation.

The problems of reclamation are many and varied; they include economic, political, and engineering as well as legal phases. Of these, the economic aspect is the most important and difficult. It involves numerous phases, among the more important of which may be enumerated payment of reclamation charges, settlement of lands for which irrigation water is available, and feasibility of undertaking new construction.

REPAYMENT OF CHARGES FURTHERS NEW CONSTRUCTION

Payment of charges as these accrue annually are vitally important to the future of reclamation activities, for without the accretions to the reclamation fund from repayment sources, new construction by the bureau will be seriously curtailed in extent. With the lesser area of public lands now available for sale, as well as the decreased amounts of money derived from mineral and oil royalties, the repayment of construction, together with operation and maintenance charges, constitutes the major portion—about two-thirds—of the revenue, from which activities of the bureau are presently financed. This limitation, however, does not apply to the Colorado River development of the bureau at Hoover Dam, which is financed by special legislation of Congress.

Business principles constitute the basis of reclamation work by the Federal Government. Funds for the construction of irrigation works are advanced by the Government under the provisions of a contract, by which the landowners agree to retire the cost of the system. This obligation of indebtedness is as binding as any other upon the lands of project settlers. Meeting these payments is often difficult, especially in times of agricultural depression. A majority of the settlers lack the necessary capital to improve their farms promptly, making it impossible for them to derive at the outset the full benefits of irrigation and the income with which to make repayments. On the whole, however, the results have been remarkably satisfactory. During 1929, reclamation settlers paid the Government 97 per cent of what was due that year on their contracts. In 1930 there was some delay in payment on a few projects, but the payments to the Government have compared favorably with those of farmers generally in connection with their obligations to banks.

The test of reclamation is whether the additional charges for irrigation works are too heavy to be met by ordinary farmers, and if the opportunities created are sufficient to equal the responsibilities so that the resulting obligations in the way of repayments can be successfully assumed. This is often little considered by proponents of new construction, when the policy of reclamation is presented in a most attractive light with the assurance that the costs of the proposed system can and will be promptly paid. When a movement for reduction in charges and postponement of repayments in connection with existing projects is inaugurated simultaneously with demands for new construction, the question arises as to whether the request is based on economic necessity, or whether it is a guise under which is an effort to break down the policy of reclamation as a business enterprise.

REPAYMENTS NOT REQUIRED ON POOR LAND

Among the more important activities of the bureau is the endeavor to assist in maintaining morale among project water users and in increasing their earning power. The morale of the settlers on reclamation projects is far better than it was a few years ago, the improvement dating from the time when farmers were relieved from payments in connection with lands of inferior quality as well as areas affected by alkali or seepage. Agricultural depression, which has in part contributed to requests for extensions and reductions in charges, is not altogether responsible, as political influences also operate. On account of the fact that Government reclamation is a production activity and one in connection with which the money expended is required to be refunded, while so many kindred activities of the United States are a direct charge on the General Treasury with no repayment requirements, there has naturally grown the belief among many that the cost of reclamation works should be borne entirely by the Government and that repayment of the construction cost should not be required.

Those familiar with the general sentiment of the East regarding reclamation are fully aware that such a policy is impossible and an attempt to adopt it could only result in an abrupt termination of all new development. Furthermore, since existing contracts now constitute the main source of revenue to the reclamation fund, their integrity is particularly essential to new construction. As it is, the income is insufficient to prosecute construction most economically on work in progress, or to meet the demands for new construction to supply water where it is urgently needed. Because money can not be provided and more progress in new development is not made, there is impatience and criticism directed toward the bureau.

THE SETTLEMENT PROBLEM

Of the total of nearly 2,000,000 acres in Federal irrigation projects, for which the Reclamation Bureau has completed works and was prepared to deliver water in 1929, there are only about one-half million acres not being cultivated. Most of this area was being used for other farm purposes, or was not yet opened to settlement, so that probably little more than 10 per cent was available for settlers.

The settlement of this area, to bring it under irrigation, agriculture, and profitable farming, constitutes, however, a problem of major significance with which reclamation is confronted. Idle lands, subject to the fixed charges of irrigation construction costs, can not long be held without financial loss to the owners as well as an ultimate loss to the Government, when development is deferred until the accumulation of delinquent reclamation charges approaches or exceeds the intrinsic land value.

The problem of settlement brings with it the question of finances and agricultural experience of prospective settlers. When the reclamation act was passed in 1902, it was framed to meet an agricultural and rural life that was primitive in character. At the time it was anticipated that the land reclaimed would be free, the cost of irrigation works low, and that self-denial and industry would be the main requirements of success.

REQUIREMENTS OF SETTLERS

Conditions to which the reclamation act has been subjected in the intervening years since its enactment have undergone a revolutionary change. The population of the States to which it applies have more than doubled, the costs of both irrigation works and the preparation of lands for irrigation have been far greater than originally estimated, and free lands have not materialized in the actual working out of the original act. The primitive agriculture, which was once considered the basis of reclamation development and progress, will no longer answer. Only by intensive agriculture through properly

[1] Address before American Farm Bureau Federation, San Francisco, Calif., February 10, 1931.

improved and equipped farms can the costs of reclamation be met. Ordinarily, it was believed that if water was provided, the settler, without capital or farming experience, could establish a home and meet repayment costs. It is now known that this can not be done. The farmer must have considerable capital or access to ample credit to adequately finance his irrigated farming activities. If not an experienced farmer, means must be provided to enable him to become one.

The necessity of capital and farming experience is even more important in connection with the settlement of new projects because of the larger costs entailed. Future construction must necessarily be more expensive for the reason that the supply of natural flow waters available for direct appropriation is limited, and consequently storage must be provided. Another factor contributing to increased costs is that existing works have embraced the least expensive and most favorable developments, leaving only those of greater cost for future construction. Where costs of from $50 to $100 per acre were involved in the past, further irrigation development will comprise charges for construction ranging from $100 to $150 and upward per acre. These costs can be repaid only if settlement takes place promptly by farmers financially able and agriculturally qualified to cultivate intensively the lands for maximum returns. With the increasing cost, greater care must be exercised in preliminary investigations to determine a project's feasibility, and particular attention must be directed to settlement and economic development, on which depends largely the return of the expenditures incurred.

BROAD ENGINEERING EXPERIENCE OF BUREAU

Engineering problems now occupy a position of lesser importance than they assumed in early construction. As a result of over 25 years' experience, the Reclamation Bureau has built up an engineering organization able to design and construct irrigation works economically and efficiently. In the early history of reclamation construction, the work was pioneering to a large degree, as there were no precedents to follow, and problems of an engineering nature were of major import. With a background of many years of successful practice and experience, engineering problems, although still of magnitude and particularly important where the stability of works is concerned for the safety of life and property, admit more readily of solution than other problems confronting western reclamation.

The interstate location of many western streams from which irrigation waters are derived and the different laws of the various States relative to water rights introduce legal problems in reclamation work. On many rivers, the irrigated farms are situated along the banks for many miles. The rights of water and their protection during periods of low flow are essential to the prosperity of farmers, as well as to the stability and value of irrigation properties. These rights are established and protected under State laws and by State authorities, which is sufficient where streams originate and the waters are used within a State's boundaries. But large rivers cross State boundaries, and in the instances of the Colorado, the Columbia, and the Missouri Rivers the watershed areas include a number of different States, and Federal reclamation works are operated in many of them. Contracts must conform to the laws of the several States as well as numerous amendments to the original reclamation act.

RIPARIAN RIGHTS

Adherence to the riparian theory in connection with water laws in some Western States, particularly California, offers problems in connection with further development of reclamation activities. Based upon English law and on conditions entirely different from those prevailing in the irrigated sections of the West, the theory of riparian rights has saddled some commonwealths with an incongruous and unhappy union of appropriative and riparian claims and uses. Some progress has been made in clarifying the legal situation as to the conflict between appropriation and riparian rights, but the menacing shadow of some features of the riparian theory lowers over western stream systems, and much is still left for the future in the way of further improvement in water law as related to irrigation use.

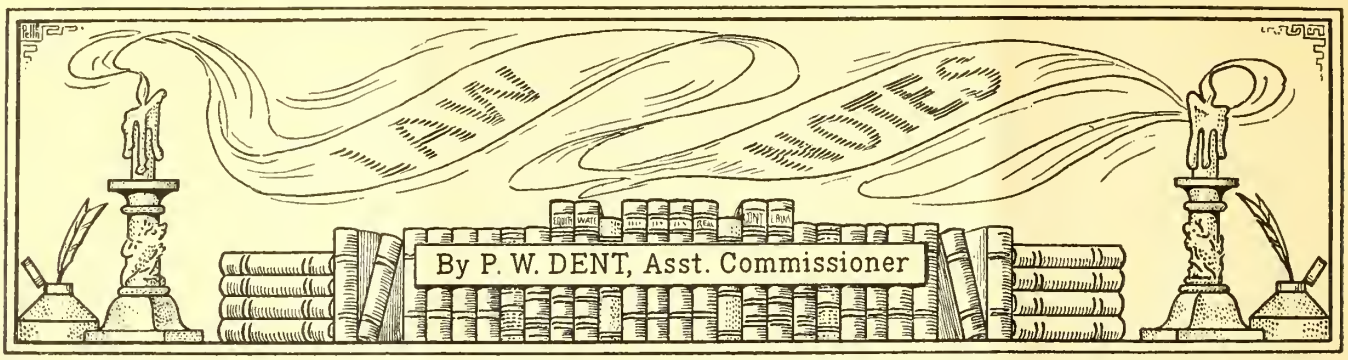
The correction of misguided opposition to the policy of Federal reclamation also constitutes a task in the administration of Government reclamation activities. Opposition to Federal reclamation originates from the mistaken belief that it contributes to the agricultural surplus. As a matter of fact crops produced on Government irrigation projects are supplemental to, rather than competitive with agricultural products of other farming regions of the United States. Less than 1 per cent of the Nation's cultivated area is included in the reclamation projects. The very nature of many of the principal irrigated crops is such that they can be successfully produced only under the peculiar climatic and soil conditions which prevail in the arid West. Certain crops, which are profitably and extensively grown on irrigated lands, are marketed at a season of the year when they can not be raised elsewhere. Then, too, reclamation projects themselves furnish extensive markets for manufactured goods as well as farm products not raised under irrigation, and thus materially benefit rather than work a hardship on other farming sections.

BENEFITS OF RECLAMATION

In concluding a presentation of the problems of reclamation, let us review briefly some of the achievements of Federal reclamation in order also to reveal the more attractive and constructive side of the picture. In 1929 the cultivated area receiving an irrigation supply from Government works was nearly two and three-fourths million acres, producing crops valued at more than $161,000,000, or $60 per acre. The cumulative value of crops raised on lands irrigated from works of the Reclamation Bureau since water was first available in 1906 has aggregated approximately one and two-thirds billion dollars. There were nearly 40,000 irrigated farms on Federal projects during 1929, with a population of 157,000; 214 towns and cities with an additional population of nearly one-half million; 130 banks with deposits aggregating $145,000,000 and 245,000 project and nonproject depositors.

The works already constructed have cost $195,000,000, but the benefits from them have not yet been fully realized in that they are not yet entirely completed, and the lands susceptible of irrigation under them have not been brought under cultivation. Even in this partially completed state, the value of the crops produced in 1929 was 80 per cent of the investment of the United States in reclamation construction. When these systems are finished the annual production of crops will exceed the entire cost of the irrigation works. Add to these results those of an indirect nature by way of contributions to the business and social life of the States and communities in which the projects are located, as well as the addition to national wealth, and it is conservative to state that no greater benefits to the Nation have ever been derived from a like investment of Government funds.

DURING the month the Lingle power plant on the North Platte project broke all previous records for output for any one month, with a total of 1,155,755 kilowatt-hours, which in turn gave it a plant factor of 88.8 per cent. Likewise the average flow of water for power use was increased beyond all previous records. The above increase in kilowatt-hours output was chiefly due to the operation of the Guernsey plant, the output being held as low as possible in order to conserve the storage water.



Supreme Court of Wyoming Upholds Irrigation District Contract with United States

IN Lincoln Land Co. *v.* Goshen Irrigation District (293 Pac. 373), decided by the Supreme Court of Wyoming November 19, 1930, the court upheld a contract made between the district and the United States for the payment of the bureau's construction cost.

Excerpts from the decision follow.

"This appeal presents questions affecting the legality of the assessment of benefits and construction charges by respondent Goshen Irrigation District against lands of appellant Lincoln Land Co., for irrigation works constructed by the United States as a part of the Fort Laramie unit of the North Platte irrigation project.

"The North Platte project was one of the first projects undertaken by the United States under the Federal reclamation act of June 17, 1902 (32 Stat. 388). The project was divided into the Interstate and Fort Laramie units. The Interstate unit, which is not affected by this controversy, was constructed first. The construction of the works for the Fort Laramie unit was long delayed, and not undertaken until 1915. (Report of Reclamation Service, 1915–16, p. 271.) The irrigable lands in this unit include a considerable acreage held in private ownership. In May, 1912, the consulting board made a report recommending commencement of construction on condition that at least 95 per cent of the owners of deeded lands sign trust deeds, thereby insuring the repayment of the building charges to the reclamation fund. This recommendation was approved by the Secretary of the Interior, and forms of trust deeds were submitted to the landowners for signatures. (Reports of Reclamation Service, 1911–12, p. 127; 1913–14, p. 191.) Later, by section 12 of the reclamation extension act of August 13, 1914 (38 Stat. 689, 43 U. S. C. A., sec. 418), it was provided 'that before any contract is let or work begun for the construction of any reclamation project hereafter adopted, the Secretary of the Interior shall require the owners of private lands thereunder to agree to dispose of all lands in excess of an area which he shall deem sufficient for the support of a family upon the land in question, upon such terms and at not to exceed such price as the Secretary of the Interior may designate; and if any landowner shall refuse to agree to the requirements fixed by the Secretary of the Interior, his land shall not be included within the project if adopted for construction.'

"It seems that the Secretary of the Interior was unwilling to authorize construction of the Fort Laramie unit until the deeded lands were pledged for their proportionate part of the cost of construction. For some time the department was insisting on trust deeds covering 95 per cent of the deeded lands, as recommended in 1912 by the consulting board, but in October, 1914, the secretary reduced the requirement to 90 per cent. June 7, 1915, there was made to the director and chief engineer of the Reclamation Service a report 'to the effect that 90 per cent of the irrigable area in private ownership was then subscribed, and shortly thereafter direction was given that final location surveys be made for the purpose of early advertisement of earthwork and the beginning of construction.' The first advertisement was made August 7, 1915. (Report of Reclamation Service 1915–16, pp. 271, 272.)

"The appellant, Lincoln Land Co., was the owner of much of the deeded lands included in the Fort Laramie unit. For convenience in discussion, the appellant's lands have been divided into two tracts, one the Rock Ranch lands, which may be disregarded for the present; the other the Horse Creek lands, of which we now speak.

"On May 12, 1915, the appellant, as grantor, gave a trust deed of its Horse Creek lands to the Wyoming Trust & Savings Bank. The deed bears the indorsement, 'Form approved by Secretary of Interior January 21, 1915,' and contains these recitals or premises:

"'Whereas the lands hereinafter described lie within the limits of the proposed Fort Laramie unit of the North Platte project, Nebraska-Wyoming, proposed to be constructed under the act of Congress of June 17, 1902 (32 Stat. 388), known as the reclamation act, which, with all acts amendatory thereof and supplementary thereto, is hereinafter referred to as the reclamation law, are now without sufficient water supply, will require irrigation before they will produce adequate crops, and the grantor desires to secure ample water rights for the irrigation thereof under the said unit; and

"'Whereas the grantor desires to make such provisions in accordance with the reclamation law for said lands as will assure perfection of water rights therefor and is willing to conform to the provisions of the reclamation extension act of August 13, 1914 (38 Stat. 686), and particularly the provisions of section 12 thereof, which require an agreement to dispose of all lands owned by it in excess of the area deemed by the Secretary of the Interior sufficient for the support of a family upon the land in question and to comply with the other requirements thereof; and

"'Whereas the grantor therefore desires to insure construction of the said Fort Laramie unit under the reclamation law aforesaid of sufficient extent to provide water for said lands and all the lands subscribed and contemplated to be reclaimed by the said Fort Laramie unit.'

"It is then in the trust deed declared that the grantor, 'in consideration of the premises, the benefits to be derived from the construction of said Fort Laramie unit,' and $1 paid by the trustee, conveys to the trustee several thousand acres of described lands, known in the case as the Horse Creek lands, subject to rights of way required by the United States.

"The terms of the trust, so far as now material, may be summarized as follows: The trustee was required to give bonds for deeds to such persons and for such portions of the lands as the grantor shall from time to time direct, the bonds to be conditioned on payments of not more than $30 per acre exclusive of improvements and charges for water right from works of the United States; and conditioned further 'that if the United States decides before January 1, 1917, to construct the said Fort Laramie unit, and by January 1, 1922, the Secretary of the Interior determines that any part of said lands covered by such bond are irrigable from and are included in said unit, the obligee, his heirs, administrators, executors, or assigns shall make, within 90 days from the date of such bond, if water-right application is then receivable for said lands, or if not then receivable, within 90 days from date when water-right application is first receivable therefor, water-right application or applications to the United States for the irrigable area of the lands obligated to be conveyed and included in said unit, in accordance with the said reclamation law, and rules and regulations thereunder, and the acceptance thereof by the United States.' It was understood that the grantor could have reconveyed to itself an irrigable area not exceeding 160 acres for which water-right application should be made to the United States within the period provided for the making of such application by holders of bonds for deeds. It was further provided that, except as to the 160 acres to be reconveyed to the grantor, 'water-right application will not be accepted from any one person in excess of the area which the Secretary of the Interior shall determine as sufficient for the support of a family.' Upon the fulfillment of the conditions of any bond for deed, the trustee was required to convey to the obligee that portion of the lands obligated to be conveyed 'as shall have had water-right application in due form made and accepted therefor.' Conveyances were to be subject and inferior to the lien to accrue to the United States by reason of any water-right application It was further provided that 'after five years from the date of the first public notice issued under the reclamation law affecting said lands' all portions of the lands for which no bond for deed had been given, and all portions for which bond had been given, but for which water-right application had not been made and accepted, should be sold from time to time by the trustee upon the direction of the Secretary of the Interior at public auction to the highest bidder qualified to make water-right application for the lands sold. The deed sets forth in some detail the procedure to be followed in carrying out this provision for sales under the direction of the Secretary of the Interior. The grantor is entitled to retain possession and receive the rents and profits of the lands, subject to the provisions of the trust, 'and shall pay all taxes, charges, and assessments that have accrued, or that during such possession shall accrue, against said lands that have now or shall hereafter and during such possession become a lien thereon.' It is provided that, on the trustee's legal disqualification or failure to act, the Secretary of the Interior, on his own motion or application of the grantor or application of the successors of the United States in control of the Fort Laramie unit, may designate a different trustee.

"After construction work on the Fort Laramie unit was commenced, no public notice of construction charges was given, and for some time after water was available for irrigation, it was furnished on a rental basis. In 1923, under State laws, the Goshen Irrigation District was organized 'to cooperate with the United States under the Federal irrigation laws,' and 'for the assumption, as principal or guarantor, of indebtedness to the United States on account of lands in said district.' The district includes lands of the appellant and other lands in Wyoming in the Fort Laramie unit.

"In 1926, negotiations between the irrigation district and the Secretary of the Interior resulted in a contract between the district and the United States. The contract, after approval by the Secretary of the Interior and the electors of the district, was signed November 24, 1926. A brief summary of its material provisions follows:

"It is recited that the district includes about 53,000 acres of lands irrigable from the works of the Fort Laramie unit constructed by the United States; that no public notice had theretofore been issued affecting the lands or fixing and determining the cost of construction, and that the landowners and entrymen of lands in the district desired to secure the benefits of the fact finders' act, infra, and through the medium of the district to take over the operation and maintenance of the irrigation works and to contract as to the manner of repayment of the cost of construction properly chargeable to their lands. The United States agreed to store water for the irrigation of lands in the district, and the district assumed and agreed to pay to the United States construction charges which should not exceed $4,985,315. The district agreed to pay each year a construction charge to be determined by multiplying the average rate per acre by the total number of irrigable acres in the district. Both the 'average rate per acre' and the 'irrigable acres' were to be determined and announced by the Secretary of the Interior following classification of the lands pursuant to regulations promulgated under authority of the fact finders' act. For the purpose of determining the annual construction payment to be made by the district all irrigable lands were to be in one class, but it was understood that the average rate per acre would be 5 per cent of the average gross annual acre income, which would depend on the classification of the land w th reference to its productive value. The annual construction charges to be paid by the district to the United States were to become due on December 1 of each year, commencing with the year 1929, with a provision for the carrying over of part of the charges for the years 1929, 1930, and 1931.

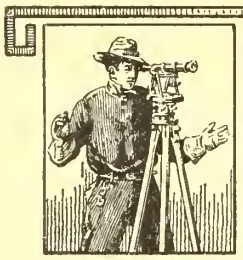
"Following the execution of this contract, and on June 8, 1927, the commissioners of the district filed their amended first report, by which it was made to appear that they had determined that 51,581 acres of land in the district would be benefited to the amount of $100 per acre by the irrigation works, and assessed the cost of construction, $4,985,000, against the benefited lands, including some 860 acres of applicant's Horse Creek lands, at the rate of $95 per acre, payable in conformity to the plan outlined in the contract of November 24, 1926.

"The Lincoln Land Co. objected to the inclusion of its Horse Creek lands in the district, and to the assessment of benefits and cost of construction. After trial in the district court, the objections in all important particulars were overruled, and the assessments confirmed. The land company appeals. There are many errors assigned in the specifications of error, but most of them are not argued in the brief, and are therefore deemed to be waived. (Automobile Ins. Co. *v.* Lloyd, 40 Wyo. 44, 49, 273 P., P. 681.)

"The contentions argued by appellant in this court go to the validity of the assessment of benefits and of cost of construction under the State irrigation district laws and under the due process clauses of the State and Federal Constitutions. The questions raised require consideration of various provisions of both Federal and State statutes, in order the better to understand the relation of the State irrigation district to the Federal Fort Laramie reclamation unit.

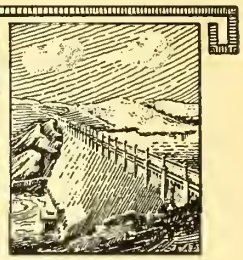
"It is conceded that works of the Fort Laramie unit constructed by the United States under the Federal reclamation act are the only source of supply of water for the irrigation district. Appellant contends that, because of the provision of section 5 of the reclamation act that no right to water for land in private ownership shall be sold for a tract exceeding 160 acres to any one landowner, the irrigation district

(Continued on page 67)



ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Easton Dam, Yakima Project, Washington

By George C. Imrie and A. A. Whitmore, Associate Engineers, Bureau of Reclamation, Ellensburg, Wash.

EASTON DIVERSION DAM is located on the Yakima River just above the town of Easton, Wash., about a mile below the junction of the Kachess and Yakima Rivers. It diverts water from the Yakima River into the Kittitas main canal for irrigating the Kittitas division of the Yakima project, comprising about 72,000 irrigable acres. The dam is located in a timbered country on the eastern slope of the Cascade Range and in a region subject to heavy snowfall during the winter months. The reservoir formed by the dam has an area of about 240 acres, contains about 4,000 acre-feet of water, and creates a beautiful mountain lake about 1½ miles long by one-half mile wide with wooded shores. Two transcontinental railroads, the Northern Pacific and Chicago, Milwaukee, St. Paul & Pacific, follow the southern shore of the lake, while the Sunset Highway, which is the principal State road connecting eastern and western Washington, crosses the upper arm of the lake.

PRELIMINARY INVESTIGATIONS

Preliminary surveys for the Kittitas division indicated that diversion for the main canal would have to be located in the vicinity of Easton. Just above the town and adjacent to the Northern Pacific main line tracks the Yakima River has cut a narrow gorge through a rock reef, and this site offered the only feasible point of diversion. During 1924 the proposed dam site was tested by drilling and examined by Kirk Bryan, geologist, of the United States Geological Survey, who reported that the rock consisted of Easton schist as mapped in United States Geological Survey folio 193. The foundations were found to be favorable, the geological report stating in part that—

"The rock is suitable for the foundations of any structure and its joints can be successfully grouted. * * *

"All the types of Easton schist are composed of minerals that would not be unduly subject to weathering and would not have greatly lessened strength when subjected to continued wetting * * *. The microscopic examination indicates that there are no minerals present in the rock or veinlets that would undergo ready change or that would invalidate the calculations of the field geologists * * *. The rock is not schistose and the original structure, which has been partly preserved, indicates that it had a composition near that of diorite."

DESIGN

In addition to topographic features several other factors had to be taken into consideration in arriving at a satisfactory design for the dam. It was necessary to provide for a practically constant lake level above the dam and headworks so as to secure the required canal capacity, but any appreciable rise in water surface above this elevation was certain to damage the main lines of two transcontinental railroads. Provision had to be made for passing by the dam during the irrigation season varying quantities of water released from the Kachess and Keechelus storage reservoirs for the lower divisions of the Yakima project. Adequate flood spillway capacity was required. It appeared that a gravity-type overflow dam with automatically controlled drum gate in the spillway section best met the conditions existing and this type was decided upon.

The dam as designed and constructed consists of a gravity-type concrete structure 248 feet long and 66 feet maximum height. The spillway section is 64 feet long and is provided with a 64-foot by 14½-foot structural-steel floating drum gate. The automatic control mechanism for the drum gate is contained in the gallery in the right pier, adjacent to the spillway section. Emergency valve for controlling the drum gate by hand operation is located in the left pier. Automatic control of the drum gate is accomplished through a float which actuates a 16-inch balanced valve, which in turn controls the water pressure in the drum gate float chamber beneath the drum gate and raises and lowers the gate. The automatic operating mechanism is designed to hold the water level in the reservoir at a practically constant level, the drum gate automatically rising and lowering to accommodate the varying inflow into the reservoir. With the drum gate in its lowest position an overflow spillway capacity of 13,000 cubic feet per second is available, which is estimated to be ample for any floods that may occur.

The dam raises the water surface approximately 43 feet above the normal low stage, the maximum operating water surface being at elevation 2,180.3. Agreements with the Northern Pacific and Milwaukee Railroads prohibit raising the water surface above elevation 2,181. A 4.8-foot by 6-foot sluice gate is provided at each side of the river, with sills at elevation 2,135 for sluicing out sand and silt from the upstream side of the dam and for passing the low flow of the river during the nonirrigation season. The sluice gates are operated by two 65:1 geared gate hoists connected to electric motors located on top of the dam. A gallery with floor at elevation 2,146.63 is provided for through the piers and spillway section which provides access to the drum gate operating machinery and interior of the drum gate and also provides a means of crossing the river at this point.

A fishway is provided on the north side of the river, being designed and constructed in conformity with the ideas of the Washington State Department of Fisheries. A unique fish guard consisting of a grid of bent steel rods is provided at each bay to discourage fish from turning back after they have once entered the fish ladder below the dam. The fishway has 20 bays with a 2-foot 1-inch rise between the bays. At the top and bottom of the fishway, water regulation is secured by means of stop plank.

The canal headworks are located at the extreme right of the dam and at an angle of 27° 43′ to the dam axis. Two 12-foot by 11-foot radial gates, motor operated, control the water diverted into the canal. Water discharged into the canal at the headgates goes directly into a short pressure tunnel under the Northern Pacific tracks and a short distance farther is carried under the Milwaukee tracks by a similar tunnel.

CONSTRUCTION

Bids for construction of Easton Dam, as covered by specifications No. 468, were opened on February 10, 1928, and contract for construction was awarded to the low bidder, C. F. Graff, of Seattle, Wash., contract No. I–2r–1266, dated March 16, 1928. Work on the contract was started in April, 1928. The original contractor lacked adequate capital for prosecuting the work and owing to financial difficulties stopped work on the contract late in 1928. The contract was then taken over and completed in October, 1929, by Hans Pederson, of Seattle, Wash., who was the principal bondsman. With the exception of a rather severe winter in 1928–29, conditions were favorable for prosecution of the work, river conditions being unusually favorable as no high water occurred in the river during the period the dam was under construction. In spite of the generally favorable conditions, however, the cost of the work to the contractor was considerably in excess of contract earnings.

Easton Dam—Costs

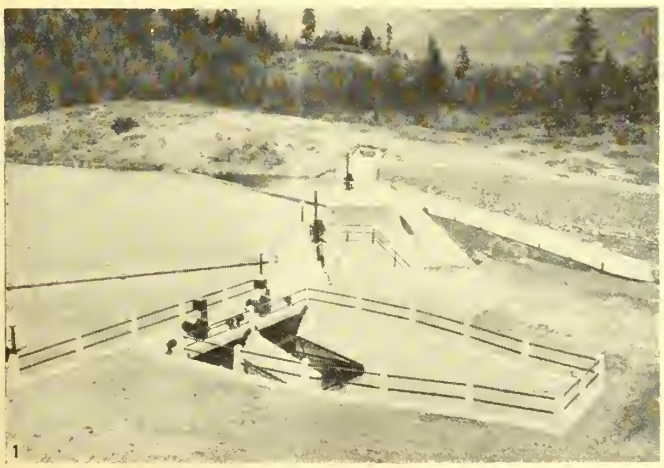
Class of work	Unit	Quantity	Contract earnings	United States materials	Total
Diversion and care of river	Lump sum		$10,000		$10,000
Excavation, all classes	Cubic yard	7,526	29,452	$105	29,557
Placing material on Northern Pacific railroad embankment	do	23,718	8,064		8,064
Back fill	do	37	16		16
Stripping for dike	do	103	88		88
Embankment for dike	do	487	584		584
Riprap on face of dike	do	39	146		146
Drilling grout holes	Linear foot	2,233	7,592		7,592
Placing grout connections	Each	107	171		171
Pressure grouting	Cubic foot	509	865	363	1,228
Concrete	Cubic yard	5,706	29,458	30,221	59,679
Concrete posts for handrailing	Each	54	157		157
Placing reinforcing steel	Pounds	60,664	1,031	1,712	2,744
Installation and painting structural steel	do	285,981	9,252	29,863	39,115
Installing lamp posts	Each	6	41	213	254
Installing copper expansion strips	Linear foot		205		205
Installing electric conduits	do	904	452		452
Installing sluice gates	Pound	34,182	2,051	1,511	3,562
Extra work			2,661	42	2,703
Subtotal			102,286	64,031	166,317
Overhead, 14.5 per cent					24,152
Total cost (exclusive of liquidated damages)					190,469

Care of river.—Temporary diversion of the river was accomplished by constructing a timber flume 12 feet wide and 9 feet high on the north side of the river with inlet floor at elevation 2,142.5. The upper cofferdam was built to about elevation 2,155, and the lower cofferdam to about elevation 2,143. Both cofferdams were of rock and gravel construction with a clay blanket on the river side and were built directly on the sand and gravel bed of the river. As a result leakage through the cofferdams was excessive, necessitating the later driving of interlocking steel sheet piling and additional blanketing before the foundations could be completely unwatered. Fortunately no high water was experienced and the temporary flume took care of the river until the main river section of the dam had been completed. The flume was then dismantled and the river allowed to pass temporarily through an opening left in the dam for this purpose near the north side. This opening was later closed and the river passed through the sluice gates.

Foundation excavation.—Excavation was carried into solid rock for a depth of from 3 to 4 feet over the entire base, the cut-off trench being excavated to a 5-foot greater depth. Excavated material was removed by stiff leg derricks.

Foundation grouting.—Grout holes were drilled on 5-foot centers in the center of the keyway for the entire length of the dam. These holes ranged in depth from 25 feet in the river channel to 10 feet on the side slopes under the upper part of the abutments. Additional grout holes were drilled where the rock appeared soft or seamy. In the south half of the spillway section, downstream from the keyway, 20-foot grout holes were drilled on 10-foot centers both ways. Grout holes were started with 2½-inch diameter holes ranging down to 1-inch diameter at the bottom. In all, 107 grout holes were drilled, the total length of all holes being 2,233 linear feet. The maximum amount of grout forced into any one hole was 38½ cubic feet while several holes would take no grout. The average quantity of grout taken per hole was 4.75 cubic feet. Compressed air with pressure up to 100 pounds per square inch was used for grouting. A minimum depth of 5 feet of concrete was placed before grouting operations were started, the grout pipe, after the concrete had set somewhat, being raised above the top of the rock so that when grouting took place, the grout was free to follow any spaces which might exist between the bottom of the concrete and the underlying foundation rock.

Concreting.—Concrete in the proportion of 1:2.75:6.25 was used for the interior portion of the dam and to secure a more impermeable surface, a mix in the proportion of 1.5:2.75:6.25 was used for the exterior 3 feet of the dam. A 1 cubic yard mixer was used and the only change required to produce the richer mix was the addition of one sack of cement to the



EASTON DAM, YAKIMA PROJECT, WASHINGTON

1. Dam and headworks, looking north from Northern Pacific Railway tracks, with reservoir full. 2. Dam from north side of Yakima River, showing spillway section; fishway in lower right hand corner

batch. The change in mix was easily and quickly made by means of signals between the inspector at the forms and the checker at the mixer. Gravel up to 3 feet in size was used in the mass concrete. These mixes were adopted only after numerous tests had been made in the Ellensburg laboratory covering the strength, impermeability, and economy of various mixes. Where extra strength was required, as in thin reinforced walls, a 1:2.4:3.6 mix was used.

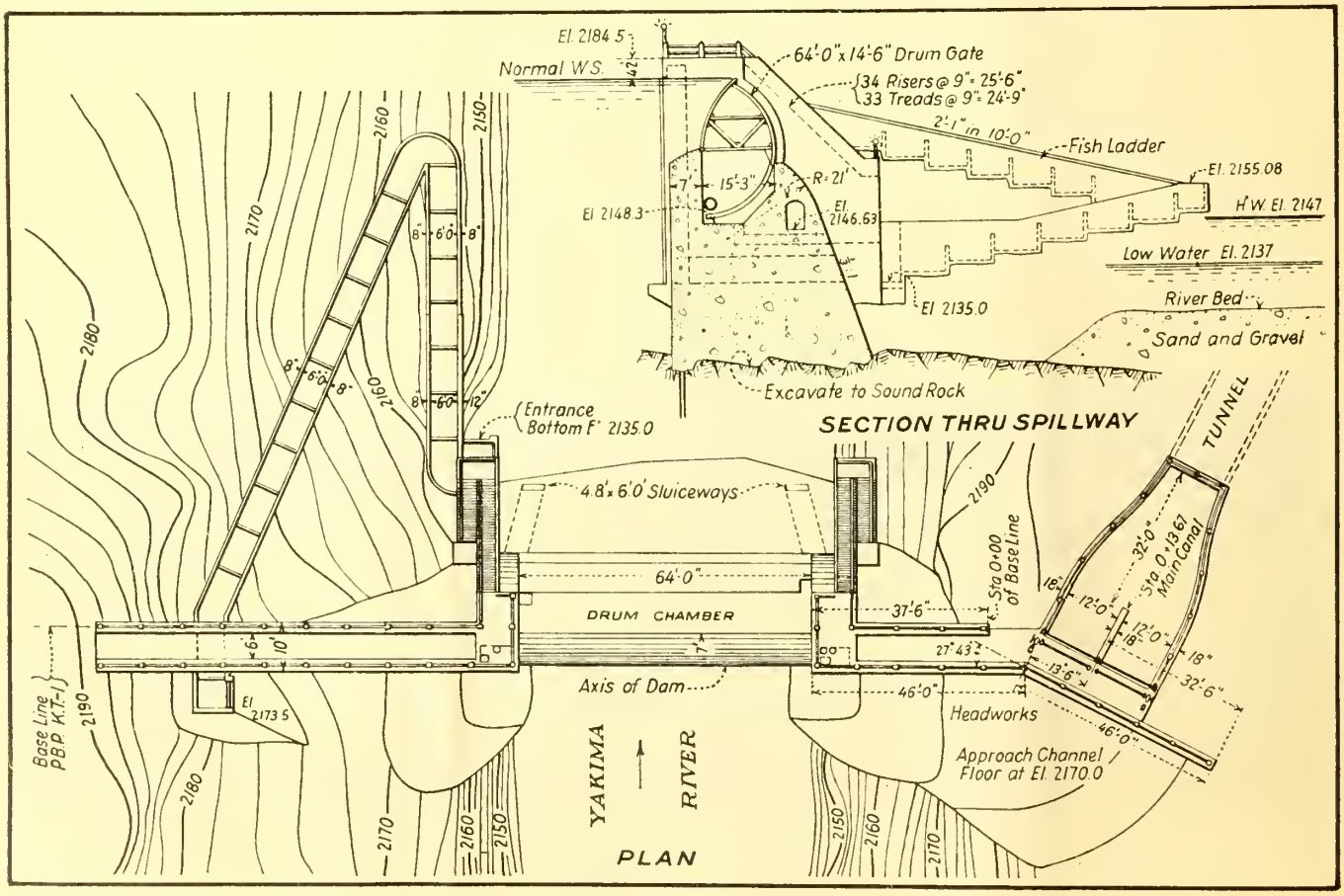
In order to secure a good bond between successive horizontal lifts, the entire surface of the old concrete, including the top and sides of the raised keys, was roughened by removing about ¾ inch of the surface with picks. The loose material was left in place and kept thoroughly wet until forms were in place for a new pour. The surface was then thoroughly cleaned, using water, air, and steel brushes. Before placing the new concrete, a thin layer (about 1 inch) of grout of 1.5: 2.75 consistency was placed on the roughened surface and brushed with steel brushes. The grout layer was followed by about a 6-inch layer of 1.5:2.75:6.25 concrete and concreting then continued with the 1:2.75: 6.25 mix for the balance of the interior pour. Concrete was placed by chuting from a tower located on the right bank of the river. All sand and gravel was shipped in from the Pioneer Sand & Gravel Co. pit located at Steilacoom, Wash. The total concrete in the dam and headworks amounts to 5,706 cubic yards.

Forms.—Metal or metal-lined forms were required by the specifications and the contractor used a metal-lined panel form 5 feet by 6 feet in size anchoring the panels by using William's type clamps on 5-foot centers vertically and 6-foot centers horizontally. One-half inch diameter anchor rods were used, being placed on approximately a 2:1 slope and anchored to loops set in the old concrete. The height of pour varied from 4 feet to 10 feet. Keyways were provided at all construction joints. The horizontal keyways were obtained by using two 2-inch by 12-inch rough planks spaced 18 inches apart at the top and 24 inches at the bottom, the two boards being held apart by two pieces of 46-pound railroad rail bent in U shape with the ball of the rail on the outside of the bend. The keyways were placed parallel to the axis of the dam on 6-foot centers. It was found that a good dense concrete could not be obtained in the keyways with the 3-foot aggregate and the richer mix with small aggregate was used for this purpose.

Erecting drum gate and wall plates.—In order to insure free working of the drum gate, a great deal of care was necessary in setting the appurtenant parts to true line and grade. In setting the 17 anchor hinges, extra care was taken to secure true alignment. The full hinges together with the 1½-inch diameter anchor bolts were assembled and set in form to line and grade with transit and level and securely braced. Concrete was then poured to within 6 feet of the bottom of the hinges. After the concrete had set, the top bracing was removed and a steel wire threaded through the bearings and sufficient tension applied to make only one center support for the wire necessary. The exact alignment and elevation was then obtained by manipulation of the lock nuts on the anchor bolts, after which the hinges were concreted in. The end wall plates were set in place after the gate itself had been erected and partly riveted.

Personnel.—Easton Dam was constructed under the general supervision of Walker R. Young, construction engineer for the Kittitas division, with Associate Engineer Archie A. Whitmore in direct charge for the United States.

IT is anticipated that in the near future border lights and a field beacon will be installed at Fly Field, the local airport on the Yuma Mesa, Yuma project, some 3 miles south of Yuma, so as to equip it for night landings. This field will be used by a shuttle air mail line from the Pacific coast.



Notes For Contractors

Boulder Canyon project.—On January 28 bids were opened at the Denver office for furnishing pumps and motors for the Boulder City water supply system. The Byron Jackson Co., of Berkeley, Calif., was low on Item 2, six horizontal pumps, 450 g. p. m., 1200-foot head, with a bid of $19,170 f. o. b. Berkeley, and resulting in a delivered cost to the Government of $20,460.47. This company was also low on Item 3, three horizontal pumps, 500 g. p. m., 170-foot head, its bid f. o. b. Berkeley being $1,470, which made a delivered cost of $1,644.21. These delivered costs for freight, and efficiency and delivery period evaluation. No award is to be made under Item 1.

Bids were also opened at Denver, during the month of February, for the following materials: On February 16 for material for a 50-foot by 150-foot steel storage warehouse; on February 19 for 20,000 barrels of cement; on February 25 for apparatus for water purification and sewage disposal plant for Boulder City.

The 10¼ miles of construction railroad from Boulder City to the dam site, for which bids were opened on January 12, was awarded to the Lewis Construction Co., of Los Angeles, Calif., with a bid of $455,509.50. Other low bidders were J. F. Shea Co., Portland, Oreg., $469,028, and Merritt, Chapman & Scott Corp., San Pedro, Calif., $486,936.

Bids will be opened at Las Vegas, Nev., on March 13, for the construction of 12 cottages, 6 of which will be four-room houses and 6 three-room. Alternative bids are being requested on a number of different types of construction. Specifications and plans have been completed for the construction of an administration building, a garage, and a dormitory. Bids will be requested for the construction of additional residences immediately after the opening of bids on March 13 for the first group.

The contract for furnishing and erecting two riveted plate-steel tanks for the Boulder City water supply, one 100 feet in diameter and 35 feet high, and one 30 feet in diameter and 19 feet high, has been awarded to the Lacy Manufacturing Co. of Los Angeles, Calif., at a total price of $21,050.

Specifications have been completed for the electrical apparatus for the Boulder City electrical distribution system; installation of the sewer and water mains; installation of the water pipe line from the river to the city; and furnishing and installing tanks for the water purification and sewage disposal plants.

Bids were opened at Denver on January 5, under invitation No. 3079-A for 28,000 railroad ties and 53 switch ties for the U. S. construction railroad, and 34 proposals were received. Award was made to the Coast Fir and Cedar Products Co. of Denver, Colo., whose bid was $12,088.11, to which was added the freight bill of $17,770.02, making a total cost of $29,858.13.

The Butterfield Construction Co. of San Diego, Calif., has the contract for constructing concrete foundations for the two water tanks at Boulder City; also building a road to the site of the tanks. The amount of the contract is $4,285.

Under invitation No. 3078-A bids were opened at the Denver office on January 6 for furnishing steel rail and track supplies for the U. S. construction railroad. Contract was awarded to the Union Pacific Railroad Co. as follows: Item 1, 1,530 gross tons (114,314 linear feet) of 90-pound relaying rail, $38,274.61; Item 2, 133 gross tons of used continuous rail joints, $3,323.85.

Explorers in Colorado River Basin

The General Land Office has published a map showing the routes of the principal explorers in the United States from 1501 to 1844, which can be found in a second edition of Geological Survey Bulletin No. 817 on Boundaries, Areas, Geographic Centers, and Altitudes of the United States and Several States.

The trail of explorers who entered or traversed the Colorado River Basin, indicated on the map facing page 32, are as follows:

1539. Margos de Niza, southeastern corner of Arizona.

1540. Coronado in 1540 entered the Colorado drainage not far east of the head of the Grand Canyon in Arizona.

1776. Dominguez and Escalante, northeastern Arizona, New Mexico, Utah, and Colorado.

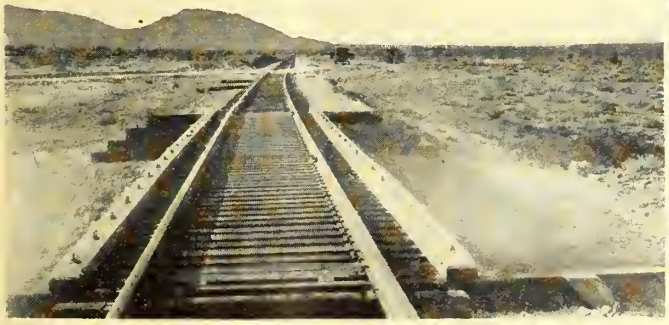
1810–12. Hunt-Astor party entered the extreme northern drainage of Green River in Wyoming, crossing over to Snake River by way of Hoback River.

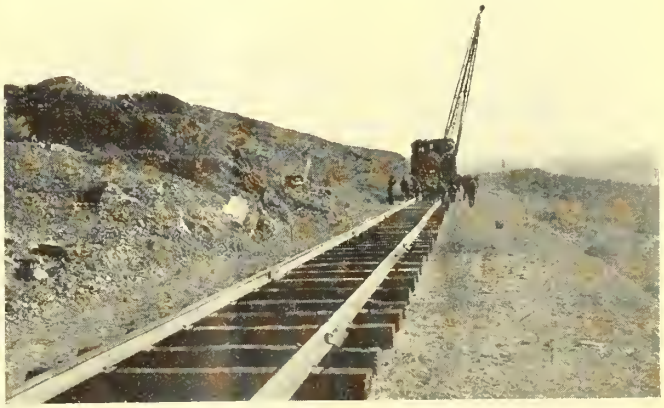
1826. Smith, Utah and northwestern Arizona on Colorado to Needles and California.

1831–1833. Bonneville, Southern Wyoming, Utah, and down Colorado to Yuma and thence to California.

1843–44. Fremont in Wyoming, Nevada, Arizonia, Utah and Colorado.

A TOTAL of 19 carloads of foodstuffs were shipped during the month to the drought sufferers in Arkansas from the North Platte Valley. Included in the shipment were potatoes, beans, flour, barley, corn, oats, carrots, cornmeal, canned goods, sugar, meat, lard, and honey. This food gift was in addition to the Red Cross drought relief quota and was consigned to the Red Cross at Wayne, Ark. The railroads transported the shipment without charge.





VIEWS OF NEW UNION PACIFIC BRANCH FROM LAS VEGAS, NEV., TO BOULDER CITY, BOULDER CANYON PROJECT

1. Railroad pass looking toward junction. 2. Track laying crew

Belle Fourche Project Had Good Season

By F. C. Youngblutt, Superintendent, Belle Fourche Project

THE Belle Fourche project came through the season of 1930 with good average crop returns, notwithstanding the shrinkage in price of grains and commodities and the prolonged dry spell that meant extra hours of labor on the farm in supplying irrigation to counterbalance the fluvial stinginess of the last half of the season. Returns of $22.38 per acre were slightly above the 5-year average, but 11 per cent below the previous year.

PROFIT IN SUGAR BEETS

Sugar beets averaged 12.3 tons per acre, or 2 tons above the 1929 mark. With the contract price remaining at $7, this crop brought good cash profits to 332 farms. Eighty-seven thousand tons were marketed from September 25 to November 10 having a gross value of $631,000, or about $89.50 per acre, including tops. Individual fields yielded as high as 26 tons per acre; but considering the farm as a unit, honors go to Oscar Reppen, of Newell, who raised 18 tons of beets per acre and had an average return of $44 per acre from diversified crops on 127 acres of irrigated land.

In discussing results of the past year, Mr. Reppen observed that a good seed bed and plenty of manure would fatten the beet check sufficiently to make this a profitable crop even in poor years when other products show red in the ledger. "Take off $25 per acre for contract labor and $1 per ton for hauling," he said, "and the balance of the work is no more burdensome than for other row crops raised on the farm." Using these figures, his crop returned $83 per acre, and, in addition, the tops provided good fall feed for the band of sheep that form the basis of operations on this farm. Aside from beets and cucumbers, Mr. Reppen markets all his crops in the form of lambs, dairy products, and poultry.

The sugar factory at Belle Fourche had a run of 94 days and sliced beets from slightly more than 10,000 acres. Including the beets under private irrigation, the pay checks to farmers of this section amounted to $885,000; and the employees' pay roll and operating expense brought total payments to the valley of something like one and one-half million dollars. Stock feeding and better farming practices, as well as increased yields of other crops, are a part of the sugar factory's ramifications that are being felt in the development of these irrigated farms. Shipments of bulky hay and marketing of small grains have almost disappeared and in their place have come the cream can, mutton and wool, hogs, poultry, and eggs. The acreage given to alfalfa has decreased 50 per cent in eight years to make room for sugar beets, corn, and other feed grains, while in the same period sheep nearly doubled in number.

GROWING OF CUCUMBERS ATTRACTIVE SIDE LINE

Growing of cucumbers for pickles continues as an attractive side line on many project farms. One hundred and eighty-three acres distributed over as many farms in 1930 produced 33,500 bushels with an average return of $150 per acre. Project salting stations shipped out 33 carloads to be processed and bottled in the Chicago plant of the Squire Dingee Pickle Co. Small patches of one-half to three acres in pickles serve to keep the Mexican help employed in picking during the part of the season when beets require no attention and also bring in neat cash sums for the landlords' share. Some of the best returns reported were from the Herman Jaskela farm, north of Newell—$275 from 1 acre—and Gus Fredlund, who lives southeast of Newell, received $445 from 2 acres.

HONEY PRODUCTION

The Belle Fourche Valley is noted for honey production in both quantity and quality. Nearly 3,000 hives dot the landscape of the project, and 100 pounds net per colony is considered only fair production where the keeper devotes his time and intelligent care to the industry. The largest apiaries, including three at

Home of J. H. Schipke, Belle Fourche Project, S. Dak.

Fruitdale and one at Newell, together produced 300,000 pounds of honey last year which went out by truck and express in all directions and left two carloads for rail shipments to more distant points. Doctor Clark's apiary at Newell has grown to 430 colonies, producing 110,000 pounds of marketable honey in 1930, valued at about $7,000. The principal apiaries at Fruitdale produced in the neighborhood of 175,000 pounds last year.

SPECIALIZED CROPS

Specialized crops and intensive production are suited to practically all portions of the project, but limitations on account of markets, hauling distance, and soil preparation require that considerable areas be given to the more conservative lines of alfalfa, dairying, and sheep feeding. These activities are going through a temporary slump because of low markets, but no doubt will remain the backbone of production along with the sugar beet industry.

The project has a number of farms that have been developed entirely from livestock profits and well-balanced operations. Mr. J. H. Schipke, who lives 7 miles northwest of Newell, purchased 80 acres of raw land in 1917 and moved under irrigation from the dry lands with a small bunch of "doggies" and a lean bank account. The first year's wheat crop equaled the purchase price of the land and enabled him to change from cattle to sheep. Three hundred to 500 ewes, a few milk cows, and poultry have placed improvements on the land valued at $10,000, and in addition have provided a livelihood for a family of 11, education for the children, and a college training for those beyond the high-school age. No cash crops are sold from the Schipke farm, and wheat grown in rotation is fed along with other grains unless the market is highly favorable. Lambs and wool, together with thrift, industry, and good management have built this farmstead, kept the taxes paid, and cleared the way for purchase of an adjoining 80 acres in 1930 which will double the livestock capacity. Hats off to the builders.

Eli Long's Ayreshires, Belle Fourche Project, S. Dak.

Newlands Holiday Turkeys Bring Good Returns

According to a recent report from the Newlands project, Nevada, shipment of turkeys by the local unit of the Northwest Turkey Growers' Association for the Christmas market amounted to 194,967 pounds, of which approximately 129,967 pounds were made up from the Newlands project. Total returns from these shipments amounted to $64,781, of which approximately two-thirds was paid to growers during the week of delivery. Carload shipments were as follows: To Los Angeles, 7; to San Francisco, 2; to Pasadena, 3. The price per pound, which was fixed by the growers, was: For prime and choice toms and hens, 33 cents; for medium toms and hens, 30 cents. The price of the Christmas crop was set by the growers association after actual orders had been placed for the entire crop. This was the first time that the buyers have ordered the turkeys and allowed the growers to fix the price, which was the same as that paid last year and reported to be the highest price obtained by turkey growers in the West during 1930.

In addition to these shipments numerous turkeys were also marketed locally and on the coast by individual growers outside of the association.

Profit in High-Grade Cattle on Sun River Project

H. L. Halladay was in Billings, Mont., several days during a recent month, where he attended the annual stock show and sale of the Yellowstone Registered Livestock Association and also looked after the sale of eight head of Hereford bulls belonging to Birch & Halladay. He reports that bidding was quite brisk, and in the case of some of the animals the final bid was twice the opening bid. With some exceptions the prices were almost equal to those obtained a year ago. Somewhat over 200 head of cattle were sold, including 25 scrub calves.

Out of 78 head of Herefords, 26 brought from $300 to $600 apiece. The others brought from $200 to $300. The Herefords averaged $270 per head and beef-strain Shorthorns $90 a head. Mr. Halladay's cattle brought an average price of $222. The high average reported for the Herefords as a whole is due to the fact that there were several show herds in the sale and there was one bull with an International Livestock Show record. He was sold for $600 to the proprietor of the Boulder Hot Springs Hotel. L. Chatterton, of Geyser, sold a bull for $575.

The bulls in the Halladay bunch were all coming 2-year-olds and they brought a price that was well up to the average and of course several times their value as beef. They went to widely separated points, some going to the extreme eastern part of the State. Of the cattle offered at the show, a number also went to Wyoming.

There was also a 4-H club fair in connection with the stock show, and a Hereford bull took first prize; a Polled Angus, second; and a beef-type Shorthorn, third.

The scrub calves sold for $25 a head and under.

A CONSIDERABLE amount of farm property changed hands during the month on the Minidoka project. One 40-acre tract southeast of Heyburn sold for $3,000 and one of the 80-acre tracts near the Minidoka Dam brought $3,500. A farm of 25 acres near Acequia brought $3,250, and one of 40 acres in the Pioneer district was disposed of for $4,500. An 80-acre tract 5 miles northeast of Rupert brought $5,000.

Encouraging Conditions on Minidoka Project

A recent issue of the Burley Bulletin published on the Minidoka project, Idaho, gives a glowing account of conditions in Burley and vicinity, reporting a normal growth, expansion, and development during the past year and a consequent optimism for the future.

The Bulletin reviews conditions in other parts of the country where business depression has been sadly felt, and takes a pardonable pride in citing Burley, Cassia County, and the Minidoka project as a whole as a bright spot in a State which has been conceded as "sitting on top of the world."

Real estate sales for Cassia County, according to the International Mortgage Bank, Overland Land & Loan Co., and the Burley Realty & Abstract Co., show transactions totaling about $210,000.

EXPANSION OF WATER SYSTEM

A marked development has been shown in Government reclamation extension. A 10 per cent increase in available water distribution has been assured by the laying aside of some $100,000 for expansion of the water capacity of the South-side Pumping Division. Over 60,000 yards of gravel were excavated in enlarging the South Side canals. A steady increase in the development and sale of power was made for the Minidoka project during the year. Commercial sales showed nearly a half million kilowatt-hours increase over 1929. The Government power lines connected with the Idaho Power Co. for the purpose of supplying the project with power during shortages supplied the power company with a great deal more power than was received.

CROP PRODUCTION AND BUILDING OPERATIONS

Crop production also showed an increase during the year. The necessity of diversification, however, was emphasized by the fact that the farmer who diversified his crops showed a profit, although low prices in some commodities caused an actual loss. Local 4-H clubs made remarkable progress during the year, and dairying advanced with the completion of tuberculosis testing and the growth and success of the Cassia County herd. The Mini-Cassia Dairymen's Association during the year paid as high as $30,000 per month for butterfat.

A normal moderate growth in building in Burley is noted by the Bulletin. The erection of two new buildings in the business district, two new farm homes, a radio station for air mail, remodeling and improvements, and the building of new structures for the Cassia County Fair demonstrate the progressive spirit of the project settlers which knows no defeat and forges steadily ahead under all conditions.

Concrete Specialists Meet

A joint meeting of the Board of Consultant Specialists on Concrete and Messrs. L. C. Hill, D. C. Henny and A. J. Wiley of the Hoover Dam Consulting Board was held at Las Vegas from January 12 to 15, and continued at Denver from January 17 to 22. The concrete board comprised P. H. Bates, chairman, of the U. S. Bureau of Standards; Franklin R. McMillan of the Portland Cement Association; Prof. Raymond E. Davis of the University of California; Prof. William K. Hatt of Purdue University; and Prof. H. J. Gilkey of the University of Colorado.

The principal object of the meetings was to consider the suitability of certain concrete materials; to outline a program of investigation to determine the properties of concrete in large masses as affected by the character of the cement; to study the transmission of heat in concrete, and methods of dissipating setting heat; and to advise the bureau which properties of concrete are of most importance in connection with the Hoover Dam.

A preliminary report was prepared at adjournment and a further report was promised in about a month. It was recommended that the Government should not undertake the manufacture of cement, unless cements having desired properties could not be obtained commercially; and that high early strength cement would not be required. The consultants also recommended that various investigations and tests be carried out before making final decision on concrete problems. These were outlined in the preliminary report and will be covered in detail in the later report. Another recommendation was that these tests be carried out at various locations depending on particular tests. These places include the U. S. Bureau of Standards, both at Denver and Washington, D. C.; the Portland Cement Association laboratory at Chicago; Purdue University; the University of California; the University of Colorado; and field offices of the bureau.

Yakima Firm Exports Fruit

The following statement shows the export shipments in car lots of fruit from the Yakima project by Richey & Gilbert during the period August 1 to December 31, 1930:

Country	Car shipments	Total car shipments	Grand total car shipments
APPLES			
Holland	36		
England	23		
Germany	22		
Greece	15		
Sweden	9		
Norway	6		
Hawaii	12		
France	4		
Miscellaneous ports	4		
		131	
Sold for cash Yakima for export		61	
Domestic shipments		277	
Total apple shipments			469
PEARS			
Export		27	
Domestic		62	
Total pear shipments			89
PEACHES, PRUNES, ETC			55
Grand total fruit shipments from Yakima by one company			613

A. G. C. Convention Addressed by Dr. Mead

At the annual meeting of the Associated General Contractors of America, held in San Francisco January 26–30, a spirit of optimism prevailed regarding the outlook for 1931 in the construction industry.

Dr. Elwood Mead, Commissioner of Reclamation, gave an inspiring talk in which he referred to Hoover Dam as the present step in a series of future developments that will be necessary to keep pace with growth in the Western States. Doctor Mead mentioned the growing necessity of water development and the benefits, both direct and indirect, that will result.

In touching upon Hoover Dam construction work he pictured the work of the contractor as great in magnitude but without complex problems. Room for construction operations at the site will be extremely limited, but careful planning of plant layout will reduce the problem to one of large-scale concrete production. Uncertainties about materials and conditions at the site are relatively less than on other projects, but the welfare of the many men and their families who must live near the dam during the long construction period warrants and has been receiving most careful thought.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, returned to Washington on February 9 from a trip to the coast, where he interviewed members of the Hoover-Young Commission with reference to the state-wide survey of water conservation; attended the annual meeting of the Associated General Contractors of America and spoke on Hoover Dam; met with interested parties on All-American Canal matters; conferred with Superintendent Priest and representatives of the Yuma project in Los Angeles relative to Yuma project matters; visited Las Vegas and Hoover damsite; and returned to Washington via Salt Lake City and Denver.

On February 10 and 12, respectively, Doctor Mead appeared before the Senate and House Committees on Irrigation and Reclamation with reference to Senate bill 6046, which authorizes an advance of $5,000,000 from the General Treasury to complete work already contracted for on present irrigation projects.

J. L. Savage, chief designing engineer, left Denver the latter part of the month to serve for the State of California on the Pine Canyon Dam consulting board.

P. A. Kinzie, engineer, left the Denver office on January 29 for Washington, where he spent several days in connection with the needle valve patent situation, returning to Denver on February 1.

Val Kuska, colonization agent of the Chicago, Burlington & Quincy Railroad, was a recent visitor on the Shoshone project.

S. O. Harper, general superintendent of construction, left Denver the latter part of the month to inspect various features of the Boulder Canyon project. From Las Vegas Mr. Harper went to Los Angeles, where he met Commissioner Mead in a conference on All-American Canal matters with the Imperial irrigation district and the Coachella Valley County water district.

Wm. J. Burke, District Counsel at Billings, Mont., spent a few days in the Washington office the latter part of the month in connection with an effort to secure railroad facilities for the Riverton project. Hearings were held by the Interstate Commerce Commission.

W. F. Kubach, Chief Accountant, left Washington on February 18 for Denver, where he will spend several days in connection with the setting up of the accounts for the Boulder Canyon project. From Denver he will go to Las Vegas, Nev., to supervise the installation of the accounting system.

Reclamation Goes Over Top in Community Chest Drive

In the recent Community Chest Campaign in Washington the quota for the Bureau of Reclamation was fixed at $375, but the 55 employees "went over the top" with 55 individual pledges, totaling $780.50, or an average of $14.19 per person Thus the Washington office more than doubled its quota and established a 100 per cent record for its entire personnel.

The accompanying photograph shows Charles N. McCulloch, Chief Clerk, holding the honor banner presented to the bureau by the campaign managers.

R. F. Walter, chief engineer, spent several days during the month in the Washington office in connection with Boulder Canyon project and general reclamation matters.

John Harvey, supervisor of classification of the Department of the Interior, spent several days recently at the Denver office gathering first-hand information regarding the staff and its operations on the Boulder Canyon project in the Denver and Las Vegas offices, after which he left for Las Vegas, Nev.

John W. Haw, director of agricultural development, Northern Pacific Railway, and D. S. Spencer, general passenger agent, Union Pacific System, with offices at St. Paul, Minn., and Salt Lake City, Utah, respectively, were in Washington during the month in connection with legislation authorizing an advance of $5,000,000 to the reclamation fund.

C. N. McCulloch, Chief Clerk, holding Community Chest banner

Yakima Project Boy Wins High Honor at Chicago Livestock Show

By A. S. Harker, Yakima Project

AT THE International Livestock Exposition in Chicago, from November 23 to December 5, Keith Jones, an 18-year-old Yakima Valley boy, won honors as junior-champion husbandman of the United States, in competition with champions from 32 States, receiving a $300 college scholarship at Washington State College where he has this year entered as a freshman in the agricultural course. He had previously qualified for entry in this contest by being selected the section champion of the Western States, securing the award of a prize trip to the National 4-H Club Congress and the International Livestock Exposition. Keith was also named the winner in a State-wide meat animal livestock project and in recognition of this achievement was awarded a 19-jewel gold watch by Thomas E. Wilson, prominent livestock breeder and chairman of the national committee on boys' and girls' club work.

For the past eight years Keith has been active in the 4-H club and has been engaged in baby beef, sheep, and swine club work and during the last three years he has added corn and dairy projects. On the basis of showmanship, herdsmanship, record book, and his animal, he won a $75 lamb awarded this year by the Roselawn Farm at the Pacific International Livestock Exposition at Portland, Oreg. His animal won second in the display, but his record in the other lines won the first prize. He also won first prize on a calf exhibit. The prize was a purebred shorthorn calf valued at $150 and awarded by Jack Napier. Both of these exhibits were judged on the same basis. He has exhibited champion steers at the Portland exposition on several other occasions.

Keith has been a member of the Yakima County 4-H judging team and has twice competed at the Spokane Interstate Fair, the Pacific International Livestock Exposition at Portland, and the Washington State Fair at Yakima. In this work he has made a very creditable record, being on the judging team which this year took first place at the Spokane fair and at the Washington State Fair at Yakima. This is the first time in history that a Yakima County judging team has taken first prize at both shows.

Keith Jones, 18-year-old champion husbandman

His club records show gross returns of $6,439 and a net return of $2,909 from his livestock projects. This year he won $500 in prizes by exhibiting his stock in 4-H contests. His premium winnings totaled $1,083. As a club member Keith has completed 21 years of work in baby beef, sheep, swine, dairy, and corn club enterprises and has steadily increased the size of his projects. In 1923 he owned two head of baby beeves and this year the number has been increased to 11 head. He started his sheep enterprise in 1926 with two head and now owns a flock of 12 purebred Hampshires. His herd of swine numbers 10, and has grown from four head in 1927.

Keith's achievements are especially noteworthy for the reason that his success has been won by hard work in developing his livestock, having started his work with common stock and not with expensive purebred animals.

Keith is the son of Mr. and Mrs. R. L. Jones, who reside on a farm under the Sunnyside division of the Yakima project about halfway between Grandview and Sunnyside, Wash. They also have two other children who are interested in 4-H club work.

Sheep owned by Keith Jones

Mrs. Iva M. McFadden has written a very interesting article on the Yuma Mesa, Yuma Federal reclamation project, for the Los Angeles Times, which was printed in the magazine section on Sunday, January 11, 1931, as follows:

Can't Stump Uncle Sam

The mesa was higher than the water, but Government engineering proved equal to the task

The United States plays such a multitude of rôles that the term "government" is loosely used to mean any number of things. In fact, to each of us it probably signifies something different because of our contact with it.

Those projects where the Government has gone about the business of helping people acquire and develop land have an interesting history. One such, which has been instrumental in bringing under irrigation 110,000 acres of desert land, lies on the border of southern California. It is known as the Yuma reclamation project, and though the general impression is that this is an Arizona affair, 15,000 of these acres are in California, while the entire intake is also on this side of the Colorado River. Of the bulk of the land lying in Arizona, 50,000 acres are in Yuma Valley proper and the other 45,000 on Yuma Mesa.

Since all these lands are higher than the river, it is necessary to lift the water above the level of the main stream.

This is the mission of Laguna Dam, which is not a storage reservoir as we are apt to interpret the word "dam," but a diversion dam of the Indian weir type. It is 4,780 feet long and raises the water level 19 feet above the old river bed. Desilting basins lie between this and the canal system, so that at least 25 per cent of the sediment is removed there, and these basins may be sluiced through gates that are electrically controlled. Thirteen and one-half miles of canals carry the water down to a point nearly opposite Yuma, irrigating the California lands of the Bard section and the Indian reservation on the way, whence the water is taken under the Colorado through an inverted syphon and reaches the Arizona side to irrigate the valley lands by gravity.

Gravity, however, will not function on the mesa since it is 60 to 70 feet above the lower lands along the river. To irrigate this, the Government has installed electric pumps to boost the water from the canals in the valley up to this higher level. The system now being used will irrigate 38,000 acres, though, as a matter of fact, only about 1,300 are actually developed and using water. Outside of the actual Government project, there are said to be some 70,000 additional acres which could be brought into the project.

AN INTERESTING AREA

This Yuma Mesa is easily one of the most interesting of our agricultural areas awaiting development. It is a part of the Yuma district which the casual traveler does not see because it lies off from the main arteries, and is some distance from the city itself. But it is a remarkably large stretch of relatively level land composed of a sandy or gravelly soil that seems to be very well drained. Apparently at one time the actual Yuma Valley was the bed or overflow land of the Colorado, while this was dry and above inundation. That elevation to-day gives it a great advantage in the matter of temperature, and it is declared to have a very mild winter climate.

SAGA OF HOOVER DAM

(Copyright by author, "Jane Hilton") [1]

Awake! ye grim Nevada hills!
Give back the cry to deserts gray!
Call on the worlds for witnessing
Of high emprise begun this day!
Give tongue! give tongue, ye western winds
To what Man's daring dream hath wrought
Through resistless strength of sustaining Faith
And the building power of Thought.

'Mid sun-drenched desert and wind-scarred rock
Whose romp obuts the stars,
Where wolf roomed wild when the West was young
And grinning Death claimed, one by one,
The bold adventurers
Who flung courageous challenge
To the desolate desert wide,
Who fought with Fate where their bones lie bleached,
Where they suffered, starved, and died—
Since Time's far dawn knew trace of life
In the land of little rain,
"Water!" has been the cry of Earth,
The moan of the sun-parched plain.
"Water, that I may bring to birth
All that I bear within!
Water! to keep my sons alive!
Water! that they may win
Their valiant losing battle
With the bitter, barren soil
That needs must fail them in damning drought,
Though the raging torrents boil
'Twixt two stern steeps of granite grey,
Sentries full grim, that hold
The water's life from my dying sons
Who chanted their challenge bold!"

The years fled past, and the cliffs still held
Their silent watch and word—
Well did they know the treasure's worth
That they were set to guard.
But Man dreamed on of a day when he,
Through the harnessing of force,
Might master those storming waters
On their wild and wasteful course,
And set them to turning turbine wheels
To generate the might
That should minister to a thousand needs
And bring into being light
To shame the stars and the pitiless sun
That mocked at the mad Earth's pain,
And gave for her prayers an answering stone
In the land of little rain.

And now shall that dream stand bodied forth,
For a million years to span
From cliff to cliff, to impound the flood
And minister to Man.
He shall harness the river's wrathful surge,
He shall tame the sullen stream;
He shall build a bulwark as wide and high
As the height and depth of his dream.
He shall carve the cliffs and turn their strength
Against the foaming flood
Until it has worked his will for him,
Until he shall say "'Tis good!"
The whir of the wheels of industry
Shall sing where the wolf howled lone,
And the children of Man, in a future day,
Shall know the peace of home
Where the bones of their grandsires bleached and burned
In the land of little rain.
They shall measure the worth of a land's rebirth
In a mighty labor pain.

[1] Pen name used by Mrs. Zoe Evalyn Gregory, of Reno, Nev.

The development which has taken place on the mesa is largely citrus. In fact it is doubtful if anything else will be planted. At least only permanent crops would seem to be able to afford the expense that is necessary to irrigate lands where one must go to such pains to bring water. Type of soil, drainage, and temperature point to it as a natural citrus district, and the trees that are already planted seem to prove that it is admirably well suited to such development.

Uncle Sam still owns much of the land. When Yuma Mesa was first put up for auction, the Government opened it at a minimum of $225 per acre. After the sale it was found that it averaged between $227 and $229 per acre for the land and construction charges. The present price is $232 per acre, which includes the charge for bringing the water to the land. It is considered that the flat cost for construction of the water system for the mesa is $200 per acre, the balance being cost of the land. The Government is very lenient in the matter of payments, 10 per cent being the down payment, the rest being spread over nine years. Deferred payments bear 6 per cent interest.

The Government, for these considerations, brings the water to each piece of land, as it is developed, in flumes, cement ditches, or underground pipes as seems advisable. For 3 acre-feet or less of water used each year, the charge is $15 per acre. More than 3 feet is paid for at the rate of $3.50 an acre-foot.

The further development of the mesa will come from those who have sufficient capital to carry some permanent crop on to a self-paying basis. Those who have already done this have trees of very fine appearance. Grapefruit is the prevailing crop, though at present a great deal of attention is being paid the Valencia orange. Navels were the first type of orange to be tried in the earlier days, but the mesa, like other desert areas, does not seem to be able to set a heavy crop. Valencias, however, escape the shortcoming of the navels, and set a good crop. This, and the fact that the desert Valencia will ripen about the time the heavy navel shipments are over, and before the coast Valencias come in, make them seem like a "good bet." At least some of the mesa landowners are giving them a thorough trial. Most of these trees are quite young, for Valencias are a new crop, only recently undertaken.

GRAPEFRUIT GROVES DO WELL

Grapefruit plantings, on the other hand, are old enough to prove that they do remarkably well. The trees have an especially fine color, most noticeable at

(Continued on p. 68)

Administration of Federal Farm Loan Acts and Methods of Amortization—Their Benefits to Borrowers

THE Federal farm loan act, which is administered by the Federal Farm Loan Board under the acts of July 17, 1916, and March 4, 1923, was designed to provide capital for agricultural development, to create standard forms of investment based upon farm mortgages, to equalize rates of interest upon farm loans, to furnish a market for United States bonds, and to create Government depositaries and financial agents for the United States.

The principal features set forth in this article are to show the advantages of amortized farm loans, the protection afforded debtors, how to organize and conduct farm loan associations, to show the merits and advantages of farm loan bonds, and the elasticity for expansion and contraction of credits to the farmers, also several tabulations and problems from which determination can be made to find the annual and semiannual payments and to find the period of time, the rate of interest, and the remaining capital due after the payment of a number of annuities.

By the creation of the Federal farm loan act, the foundation of really the first extensive and efficient system of agricultural banking in the United States under Federal control and direction with unlimited resources to meet any requirements that may materialize through the growth of the plan, has been the institution of the Farm Loan Board, Federal farm land banks, national farm loan associations, and the joint-stock land banks.

ORGANIZATION AND POWERS OF BOARD

The Federal Farm Loan Board consists of seven members, including the Secretary of the Treasury, who is a member and chairman ex officio. The other six members are appointed by the President of the United States by and with the advice and consent of the United States Senate. Of the six members appointed not more than three are appointed from one political party. All are citizens of the United States and are required to devote their entire time to the business of the board. The purpose and powers granted to this board under the act are briefly as follows:

1. To divide the continental United States, excluding Alaska, into 12 districts and organize, charter, and establish a Federal land bank in each district and to charter national farm loan associations and joint-stock land banks.

2. To appoint a farm loan register, land bank appraisers, and land bank examiners in each district.

3. To receive applications for issue of farm loan bonds.

4. To review and alter the rate of interest to be charged by Federal land banks.

5. To make rules and regulations respecting the charges made to borrowers on loans for expenses of appraisal, determination of titles and recording of same.

6. To exercise general supervisory authority over the Federal land banks, the national farm loan associations and the joint-stock land banks.

Before commencement of business every Federal land bank must have a subscribed capital stock of not less than $750,000, which shall be divided into shares of $5 each and may be subscribed for and held by any individual, firm, or corporation or by the government of any State or of the United States. When a bank is designated and selected by the Secretary of the Treasury it shall be a depositary of public funds, it shall issue and sell farm loan bonds, subject to the approval of the Federal Farm Loan Board and it shall invest the funds in qualified first mortgages on farm lands.

FARM LOAN ASSOCIATIONS

Corporations, to be known as national farm loan associations, may be organized by persons desiring to borrow money on farm mortgage security. The articles of the associations shall specify in general terms the object for which they were formed, the territories within which operations are to be carried on and any other conditions, not inconsistent with the law. Said articles must be signed by all the persons uniting to form the association or associations, and copies of the articles are required to be filed with the Federal land bank for the respective districts. Ten or more persons who are the owners or about to become owners of farm lands qualified as security for a mortgage loan may unite to form a national farm loan association, with a board of directors of five members only and a secretary-treasurer, who need not be a shareholder of the association. When the articles of the association are forwarded to the district Federal land bank it shall be accompanied by an affidavit stating that each of the subscribers is the owner or about to become the owner of farm land; that the loan desired by each person is not more than $10,000 nor less than $100; and that the aggregate of the loans is not less than $20,000, to which must be attached a subscription to stock in the Federal land bank equal to 5 per cent of the aggregate sum desired on mortgage loans.

HOW TO OBTAIN A LOAN

Whenever any person desires to secure a loan on a first mortgage he shall make application for membership to the national farm loan association of his district, stating the amount of the loan desired and subscribing for capital stock to the extent of 5 per cent of the loan requested, which subscription must be paid in cash upon the granting of the loan. Upon receipt of the application by the national farm loan association it is referred to the loan committee who will examine the land offered as security and make a detailed written report, giving an appraised valuation and other appurtenant information as may be required.

A loan may be requested to provide funds for the purchase of land for agricultural uses, farm equipment, fertilizer, livestock, buildings, and improvements of farm lands, also to liquidate indebtedness of land mortgages. No loan, however,

ANNUAL INSTALLMENTS

The annuity which will amortize a capital of $1 at a fixed rate of compound interest for 1 to 40 years.

Year	3 per cent	3½ per cent	4 per cent	4½ per cent	5 per cent	5½ per cent
1	$1.0300000	$1.0350000	$1.0400000	$1.0450000	$1.0500000	$1.0550000
2	.5226108	.5264011	.5301960	.5339975	.5378048	.5416180
3	.3535303	.3569367	.3603485	.3637736	.3672085	.3706547
4	.2690271	.2722527	.2754908	.2787444	.2820121	.2852951
5	.2183546	.2214827	.2246279	.2277923	.2309751	.2341764
6	.1845985	.1876691	.1907625	.1938783	.1970177	.2001788
7	.1605068	.1635451	.1666103	.1697014	.1728199	.1759642
8	.1424568	.1454773	.1485281	.1516095	.1547219	.1578639
9	.1284342	.1314464	.1344934	.1375745	.1406901	.1438394
10	.1172308	.1202417	.1232912	.1263789	.1295047	.1326677
11	.1080776	.1110924	.1141493	.1172483	.1203889	.1235705
12	.1004622	.1034845	.1065524	.1096662	.1128254	.1160291
13	.09402979	.09706190	.1001439	.1032753	.1064558	.1096842
14	.08852656	.09157104	.09466916	.09782034	.1010240	.1042790
15	.08376672	.08682834	.08994124	.09311378	.09634230	.09962547
16	.07961095	.08268510	.08582018	.08901536	.09226992	.09558242
17	.07595263	.07904332	.08219868	.08541758	.08869914	.09204184
18	.07270883	.07581702	.07899347	.08223689	.08554620	.08891978
19	.06981408	.07294045	.07613870	.07940734	.08274500	.08615000
20	.06721580	.07036125	.07358187	.07687610	.08024255	.08367926
21	.06487186	.06803674	.07128021	.07460056	.07799612	.08146470
22	.06274751	.06593224	.06919890	.07254561	.07597052	.07947119
23	.06081399	.06401896	.06730914	.07068246	.07413683	.07766959
24	.05904751	.06227295	.06558696	.06898703	.07247088	.07603533
25	.05742796	.06067418	.06401204	.06743900	.07095248	.07454931
26	.05593841	.05920550	.06256747	.06602133	.06956432	.07319302
27	.05456429	.05785250	.06123860	.06471946	.06829186	.07195225
28	.05329331	.05660278	.06001304	.06352080	.06712255	.07081433
29	.05211476	.05544553	.05888003	.06241461	.06604555	.06976853
30	.05101934	.05437144	.05783015	.06139154	.06505144	.06880534
31	.04999900	.05337249	.05685540	.06044346	.06413211	.06791661
32	.04904670	.05244161	.05594869	.05956318	.06328046	.06709513
33	.04815619	.05157254	.05510364	.05874450	.06249007	.06633465
34	.04732203	.05075976	.05431482	.05798190	.06175546	.06562955
35	.04653934	.04999843	.05357736	.05727047	.06107173	.06497486
36	.04580384	.04928423	.05288694	.05660577	.06043447	.06436631
37	.04511166	.04861330	.05223961	.05598401	.05983980	.06379988
38	.04445939	.04798222	.05163200	.05540168	.05928423	.06327210
39	.04384390	.04738780	.05106087	.05485566	.05876563	.06277988
40	.04326242	.04682736	.05052353	.05434315	.05827817	.06232031

SEMIANNUAL INSTALLMENTS

The semiannuity which will amortize a capital of $1 at a fixed rate of compound interest for 1 to 40 years.

Installments	3 per cent	3½ per cent	4 per cent	4½ per cent	5 per cent	5½ per cent
1	$1.0150000	$1.0175000	$1.0200000	$1.0225000	$1.0250000	$1.0275000
2	.5112780	.5131666	.5150495	.5169405	.5188271	.5207204
3	.3433856	.3450682	.3467545	.3484499	.3501397	.3518346
4	.2594471	.2610324	.2626242	.2642224	.2658175	.2674211
5	.2090893	.2106226	.2121598	.2137013	.2152471	.2167987
6	.1755273	.1770231	.1785263	.1800354	.1815503	.1830711
7	.1515573	.1530308	.1545134	.1560003	.1574952	.1589978
8	.1335854	.1350428	.1365093	.1379853	.1394673	.1409582
9	.1196112	.1210582	.1225152	.1239816	.1254569	.1269413
10	.1084352	.1098756	.1113263	.1127878	.1142586	.1157400
11	.09929477	.1007303	.1021777	.1036367	.1051058	.1065866
12	.09168084	.09310410	.09455956	.09601762	.09748689	.09896882
13	.08524082	.08667236	.08811828	.08957708	.09105481	.09253274
14	.07972382	.08115582	.08260172	.08406256	.08553636	.08702472
15	.07494485	.07637753	.07782537	.07928854	.08076622	.08225928
16	.07076563	.07219965	.07365007	.07511682	.07659884	.07809724
17	.06708008	.06851640	.06996976	.07144058	.07292762	.07443192
18	.06380620	.06524493	.06670201	.06817739	.06966998	.07118075
19	.06087886	.06232077	.06378168	.06526200	.06676050	.06827815
20	.05824611	.05969134	.06115657	.06264217	.06414696	.06567186
21	.05586580	.05731479	.05878465	.06027581	.06178720	.06331950
22	.05370370	.05515650	.05663133	.05812833	.05964648	.06118648
23	.05173112	.05318806	.05466799	.05617108	.05769627	.05924420
24	.04992439	.05138577	.05287101	.05438035	.05591268	.05746873
25	.04826375	.04962960	.05120033	.05273607	.05427583	.05584009
26	.04673225	.04818329	.04969915	.05122144	.05276864	.05434126
27	.04531552	.04679090	.04829299	.04982196	.05137678	.05295786
28	.04400131	.04548159	.04698958	.04852536	.05008786	.05167748
29	.04277902	.04426430	.04577828	.04732091	.04889119	.05048945
30	.04163943	.04312984	.04464988	.04619940	.04777755	.04938450
31	.04057449	.04207013	.04359629	.04515286	.04673890	.04835460
32	.03957726	.04107820	.04261052	.04417421	.04576823	.04739272
33	.03864164	.04014786	.04168651	.04325728	.04485930	.04649261
34	.03776207	.03927374	.04081864	.04239662	.04400658	.04564882
35	.03693383	.03845090	.04000212	.04158738	.04320549	.04485652
36	.03615260	.03767513	.03923277	.04082528	.04245150	.04411138
37	.03541456	.03694253	.03850669	.04010652	.04174083	.04340959
38	.03471635	.03624996	.03782048	.03942762	.04107004	.04274771
39	.03405481	.03559405	.03717106	.03878549	.04043608	.04212263
40	.03342728	.03497216	.03655566	.03817741	.03983616	.04153159
41	.03283123	.03438177	.03597181	.03760091	.03926781	.04097207
42	.03226440	.03382062	.03541724	.03705369	.03872869	.04044181
43	.03172480	.03328672	.03488987	.03653369	.03821683	.03993877
44	.03121052	.03277815	.03438787	.03603906	.03773030	.03946105
45	.03071951	.03229326	.03390955	.03556810	.03726744	.03900697
46	.03025140	.03183048	.03345335	.03511926	.03682670	.03857498
47	.02980358	.03138841	.03301785	.03469112	.03640663	.03816363
48	.02937514	.03096574	.03260178	.03428236	.03600595	.03777161
49	.02896492	.03056130	.03220390	.03389184	.03562342	.03739777
50	.02857183	.03017397	.03182316	.03351840	.03525800	.03704098
51	.02819481	.02980276	.03145851	.03316105	.03490865	.03670019
52	.02783300	.02944668	.03110903	.03281886	.03457442	.03637449
53	.02748550	.02910497	.03077386	.03249097	.03425444	.03606302
54	.02715151	.02877677	.03045222	.03217657	.03394793	.03576496
55	.02683030	.02846133	.03014333	.03187494	.03365414	.03547958
56	.02652118	.02815798	.02984651	.03158534	.03337238	.03520617
57	.02622351	.02786611	.02956115	.03130716	.03310198	.03494409
58	.02593673	.02758508	.02928662	.03103984	.03284239	.03469275
59	.02566023	.02731434	.02902240	.03078271	.03259303	.03445158
60	.02539354	.02705341	.02876791	.03053536	.03235336	.03422007
61	.02513615	.02680177	.02852274	.03029726	.03212291	.03399772
62	.02488761	.02655895	.02828639	.03006798	.03190122	.03378407
63	.02464751	.02632458	.02805844	.02984706	.03168786	.03357871
64	.02441544	.02609825	.02783850	.02963413	.03148244	.03338122
65	.02419104	.02587954	.02762620	.02942881	.03128460	.03319125
66	.02397396	.02566818	.02742118	.02923072	.03109394	.03300840
67	.02376384	.02546376	.02722311	.02903957	.03091019	.03283240
68	.02356041	.02526600	.02703168	.02885502	.03073296	.03266289
69	.02336337	.02507462	.02684661	.02867679	.03056202	.03249958
70	.02317244	.02488933	.02666761	.02850461	.03039709	.03234221
71	.02298735	.02470988	.02649442	.02833819	.03023788	.03219050
72	.02280787	.02453603	.02632678	.02817731	.03008414	.03204424
73	.02263376	.02436752	.02616451	.02802172	.02993566	.03190314
74	.02246481	.02420417	.02600732	.02787121	.02979218	.03176701
75	.02230081	.02404573	.02585505	.02772555	.02965354	.03163563
76	.02214154	.02389204	.02570748	.02758458	.02951952	.03150881
77	.02198685	.02374288	.02556443	.02744809	.02938993	.03138636
78	.02183653	.02359809	.02542573	.02731591	.02926461	.03126809
79	.02169044	.02345750	.02529120	.02718785	.02914335	.03115384
80	.02154840	.02332096	.02516067	.02706377	.02902601	.03104345

may exceed 50 per cent of the value of the land mortgaged and 25 per cent of the permanent insured improvements thereon, which value is ascertained by the appraisers of Federal land banks.

Every mortgage contains a stipulation for the repayment of the loan on the amortization plan, by means of a fixed annuity or semiannuity covering first, a charge on the loan; second, a charge for administration and profits at a rate not exceeding 1 per cent, said two rates combined constituting the interest rate on the mortgage; and third, such amounts to be applied on the principal as will amortize or extinguish the debt within an agreed period of not less than 5 years, nor more than 40 years.

Extracts from the Federal farm loan act on farm loan bonds, provide that Federal or joint-stock farm loan bonds must be secured by collateral deposited with a farm loan register. When a Federal land bank makes application to the Federal Farm Loan Board for an issue of farm loan bonds, it must tender with the application as collateral security first mortgages on farm lands or United States Government bonds, not less in the aggregate amount than that of the bonds proposed to be issued. Bonds are issued in denominations of $40, $100, $500, and $1,000, and shall run for a specified mini-

mum and maximum period, subject to payment and retirement at the option of the land bank. They have interest coupons attached, payable semiannually, and shall be issued in series of not less than $50,000. They bear a rate of interest not to exceed 5 per cent per annum and they are not taxable by national, State, municipal, or local authorities.

From the foregoing it may be readily surmised that the security of the bonds issued by the Federal farm loan banks having as collateral first mortgages on carefully appraised farm lands really increases in value each year and as a farmer pays his annual or semiannual installment covering the interest and the amortization quota, he thereby reduces his loan and by this reduction of the loan automatically increases the value of the collateral security of the mortgage.

ELASTICITY OF CREDIT PROVIDED

The elasticity for expansion and contraction of credits to farmers is evident from the Federal farm loan act that the credit capacity of the system has the unique advantage of expanding and contracting credit to the farmers according to their need. There are 12 land banks, with a capital stock of $750,000 each and according to the act each land bank may borrow by issuing bonds twenty times its capital secured by first mortgage on farm lands and indorsed by the Federal farm loan association. Futhermore, each association in securing a loan from the land bank for one of its members is required to subscribe to the capital stock of the land bank in an amount equal to 5 per cent of the secured loan; therefore, the automatic credit expansion of the land bank is somewhat as follows:

Capital of a land bank	$750, 000
Bond issued, twenty times the capital	15, 000, 000
New captial subscribed at 5 per cent of the loans on $15,000,000	750, 000
New bonds issued twenty times the new capital	15, 000, 000

Therefore, there is no limit to the expansion of credit for the ultimate benefit and use of the farmers. The contraction of credit also results automatically, because the land banks are required to pay off the farm loan bonds whenever they mature and to purchase them at par or below par from the funds of the amortization quotas, and other payments made on the principal of the first mortgages.

PROBLEMS

When the borrowed capital, the rate of interest, and the period of time are known, the annuity can be determined from the accompanying annual and semiannual installment tables as follows:

If a farmer, through the farm loan association of which he is a member, borrows from the Federal land bank of his district $2,500 at 4½ per cent interest per annum, which is to be redeemed or liquidated in 15 years in 15 equal annual installments, the solution is as follows:

The table of annual installments shows that $1 for 15 years at 4½ per cent is $0.09311378; therefore the annuity of $2,500 will be:

$$\$0.09311378 \times 2{,}500 = \$232.78$$

Similarly, if the above loan is to be redeemed in 20 years, in 40 semiannual installments at 5 per cent interest, by referring to the table of semiannual installments it will be found that $1 for 20 years, or 40 installmentsat 5 per cent, is $0.03983616; therefore, the semiannuity of $2,500 will be:

$$\$0.03983616 \times 2{,}500 = \$99.59$$

If a farmer finds he can spare from his annual income approximately $200 and desires to know the amount he can borrow at a given interest rate of 5 per cent for 20 years, he may refer to table of annual installments, which shows that $1 at 5 per cent in 20 years is $0.08024255; therefore, with an annuity of $200 the capital it will amortize will be:

$$\$200.00 \div 0.08024255 = \$2{,}492.44$$

In a case where the farmer knows the capital borrowed, the annuity, the period of time, and the rate of interest, and desires to know the amount of the remaining capital due after a payment of a number of annuities the procedure is as follows: Find what is the remaining capital after a payment of six years, for example, of $320.97 each, the loan being made for 20 years at 5 per cent on $4,000. Divide the annuity of the loan by the annuity of $1 for the remaining length of time as follows: The annuity of $1 for the remaining 14 years is $0.1010240, as found in the table, under 5 per cent column, line of 14 years; therefore $320.97 ÷ 0.1010240 = 3177.18 remaining capital due.—*Herbert R. Pasewalk, Assistant Chief Accountant, Washington Office.*

Bureau of Reclamation

The annual payments required to be made from the reclamation fund to the general funds in the Treasury, as reimbursement for advances made in accordance with the provisions of the act 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," approved June 25, 1910, as amended, are hereby suspended for a period of two years beginning with the fiscal year ending June 30, 1931.—*Extract from first deficiency act, fiscal year 1931, approved February 6, 1931.*

THE Vale Owyhee Government Projects Land Settlement Association received by mail during the month 43 inquiries relative to project lands, in addition to personal interviews with 13 interested prospects who called at the office. Twenty requests for information regarding the five farm units of public land opened to entry on February 9 had been received by February 1.

A new home on the Yakima Project, Wash.

Wyoming Court Upholds Contract

(Continued from p. 53)

can not legally supply water for appellant's lands in excess of 160 acres, and therefore such lands will receive no benefit that can support an assessment for construction charges.

"The State irrigation district laws contain nothing to prevent the district from supplying water for appellant's lands in excess of 160 acres. It is contended by the district that the prohibition of the Federal act has no application after the United States has transferred to a State irrigation district the care and operation of the project works, charging the district with construction costs that include expenses incurred in providing for irrigation of tracts exceeding 160 acres held by one landowner. That question we need not decide, but shall assume for the purpose of this case that the district is bound by the prohibition of the Federal act.

"Granting then, that the district can not legally sell water for irrigation of appellant's lands in excess of 160 acres, we are of opinion that it does not follow that the excess lands are not benefited. The history of the Fort Laramie unit, particularly the trust deed of May 12, 1915, shows that appellant, in order to conform to the Federal laws, and induce the United States to construct the unit works for the benefit of appellant's lands, consented to dispose of its excess holdings pursuant to the plan outlined in the trust deed. After the construction of the unit works whereby water has been made available for irrigation of the lands, the appellant can not be heard to say that excess lands which it retains are not benefited.

"Appellant's answer to this is that the Secretary of the Interior abandoned the plan outlined in the trust deed by failing to give public notice. It seems to be agreed that no public notice affecting the lands in question has been or will be given. The trust deed, as shown above, provides that, 'after five years from the date of the first public notice' excess lands of appellant that have not been disposed of in accordance with the plan thereinbefore outlined, shall be sold at public auction on the direction of the Secretary of the Interior."

(To be continued in April issue)

EQUIPMENT consisting of a radio directional beacon, teletype receiving system, and short and long wave receiving and sending radio equipment with a wide receiving and transmission radius, is in transit for equipping an emergency landing field on the southern air mail route at Wellton, Ariz., some 40 miles east of Yuma.

Pending Legislation

H. R. 16422, "A bill authorizing the establishment of Boulder City town site, and necessary expenditures in connection therewith, and for other purposes."

The bill was introduced January 21, 1931, by Congressman Arentz, of Nevada.

It provides for the establishment and operation, under the direction of the Secretary of the Interior, of a town site in the vicinity of construction work on Hoover Dam and appurtenant structures for the use of the employees of the Government and of the contractor. The nearest town to the site of the dam is approximately 30 miles distant, and is too far to be considered as a place of residence for those to be employed on the work.

Authority is given by the bill to the Secretary of the Interior to expend funds from the Colorado River dam fund established by the Boulder Canyon project act.

January 27, 1931, the Secretary of the Interior submitted to the chairman of the House Committee on the Public Lands a memorandum from the acting commissioner of the bureau recommending favorable consideration of the bill. The Secretary concurred in Mr. Dent's recommendation.

January 31, 1931, the bill was favorably reported out of committee, with recommendation that it pass without amendment.

A similar bill, S. 5797 introduced January 21, 1931, by Senator Oddie, was favorably reported by the Senate Committee on Irrigation and Reclamation under date of January 26, 1931, without amendment. This bill passed the Senate February 10, 1931.

H. R. 16215, "A bill authorizing the sale of surplus power developed under the Grand Valley reclamation project, Colo."

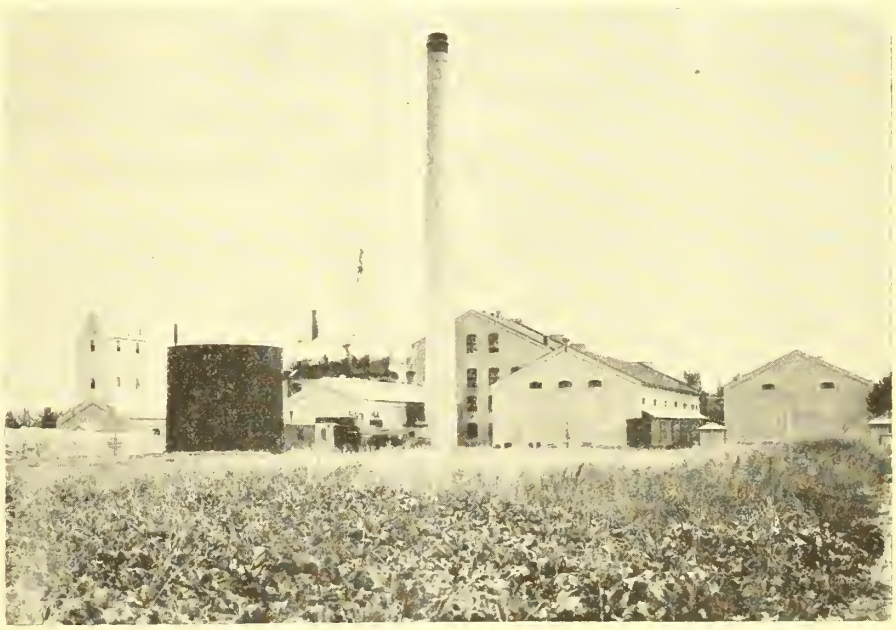
Introduced January 15, 1931, by Congressman Taylor, of Colorado.

The purpose of the bill is to authorize the Grand Valley Water Users' Association to provide for this development at its own expense, or to enter into a contract with a private corporation for the development. The bill would also authorize the extension of the contract period from 10 years, the present time limit under the law, to 25 years.

January 24, 1931, the Secretary of the Interior transmitted to the chairman of the House Committee on Irrigation and Reclamation a memorandum submitted by Commissioner Mead, recommending favorable consideration of the bill, if amended to eliminate as inapplicable the clause providing that the money derived from the sale or development of power be credited in accordance with subsection I of section 4, act of December 5, 1924. The Secretary expressed agreement with Commissioner Mead.

January 30, 1931, the bill was reported by the committee with recommendation for passage, with amendment suggested by the Bureau of Reclamation.

February 2, 1931, a bill, S. 5981, similar to amended H. R. 16215, was introduced in the Senate by Hon. L. C. Phipps, of Colorado.



Grain elevators at Meridian, Boise Project, Idaho

Can't Stump Uncle Sam

(Continued from p. 63)

this time of year when so many grapefruit trees in the various desert districts have a tendency to look yellow. Whether this fresh green which the mesa trees are able to maintain is because of the general suitability of the soil and climate, or more specifically is due to drainage, has not been determined. Certainly all well-kept groves may be freely watered and still hold a remarkably fine color.

Seven-year-old grapefruit trees are yielding five and six boxes to the tree, and the fruit has both wonderful size and texture. For the most part it is being sold through the California Fruit Growers' Exchange, and is packed in Yuma by the Desert Grapefruit Co., a concern which handles packing on a fixed charge basis. A new house belonging to this packing company is now located at Yuma, the fruit itself going out under the Sunkist label.

Water was first brought to the Yuma Mesa in 1922, so that the whole project is rather young, but a number of groves were set out in the spring of 1923, and are now giving their owners very nice returns. They have been judiciously watered, well fertilized from the very beginning and carefully cultivated. Many people interested in the mesa development are busily at work elsewhere putting their surplus into these groves. Such men are living in various parts of Arizona and in California as well. Though there are several syndicates with comparatively large holdings, the majority of the groves are individually owned and are cared for by a few resident owners, who make a business of undertaking the farming of a number of groves for outside people.

Many groves are using underground pipe lines, which give good results even though the water has not lost all its silt before arriving on the mesa. In this way there is no loss of land and orchards have a trim and well-kept appearance.

These very fine-looking groves will be found on the most intimate terms with the raw desert. One travels over quite a stretch of virgin soil, comes to a few splendid groves, and passes on again to greasewood and untouched land. All the soil has the appearance of being loose and free. The University of Arizona has established an experiment station which is making a special study of citrus problems on the mesa, and the project is being given every consideration. Uncle Sam certainly has builded substantially, and those who have made profits from their groves have acted in like manner. Certainly for those who can finance the development of permanent crops and who believe in the future of desert citrus, Yuma Mesa is a most interesting district.

Boulder Canyon Project Notes

The run-off of the Colorado River at Yuma, Arizona, for the month of January was 171,000 acre-feet, which is the lowest in 29 years of record, and 33 per cent of the January average of 521,000 acre-feet. Maximum run-off occurred in 1916, with 2,637,000 acre-feet. Similar river conditions prevailed at the Hoover dam site, where the formation of sand bars was very marked and navigation with the larger boats was impossible.

Dr. F. L. Ransome, geologist, and a member of the Hoover Dam Consulting Board, completed a preliminary field examination of diamond drill cores and geology of the Arizona and Nevada spillway sites on January 31.

The Western Union is paralleling the Union Pacific branch railroad to Boulder City with a telegraph line.

The Union Pacific branch railroad extending from the Los Angeles and Salt Lake main line to Boulder City was completed and opened to traffic on February 5. The first commercial freight shipment was received at the interchange yard near Boulder City on January 31, and consisted of a carload of lumber for camp construction for R. G. LeTourneau (Inc.), subcontractors on the highway.

The General Construction Co., of Seattle, Wash., awarded the contract for the Boulder City-Hoover Dam highway, has sublet the work to R. G. LeTourneau (Inc.), Stockton, Calif., which concern was the second low bidder.

The Southern Sierras Power Co. is making excellent progress on the construction of the power transmission line from Victorville, Calif., to the Hoover Dam site, and a survey party is locating a telephone line over the same route. A substation will also be built by the company in the vicinity of the dam site.

The Washington office has available for free distribution the following Boulder Canyon project circulars: General Information, Questions and Answers, Employment, Contracts, Townsite General, and Townsite Leases and Concessions.

On February 15 bids were opened at Carson City, Nev., by the State highway engineer for constructing 10.2 miles of the Las Vegas-Boulder City highway, to extend from Las Vegas in a southeasterly direction toward the new town.

A preliminary report covering construction of the All-American and Coachella Branch canals, and including diversion dam and desilting works, has been completed by H. J. Gault in the Denver office. The report is now being studied by bureau and Imperial Irrigation District officials.

An appraisal board recently appointed to set valuations on lands in the Muddy River Valley, Nev., to be included in the reservoir, met at Las Vegas on February 3. Members of the board are Harry E. Crain, of Cheyenne, Wyo., Cecil W. Creel, of Reno, Nev., and Levi Syphus, of St. Thomas, Nev.

Milwaukee Railroad Fosters Sun River Settlement

The colonization department of the Milwaukee Railroad, under the direction of R. W. Reynolds, with headquarters in Chicago, has taken a most important step looking to the settlement of the Sun River project. The railroad has engaged a full-time immigration agent who will devote his whole time to securing settlers for this project. He is working on a salary instead of commission, and this fact gives assurance that such settlers as he brings to the project will be of a high type and the kind that both the railroad and the local residents desire. Mr. Reynolds has specifically instructed the immigration agent to carefully select all settlers.

SIX families, totaling 52 persons arrived on the Lower Yellowstone project during the month and located on farms they had previously arranged to purchase. During the recent settlement campaign about 180 persons, including women and children, have moved to the project.

PROSPECTS for construction work in various lines are better than usual on the Boise project, and as a result construction equipment houses are establishing or enlarging important branches in Boise.

While on a recent trip to Washington on project matters D. W. Aupperle, of Grand Junction, Colo., Grand Valley project, called several times at the Washington office.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, 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, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do J. R. Alexander	Do. Las Vegas, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Las Vegas, Nev.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	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	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	H. H. Berryhill	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	J. C. Avery	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	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 [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay 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. Nelle 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	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	W. R. Young and C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin	Spokane, Wash	H. W. Bashore	

BUILDINGS ON FARM OF NELS BACH, 2 MILES NORTH OF SIDNEY, LOWER YELLOWSTONE PROJECT, MONTANA-NORTH DAKOTA

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22, NO. 4 APRIL, 1931

Courtesy of Associated Press.

APPROVING AWARD OF CONTRACT FOR CONSTRUCTION OF HOOVER DAM

On March 11, at 10 o'clock a. m., in the presence of a number of Government officials, press correspondents, and photographers, Hon. Ray Lyman Wilbur, Secretary of the Interior, signed the award of contract to the Six Companies Incorporated, 760 Market Street, San Franscico, Calif., the low bidder, for the construction of Hoover Dam, power plant, and appurtenant works at the bid price of $48,890,995.

Left to right: Hon. Phil D. Swing, U. S. Representative from California; Secretary Wilbur; Dr. Elwood Mead, Commissioner, Bureau of Reclamation.

APPROVAL OF PROJECT

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Before a project may be approved for construction a finding must be made by the Secretary of the Interior as to its feasibility, and the project must also be approved by the President of the United States.

The original reclamation act of June 17, 1902, provides "that upon the determination by the Secretary of the Interior that any irrigation project is practicable, he may cause to be let contracts for the construction of the same in such portions or sections as it may be practicable to construct and complete as parts of the whole project."

This provision was materially strengthened by the act of December 5, 1924, which provided that "no new project or new division of a project shall be approved for construction, or estimate submitted therefor, by the Secretary until information in detail shall be secured by him concerning the water supply, the engineering features, the costs of construction, land prices, and the probable cost of development, and he shall have made a finding in writing that it is feasible, that it is adaptable for actual settlement and farm homes, and that it will probably return the cost thereof to the United States."

NEW 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. 22, No. 4 APRIL, 1931

Interesting High Lights on the Federal Reclamation Projects

APPROXIMATELY 450 acres of carrots were planted on the Yuma project, and the marketing of the crop started during February to continue until May. Yields vary from 190 to 250 crates per acre, with quality reported as good. The price quoted at the close of the month was $1.25 per crate.

STUDENTS from the Orland High School took high honors at a recent livestock judging contest held at Gridley, Calif., in which 9 Sacramento Valley high schools with 60 contestants were entered. Orland, with 6 entries, was awarded first place with a total of 1,992 points. Wilmar Macy, an Orland student, had the highest individual score, making 352.5 points. Orland entries were also awarded third, fourth, fifth, and seventh places in the contest.

THE Chamber of Commerce on the Orland project, cooperating with the Achean Club of Willows, collected a carload of food supplies which was shipped the latter part of the month to the drought-stricken area in Arkansas.

DURING the month two different flights of Army cadet flyers from Marsh Field, Calif., landed at Fly Field, the local airport on the Yuma project. The flights consisted of 25 to 28 planes each. These cross-country flights are a part of the training course for the student Army flyers. Fly Field was used as the terminus of these flights.

PICKING of grapefruit on the Auxiliary division of the Yuma project continued all month with good quality and normal yield reports. Picking will probably be completed by the latter part of April. Fifteen cars were packed and shipped through the local packing shed during February.

NINE carloads of onions and potatoes were shipped from the Uncompahgre project to the drought sufferers in Arkansas during the month. These shipments were donated and the cars were hauled free of charge by the railroads.

A NEW branch factory for the manufacture of sheet-metal products is in process of construction in Boise, Boise project, Idaho.

A BOARD appointed to appraise or reappraise all unsold town lots or acreage tracts in the town site of Acequia, Minidoka project, has completed the work, and April 15 has been set as a tentative date for the sale of these lands. More than 160 tracts were appraised.

AN ORGANIZATION on the Huntley project known as the Huntley Tractor Owners' Association has been formed with the object of reducing the cost of crop production through the cooperative purchasing of motor fuels and lubricants. They have contracted with the Yale Oil Corporation of Billings, through its agent at Nibbe, Mont., for the purchase of these products at prices which will mean a saving to its members.

ON the Vale project 153 inquiries were received during the month by mail by the Vale-Owyhee Government Projects Land Settlement Association, and 17 interested persons called at the office relative to project lands, 400 acres of land available for sale were disposed of by the association, and a number of inquiries were received by the project office. There are now about 24 families on the Bully Creek West Bench unit, who are busily erecting houses and making other improvements in preparation for crops in advance of the first delivery of water to be made this spring.

THE new plant of the Dairymen's Cooperative Creamery on the Boise project was put into operation during the month.

HAVEN LEIGH, of the South Side pumping division, Minidoka project, was awarded a trophy by the Dairy Tribune of Moorestown, Ill., as the Idaho State winner of the high butterfat-producing herd in cow-testing associations. Mr. Leigh's cows averaged 508 pounds of butterfat each during the year.

SINCE settlement work was started on the Lower Yellowstone project in 1927 by the Lower Yellowstone Development Association 40 families, comprising 266 persons, have moved to the project through the direct efforts of the association.

TWO sales of project property in the Malta district of the Milk River project were completed during the month, and negotiations are pending in three other cases. In addition two dry-land farmers leased project farms for the 1931 season with options to buy. On several tracts recently transferred new buildings are being erected and old buildings repaired.

PREPARATIONS are being completed in the Bureau of Reclamation for openings this spring of 35 public-land farm units on the Willwood division of the Shoshone project, Wyoming; 50 units on the Pilot division of the Riverton project, Wyoming; and 87 units on the Greenfields division of the Sun River project, Montana. Public notices, application blanks, and descriptive literature will be available later, and requests for information should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C., or the superintendent, Bureau of Reclamation, Powell, Wyo.; Riverton, Wyo.; or Fairfield, Mont.

Committee on the Conservation and Administration of the Public Domain Indorses Federal Reclamation

THE report to the President of the Committee on the Conservation and Administration of the Public Domain was released by him and made public on March 9, 1931.

It will be recalled that the committee was appointed to make a study of and report on the disposition of the remaining public domain under authority of the act of April 10, 1930, which authorized an appropriation of $50,000 for this purpose. Funds were made available in the Interior Department appropriation act, approved on May 14, 1930. The committee comprised 13 members from the 11 public land States and 7 members from Eastern States. James R. Garfield, former Secretary of the Interior, was chairman. Dr. Elwood Mead, Commissioner of Reclamation, represented California on the committee. Hugh A. Brown, director of reclamation economics, Bureau of Reclamation, was designated executive secretary.

Among the public-land problems considered by the committee, safeguarding the reclamation fund was deemed of the utmost importance to the future development of the West and the Nation. It was felt that no action should be taken which would result in curtailing or threatening this important work. The general statement in the report concerning reclamation and the specific recommendations thereon are as follows:

RECLAMATION

The public-land States include that vast arid portion of our country where farming is not possible without irrigation. Congress early recognized this essential difference from the rest of the country where settlement under the homestead laws brought about full agricultural development, and enacted the desert land and Carey Acts to supplement the homestead law. Under these laws, by private and community effort, the essential agricultural development of the West received its first impetus. The limit of development by private enterprise was reached when the low-water flow of the streams was all appropriated and it became necessary to provide storage of the floods to be held for use during the dry season. The high cost and long development period of these larger project made them prohibitive from the standpoint of comparatively short-term investments, and many well-intentioned efforts in this direction resulted in total loss of investment not only by the promoters but by thousands of settlers as well.

This led to the enactment of the reclamation act, designed to make possible in the arid States the building up of farm population and production in fair proportion to the steadily increasing urban population of those States based upon mining, lumbering, and, along the coast, shipping and industrial pursuits.

The reservation of certain vast resources within the Western States for future national needs is one of the major factors making it impossible for these States at the present time to finance their own reclamation requirements.

The reclamation act was originally conceived to supplement private enterprise by the construction or completion of projects beyond the resources of private promotions and individual or collective means. That conception rapidly grew and expanded until the theory of the right of the United States as the proprietor of public lands to improve them by reclamation and irrigation was fully recognized and took form in the construction by the Federal Government of great reclamation projects devoted primarily to that purpose.

Although the development of Federal reclamation is of tremendous importance to the West, the value of crops grown on irrigated lands in these projects is only three-fourths of 1 per cent of the total crop value of the Nation.

It is not within the scope of this report to detail the benefits to the public-land States and to the Nation which have flowed in ever-increasing measure from the adoption of that policy. Fundamentally it may be said that reclamation has surmounted the barriers of aridity, controlled and converted for useful purposes the menace of the flood, pushed back the frontiers of the desert, and subordinated them all to the service of the purposes of our forefathers in their efforts to establish permanent homes and prosperous communities on the public domain.

In the formulation of the policy of reclamation it was decided that the salable resources represented by the public domain should be drawn upon for the capital necessary for the program. Thus proceeds from the sale of public lands and 52½ per cent of the royalties derived under the mineral leasing act of February 25, 1920, are covered annually into the revolving fund for reclamation. From the former source, since the passage of the act of June 17, 1902, to June 30, 1930, $110,332,537.76, and from the latter source since February 25, 1920, to June 30, 1930, $38,285,947.38 have been paid into that fund. In addition, $59,360.35 has been received from the proceeds of Federal water-power licenses and $68,296.51 from royalties and rentals from potassium deposits.

The additions to the fund from the sale of public lands in recent years have shown a trend to decline steadily, until in the fiscal year ending June 30, 1930, this accretion amounted to only $690,563.36, whereas the proceeds from the mineral leasing act for that year were three and one-third times and project collections almost nine times that amount. This is material, in that it demonstrates clearly the comparatively insignificant part which the diminishing returns from the sale of public lands are destined to play in the future of reclamation.

The reclamation of the arid and semi-arid West is assuming proportions of increasing significance as knowledge and experience enlarge the useful field of our first endeavors and reveal the multiplicity of problems involved in the development and protection of every project. Drainage, colonization, flood control, erosion, power, and kindred subjects have in fact or should become major pieces in the mosaic which is now the Reclamation Service.

In order that no part which is important to the whole shall be omitted, the integrity of the reclamation fund must be guarded carefully. Approximately 67 per cent of the annual income to the fund is from project collections, about 26 per cent from royalties under the mineral leasing act, leaving but 7 per cent from all other sources. The primary factor, then, is the safeguarding of project payments, and the secondary is the insurance of the future maintenance of accretions from the royalties received under the mineral leasing act in a percentage at least substantially as at present. The administrative policies of the Reclamation Service, if undisturbed, will assure the first, and nature has apparently undertaken to underwrite the second. Comparatively recent discoveries of great oil and gas fields in California and New Mexico, where a portion of the public domain participates in their riches, should supply for years to come from permits and leases now in good standing the desired percentage. The public domain in Wyoming has been by far the greatest contributing area in the past and is at present giving promise of continuing that aid. The public domain in Montana, Utah, and Colorado has been and continues to be a hopeful prospect for the future. The immense deposits of coal in the public lands of the Western States, ranging in character from lignite to anthracite, and

the deposits of phosphate, sodium, and potash constitute a resource from which future supplies of fuel and fertilizer materials may be derived for national use and will produce an increasingly large revenue. Thus any disposition of the unreserved, unappropriated public domain which does not disturb that desirable condition will withstand attack upon any theory of injury to reclamation.

Moreover, such disposition should be made with such reservations to the United States as may certainly provide for future projects when and as economic conditions justify the undertakings.

FLOOD CONTROL

Mention has been made of flood control in connection with reclamation. Much has been accomplished by projects already constructed primarily for irrigation, and the Boulder Canyon project will reach the apex of achievement for the arid West in that respect. But the far-reaching benefits of each successful project in the protection of lands below the impounding works serve only to intensify recognition of the immensity of the field still unoccupied. None of the public-land States is free from the danger and devastations of floods, but the flood which wipes out a prosperous community or destroys an area in an agricultural district is a national and regional as well as a State calamity, varying in importance only to the extent of the property destroyed and the number of lives wasted. Whether it be the Mississippi at flood with its dreadful potentialities, or the Rio Grande above the Elephant Butte, or the Colorado above Boulder Canyon after that project has been completed, or any stream in the West subject to the same destructive forces in flood time as are these great river systems, the principle that the problem of control is national and regional as well as State remains the same and should be recognized. It varies only in terms of solution, the difficulties, and the costs. It calls for cooperative measures between the Nation and the State, or States, if more than one is benefited, and a just division of costs based upon an appraisal of the benefits received. As an incident to flood-control projects, the generation of power and the development of water for irrigation can be made to pay their part, but the frequent practice of the past of loading all the costs upon the shoulders of the landowner is inequitable and should be discontinued. Recognition of that principle appears in the Boulder Canyon project act.

The policy should be enlarged to include all projects now under way or hereafter undertaken until a definite plan of Federal participation has been evolved. Reservoir sites on the public domain have already been located and reserved, and others should be, with a view to future requirements. On interstate streams such sites should be reserved in the United States until the States, by compact ratified by Congress, shall determine their position in the set-up agreed upon by that means.

Constitutional support for Federal participation in projects primarily for flood control might be found (1) in the interstate commerce clause for the improvement of navigation where the watershed is on a navigable stream; (2) in the treaty-making power where the watershed is on an international stream in connection with which the United States has undertaken to fulfill a treaty obligation; (3) in the authority reserved to the States to enter into compacts subject to approval by Congress where the watershed is on an interstate stream, the use of which has been made the subject of such compact approved by Congress and necessarily involves a program of flood control for the protection of that use, or uses, especially where the Federal Government owns reservoir sites and rights of ways, instrumentalities essential to the prosecution of such a program; and (4) in the authority of the United States as a proprietor to construct irrigation projects for the improvement of its public lands where the watershed is above a project already built and flood-control measures would protect that project from silting or other damage from uncontrolled floods.

The arid States of the West have adopted a system of water law peculiar to their necessities. The right to water depends upon appropriation for and application to a beneficial use, and the first in time is the first in right. All water not applied to a beneficial use belongs to the public, and no right to water may be initiated unless by authority of the agencies provided by the laws of the respective States for the administration of water resources. On interstate streams, as between States having that system of water ownership and public control, the Supreme Court of the United States has held that the same principles shall apply in the determination of priorities between users in different States. Vast property rights and the flourishing cities and towns of the arid States owe their existence to and have been built upon these cardinal principles which have been recognized by Congress. The use by the United States of water has been subjected to the laws of these States, in the reclamation act, the Federal water power act, and the Boulder Canyon project act. Flood-control measures should conform to the same policies and principles.

SPECIAL RECOMMENDATIONS

The present conservative policy of reclamation development should be continued. Under it construction expenditures each year are restricted to the payments from settlers and the income from other sources provided for in the law. If payments are not made, works will not be built. This makes of reclamation a sound business policy and is a strong influence toward maintaining the integrity of the contracts.

Where projects require a larger investment than can be met from the reclamation fund they should be dealt with by Congress in special acts similar in character to the Boulder Canyon project act.

We recommend that in the undertaking of any project there should be no interference with the laws of the State relating to the appropriation, control, or distribution of the water or with vested rights secured thereunder.

Past experience, coupled with the urgent need of additional funds for accelerating and continuing construction work on irrigation projects, points conclusively to the desirability of adopting a definite policy relative to hydroelectric development, under which the power receipts should be used, first, to repay the cost of the power plant and appurtenant works; second, the cost of the reservoir and dam which regulates the delivery of water to the plant; and after that, all net revenues should be credited to the reclamation revolving fund.

The policy should be continued of having a central organization to design and build works, but to transfer these works to the control and management of the water users as soon as the projects are settled and developed.

We approve and adopt from the report of committee of the irrigation division of the American Society of Civil Engineers, made October 4, 1928, the following:

"The conservation of the water in the rivers and lakes of the country should be under public control and in order to lay a proper foundation for the making of comprehensive plans the Federal and State Governments should gather data, compile statistics, and conduct studies necessary to determine the feasibility of projects.

"The regulation of the flow of streams for the prevention of floods and for the best possible utilization of the waters should be undertaken by the States, or jointly by the United States and the States under such suitable forms of cooperation as may be appropriate under the constitutional authority now delegated to each. They should prepare and adopt comprehensive plans for such regu-

lation and should bear an equitable portion of the cost of water-storage and flood-control work when the economic aspects after full investigations are found to be favorable, and the remainder of the cost should be allocated to flood-control, irrigation, power-development, municipal water-supply, and other purposes.

"Where protection against flood waters results from the regulation of stream flow by means of reservoirs or otherwise, the proportion of the cost of the flood-control work not assumed by the Federal or State Governments should be assessed against the lands and other properties which receive benefit therefrom."

DR. MEAD'S COMMENTS

In commenting on the report, Doctor Mead said:

"The Bureau of Reclamation is especially gratified at the attitude of the Committee on the Conservation and Administration of the Public Domain toward Federal reclamation as reflected in the report. During the course of the many discussions of public-land problems there was general unanimity among the members that, irrespective of the action finally determined upon as to the disposition of the public land, the reclamation fund should be safeguarded in every way with a view to the continuation of the present conservative policy of construction. It was recognized by the members that the future development of the West is dependent in large measure on the complete utilization of its water supply and that only through such complete utilization in an orderly manner can the greatest benefits flow to this section of the country and to the Nation. They also recognized that project repayments constitute the chief source of revenue at present and that only a small proportion of the revenues to the reclamation fund comes from sales of public land. It was the belief therefore that the primary factor is to provide for prompt repayment of charges by the water users and the recognition on their part of the sanctity of their contract obligations to the Government. A secondary factor is the definite assurance of the future maintenance of accretions to the reclamation fund from royalties received under the mineral leasing act.

"Among the specific recommendations of the committee is one that deals with the disposition of power revenues, under which the power receipts would be used, first, to repay the cost of the power plant and appurtenant works; second, the cost of the reservoir and dam which regulates the delivery of water to the plant; and after that all net revenues should be credited to the reclamation revolving fund. This policy is in effect on several projects and should be made uniform for future power development.

"The project power plants not only lower construction costs but are a source of income and social betterment afterwards. Cheap power enables farmers to light their homes and operate small farm machinery and home appliances. On some projects the income from hydroelectro power is nearly equal to the payments from irrigation.

"The policy as to commercial power development incorporated in this recommendation of the committee does not work any injustice on the water users of the various projects. In such cases the costs of the plants would not be charged to the water users of the project and they would not be obligated to repay any part of the cost incurred by the United States in their construction. On the other hand the water users benefited by cheaper construction. They are benefited by having cheap power to light their homes and operate farm machinery. They will benefit by its influence in promoting local industrial development."

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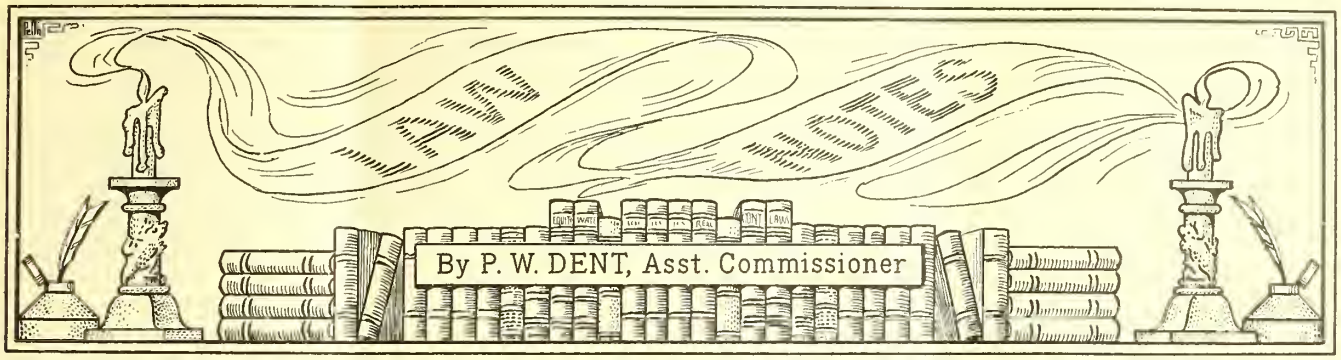
BOULDER CANYON PROJECT

1. END OF U. P. RY., LAS VEGAS TO BOULDER CITY, RECLAMATION SURVEY CAMP IN BACKGROUND.
2. CONSTRUCTION CAMP, HOOVER DAM HIGHWAY.
3. HIGHWAY CONSTRUCTION.



Supreme Court of Wyoming Upholds Irrigation District Contract With United States

(Continued from March issue)

WE do not think the secretary's failure to give public notice ought to have the effect of frustrating the plan for disposal of appellant's excess lands. We do not understand that appellant contends that the cost of construction is any higher or the terms of payment any harsher because not declared by public notice. It is probably true that when the trust deed was made both appellant and the reclamation officers understood that construction charges would be fixed by public notice. It was determined that five years thereafter should be the limit of time appellant should have for disposing of its excess lands. After the expiration of that time, the secretary was given the right to compel sales at public auction. If there had been no additional Federal legislation, public notice would no doubt have been given, and construction charges have become due pursuant to the reclamation extension act. Before the completion of construction work on the Fort Laramie unit additional legislation (act of Congress of May 15, 1922, supra) permitted the Secretary of the Interior to enter into contracts fixing the dates of payment of construction charges by irrigation districts notwithstanding the provisions of the reclamation extension act. (See 50 L. D. 142, 223.) Other legislation (fact finders' act, supra) provided for repayment of such charges in annual installments based on the productive power of the land. When, in taking advantage of this new legislation, the amount and terms of payment of construction costs were fixed by the contract of November 24, 1926, between the United States and the irrigation district, there was no purpose to be served by the public notice provided for in section 4, supra, of the reclamation act.

We do not think the trust deed contains anything to show that the giving of public notice was a condition qualifying the arrangement by which appellant, by agreeing to dispose of its excess lands, obtained the benefit of the construction of the contemplated works. The public notice was mentioned as a step in the administration of the Federal law whereby it was supposed the cost of construction would be announced and assessed. There was no express stipulation that it would be given. It was merely assumed that it would be given. Nothing was said as to what would happen if it were not given, although the deed provided for reconveyance of the trust lands if other conditions were not fulfilled. If we concede that there was an implied condition that public notice should be given, we see no reason for holding that it was of the essence of the transaction. The condition qualified the Secretary's right to require disposition of the lands. It would seem that it was substantially performed when construction costs were made known and assessed by other legal means. [See Hebert *v.* Dewey, 191 Mass. 403, 411, 77 N. E., 822; Joseph *v.* Catron, 13 N. M. 202, 81 P. 439, 1 L. R. A. (N. S.) 1120.]

It seems that the Rock Ranch lands were not included in the trust deed, but the contention that the district can not legally furnish water for more than 160 acres of those lands is not pressed. The evidence shows some 500 acres of the Rock Ranch lands are now being irrigated from the district works.

The State irrigation district law (sec. 964, supra) provides for assessment of cost of construction against the several benefited tracts "in proportion to the benefits," without specifying any rule to be followed by the commissioners in ascertaining the benefits. In the case at bar the commissioners determined that each irrigable acre would be benefited the same amount. Appellant contends that such an assessment does not represent the judgment of the commissioners as to benefits, but is an arbitrary exaction, regardless of benefits, pursuant to the contract of the district with the United States. The actual burden imposed on landowners by the assessment pursuant to the contract of November 24, 1926, can not be understood without consideration of the terms of payment. In the report of 1924 of the committee of special advisers on irrigation (S. Doc. 92, 68th Cong., 1st sess., p. 54) it was said:

"In considering the acre cost of water right under the Federal irrigation projects it must be remembered that the cost under public notice is, after all, an apparent cost. The real cost is considerably less. This results from the fact that the repayment period covers many years (under the extension act 20 years) and that during the period of repayment there are no interest charges except against overdue payments. The use of Government money without interest for a relatively long period of time has a direct cash value to the farmer.

"At 4 per cent the interest on the money advanced by the Government under the repayment period would amount to more than one-third of the capital invested. The acre charge is therefore really only two-thirds of what it appears to be. * * *. It is altogether too common to consider the acre costs on the Federal reclamation projects without reference to the advantage resulting from use of Federal money without an interest charge, when in fact the water user is requested to pay annually an amount equal to 5 per cent on the acre cost and then at the end of the 20-year period is forgiven the capital charge."

In the same report (pp. 4, 147) the committee recommended the plan of repayment adopted by the fact finders' act, supra. It is that plan as outlined in the contract of November 24, 1926, that the commissioners followed in making the assessment of cost of construction in the case at bar.

There were introduced in evidence the departmental regulations that were followed in classifying the district lands. These regulations provided that land classifiers should consider in their examinations "(*a*) the natural productive power of the soil under good agricultural

practice; (*b*) other conditions that influence productivity, such as uneven topography, making irrigation difficult and expensive, alkali, gravel subsoil, hardpan, water-logging, forest covering, etc.; and (*c*) the distance of the land from railroad and other carriers and from markets." The combination of these factors determined the class to which a given farm unit belonged. The inherent fertility of the soil and the topography of the land were the two chief factors of consideration. Pursuant to these and other more detailed instructions, the lands were required to be classified according to productive power. This was done. There are six classes, of which only the first four are assessed with construction charges. Lands of the fifth class are those not at present susceptible of agricultural use, and lands of the sixth class are those that appear to be permanently non-agricultural under practices of irrigation farming.

After the classification of the lands, it was necessary to ascertain the average annual gross acre income from lands of the four classes to be charged with costs of construction. This income, omitting fractions, was $38 for lands of class 1, $33 for class 2, $24 for class 3, and $16 for class 4. On that basis the annual construction charges would be $1.90, $1.65, $1.20, and 80 cents, respectively. If payments are continued at the same rates until the total charges of $95 per acre are paid, the payments reduced to present value, considering money worth 5 per cent, would amount to about $36 for first-class lands and $15 for fourth-class lands.

We are of opinion that the district commissioners in assessing costs of construction in accordance with the above plan, in cooperation with the Federal authorities, did not violate the State statutes. The Federal reclamation act, section 4 (43 U. S. C. A., sec. 461), provides that construction charges "shall be apportioned equitably," and so far as we are informed it has always been deemed equitable in the administration of that act to determine the acre cost by dividing the total cost by the number of irrigable acres in the project.

Special assessments are levied on the theory of special benefits, and apportionment of the total cost among the benefited tracts according to area, frontage, or value does not disprove the consideration of benefits if it does not result in manifest injustice and inequality. (McGarvey *v.* Swan, 17 Wyo. 120, 96 P. 697.) In the case just cited, the rule of apportionment was fixed by the legislature. When that has not been done we do not think it necessarily follows that the tribunal appointed by the legislature to make the assessments must attempt to assess the benefits one by one without some rule or principle of general application that will make the assessments reasonable and proportional according to benefits. (See Sears *v.* Board of Aldermen, 173 Mass. 71, 53 N. E. 138, 43 L. R. A. 834; Rogers *v.* City of Salem, 61 Or. 321, 122 P. 308; Jones *v.* City of Sheldon, 172 Iowa, 406, 154 N. W. 592; Worth *v.* Town of Westfield, 81 N. J. Law, 301, 80 A. 104; O'Reilley *v.* City of Kingston, 114 N. Y. 439, 21 N. E. 1004; City of Springfield *v.* Sale, 127 Ill. 359, 20 N. E. 86; Chicago & N. W. R. Co. *v.* City of Albion, 109 Nebr. 739, 192 N. W. 233.)

We assume that the commissioners of the district had no right to assess the cost of construction pursuant to a rule or principle that would disregard proportionate benefits, but we do not believe they have done that. The record warrants the belief that it was their honest judgment that each irrigable acre would be benefited equally, especially in view of the plan of repayment of which landowners and entrymen were permitted to take advantage by cooperation with the United States. The fact that the assessment on that basis was approved by the authorities who acted on behalf of the United States was entitled to some consideration by the commissioners and the court in determining whether the charges were assessed equitably. The district was organized for the purpose of cooperating with the United States, and the commissioners were granted broad powers in the making of contracts to further that purpose. There is no reason to suppose that the United States would have agreed to the terms of the contract of November 24, 1926, if the commissioners had insisted on fixing the acre-construction charge on a different basis. We do not believe the court would be justified in holding that the assessments have been made on a plan that was unjust or inequitable.

The appellant contended that the assessments complained of were substantially in excess of the actual benefits, but the evidence on that issue was conflicting, and the finding of the trial judge can not be disturbed. The principal ground for continuing to press the contention in this court is that it was shown without dispute that the market value of the lands has not been increased by an amount equal to the assessments. But this evidence as to the market value of the lands was not at all conclusive. Evidence on behalf of the district justified the finding that after water was made available for irrigation of the lands their market value, subject to the assessed charges, was substantially more than their value as arid lands. Often the benefit contemplated by the statute does not result in an immediate increase in the value of the land, and in

(Continued on p. 84)

Recently Enacted Legislation

Portions of Town Sites

[Public—No. 655—71st Congress]

An act to amend the act approved March 2, 1929, entitled "An act to authorize the disposition of unplatted portions of Government town sites on irrigation projects under the Reclamation Act of June 17, 1902, and for other purposes."

That section 1 of the act of March 2, 1929, entitled "An act to authorize the disposition of unplatted portions of Government town sites on irrigation projects under the reclamation act of June 17, 1902, and for other purposes" (45 Stat. L. 1522; U. S. C., Supp. III, title 43, sec. 571), be amended to read:

"That the Secretary of the Interior is hereby authorized, in his discretion, to appraise, and sell, at public auction, to the highest bidder, from time to time, under such terms as to time of payment as he may require, but in no event for any longer period than five years, any or all of the unplatted portions of Government town sites created under the act of April 16, 1906 (34 Stat. 116), on any irrigation project constructed under the act of June 17, 1902 (32 Stat. 388), or acts amendatory thereof or supplementary thereto: *Provided*, That any land so offered for sale and not disposed of may afterwards be sold, at not less than the appraised value, at private sale, under such regulations as the Secretary of the Interior may prescribe. Patents made in pursuance of such sale shall convey all the right, title, and interest of the United States in or to the land so sold."

Approved, February 14, 1931.

Motor-Vehicle Travel

[Public—No. 644—71st Congress]

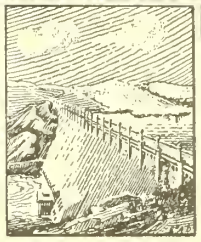
An act to permit payments for the operation of motor cycles and automobiles used for necessary travel on official business on a mileage basis in lieu of actual operating expenses.

That a civilian officer or employee engaged in necessary travel on official business away from his designated post of duty may be paid, in lieu of actual expenses of transportation, under regulations to be prescribed by the President, not to exceed 3 cents per mile for the use of his own motor cycle or 7 cents per mile for the use of his own automobile for such transportation, whenever such mode of travel has been previously authorized and payment on such mileage basis is more economical and advantageous to the United States. This act shall take effect July 1, 1931, and all laws or parts of laws are hereby modified or repealed to the extent same may be in conflict herewith.

Approved, February 14, 1931.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Madden Dam—Panama Canal Zone

By R. F. Walter, Chief Engineer, and J. L. Savage, Chief Designing Engineer, United States Bureau of Reclamation, Denver, Colo.

UPON request of the Governor of the Panama Canal Zone to the Secretary of the Interior, the Bureau of Reclamation has had occasion during the past year and a half to make studies relative to the construction of the proposed Madden Dam, one of the important features of the Panama Canal development. This work began on November 14, 1929, when the writers were detailed by the Secretary to act in a consulting capacity on the location and design of this dam.

A visit was made to the site of the work during the early part of January, 1930, during which the main dam site and the two adjacent ridges were carefully examined, and also, foundation drill cores and construction material available in the vicinity. Opportunity was taken at this time to discuss and consider the various problems involved in the proposed construction with the canal officials and engineers. Under date of March 1, 1930, a report was submitted to the Governor of the Canal Zone. This report took up several possible designs with estimates of cost, for each of the main features, such as the main dam, auxiliary dams, spillway, outlet works and power plant; suggested a definite location at the general site for the main dam; and included descriptions, data and drawings of works completed by the Bureau which might be of use in studies for determining the most practical and economic construction.

After this report had been studied by the canal personnel and additional data furnished, the canal designing engineer spent some time during the summer of 1930 in the Denver office of the bureau and in visiting a number of the dams completed or under construction by the bureau. More definite ideas of the requirements having thus been crystallized, a further report under date of December 15, 1930, was prepared. Briefly, this included a written and graphical description of four different types of main dam, three different plans for spillways, and four plans for outlet works, the locations and plans for spillways and outlet works being partly dependent on the type of dam. It also covered a description of the power plant with three different penstock layouts, likewise dependent on the type of dam. The various designs were supported by detailed estimates of costs, the summary sheet of which embraced 21 combinations of distinct features.

This report, as well as other data made available by the Canal Zone, served as a basis for the deliberations of another board meeting at the site of the work during the last week of the year just closed. This board, consisting of Geologist F. L. Ransome, Consulting Engineer A. J. Wiley, and the writers, completed its report upon arrival at New Orleans on January 8, 1931. Definite recommendations were made relative to final designs for the several parts of the proposed construction. On January 19 of this year the Bureau of Reclamation was requested to prepare these designs and also the construction specifications, and this work is now in progress in the Denver office.

HISTORICAL

A reservoir in the upper Chagres River Valley has been contemplated for about 35 years. When the second French canal company, which began operations in October, 1894, adopted a lock rather than a sea level canal it was foreseen that, sooner or later, storage additional to that available in the upper few feet of Gatun Lake would be required. The French engineers selected a site near the village of Alhajuela. The American Isthmian Canal Commission, upon the occupation of the Canal Zone by this country in May, 1904, also realized the eventual need of more storage and after investigations agreed that the site selected by the French was the most suitable. The present site of the main dam, determined after a study of recent topographical surveys, diamond drilling, and geological examination, is at approximately the same location.

REASONS FOR CONSTRUCTION

The prime reason for the construction of the Madden Reservoir, and that which has been foremost in mind since its conception, is to provide for the anticipated increase in water demand due to normal growth in traffic through the canal. The available storage supply in Gatun Lake—i. e., the capacity between elevation 80 and 87—is only adequate during a long dry season to operate the present two sets of locks under full requirements without providing for the necessary electric power generation at Gatun Dam. During an extremely long dry season a reserve Diesel electric power plant located at Miraflores may be used to conserve the lake storage entirely for lockages. In a report of April 29, 1929, on the Traffic Capacity of the Panama Canal, the Governor of the Canal Zone estimated that the additional lockage capacity would not be needed for traffic until 1960, but suggested construction should be commenced 10 years prior to the demand for it.

The immediate urgencies for the completion of the Madden Reservoir and power plant are stated below in the relative order of their importance:

(1) To increase the storage water supply for the dry seasons so that it will not be necessary to lower the surface of Gatun Lake below elevation 80. If the surface falls below this elevation, the water depth in Gaillard Cut is insufficient to insure the safe passage of deep-draft vessels.

(2) To provide flood control, thus preventing probable damage at some time to existing works, and reducing cross currents in the canal at the present mouth of the upper Chagres River at Gatun Lake, these currents being a serious menace to navigation during periods of heavy run-off.

(3) To eliminate the necessity of running the Diesel electric power plant during the dry seasons by the generation of power at the Madden hydroelectric plant, this to result in a considerable reduction of operating expenses.

GEOLOGY

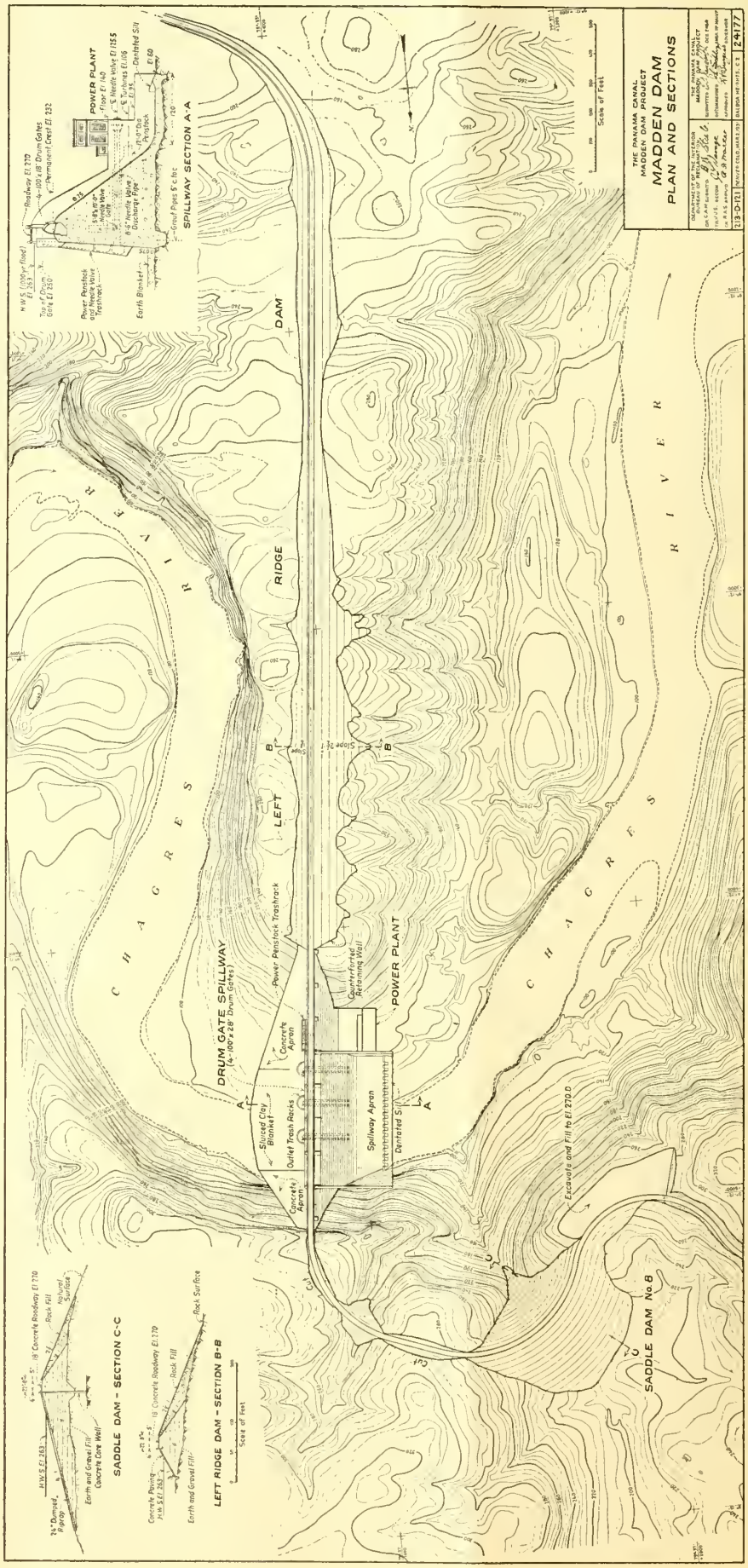
In general, the geologic stratifications, which underlie the reservoir and the main dam site, particularly their shape, are excellent. The valley is formed in a moderately folded syncline, the axis of which runs approximately north and south. The dips of the strata to the axis

seldom exceed 5°, except in the ridge on the west side of the reservoir between the Chagres River and the Quebrada Madronal, a small stream on the east, where the dips are as sharp as 40° in a few places.

The main dam site is located at the lowest part of the geologic basin, and, due to the thickness of the highest stratum of the syncline, the foundation will be entirely in this material. The lower strata of the syncline outcrop at varying distances from the dam site and by reason of the relatively inferior quality of these lower strata are of particular interest in the proposed construction where they outcrop on the rim of the reservoir. The term "rim" is used in connection with the reservoir, as saddles of the Madronal ridge on the right and the Azote Caballo ridge on the left of the main dam site are below the contemplated high-water surface. Several required saddle dams or dikes will thus be founded on the lower outcrops.

Sinkholes and caverns occurring below the flow line of the reservoir in the limestone of the rather narrow Madronal ridge have been the object of much geological investigation. The recent board recommended clay filling through angle drill holes for parts of these and for open crevices where there is danger of leakage from the reservoir.

The top stratum of the syncline, which will form the entire base of the main dam, is a massive fine-grained calcareous sandstone practically impermeable and gray in color. The granules of which it is composed originated from various igneous rocks and show considerable diversity in mineral character and degree of decomposition. While this sandstone is comparatively soft, it has been tested and found to have a bearing strength greatly in excess of the stresses which it will be required to stand by superimposition of the massive concrete dam. The photographic illustration shows this material at the right abutment of the main dam, the axis of which runs into the tunnel which was driven to study the formation. The stratum immediately below this is also a sandstone, and the demarcation between the two is not pronounced. This latter formation is coarser grained than the former, contains more shell fragments, and is more calcareous. However, it has sufficient bearing strength and is also practically impermeable. Some of the grout holes under the dam will be drilled a short distance into this stratum. The descending four successive formations are limestone, clay, grits, and igneous rock, the last consisting of various basaltic and porphyritic lava flows and breccias.



DESIGNS

The main features of the Madden Reservoir construction consist of the main dam across the Chagres River, the

power plant, the left ridge dam, Saddle Dam No. 8, Saddle Dam No. 5, and 11 other saddle dams. The descriptions which follow cover the designs recommended by the board in its report of January 8, 1931. Studies in connection with the preparation of these at the present time in the Denver office may result in some changes in minor features, but it is contemplated they will be essentially unchanged.

The main dam will be of the massive concrete straight-gravity type consisting of the overflow spillway section across the river and the right and left abutment sections. These three sections will be similar in design except for the special requirements of the spillway section. The downstream faces of all sections will be constructed on a ¾ : 1 slope. The toe of the spillway section will be extended approximately 120 feet as a concrete apron, on the downstream end of which a dentated sill will be provided to reduce the velocity of the falling sheet of water and to prevent undercutting. This apron will be securely anchored into bedrock by steel anchor bolts grouted into the foundation and by a rectangular cut-off trench below the toe.

All sections of the dam will be built in panels about 56 feet in length, formed at the ends so that they will be keyed together. The resulting joints, which, after the setting heat of the concrete has been dissipated, will open by cooling under natural conditions, are to be provided with systems of pipes for later pressure grouting. Excavation for the base of the dam will be carried well into solid rock, and a cut-off trench will be excavated beneath the upstream heel. Grout holes spaced not less than 5 feet apart will be drilled in the bottom of this trench to depths of about 20 feet, and after concrete has been placed in the trench and to a depth of at least 8 feet over the adjacent foundation of the dam grout will be applied under pressure, thus sealing any openings between the concrete and the foundation and closing seams in the rock. The section of the dam is designed for stability with full uplift pressure at the heel, decreasing to tail-water uplift at the toe, both for the maximum estimated flow during a thousand-year period, the resulting pressure being applied upon two-thirds of the base area. It is estimated that the height of the dam at maximum section from the lowest point of the foundation to the top of the roadway at elevation 270 will be about 220 feet. In order to increase the percolation distance under the base of the dam and to reduce the uplift pressure, a sluiced clay blanket, for almost the full width of the spillway section and extending about 150 feet upstream, will be laid on the stripped bed rock. Likewise, concrete blankets will be placed on the bedrock upstream from the abutment sections, these varying in length from 150 feet where they join the clay blanket to 20 feet at the ends of the abutments.

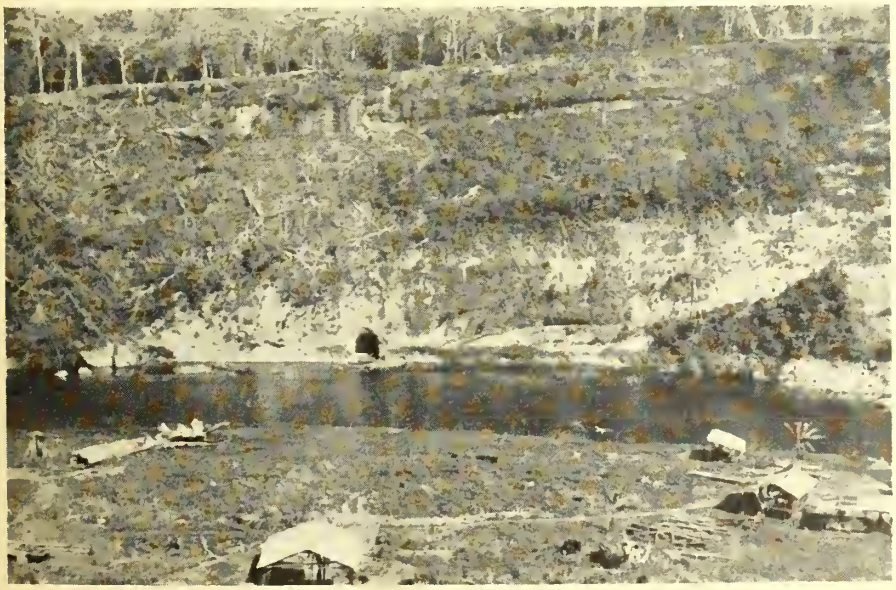
The spillway will be divided into four 100-foot openings by three piers, and drum gates 18 feet high will be mounted on the crest in these openings. These gates, manufactured from structural steel plates and shapes, will be automatically controlled and will have a remote manual control so that they can be operated from the switchboard in the power house. A recording position indicator will be installed for each gate. The crest of the drum gates when fully raised will be at elevation 250, which will control the normal high water surface in the reservoir. The capacity of the reservoir at this elevation will be about 622,000 acre-feet. With the drum gates down, all outlet works open, and the reservoir surface at elevation 263, a flow of 280,000 second-feet will pass the dam, this being the estimated 1,000-year flood. The bridge over the spillway will consist of flat concrete arches spanning the gate openings. To keep the same architectural effect, the tops of the abutment sections will be formed to simulate these arches and the supporting piers.

Outlets through the dam will be provided by six openings formed in the base of the spillway section and by two plate-steel discharge pipes embedded in the abutment section at the power plant location, these latter being located between and alternating with the three power penstocks. Each of the openings through the spillway section will be controlled by two 5 foot 8 inch by 10 foot hydraulically operated slide gates arranged in tandem, and the flow through each of the two discharge pipes will be regulated by an 84-inch needle valve installed at the outlet end. The inlet ends of all outlets including power penstokes will be protected by concrete and structural steel trash racks.

The hydroelectric power plant will be located immediately downstream from the river end of the left abutment section, and the substructure will be monolithic with the concrete of the dam. The power plant will be designed for three units, each of about 7,500 kilowatts capacity. It is probable that only one, or possibly two, of the generator units will be installed at the time of the construction of the dam. The power penstocks will be 12 feet in diameter. The power house will be 44 feet in width by 143 feet in length, and this building will also house the needle valves regulating the outlet discharge pipes. Transformer, switching station, and protective apparatus will be of the outdoor type.

The left-ridge dam, which is practically a continuation of the main dam on the south, and located for almost its entire length on the same tangent, will be an earth and gravel and rock-fill embankment with a concrete-paved upstream slope. It will have a crown width of 20 feet, an upstream slope of 1¾ : 1 and a downstream slope of 2½ : 1. The top of embankment or roadway will be at elevation 270, and as a further protection against wave action the freeboard will be augmented by a concrete parapet wall 3 feet in height. The fill at the right end of this dam will be supported by a counterforted concrete retaining wall.

Saddle Dam No. 8, located about 800 feet west of the right abutment of the main dam, will also be an earth and gravel and rock fill, and the downstream slope on the rock fill will be 2½ : 1. The upstream slope will be 4 : 1 and the earth and gravel fill on this slope will be protected by a 12-inch layer of gravel and a 2-foot thickness of dumped igneous rock riprap. A concrete core wall will extend



Right abutment of Madden Dam

from an anchorage in the impervious rock, several feet below the base of the dam, to an elevation of 273, the top 3 feet serving as a parapet wall. The axis of this dam forms a reversed curve.

Saddle Dam No. 5 will be similar in design to Saddle Dam No. 8, except that the top of the core wall will terminate at elevation 260 and no parapet wall will be constructed, though the crown of the embankment will be constructed to elevation 273.

Eleven other smaller saddle dams will be built, all of the earth and gravel and rock-fill type, and varying in height from 30 to 14 feet. The crown width of these dams will be 20 feet, the upstream slopes 4:1 and the downstream slopes 2½:1. Due to their protected locations and the heavy growths of timber which will remain standing above elevation 240, none of these dams will be subject to destructive wave action. The upstream slopes will therefore not be reinforced with riprap. Trenches filled with an earth core will be extended down to impervious material below the bases of these dams. No parapet walls will be constructed, but the crowns of these dams will all be at elevation 273.

CONSTRUCTION PLANS

Aggregates for concrete will be obtained from the river channel near the main dam, and it is believed that much of the material removed in excavation for the foundation of the dam will be satisfactory, after screening and grading, for use in concrete. Materials suitable for the required embankment construction are generally available in the near vicinity, though a moderate length of haul may be necessary for igneous rock riprap. It is anticipated that the designs for the work described will be completed so that final specifications may be issued during June of this year.

ACKNOWLEDGMENTS

The writers are indebted to various officials of the Canal Zone not only for an abundance of pertinent data, consisting of reports and drawings, but also for many courtesies extended during the two trips to the site of the work. Col. Harry Burgess is Governor of the Panama Canal Zone with full authority under the President in all Canal Zone affairs. Col. J. L. Schley, engineer of maintenance for the Panama Canal, is in general charge of the Madden Dam project. Mr. E. S. Randolph, designing engineer for the Madden Dam project for the Panama Canal, and three assistants will be temporarily located in the Denver office until the designs and specifications are completed.

Notes for Contractors

Boulder Canyon project.—Bids for construction of the Hoover Dam, power plant, and appurtenant works were opened at Denver, Colo., on March 4, with three bids received, as follows: Six Companies (Inc.), 526 Phelan Building, San Francisco, Calif., $48,890,995.50; the Arundel Corporation, Pire 2, Pratt Street, Baltimore, Md., $53,893,878.70; Woods Bros. Corporation, Lincoln, Nebr., $58,653,107.50.

Work is being continued on detailed designs, for the administration building, clubhouse, city hall, which will include the post office and jail, garage which will include quarters for the fire department, and several of the larger residences. It is expected that advertisement for bids for the construction of the next group of buildings will be issued about April 10. Plans and specifications are being prepared for street grading, paving, sidewalks and curbs, water and sewer systems.

Bids were opened at Denver on February 19, under invitation No. 3100–A, for 20,000 barrels of cement. Ten proposals were received and the low bid made by the Monolith Portland Cement Co., of Los Angeles, Calif., was $1.50 per barrel f. o. b. Monolith, less $0.40 per barrel for sacks returned at contractor's expense.

Owyhee project.—Under specifications No. 499–D, bids opened January 16, 1931, for furnishing one 60 by 12 foot structural steel ring gate for installation in the spillway structure at Owyhee Dam, award has been made to John W. Beam, of Denver, Colo., whose bid was $25,600, discount 0.5 per cent, f. o. b., Peotone, Ill. The ring gate will be manufactured by the Continental Bridge Co., of Peotone, Ill., and the shafting, gears, racks, etc., for the equalizing device by the Foote Bros. Gear & Machine Co., of Chicago, Ill. The estimated weight of the ring gate and appurtenances is 370,000 pounds.

Yakima project.—It is expected to advertise for bids for construction of the Cle Elum Dam, on the Cle Elum River, about May 15, and to open bids about June 15. Plans call for an earth-gravel structure about 125 feet in height and containing 450,000 cubic yards. The estimated cost of the Cle Elum Dam and Reservoir is $3,500,000.

Efficient Irrigation Practice

By R. F. Walter, Chief Engineer, Bureau of Reclamation

On most of our projects there is, at least in the earlier years of operation, considerably more water available for use than needed by the limited areas then developed, with the result that irrigation practices are adopted with a view only to making irrigation as easy as possible for the settler. When the project area grows and the need for the adoption of more efficient irrigation methods becomes advisable, there is more or less opposition by the irrigator to such changes.

It is becoming more apparent that the time to adopt the proper irrigation practices or methods is from the start of irrigation. To this end, and especially in view of the limited water supply that will prevail on the Vale project, constant attention should be given to the proper education of the irrigators and of the district board in the matter of efficient irrigation practice. Among the matters that should receive special attention is the necessity for careful leveling before perennial crops, such as alfalfa, are planted; the avoidance of long runs in the irrigation of fields; the use of the largest practicable irrigating heads by the irrigators; the full attention to the distribution of water while it is being received by the irrigator; and rotation in deliveries, both as to individuals and as to laterals.

Kennewick Highlands Project Approved

On the recommendation of Secretary Wilbur, the President on March 7, 1931, approved for construction the Kennewick Highlands unit on the Yakima project, Washington.

The Kennewick Highlands is a tract of about 4,000 acres adjacent to the town of Kennewick, of which 2,500 acres are now irrigated. Replacements in the pumping plant and pipe lines are necessary and the settlers have been unable to effect needed improvements because of excessive maintenance charges.

It is proposed to replace the present worn out 24-inch pipe line with a 34-inch wood-stave pipe line, and to replace the pumps now in use with modern pumps. The distribution system will also be improved. To provide cheaper power, it is planned to build a canal of 1,000 second-feet capacity, 2½ miles long, paralleling the Yakima River at Prosser, to develop 40 feet of head and produce 3,200 horsepower of electrical energy.

A satisfactory contract has been made with the irrigation district. An appropriation of $640,000 is available for construction of the project.

Hoover Dam Bids Opened

Six Companies (Inc.), of San Francisco, Calif., 526 Phelan Building, 760 Market Street, submitted the low bid of $48,890,-995.50 for construction of the Hoover Dam, power plant, and appurtenant works. The bids were opened at 10 o'clock a. m. on March 4 at the Denver, Colo., office of the Bureau of Reclamation; three regular and two irregular bids were received.

The six companies combining to make the low bid were the Utah Construction Co., of Ogden, Utah; Henry J. Kaiser and W. A. Bechtel (of Oakland and San Francisco, Calif., respectively); MacDonald & Kahn, of Los Angeles, Calif.; Morrison-Knudson Co., of Boise, Idaho; J. F. Shea & Co., of Portland, Oreg.; and the Pacific Bridge Co., of Portland, Oreg.

The second low bid of $53,893,878.70 was submitted by the Arundel Corporation, of Baltimore, Md., with whom was associated Lynn H. Atkinson, of Los Angeles. Woods Bros. Construction Co., of Lincoln. Nebr., with a bid of $58,653,-107.50 was third low bidder. Associated with the Nebraska company in its bid was A. Guthrie & Co., of Portland, Oreg.

All of the companies combining to make the low bid are well and favorably known in general construction work in the Western States. The Utah Construction Co. has successfully completed several large contracts for this bureau, including the 160-foot Deadwood Dam in Idaho, the 195-foot Gibson Dam on the Sun River in Montana, the Guernsey Dam in eastern Wyoming, and the American Falls Dam on the Snake River in Idaho. The Kaiser Paving Co., of Oakland, and W. A. Bechtel, of San Francisco, are well known on the west coast. MacDonald & Kahn (associated with Fisher & Ross) were the low bidders on the San Gabriel Dam in California in November, 1928, their bid being $11,250,040; however, because of foundation conditions which developed, this project was not completed. Morrison-Knudson Co., of Boise, has done considerable work for this bureau; and J. F. Shea & Co., are now engaged on tunnel work on the Owyhee project in Oregon. All six companies are members of the Associated General Contractors of America.

Francis T. Crowe, manager of Six Companies (Inc.), will be in charge of construction of the dam. Mr. Crowe has been associated with the Utah Construction Co. for the past few years as superintendent of construction and built the Gibson and Deadwood Dams. He was for many years with the Bureau of Reclamation, starting in 1904 as an engineering aide, and was filling the position of general superintendent of construction when he resigned in 1925. Mr. Crowe was engineer in charge of construction of the Jackson Lake Dam in Wyoming, and also built the Tieton Dam on the Yakima project in Washington, an earth and rock-fill structure 222 feet in height. He was also for a short time first assistant to the construction engineer on the 349-foot Arrowrock Dam in Idaho, and at one time was project manager of the Flathead (Indian) project in Montana.

Mr. Crowe is 48 years of age and a graduate of the University of Maine. He is generally considered to be one of the most competent construction engineers in the country, and the Government is fortunate in having such a capable man in charge of building this important project.

W. H. Wattis, president of the Utah Construction Co., is president of the Six Companies (Inc.). These companies at the present time have $30,000,000 worth of unfinished contracts now on hand, and in their lifetime have completed an aggregate of $400,000,000 in contract work.

On March 11 Secretary Wilbur approved award of contract to the Six Companies (Inc.). The contractors will immediately begin moving in their plant and equipment and start to build their construction camp.

Aerial Service Salt River Project

Phoenix has daily air mail and passenger service on the Western Air Express lines operating both ways through Los Angeles, Phoenix, Tucson, Douglas, El Paso, Big Springs, Fort Worth, Dallas, Shreveport, Jackson, and Atlanta, known as the "Fair Weather Route."

The planes are 8-passenger, trimotor Fokkers, equipped with 2-way radiophones.

There are 4 airports on the project, 3 in Phoenix and 1 at Chandler, where planes are available for hire, but no regularly scheduled passenger service is maintained other than the mail service.

A SERIES of sugar-beet meetings were recently held on the Belle Fourche project to emphasize the importance of proper culture. Soil preparation, use of fertilizer, most efficient irrigation methods, and value of by-products in feeding were discussed.

Sale of Government Town Sites

On the Klamath project, Oregon-California, 178 town lots in Tule Lake town site, Modoc County, Calif., will be offered for sale at public auction at the town site beginning at 10 a. m., April 15, 1931. Payment for lots may be made in cash at the time of purchase or one-fifth cash and the balance in four equal annual installments with 6 per cent interest on deferred payments.

On the Huntley project, Montana, nine tracts ranging in size from 25 to 120 acres in unplatted portions of Anita, Ballantine, and Huntley town sites, will be placed on sale at public auction on April 18 at the United States land office at Billings, Mont., at 10 o'clock a. m. Payment for lots to be made in cash at time of sale or one-fifth cash and the balance in four equal annual installments with 6 per cent interest on deferred payments.

On the Minidoka project, Idaho, 191 town lots and 10 acreage tracts, averaging 2½ acres each, will be offered for sale at public auction on April 15 at 10 o'clock a. m. Payment to be made in cash at time of sale or one-fifth cash and the balance in four equal annual installments with interest at 6 per cent on deferred payments.

On the Shoshone project, Wyoming, 66 lots in Powell town site will be offered for sale at public auction at the project office in Powell, Wyo., on April 5 at 10 o'clock a. m. Nine of the lots have substantial improvements. Payment for lots may be made in cash or one-fifth cash and the balance in four equal annual installments with interest at 6 per cent on deferred payments.

Owyhee Dam Construction Resumed

The General Construction Co., contractors on the Owyhee Dam, Owyhee project, in eastern Oregon, resumed work on February 23, starting with a small force of about 50 men, stripping forms and preparing for concreting operations, which began on February 27, with the pouring of piers under sluice-gate conduits. The force was increased to about 300 by the end of March. During the 53-day lay-off all the plant and equipment was overhauled. At the close of February the contract was 51 per cent completed and the time 57 per cent elapsed.

Boulder Canyon Project Notes

The Towner Rating Bureau, of New York City, under date of February 6, 1931, advised that the premium rate on the performance bond of $5,000,000 for the Hoover Dam work is to be $16.87½ per thousand on the contract price. This is a 25 per cent reduction on the rate charged for the San Gabriel Dam in California, where the construction period called for was six-years, as compared to seven years on the Colorado work. The low bid on the San Gabriel Dam was $11,250,040, total estimated cost $25,000,000, and concrete yardage 3,800,000. On the Hoover Dam and power house job the low bid was $48,890,995, total estimated cost is about $90,000,000, and concrete yardage 4,500,000.

The reservoir formed by the Hoover Dam will be about 115 miles long, but this exceptional length is to be exceeded by the reservoir on the Osage power project at Bagnell, Mo., which will be 129 miles long, according to press reports. However, the Boulder Canyon Reservoir will be much larger, having an area of 145,000 acres, as compared with 61,000 acres for the Osage Reservoir.

It is interesting to note that the difference of $5,000,000 between the two lowest bids was in item 54, placing 3,400,000 cubic yards of concrete in the dam. The Six Companies bid was $2.70 and the Arundel Corporation $4.15 per cubic yard. On the 1,563,000 cubic yards of tunnel excavation both concerns bid $8.50 per cubic yard.

Six hundred and seventy-three written inquiries as to employment in connection with the Boulder Canyon project were received and answered by the Denver office during the month of February.

The surety companies furnishing the $2,000,000 bid bond for the Six Companies (Inc.) were the Fidelity & Deposit Co., of Maryland, Hartford Accident & Indemnity Co., National Surety Co., and the United States Fidelity & Guaranty Co.

A newspaper report from San Francisco states that the Six Companies (Inc.) will soon open an employment office in that city to hire workmen for the big job. It is also stated that 1,000 men will be taken to the dam site and Boulder City to commence operations, and that there will be 3,500 to 4,000 men employed by January 1, 1932.

The Southern Nevada Telephone Co., which owns and operates the telephone system at Las Vegas, Nev., has extended its system to Boulder City and is now supplying local and toll service at the latter point.

A carload of aggregates has been shipped from the Arizona gravel deposits to Denver. This is to be used in making compressive strength and other tests at the new testing laboratory at the local office of the United States Bureau of Standards, where a 4,000,000-pound testing machine is being installed.

R. G. LeTourneau (Inc.), subcontractor for the General Construction Co. on the Boulder City-Hoover Dam highway, began operations on February 2, which was 14 days in advance of receipt of notice to proceed. On March 2 this firm was awarded the contract for building the Santiago Canyon Dam in California, a private project, with a bid of $507,721.50.

The Lewis Construction Co. has built a pioneer road to the dam site for the use of the Southern Sierras Power Co. in transporting equipment for the substation. This will enable the power company to install the equipment ahead of the required date, June 25, 1931.

The agent for the Union Pacific at Boulder City announces that during the month of February 3,238,870 pounds of carload freight and 68,646 pounds of less-than-carload shipments were received at Boulder City.

The construction of the presedimentation tank and river intake of the water-supply system will probably be handled by Government forces, in order to expedite this construction and make water available at Boulder City at the earliest possible date.

F. F. Smith, post-office inspector for the San Francisco division, is discussing possible arrangements for a post office at Boulder City with the Denver and Las Vegas offices.

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- Advances to reclamation fund, bill S. 6046. Cong. Record, March 3, 1931, v. 74, pp. 6984–6989.
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Hoover Dam:
- Hoover dam specifications (long article with inset drawings) illus. Western Construction News, January 10, 1931, v. 6, pp. 2–11. (Editorial, p. 1.)
- Hoover Dam unprecedented in history. Illus. National Magazine, February, 1931, v. 59, p. 213–215.

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- Development of Boulder City includes modern health resort. U. S. Daily, March 10, 1931, v. 6, pp. 1–2.
- $48,890.995 low bid for construction of Boulder Canyon (Hoover) Dam. Eng. News-Record, March 5, 1931, v. 106, p. 409.

Ashurst, Hon. H. F.:
- Colorado River case (orig. No. 19, U. S. Supreme Court). Bill of complaint by K. Berry Peterson, Atty. Gen., Arizona, briefs by States and Dept. of Interior. Congressional Record, February 11, 1931, v. 74, pp. 4722–4741.

Garfield, James R., chairman:
- Grant to States of public lands is recommended (Public Domain Commission Report). U. S. Daily, March 9, 1931, v. 6, pp. 1, 5, and 8 (pp. 53, 57, and 60).

Brown, Hugh A.:
- Studies are conducted on results of Federal irrigation activities. U. S. Daily, March 10, 1931, v. 6, p. 12 (p. 76).

Index, New York Trust Co.:
- Making the American desert bloom. Increasing importance of Federal reclamation. The Index, N. Y. Trust Co., October, 1930, v. 10, No. 10, pp. 199–204.

Darlington, Thomas D.:
- Conquering the Colorado. Profusely illus. Explosives Engineer, January, 1931. (Reprinted as 8-page separate for general distribution.)

Lippincott, J. B., chairman:
- Report of the committee of the irrigation division of the Am. Soc., C. E., on A National Reclamation Policy. Proc. A. S. C. E., January, 1931, v. 57, pp. 129–133.

Cle Elum Dam:
- Construction of Cle Elum Dam approved by President. Western Contruction News, January 25, 1931, b. 6, p. 49.

Crops in Yakima Valley Make Fine Showing

According to a recent issue of the Yakima Herald, Yakima Valley produced in 1930 one of the largest crops in its history, the returns piling up the imposing total of $40,280,000. This favorable result has demonstrated the stability of agriculture under irrigation and again ranked this valley among the foremost agricultural districts of the United States, both growers and shippers declared.

The production was heavy in nearly all crops, and this excellent showing, together with the continued activity in various manufactures and the increase in building construction with attending pay rolls, accounts for the comparative financial security that this region has enjoyed.

FRUIT INCOME LARGE

Toward the impressive total of $40,280,000 in aggregate returns fruit furnished $19,621,000, or nearly half of the total and approximately as much as in any season in recent years.

The two major commodities, apples and pears, gave the growers the largest crops they have ever harvested. The apple tonnage aggregated 17,260 cars, compared with 12,717 in 1929 and the former peak of production of 16,031 cars in 1928. Compared with 1929, an increase in production was shown, not only in apples and pears, but in potatoes, tomatoes, hay, wheat, hops, lambs, wool, eggs, and dairy products.

SHIPMENTS GREATER

The commodities produced will fill 53,976 cars, as compared with 43,700 in 1929. The fruit movement from the valley will reach the big total of 26,345 cars, while only 19,837 cars were required to handle the production in 1929.

In addition to the tonnage shipped out of the valley, close to a million dollars worth of grain, hay, and other farm crops were used in the production of $7,000,000 worth of livestock and livestock products. The value of such feeds is not included in the accompanying statistical table, but is accounted for in the figures for livestock, poultry, meats, eggs, and dairy products.

TRUCKS MOVE PRODUCTS

All values are given in terms of the receipts by the shippers, and are not the returns to the growers, that is, the prices are those on board of cars and not those received by the producers.

Among the striking things revealed in the crop survey was the large volume of fruits and vegetables moving by motor truck out of the valley. This traffic amounted to the surprising equivalent of 700 railroad carloads. This class of shipping was chiefly to the coast, although some loads went to Spokane and other points in eastern Washington. Fruits valued at $350,000 were hauled by trucks out of the valley, this movement being of comparatively recent development.

INCREASED PAY ROLLS

The canning of pears in Yakima and Sunnyside this season was on an exceedingly large scale. All the fruit was delivered to the plants in motor trucks, and not a single railroad car containing pears was unloaded at the canneries.

More persons were employed by the fruit industry in 1930 than during the preceding season, and this was due to the greatly increased production. The wages with few exceptions were maintained on the level of 1929, making an exceedingly large pay roll for the valley. Processing of fruits and vegetables was on a larger scale than ever known here before, and that further augmented the turnover of funds in this district.

WATER SUPPLY CONDITIONS

The mild weather, characteristic of the present winter, continued throughout February except in southern California, Arizona, and parts of New Mexico, where heavy rains and some snow were experienced.

For reservoirs with concurrent data available the storage contents on February 28 were 4,700,000 acre-feet, compared with 5,200,000 acre-feet for the same date in 1930.

The storage for the Salt River project was materially increased owing to heavy rains on the watershed, now larger than for several years.

Early demands on storage are expected, and on some projects shortages are likely to occur. Grouting operations at Deadwood Dam are being expedited in order that the reservoir may store water this year and augment the power at the Black Canyon power plant.

Temperatures for the month were above normal and in some cases the highest of record. While precipitation, mainly in the form of light snows, improved the water-supply outlook somewhat, the snow cover at the end of the month was only about half of normal and deficient run-off for the current year now appears practically inevitable.

SHIPMENTS OF PRODUCE FOR YEAR 1930 SET RECORD

Crop	Number of cars	Value of shipment
Fresh fruits and melons	26,345	$19,621,492
Vegetables	8,395	2,856,339
Preserved fruits and vegetables	1,030	3,329,620
Grain	1,575	1,159,200
Grain products	580	561,250
Hay, straw, and hay products	7,458	1,429,145
Hops	135	637,000
Miscellaneous crops	132	424,435
Livestock	1,168	1,905,300
Livestock products	667	2,148,700
Dairy products	550	1,903,200
Poultry and eggs	185	792,350
Miscellaneous products	5,756	3,511,969
Grand total	53,976	40,280,000

LAMBING was practically completed on the Minidoka project at the close of the month, with unusually large percentages of increase in nearly all flocks. Losses were small and the lambs were doing well. Many early lambs had been sent to market. The Minidoka County wool pool signed contracts with some 200 growers for more than 17,000 fleeces, to be delivered during 1931.

Agricultural Demonstration Work on the Reclamation Projects

A YEAR or so ago representatives of the Bureau of Reclamation and of the Extension Service of the Department of Agriculture held a conference to work out a program of cooperation in extension work on irrigation projects, with a view to promoting better agriculture on the projects.

As a result of this conference the Bureau of Reclamation receives copies of monthly reports by county agents and demonstrators on many of the projects, and project superintendents are enabled to keep informed on the yearly programs of extension work bearing more or less directly on reclamation problems.

It is the desire of the bureau that every effort be made to further this cooperation. In this connection it is gratifying to note that in a recent letter Dr. C. W. Warburton, director of extension work, refers to "the very fine spirit of cooperation shown generally by the project superintendents and other Bureau of Reclamation employees."

The Department of Agriculture has an appropriation of $39,255 for the employment of extension workers. The actual expenditures, by projects, in the fiscal year 1 930, and the allotments for 1931 are shown in the accompanying tabulation.

RECLAMATION DEMONSTRATIONS

Project	Expenditure fiscal year ended June 30, 1930	Allotment fiscal year ending June 30, 1931
Supervision, field	$3,748.82	
Yuma, Ariz		$2,075.00
Uncompahgre, Colo	3,199.92	3,200.00
Grand Valley, Colo	300.00	1,146.67
Minidoka, Idaho	2,700.00	2,700.00
Flathead, Mont	2,090.00	1,800.00
Huntley, Mont	2,499.96	2,500.00
Milk River, Mont	600.00	2,400.00
Sun River, Mont		2,400.00
North Platte, Nebr	4,738.74	4,800.00
North Platte, Wyo		276.67
Newlands, Nev	3,326.25	3,001.73
Umatilla, Oreg	2,400.00	2,400.00
Klamath, Oreg	2,400.00	2,400.00
Belle Fourche, S. Dak	2,400.00	2,400.00
Strawberry, Utah	2,200.00	2,400.00
Shoshone, Wyo	2,400.00	2,400.00
	35,003.69	38,300.07
Unexpended	4,251.31	
Unallotted		954.93
Allotted to office of reclamation demonstrations	39,255.00	39,255.00

The allotments to the projects are all used in direct payments on salaries of extension agents who are employed cooperatively with the States and counties in which they are working. In some cases the entire amount of salary is paid from the Federal appropriation, and in others only a part of the salary is so paid. In all cases, expenses of the workers are paid from State or county funds. The proportion of salary paid from the Federal appropriation varies with the different projects.

No specific part of the agent's time is devoted to irrigation project demonstrations, though in most instances the irrigation project constitutes the major part of the agriculture of the county, and as a consequence the project takes the major part of the agent's time. In some cases, as in the Yuma and Huntley projects, the demonstrator is an assistant county agent, giving his entire time to project farmers.

Milk River Project Enjoys Open Winter

The Milk River project, Montana, at an elevation of 2,200 feet, has a normal temperature range of −40° to 100° F., an average irrigation season extending from April 16 to September 30, and produces alfalfa, grains, vegetables, sugar beets, potatoes, and livestock. The general impression prevails that Milk River, lying as it does in the extreme north of Montana, has winters which are too rigorous for comfort or pleasure and that it is a place to be avoided except during the milder seasons.

There is always a variety of climate, including plenty of sunshine and fresh air, which afford pleasant healthful weather and make northern Montana hard to beat, even during the months of October to April. The month of February this year, which was exceptionally pleasant, was characterized by many outdoor sports among which were golfing, tennis playing, skating, and, strangest of all, swimming. Knowing the superintendent's reputation for veracity the statement regarding outdoor sports in general may be accepted without question, but swimming in midwinter on the Milk River project demands an explanation, which he gives as follows: The "burning well" in the vicinity of Nelson Reservoir, with its pool of warm water immediately below a perpetually burning gas fire, has provided a popular resort for bathers, especially those who seek the beneficial results of open-air bathing in water of alleged medicinal value.

Fishing on a commercial basis has also been carried on, over two carloads of fish having been taken from under the ice of Bowdoin Lake and shipped to eastern markets.

Sugar beets raised on Milk River project, Montana

The value of Federal irrigation, which has never been questioned by those who have been closely associated with the work at different periods since its inception, has been demonstrated during the past season of almost unprecedented drought to the satisfaction of many former doubters, when numerous farmers from the surrounding dry-land areas whose crops had been a total failure took advantage of the opportunities offered in the irrigated sections and purchased available properties from owners of large holdings who were willing to subdivide and sell at reasonable prices. Milk River has had a goodly share of the nearby drought-stricken farmers and there are still a few opportunities to purchase privately owned farms on this favored project. The superintendent, Mr. H. H. Johnson, at Malta, Mont., is ready to answer all inquiries from prospective settlers regarding the Milk River project.

Project Histories

The Kittitas Division of the Yakima project has the honor of sending in the first project history for the year 1930. This report consists of 143 pages, index, 49 photographs of special interest showing construction work on siphons, dams, etc., 3 maps, 15 blue prints of project organization, abstracts of bids, progress charts, and capacity and discharge curves.

ALL livestock on the Uncompahgre project are in good condition. The sheep-feeding program increased somewhat this year over that in effect during the past winter owing to the low price of lambs and the generally favorable terms offered by owners of large flocks.

Irrigated Area of the United States—Census of 1930

The preliminary announcement of the results of the 1930 census of irrigation shows that the area actually irrigated in 1929, including rice irrigation in Arkansas, Louisiana, and Texas, was 19,578,441 acres, compared with 19,191,716 acres in 1919, an increase of 386,725 acres, or 2 per cent.

Excluding the area irrigated for rice production, and confining the data to the irrigation of arid land in the 17 arid and semiarid States west of the one hundredth meridian, the area irrigated in 1929 was 18,759,885 acres, compared with 18,329,424 acres in 1919, an increase of 430,461 acres, or 2.3 per cent.

The largest percentage of increase was found in Texas, where 582,695 acres were irrigated in 1929, exclusive of rice irrigation, compared with 322,656 acres in 1919, an increase of 80.7 per cent, followed by Kansas, 47.6 per cent; Arizona, 23.5 per cent; and Nebraska, 19.4 per cent. Nine of the 17 States showed decreases ranging from 35.4 per cent in South Dakota to 3.5 per cent in Utah.

Evidently there is little, if any, basis for the claim heard from time to time that the development of these irrigated areas has had any material effect on overproduction during the past decade, and, of course, the effect of Federal reclamation under the conservative policy of construction in force, is even less evident.

The accompanying table gives the figures, by States, for 1919 and 1929:

ACREAGE IRRIGATED, 1919 AND 1929

States	1919	1929 (preliminary estimate)	Per cent increase or decrease
Arid irrigation			
Arizona	467,565	577,263	23.5
California	4,219,040	4,731,632	12.1
Colorado	3,348,385	3,426,022	2.3
Idaho	2,488,806	2,152,176	−13.5
Kansas	47,312	69,841	47.6
Montana	1,681,729	1,580,321	−6.0
Nebraska	442,690	528,680	19.4
Nevada	561,447	487,241	−13.2
New Mexico	538,377	551,420	2.4
North Dakota	12,072	8,851	−26.7
Oklaboma	2,969	890	−70.0
Oregon	986,162	937,068	−5.0
South Dakota	100,682	65,020	−35.4
Texas	322,656	[1] 582,695	80.7
Utah	1,371,651	1,323,703	−3.5
Washington	529,899	503,458	−5.0
Wyoming	1,207,982	1,233,604	2.1
Total arid irrigation	18,329,424	18,759,885	2.3
Rice irrigation			
Arkansas	143,946	151,305	5.1
Louisiana	454,882	452,251	−0.6
Texas	263,464	[2] 215,000	−18.4
Total rice irrigation	862,292	818,556	−5.1
Grand total	19,191,716	19,578,441	2%

[1] Total area irrigated in Texas, including rice, 797,695 acres.
[2] Rice irrigation based on data in Yearbook Department of Agriculture.

OWNERS of the Otato factory at Burley, Minidoka project, began operations on March 1. A large quantity of potatoes was bought preparatory to operation.

Home of Felix Bessler, Willwood Division, Shoshone project, Wyoming

1931 Educational Directory

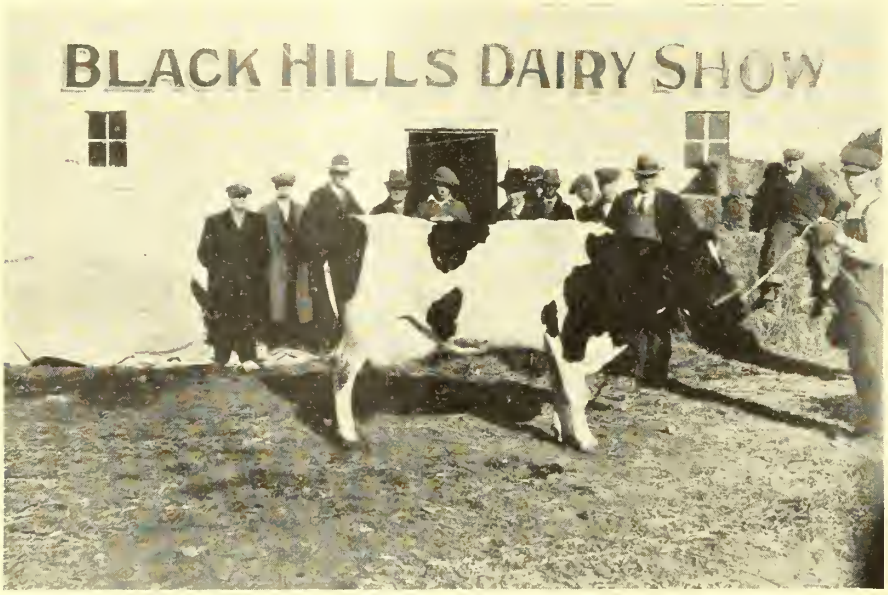
The Department of the Interior announces that the office of education has completed two parts of the 1931 Educational Directory listing nearly 12,000 school officials of the United States. Part I includes elementary and secondary school systems and Part II the institutions of higher education.

These documents are now available from the Superintendent of Documents, Government Printing Office, Washington, D. C., Part I at 15 cents a copy and Part II at 10 cents a copy.

Part III, listing educational associations, boards, and foundations and educational periodicals, will be ready for distribution later.

A CARLOAD of provisions for the drought-stricken area was sent from the Belle Fourche Valley on the 16th of the month. This shipment comprised flour, canned goods, honey, sugar, cured meats, and beans, totaling 40,000 pounds. The shipment was consigned to the American Red Cross at Dardanelle, Ark.

Belle Fourche Project Produces Prize Winning Cattle



Holstein winner of sweepsteakes, Belle Fourche project, South Dakota

Holstein cows owned by Belle Fourche project dairymen won the sweepstakes and also the cellar championship in the annual dairy show held at Vale during January. Seventeen entries of various breeds competed for prizes on the basis of production, under tests that extended over a period of one week. Premiums aggregating $200 were offered by the sponsors of the show as a means of stimulating dairying and encouraging better breeding in the grade herds.

The Belle Fourche Valley Dairy Development Committee had the support of all the commercial clubs and other business organizations in promoting this annual demonstration of production from good cows in comparison with the boarders and duds. The latter class in some cases were a revelation, even to their owners, when tests indicated a balance on the wrong side of the ledger. At the time of the show butterfat was valued at 22 cents per pound, a mark that requires the very best practice in dairying and leaves no margin for dallying with a scrub cow.

A banquet on the last day of the show was attended by about 300 people, and a speaking program emphasized the lessons to be learned from the results of the tests, which were tabulated and exhibited on a large chart. Speakers representing the dairy department of the State College, the Chicago & North Western Railway, and the Utah-Idaho Sugar Co., and others advanced many valuable suggestions concerning the factors that make for successful dairying. It was pointed out that a good cow constitutes only one-third of the prescription, and that a dairy-minded farmer and the right kind of feed are necessary for a profit-making dairy unit. One speaker called attention to the real "farm relief" that walks around on the four legs of a dairy cow, stating that a good herd properly cared for will bring larger returns than any other investment.

The dairy committee also sponsored an essay contest, open to all grade school pupils, on Value of Dairying to Farmers. Doris Maass, of the Horse Creek community, won the first prize of $10, and second prize went to Gladys Dolphin, of Vale. The following tabulation shows production and profits from the various cows and the standing of each cow entered in the show.

Placing	Owner and breed	Cost of feed	Milk produced (pounds)	Average test	Butterfat produced	Price of fat	Value of fat and skim milk	Profit
1	Harve Cooper, Holstein	$2.31	404.4	3.6	14.56	$0.22	$3.93	$1.62
2	H. W. Roswell, Holstein	2.31	357.1	4.0	14.28	.22	3.78	1.47
3	C. C. Miller, Holstein	2.22	328.1	3.4	11.16	.22	3.05	.83
4	H. G. Milne, Holstein	2.03	237.3	4.0	9.49	.22	2.52	.49
5	John Killinen, Holstein	2.04	239.7	3.5	8.39	.22	2.28	.24
6	C. A. Wood, Holstein	2.03	193.3	2.8	5.41	.22	1.54	−.49
1	Charles Thomas, Guernsey	2.03	177.5	5.0	8.88	.22	2.26	.23
2	Lee Semmons, Guernsey	2.00	131.3	5.5	7.22	.22	1.82	−.18
1	William Polly, Jersey	2.02	138.2	4.9	6.77	.22	1.74	−.28
2	Charles Huffback, Jersey	1.71	127.0	4.8	6.10	.22	1.57	−.14
1	Wilbur Long, Ayrshire	2.11	337.9	3.7	12.50	.22	3.36	1.25
2	Julius Viken, Ayrshire	2.03	221.3	3.6	7.97	.22	2.14	.11
3	J. R. Mock, Ayrshire	2.03	147.2	3.8	5.59	.22	1.49	−.54
1	C. I. Parks, Shorthorn	2.03	186.8	4.2	7.85	.22	2.06	.03
1	J. F. Heetland, Brown Swiss	2.14	277.9	4.2	11.67	.22	3.07	.93
2	Milo Thurlow, grade	1.91	260.7	4.3	11.21	.22	2.94	1.03
3	W. F. Long, grade	1.90	271.6	4.1	11.14	.22	2.94	1.04

Feed prices—Alfalfa, $8 per ton; grain mixture, $1 per hundredweight; silage, $4 per ton; pulp, $2.50 per ton.

Water Improvement District Makes Prompt Payments

On March 2, El Paso County water improvement district No. 1, Rio Grande project, transmitted to the Bureau of Reclamation two checks in the sums of $211,860 and $105,000.30, or a total of $316,860.30. The larger check is in full payment of construction charges accruing to date, less the balance of $39,075 remaining on the $350,000 Riverside Canal fund, all of which balance has not yet been collected, but which when collected will be retained by the district in accordance with past practice and notices of repayment for construction charges, for possible expenditure on the Riverside Canal pending its completion.

The smaller check of $105,000.30 represents the total collected by the district to date on the operation and maintenance and storage charges for 1930. The balance remaining unpaid of the 1930 operation and maintenance charges amounts to $61,200, on which the district is still making collections.

In making prompt payment of its charges, thus ignoring the three months' grace allowed by the notices of repayment of operation and maintenance charges at provided by the extension act, the district greatly assisted in the relief of the temporary shortage in the reclamation fund.

Irrigation District Contract Upheld

(Continued from p. 74)

many cases of actual benefit it is not possible to prove a corresponding increase in market value. (Nampa, etc., Irr. Dist. *v.* Petrie, 37 Idaho, 45, 57, 223 P. 531, 534; Central Pac. R. Co. *v.* Truckee Carson Irr. Dist., 49 Nev. 278, 298, 245 P. 285, 291.)

The judgment appealed from will be affirmed.

Make Blue Monday Disappear for the Home Maker

I HAVE been asked to present something on home laundry, equipment, arrangement, and supplies. In doing this I have thought of the various types of homes on our projects to be considered. The bungalow type with all rooms on one floor presents the idea that a separate room for laundry should be provided if possible.

EQUIPPING A HOME LAUNDRY

It is very desirable to keep the handling of soiled clothing and the odors and steam of laundry work from the kitchen, where food is prepared.

The size of such a laundry depends on the number and size of the articles with which it is equipped. A completely equipped home laundry with articles of regulation size requires about 200 square feet. There should be a convenient arrangement of the standard pieces of equipment that have been found useful in the average-sized family, having in mind the convenience, comfort, and safety of the worker. A large table so placed that it can be used for sorting the soiled clothes will be found helpful and a folding rack above the table furnishes a convenient place for the finished garments after they are ironed either on the board or on the ironer. This arrangement also conserves space. The stove should be placed near the washer, so that the clothes can be transferred easily if they are to be boiled.

Attention should be given to the lighting and ventilation of the laundry. Natural lighting should strike it from the side. The common practice of locating stationary tubs or trays under a basement window brings them so close to the wall that the light from a relatively high window does not strike them. If the window arrangement is poor, a good source of properly directed artificial light should be placed over each large piece of equipment. All electric wiring and devices should be properly insulated.

Doors and windows should be so placed as to give thorough ventilation. The walls should be painted or otherwise treated so that they are not affected by steam and are washable. They should be light in color. The floor should be of material that wears well, is not too hard for the feet, does not soak water, or get slippery when wet, and is easily cleaned. Wood and concrete are most practical. Concrete has the advantage that it is not affected by water, can be fitted with a drain, and is not slippery. It is, however, fatiguing to stand on, but this may be overcome somewhat by the use of rubber mats or low wooden platforms. These have the additional advantage of being safety precautions if electrical devices are being used. Linoleum, particularly when cemented down so that water can not get under it, is in some ways a satisfactory covering for a laundry floor of either wood or concrete.

Some helpful washing devices are on the market in addition to various types of washing machines. When for any reason it is not possible to install a machine, considerable assistance may be obtained from some of these devices. One is a perforated funnel made to fit in a wash boiler. This works on the same principle as a coffee percolator and increases the circulation of water through the clothes. The funnel-on-a-stick type of washer, which was the forerunner of the vacuum-cup washing machine, makes it possible to wash very soiled or infected clothing without immersing the hands. The stick can also be used to lift the wet clothes from the boiler to the tub, although a smooth broom stick is equally satisfactory. What might be termed "portable washers" are also available. One such type is a pump operated by an electric motor which maintains the circulation of water in the tub and keeps the clothes in motion. Another consists of a set of inverted cones which act on the vacuum principle mentioned above. This can be fastened to the tub and operated by hand or motor. All of these devices are improvements over the washboard method.

PICKING OUT A WASHING MACHINE

Most women realize the convenience of a washing machine, especially if it can be run by electricity, but they are often puzzled when it comes to making a selection from among the many different makes. All of the makes on the market can be classified into four types, according to the principle on which they operate.

Selection becomes a matter of personal preference for a particular operating principle. Each type has its advantages. In all, the washing is done by some device that forces soapy water through the clothes until they are clean.

The cylinder type of washer has a perforated cylinder of metal or wood in which the clothes are placed. This revolves in an outer container holding soap and water. The cylinder has blunt projections on the inside, which carry the clothes along as it revolves. It reverses its direction automatically from time to time. The water gushes through the perforations and cleanses the clothes. There is a second type of cylinder machine in which the cylinder is in the form of a flattened perforated box which moves back and forth so that the clothes tumble from one end to the other.

The "dolly" principle consists of a revolving device suspended in the center of the tub, fastened either to the lid or to the bottom. This carries the clothes first in one direction and then in the other. The corrugation of the sides and bottom of the tub help to cleanse the clothes partly by friction.

In the oscillating type of machine, the tub itself rocks and tilts back and forth, tossing the clothes from one end to the other, and the water moves in a curving path.

The vacuum-cup type of machine is a development of the funnel on a stick device in vogue 20 or more years ago. The soapy water is forced through the clothes by the pressure and suction produced by the cups.

When buying an electric machine specify the voltage of the local current and whether it is direct or alternating and, if alternating, the cycle. Consider the shape and size of the machine in relation to the room where you expect to use it. Be sure it is not too large. Choose a flat

top if you are likely to want it for a working surface between wash days. Buy a machine of the right capacity for your average washing, and of the right height for you to operate. Find out whether the manufacturer's repair service is easily available. Simple construction is advisable. The frame should be strong and rigid, but it should be possible to roll the machine about on casters. The mechanism and gearing must be properly covered for safety and cleanliness, and the motor should be located where it will not get wet. Ask how often the machine must be oiled and whether that can be done easily. Any movable parts, such as a cylinder, should be light in weight and easy to handle. The water outlet should be practical for easy drainage. See whether the wringer can be used when the machine is washing. Consider the possible advantages of a centrifugal drier.

Above all, when you have bought your machine give it good care. Follow the directions that come with it, especially in regard to the weight of clothes to be put in at one time. Oil it regularly and dry it after each use.

Power Development in Austria

The Austrian Government has recently decided to construct a large hydroelectric power plant in northern Tyrol, according to a consular report. Two banking concerns in Vienna will finance the project. Waters of the Inn River and tributaries will be used to develop power with reservoirs at the Plan and Heiterwung Lakes.

For the completion of the project, it is contemplated that 14 years of continous work will be required, and the total cost of the undertaking will amount to $143,000,000. The power station at Silz, in the Inn Valley, will be built immediately. This particular plant will require three years to complete and its output will be 400,000,000 kilowatt-hours per year. The entire project will have a capacity of 1,000,000 horsepower and produce 2,300,000,000 kilowatt-hours yearly. This corresponds approximately to the total electric energy consumed in Austria at the present time.

Unemployment conditions will be relieved by the proposed construction, which will keep 7,000 workmen busy for 14 years, resulting in a saving of $22,000,000 in unemployment dole. Allied industries manufacturing materials and machinery will also benefit. Among the principal material requirements are 1,000,000 barrels of cement, 77,000,000 pounds of piping material, 95,000,000 pounds of iron equipment, and 51,000,000 pounds of machinery.

Sugar factory, Lovell, Shoshone project, Wyoming

Series of Addresses on Engineering-Economic Problems

The department of civil engineering and the institute of arts and sciences of Columbia University, in cooperation with the New York section of the American Society of Civil Engineers, has arranged a series of addresses on the Major Engineering-Economic Problems of the Day, to be given at Columbia University, New York City.

The foreword of the program is as follows:

"There has probably never been a period in American history when the United States was faced with the necessity of making more far-reaching and important decisions in regard to governmental and economic policies than at the present day. Many of these problems are primarily engineering in their origin.

"Their solution is so intimately connected with engineering activities that participation and cooperation of the engineering profession is essential in the formulation of policies of development and control.

"Recognizing the need among the members of the profession for a broader understanding of the social and economic relationships of engineering and on the part of the public for a wider appreciation of the necessity of engineering advice in connection with Government policies relating to public works and utilities, Columbia University has arranged this series of addresses by the foremost authorities in their respective fields."

The program follows:

March 2. The Boulder Canyon Project, by Dr. Elwood Mead, Commissioner of Reclamation:

The Bureau of Reclamation was established under the administration of President Roosevelt in 1902. Its engineers have built many famous dams for irrigation and are now engaged in constructing the largest dam in the world for both irrigation and power. The Federal Government has thus entered the power field. Doctor Mead will describe this great project and discuss the principles and policies involved in the distribution of costs and benefits.

March 16. The Power Problem, by Col. William Kelly, vice president of the Buffalo, Niagara & Eastern Power Co.

March 23. The Economics of the Highway Era (speaker to be announced).

March 30. Our Inland Waterways, by Maj. Gen. T. Q. Ashburn, chairman of the Inland Waterways Corporation.

April 13. The Railroad Situation, by Charles F. Speare, financial editor, the Consolidated Press.

April 20. The Transportation Problem—A Survey and Review, by William Z. Ripley, professor of political economy, Harvard University.

April 27. The Mississippi Problem, by Gen. Lytle Brown, Chief of Engineers of the United States Army.

May 4. The St. Lawrence Project, by Maj. Gen. Edgar Jadwin, Chief of Engineers, United States Army, retired.

THE preliminary announcement of the Bureau of the Census gives the irrigated area of the United States as 19,578,441 acres for 1929.

A GOOD farm garden will not only let the farmer live better, but it has been shown to add several hundred dollars worth of living to his farm.

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, 1932, and for other purposes

(Act February 14, 1931, Pub. No. 666, 71st Cong., 3d sess.)

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, $145,000; for office expenses in the District of Columbia, $23,000; in all, $178,000;

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 $178,000 for personal services and $27,000 for other expenses in the office of the chief engineer, $25,000 for telegraph, telephone, and other communication service, $7,000 for photographing and making photographic prints, $54,000 for personal services, and $12,000 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 $20,000 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 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 1931 is continued available for the same purpose for the fiscal year 1932;

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 1931 is continued available for the same purpose for the fiscal year 1932;

Yuma project, Arizona-California: For operation and maintenance, $265,000; for continuation of construction of drainage, $20,000; in all, $285,000: *Provided*, That not to exceed $25,000 from the power revenues shall be available during the fiscal year 1932 for the operation and maintenance of the commercial system;

Orland project, California: For operation and maintenance, $39,000;

Grand Valley project, Colorado: For continuation of construction, $15,000;

Boise project, Idaho: For continuation of construction, Arrowrock division, $40,000; for operation and maintenance, Payette division, $25,000; in all, $65,000: *Provided*, That the unexpended balances of the appropriation of $60,000 for continuation of construction, Arrowrock division, fiscal year 1930, and of the appropriation of $280,000 for continuation of

construction, Arrowrock division, fiscal year 1931, shall remain available for the same purposes during the fiscal year 1932;

Minidoka project, Idaho: For operation and maintenance, reserved works, $29,000; continuation of construction gravity extension unit, $250,000, together with the unexpended balance of the appropriation for this purpose for the fiscal year 1931; for cleaning up Jackson Lake Reservoir in Wyoming, in cooperation with the National Park Service, $50,000, either by direct expenditure or by transfer to the National Park Service to be available until expended: *Provided*, That the expenditure from the reclamation fund for such clean-up shall not be charged as a part of the construction or operation and maintenance cost payable by the water users under the project, but shall be offset and recouped from revenues from the rentals of storage from the reservoir: *Provided further*, That not to exceed $50,000 from the power revenues shall be available during the fiscal year 1932, for the operation of the commercial system; and not to exceed $125,000 from power revenues shall be available during the fiscal year 1932 for continuation of construction, south side division; in all, $329,000;

Bitter Root project, Montana: For liquidating all bonded and other indebtedness of the Bitter Root irrigation district, $500,000; for loaning to said irrigation district for necessary construction, betterment, and repair work, $50,000; in all, $550,000, 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, $7,500; continuation of construction, $16,500; in all, $24,000;

Sun River project, Montana: The unexpended balance of the appropriation for continuation of construction for the fiscal year 1931 shall remain available for the fiscal year 1932, for the purposes for which originally appropriated and for drainage construction.

North Platte project, Nebraska-Wyoming: Not to exceed $60,000 from the power revenues shall be available during the fiscal year 1932 for the operation and maintenance of the commercial system;

Carlsbad project, New Mexico: For operation and maintenance, $70,000;

Rio Grande project, New Mexico-Texas: For operation and maintenance, $375,000; for continuation of construction, $100,000; in all, $475,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1931 shall remain available for the same purposes for the fiscal year 1932;

Owyhee project, Oregon: For continuation of construction, $3,000,000;

Baker project, Oregon: Of the unexpended balance of the appropriation for this project for the fiscal year 1931, $250,000 is reappropriated and made available for the fiscal year 1932, for the construction of Thief Valley Reservoir, of which amount not to exceed $41,069 shall be available for the purchase of rights of way therefor: *Provided*, That contracts for the sale of such rights of way to the Government are executed prior to September 1, 1931;

Vale project, Oregon: For operation and maintenance, $15,000; for continuation of construction, $150,000; in all, $165,000;

Klamath project, Oregon-California: For operation and maintenance, $41,000; continuation of construction, $315,000; for refunds to lessees of marginal lands, Tule Lake, $6,000, plus the unexpended balance of the appropriation for this purpose for the fiscal year 1931; in all, $362,000;

Belle Fourche project, South Dakota: For continuation of construction, $150,000;

Salt Lake Basin project, Utah, first division: The unexpended balance of the appropriation for construction of Echo Reservoir and Weber-Provo Canal, for the fiscal year 1931, shall remain available for the same purposes for the fiscal year 1932;

Salt Lake Basin project, Utah, second division: The unexpended balance of the appropriation for the fiscal year 1931 shall remain available for the same purposes for the fiscal year 1932;

Yakima project, Washington: For operation and maintenance, $325,000: *Provided*, That the unexpended balances of the appropriations for continuation of construction for the fiscal years 1929 and 1930 continued available for the same purpose for the fiscal year 1931 shall be available during the fiscal year 1932;

Yakima project (Kittitas division), Washington: For operation and maintenance, $35,000; for continuation of construction, $796,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1931 shall remain available during the fiscal year 1932; in all, $831,000;

Yakima project (Kennewick Highlands unit), Washington: The unexpended balance of the appropriation of $640,000 for construction for the fiscal year 1931 shall remain available for the same purpose for the fiscal year 1932;

Riverton project, Wyoming: For operation and maintenance, $30,000 of the unexpended balances of the appropriations for this purpose for the fiscal years 1930 and 1931 shall continue available for this purpose for the fiscal year 1932: *Provided*, That not to exceed $20,000 from the power revenues shall be available during the fiscal year 1932 for the operation and maintenance of the commercial system;

Shoshone project, Wyoming: For continuation of construction, Willwood division, $17,000; for operation and maintenance, Willwood division, $16,000; in all, $33,000: *Provided*, That the unexpended balance of the appropriation for construction, Willwood division, for the fiscal year 1931, shall remain available for the same purposes for the fiscal year 1932: *Provided further*, That not to exceed $20,000 from power revenues shall be available during the fiscal year 1932, for the operation and maintenance of the commercial system;

Secondary projects: For cooperative and general investigations, the unexpended balance of the appropriation for this purpose for the fiscal years 1930 and 1931, contained in the First Deficiency Act, fiscal year 1930, is continued available for this purpose for the fiscal year 1932;

For investigations necessary to determine the economic conditions and financial feasibility of new projects and for 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, $50,000: *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;

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, $25,000, 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;

Refunds of construction charges: The unexpended balance of the appropriation of $100,000 contained in the first deficiency act, fiscal year 1928, for refunds of construction charges theretofore paid on permanently unproductive lands excluded from the Federal reclamation projects specified in the act approved May 25, 1926 (U. S. C., Supp. III, title 43, sec. 423a), in accordance with section 42 of said act, is hereby made available for the same purposes for the fiscal year 1932;

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 1932, 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 1932 exceed the whole amount in the "reclamation fund" for the fiscal year;

Ten per cent of the foregoing amounts shall be available interchangeably for expenditures on the reclamation projects named; but not more than 10 per cent 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;

Whenever, during the fiscal year ending June 30, 1932, the Commissioner of the Bureau of Reclamation shall find that the expenses of travel, including the local transportation of employees to and from their homes to the places where they are engaged on construction or operation and maintenance work, can be reduced thereby, he may authorize the payment of not to exceed 3 cents per mile for a motor cycle or 7 cents per mile for an automobile used for necessary official business;

Total, from reclamation fund, $6,971,000.

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), $100,000, to be immediately available.

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. III, title 33, ch. 15A); $15,000,000 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 the amount hereby appropriated, not to exceed $50,000, reimbursable, shall be available for investigation and reports as authorized by section 15 of the Boulder Canyon project act.

Extracts from Second Deficiency Act Fiscal Year 1931

Advances to the reclamation fund: To carry out the provisions of the act entitled "An act to authorize advances to the reclamation fund, and for other purposes," approved March 3, 1931, $5,000,000.

Milk River project, Montana: For continuation of construction, fiscal years 1931 and 1932, $11,000.

Secondary projects: For continuation of investigations of the Seminoe Dam and Reservoir and other possible storage sites and power development in connection with proposed and existing reservoirs on the North Platte River and its tributaries in Wyoming, fiscal years 1931 and 1932, $75,000: *Provided*, That nothing done in pursuance hereof or under the authority hereof, shall be construed to initiate or enlarge or constitute any water right or appropriation of water, or any priority of appropriation of water whatever.

North Platte project, Nebraska-Wyoming: For the purpose of enabling the Secretary of the Interior to construct rural trunk transmission lines, including necessary transformers, into farm settlements, communities, and municipalities, within the North Platte irrigation project, the inhabitants of which are able to finance feeder or distribution systems and to guarantee to the power system a fair measure of profit, not to exceed $30,000 shall be available from the power revenues of the Lingle and Guernsey power plants, North Platte irrigation project. Approved March 4, 1931. (Public, No. 869, 71st Cong.)

Mr. Cramton to Appraise Boulder City Lots

The Secretary of the Interior announced on March 23 that he had appointed Hon. Louis C. Cramton, of Michigan, former Member of Congress, as Special Attorney to the Secretary to have charge of the appraisement of lands and the making of lease concessions for residential and business property at Boulder City, Nevada, the new town which is to be the place of abode of the workers who will build Hoover Dam. Mr. Cramton's headquarters will be at Washington, D. C., but much of his time will be spent at the townsite. The land at Boulder City will be owned by the Government and leased by those who wish to live on or conduct business establishments on it. Mr. Cramton will pass on these leases.

MR. CRAMTON TAKING THE OATH OF OFFICE

Left to right: E. K. Burlew, Administrative Assistant to the Secretary of the Interior; Dr. Elwood Mead, Commissioner of Reclamation; Mr. Cramton; Miss Mae A. Schnurr, Assistant to the Commissioner.

FUNDS AVAILABLE, FISCAL YEAR 1932—APPROPRIATIONS, UNEXPENDED BALANCES, FUNDS TO BE ADVANCED, AND POWER REVENUES

Direct appropriation	Unexpended balances continued available (estimated)	Power revenues appropriated	Funds to be advanced (estimated)	Total available	Project and other items	Examination and surveys	Storage system	Canal system	Lateral system	Drainage system	Power system	Irrigable land surveys	Telephone system	Operation and maintenance: Appropriated	Operation and maintenance: Funds advanced	Miscellaneous
					Reclamation fund											
$178,000				$178,000	Washington office											$178,000
	$35,000			35,000	Examination and inspection of projects									[2] $35,000		
	71,000			71,000	Operation and maintenance of reserved works									[2] 71,000		
285,000		$25,000		310,000	Yuma:											
					Irrigation system					$20,000				265,000		
					Commercial power system									25,000		
39,000				39,000	Orland									39,000		
15,000			$20,000	35,000	Grand Valley	$600			$1,400	13,000					$20,000	
			140,000	140,000	Uncompabgre										140,000	
65,000	285,000		30,000	380,000	Boise:											
					Reserved works										30,000	
					Arrowrock division		$250,000			35,000						
					Payette division									25,000		
					Twin springs storage		40,000									
329,000	300,000	175,000	91,000	895,000	Minidoka:											
					Reserved works									29,000	91,000	
					Commercial power system									[1] 50,000		
					Clearing Jackson Lake Reservoir		50,000									
					South Side pumping station			$100,000		25,000						
					Gooding division			300,000	250,000							
35,000			43,000	78,000	Milk River:											
					Chinook division									7,500		
					Malta and Glasgow divisions			5,000	2,500						43,000	
					St. Mary storage unit		9,000	11,000								
	200,000			200,000	Sun River irrigation system			200,000								
			22,000	22,000	Lower Yellowstone										22,000	
550,000				550,000	Bitter Root liquidating bonded indebtedness and construction betterment work									50,000		500,000
		90,000	50,000	140,000	Nortb Platte						$30,000					
					Reserved works										50,000	
					Power system									[1] 60,000		
70,000				70,000	Carlsbad									70,000		
475,000	28,000			503,000	Rio Grande					98,000				375,000		30,000
3,000,000				3,000,000	Owyhee		1,483,000	1,485,000	30,000			$2,000				
	250,000			250,000	Baker		250,000									
165,000				165,000	Vale	15,000	65,000	22,000	33,000	10,000		5,000		15,000		
			4,000	4,000	Umatilla										4,000	
362,000	4,000		73,500	439,500	Klamath:											
					Main division					100,000					70,000	
					Tule Lake division			59,000	101,000	53,000		1,000	$1,000	41,000	1,500	
					Langell division										2,000	
					Refunds to lessees											10,000
150,000			75,000	225,000	Belle Fourche					150,000					75,000	
	400,000			400,000	Salt Lake Basin:											
					First division		100,000									
					Second division		300,000									
325,000	1,200,000			1,525,000	Yakima:											
					Storage division		1,200,000							75,000		
					Sunnyside division									150,000		
					Tieton division									100,000		
831,000			35,000	866,000	Yakima-Kittitas division			389,500	388,000			18,500		35,000	35,000	
	400,000			400,000	Yakima-Kennewick division						400,000					
	30,000	20,000		50,000	Riverton:											
					Irrigation system									[2] 30,000		
					Commercial power system									[1] 20,000		
33,000	22,000	20,000	1,200	76,200	Shoshone:											
					Willwood division			6,500	22,000	10,000				16,000		500
					Reserved works										1,200	
					Commercial power system									[1] 20,000		
75,000	150,000			225,000	Secondary	225,000										
50,000				50,000	Economic surveys and investigations	50,000										
	54,000			54,000	Refund of construction charges											54,000
25,000				25,000	Giving information to settlers											25,000
7,057,000	3,429,000	330,000	584,700	11,400,700	Total reclamation fund	290,600	3,747,000	2,578,000	827,900	514,000	430,000	26,500	1,000	1,603,500	584,700	797,500
					General Treasury											
100,000				100,000	Colorado River front work and levee system									100,000		
15,000,000				15,000,000	Hoover Dam and appurtenant works	50,000	14,950,000									
15,100,000						50,000	14,950,000							100,000		
22,157,000	3,429,000	330,000	584,700	26,500,700	Grand total	340,600	18,697,000	2,578,000	827,900	514,000	430,000	26,500	1,000	1,703,500	584,700	797,500
29,000				29,000	Yuma auxiliary reclamation fund										29,000	

[1] Power revenues, appropriated for O. & M., $175,000.

[2] Unexpended balances for O. & M., $136,000.

Fly Control Method at St. Elizabeths Hospital Proves Successful

By D. A. Brodie, Farm Superintendent

RECENT experience has demonstrated the value of an entirely new principle in fly control that originated at St. Elizabeths Hospital, United States Department of the Interior, Washington, D. C.

This principle, which accomplishes the double purpose of effectively suppressing flies without impairing the fertilizing value of farm manures, is based on the fact that fly larvæ migrate from their breeding places, usually in great numbers, and go into pupation in the adjacent soil, and from an economic standpoint the period of this migration is the most vulnerable part in the whole life cycle of the fly. To destroy the fly at this stage of his development and by the method here described is believed to be the most simple, logical, and effective means yet devised for maintaining control of the fly problem on a large scale.

THE FLY'S HABITS

It is well known that the fly lays its eggs in farm manure or other suitable material where its natural food is abundant. According to authorities, each female is capable of laying 150 or more eggs at a time and may deposit several such batches during her active period, which accounts for the myriads of larvæ to be found in each day's accumulation of manure. It is also pretty well known that in a few days these larvæ are all gone, and it is right here that most of us lose sight of the fly. To the careful observer, however, it is known that the larvæ, when fully grown, leave the manure pile, or wherever they have been feeding, and pupate in the soil immediately adjacent, seldom traveling more than 10 to 20 feet before finding a suitable place to dig in. By stirring up the ground within this radius the pupæ can readily be found imbedded in the soil, and usually only an inch or two below the surface. Here also is revealed the complete metamorphosis of the fly from the larval to the adult. Larvæ, active and fresh from the manure pile, may be found in the same pocket with larvæ, that appear distorted to the naked eye taking on the pupa form, live pupa easily distinguished by their bright reddish-brown oblong casing, like an elongated bead from a lady's necklace, and empty dark-brown, almost black pupa shells, each with a large hole in one end, where the winged fly escaped; hundreds of them in each exposed pocket. No stretch of the imagination is required to picture the continuous procession of flies coming in as larvæ, resting a while as pupæ, finally breaking out of their casings, shaking the dust from their wings, and flying away. Is it any wonder that we have flies? How futile seem our puny efforts to control this menace by trapping, poisoning, and spraying the adult fly when we realize this continuous reinforcement of on-coming swarms.

These observations soon made it plain that the most vulnerable period in the life cycle of the fly is during the few minutes that it takes him to travel from the manure pile to the pupation grounds. From time immemorial man has been fighting the fly in the winged stage with indifferent results. In the manure pile he is safe unless measures destructive to the manure are applied. But during this migration period he must come out into the open, a helpless, creeping, wingless creature, fully exposed and defenseless. Here is where he may be trapped in the path that the processes of nature demand that he must go. Theoretically at least every maggot in the pile might be destroyed at one fell swoop. Here the problem of fly control without injury to the precious farm manure is simmered down to one definite course of action. All we need now is the trap, and that is simple.

TRAPPING THE FLY

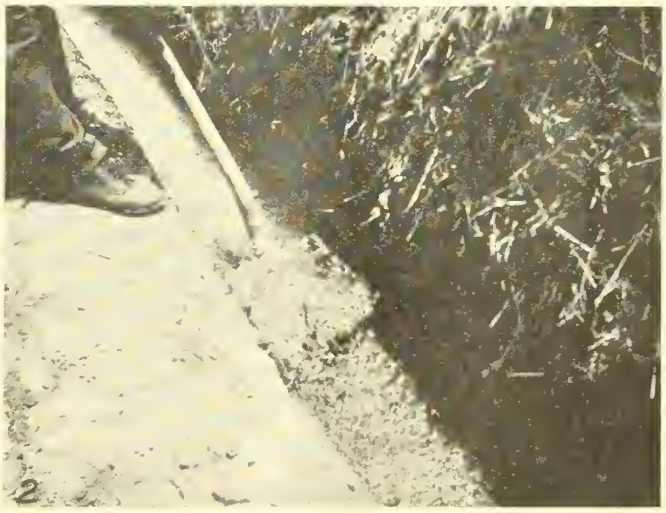
Concentrate all the manure into one compact pile, dig a small trench completely around it, use an effective larvicide to destroy the larvæ as they fall in, and as far as the larvæ in that pile are concerned they are doomed.

After a few preliminary tests, in which spent crankcase oil from the garage was found to be an excellent larvicide, the first rick was begun. Immediately, a trench, about 15 inches wide and a foot deep, was dug across the far end and along the sides and enough crankcase oil to cover the bottom to a depth of about 2 inches was poured into it. With each day's hauling the trench was extended on both sides so that when the rick was finished all that remained to be done was to connect the two ends of the trench across the open end, thus surrounding the whole pile with the oil moat.

It was observed that during the hot days that followed the larvæ began dropping into the oil in less than 12 hours after the trench was dug. See Figure 1, showing a trench just completed with the surface of the oil on the side already covered with larvæ.

In the next illustration a close-up view of the trench affords some idea of the destruction of fly larvæ.

(Continued on p. 92)



GETTING RID OF FLIES

1. Manure pile completely surrounded by oil trench. Surface of oil is white with floating dead and dying larvæ. 2. A close-up view of oil trench showing how dead and dying larvæ may be lifted out by the shovelful

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, gave an address on March 2 before the Department of Civil Engineering and the Institute of Arts and Sciences of Columbia University, New York, as the first of a series of lectures arranged by the University in cooperation with the New York section of the American Society of Civil Engineers. The subject of Doctor Mead's address was The Boulder Canyon Project.

On March 9 the Commissioner delivered a lecture in Bethlehem, Pa., before the Lehigh University and the local branch of the American Society of Civil Engineers. A number of professors from Lafayette University also attended the lecture.

Doctor Mead left Washington on March 28 to visit several of the southwestern projects and to look over the Parker-Gila project in Arizona.

During the absence of Commissioner Mead and pending the return to the office of Assistant Commissioner Dent, Miss Mae A. Schnurr, Assistant to the Commissioner, has been designated Acting Commissioner.

P. W. Dent, Assistant Commissioner and Chief Counsel, left Washington for Los Angeles on March 14 for the purpose of negotiating contracts in connection with the Boulder Canyon project. He will also confer with Mr. Cramton at Las Vegas with respect to plans for Boulder City. In addition his visit takes him to the Yuma and Rio Grande projects.

Porter J. Preston, superintendent of the Yakima project, Washington, left Yakima on March 15 for Denver, Colo., to take charge of the Colorado River investigations. John S. Moore has taken over the affairs of the Yakima project as acting superintendent.

It is with regret that announcement is made of the death on March 3 of Joseph C. Avery, special fiscal agent on the Klamath project. In November Mr. Avery suffered an attack of flu, followed by pneumonia, and later developed an inflammation of the heart, which was the immediate cause of his death. Mr. Avery has been employed by the bureau on the Klamath project since 1923.

F. E. Weymouth, former chief engineer, was in the Denver office during the month for the purpose of discussing the application of the Metropolitan water district of California, of which he is now chief engineer, before the Federal Power Commission for construction of a dam and power plant at or in the vicinity of the Parker dam site.

J. L. Savage, chief designing engineer, spent two days the first of the month on the Boulder Canyon project, going from there to Globe, Ariz., where he investigated the Dorr clarifiers and classifiers installed at certain mining properties and obtained first-hand information for use in connection with the grading of concrete aggregates for Hoover Dam and the problem of desilting the Colorado River at the All-American Canal diversion dam. Mr. Savage also served for the State of California on the Pine Canyon Dam consulting board, returning to Denver early in the month.

C. D. Greenfield, agricultural development agent of the Great Northern Railway, visited the Milk River project early in the month.

E. E. Lewis, superintendent of the Huntley project, returned to the project on March 1 after an absence since December 19 last. During his absence from headquarters Mr. Lewis visited several irrigation projects in the Southwest and enjoyed a pleasant and profitable winter.

Fly Control Method

(Continued from page 91)

In conclusion, it may be stated that this plan has succeeded far beyond expectations, and St. Elizabeths Hospital enjoyed a season of appreciable relief never before experienced in fly time. Flytraps, screens, and sprays are still in use to be sure and must continue to be used because not all fly-breeding places can be brought under this scheme, but with all the farm manure and other refuse brought together and trenched in this way the fly menace is materially checked at the main source of incubation.

Furthermore, before another year rolls around the labor of digging the trench will be eliminated by the installation of concrete trenches which will still further simplify the process.

W. J. Burke, district counsel, spent a few days on the Lower Yellowstone project in the consideration of irrigation matters, particularly the purchase of tax certificates.

A trip has been planned by Val Kuska, colonization agent of the Burlington Railroad, to interest prospective settlers in the Willwood division of the Shoshone project. Mr. Kuska expects to travel as far as Kansas and L. H. Mitchell, superintendent of the Shoshone project, is to accompany him.

W. O. Fleenor, manager, and Phil Rouse, engineer, for the Gering-Fort Laramie irrigation district, were visitors at the North Platte project office during the month.

George O. Sanford, Assistant Director of Reclamation Economics, left Washington on March 31 for the West. He will first visit the Uncompahgre project, Colorado, going from there to the Humboldt and Truckee River districts in Nevada, and later to the Milk River and Sun River projects, Montana.

W. F. Kubach, chief accountant, has been in the Denver office during the past few weeks preparing a system of accounts for the Boulder Canyon project.

N. E. Fordham, master mechanic in the Denver office, was on the Rio Grande project during the month in connection with the work of increasing the air inlets to the throats of the outlet conduits in Elephant Butte Dam.

Passing of Governor Emerson

Gov. Frank C. Emerson, of Wyoming, passed away on February 19, following a sudden illness. He was particularly active, both in his former capacity as State engineer and as governor, in Colorado River matters, being the only engineer among the executives of the Colorado River Basin States. Governor Emerson was very active in recent years in obtaining a correct and up-to-date inventory of the remaining possibilities of irrigation development.

J. W. Myer, chief of mails and files, Washington office, is in Las Vegas, Nevada, installing a filing system.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Dehler, Hydrographic Eng.; L. N. McClellan, 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, Calif.
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, Calif.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	do	Do.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	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	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	H. H. Berryhill	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		do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	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 [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Jct., Colo.
Boise [1]	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, Idaho.
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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay 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. Nelle 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	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	Manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa, Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	W. R. Young and C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin	Spokane, Wash	H. W. Bashore	
Colorado River Basin	Denver, Colo	Porter J. Preston	

100 NEW SETTLERS WERE ADDED TO LOWER YELLOWSTONE PROJECT, MONTANA-NORTH DAKOTA, DURING THE YEAR 1930—70 FARMERS AND 10 FAMILIES REPRESENTED IN THE GROUP

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22, NO. 5 MAY, 1931

Photo. by West, Bu. of Rec.

HON. RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR, SIGNING THE CONTRACT ON APRIL 20, 1931, FOR THE CONSTRUCTION OF HOOVER DAM, BOULDER CANYON PROJECT

STANDING NORTHCUTT ELY, EXECUTIVE ASSISTANT TO SECRETARY, W. A. BECHTEL, FIRST VICE PRESIDENT SIX COMPANIES (INC); E. J. HARDING, MANAGING DIRECTOR, ASSOCIATED GENERAL CONTRACTORS OF AMERICA; MISS MAE A. SCHNURR, ACTING COMMISSIONER, BUREAU OF RECLAMATION, REPRESENTING THE BUREAU IN THE ABSENCE OF COMMISSIONER MEAD

DR. ELWOOD MEAD, COMMISSIONER OF RECLAMATION (AT TOP) AND R. F. WALTER, CHIEF ENGINEER, SIGNING THE CONTRACT WITH THE SIX COMPANIES (INC.) FOR THE CONSTRUCTION OF HOOVER DAM, POWER PLANT, AND APPURTENANT WORKS, BOULDER CANYON PROJECT

UPPER, STANDING LEFT TO RIGHT: WALKER R. YOUNG, CONSTRUCTION ENGINEER; A. B. APPERSON, CAPITALIST; CECIL W. CREEL, DIRECTOR OF EXTENSION, UNIVERSITY OF NEVADA; J. A. MCEACHERN, PRESIDENT GENERAL CONSTRUCTION CO., SEATTLE; JOHN C. PAGE, OFFICE ENGINEER, BOULDER CANYON PROJECT; A. E. CAHLAN, EDITOR REVIEW-JOURNAL, LAS VEGAS; GEORGE W. MALONE, STATE ENGINEER OF NEVADA; LOUIS C. CRAMTON, SPECIAL ATTORNEY TO THE SECRETARY OF THE INTERIOR; CHARLES P. SQUIRES, EDITOR THE AGE, LAS VEGAS; P. W. DENT, ASSISTANT COMMISSIONER, BUREAU OF RECLAMATION; R. J. COFFEY, DISTRICT COUNSEL, BUREAU OF RECLAMATION. LOWER, STANDING LEFT TO RIGHT: EARLE R. MILLS, CHIEF CLERK, BOULDER CANYON PROJECT; A. E. CAHLAN; JOHN C. PAGE; O. W. YATES, PRESIDENT LAS VEGAS CHAMBER OF COMMERCE; WALKER R. YOUNG; CHARLES A. DOBBEL, EXECUTIVE ASSISTANT TO THE SECRETARY OF THE INTERIOR; LOUIS C. CRAMTON; J. R. ALEXANDER, DISTRICT COUNSEL, BUREAU OF RECLAMATION; GEORGE W. MALONE; S. L. GILLAN, PRESIDENT ENGINEERS' CLUB, LOS ANGLES; MYRON C. BURR; FRED HESSE, MAYOR OF LAS VEGAS; CHARLES P. SQUIRES.

NEW 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. 22, No. 5 MAY, 1931

Interesting High Lights on the Federal Reclamation Projects

IN the Malta district of the Milk River project four land sales were completed during the month and a few other transfers were pending. Quite a number of leases also were made.

THE Lower Yellowstone Development Association has decided to continue development work again this year. A representative will begin work in the Colorado territory in the near future.

PICKING of late lettuce on the Yuma project continued throughout the month with heavy shipments of this commodity. The early completion of the picking and marketing of the entire crop was anticipated.

SIX new families have recently arrived on the Sun River project. No farms are for rent at present, although a few places are offered for sale. Many inquiries concerning settlement and home possibilities continue to come in from interested persons.

ANNOUNCEMENT has been made by the Varney Air Lines, holders of the contract for carrying mail on the route from Salt Lake City to Seattle, Wash., that they will start immediately on the construction of a $50,000 depot at the Boise airport, Boise project, Idaho.

THE State Highway east from Yuma to Phoenix, some 200 miles distant, which is a Federal-aid project, is being rapidly developed with oiled surfacing. At present there are approximately 50 miles of pavement, and of the remaining 150 miles, all but 8 are now oil surfaced. Traffic over this highway, which is the main southern transcontinental route, is heavy throughout the year.

A CARLOAD of honey left Fruitdale, Belle Fourche project, on March 26 bound for France. This shipment was consigned to a firm at Jersey City, N. J., and will be loaded on board ship at that point for its final destination.

PUBLIC LAND OPENING, RIVERTON PROJECT, WYOMING

The Secretary of the Interior has announced an opening to entry on May 1, 1931, of a tract of public land comprising 50 farm units on the Pilot division of the Riverton irrigation project, Wyoming. The farm units have an irrigable area ranging from 46 to 106 acres.

Until August 3, 1931, these lands will be open to entry only by ex-service men who have served in the United States Army or Navy in any war.

Requests for public notices, farm application blanks, and further information should be addressed to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington, D. C., or to the Superintendent, Bureau of Reclamation, Riverton, Wyo.

LAMBING, which has been in progress on the Vale project since February 1, is now nearly completed. A number of sheep men have reported 150 per cent increase of lambs. The sheep are now being trailed to the summer ranges.

SPRING pruning and plowing of orchards on the Orland project were completed on April 1. A heavy set of almonds and apricots developed, indicating a large yield this year provided there are no late spring frosts. Oranges and other fruits gave promise of prolific blooming. Alfalfa made good growth. The first cutting is now ready for harvest.

A HERD of Holstein cows owned by S. W. Beck, of Paul, Minidoka project, made an unusual record during the year 1930 by producing an average of 404 pounds of butterfat and 10,710 pounds of milk. One cow yielded 613 pounds of butterfat and 17,854 pounds of milk. The Mini-Cassia Cooperative Dairymen's Association during a recent month purchased 1,074,862 pounds of milk containing 40,215 pounds of butterfat. In addition 18,243 pounds of cream butterfat were bought, or a total of 58,458 pounds of butterfat, an increase of nearly 4,400 pounds over the record of the corresponding month last year.

NO apprehension is felt for a water shortage this season on the Lower Yellowstone project as the minimum flow over a period of 30 years at Intake has been three times the capacity of the canal.

THE cantaloupe and watermelon crops on the Yuma project will be ready to market early in June.

A 40-ACRE farm near Acequia, Minidoka project, including some livestock, was sold during the month for $5,000, and another tract of 40 acres between Paul and Rupert was disposed of for $5,750.

UNEMPLOYMENT conditions on the Carlsbad project have been somewhat improved on account of road work in the vicinity and increased activity on the farms.

SEVERAL new settlers located on the Belle Fourche project during March. The new tenants, who came principally from the dry-land sections to the east and north, have a fair layout of stock and equipment with which to begin immediate operations.

President Approves Baker Project, Oregon

The Secretary of the Interior finds the project feasible from an engineering and economic standpoint

PRESIDENT HOOVER on March 18, 1931, approved the construction of the Baker project, Idaho, as submitted to him in the following letter from the Secretary of the Interior.

DEPARTMENT OF THE INTERIOR,
Washington, March 17, 1931.

THE PRESIDENT,
The White House.

MY DEAR MR. PRESIDENT:

Section 4 of the act of June 25, 1910 (36 Stat. 835), provides in effect that after the date of that act no irrigation project to be constructed under the act of June 17, 1902 (32 Stat. 388) and acts amendatory thereof or supplementary thereto, shall be undertaken unless and until the project shall have been recommended by the Secretary of the Interior and approved by the direct order of the President.

Subsection B, section 4, act of December 5, 1924 (43 Stat. 701), provides as follows:

"That no new project or new division of a project shall be approved for construction or estimates submitted therefor by the Secretary, until information in detail shall be secured by him concerning the water supply, the engineering features, the cost of construction, land prices, and the probable cost of development, and he shall have made a finding in writing that it is feasible, that it is adaptable for actual settlement and farm homes, and that it will probably return the cost thereof to the United States."

The various features requiring investigation and report in connection with the Baker reclamation project, Oregon, under subsection B, section 4, act of December 5, 1924, supra, will be discussed in the order in which presented in that subsection, as follows:

IRRIGATION PLAN AND WATER SUPPLY

The Lower Powder River Valley, with a length of 12 miles and an average width of 1 mile, containing a gross area of 7,400 acres, lies from 15 to 20 miles northeasterly of Baker City, Oreg. The irrigable lands of the valley, comprising about 6,000 acres, are served by canals diverting from Powder River, which traverses the entire valley, and a large part of the lands have been under irrigation for many years. Stream flow has never been adequate after midsummer to meet the valley requirements and has been further reduced in recent years by upstream irrigation development. It is proposed to construct the Thief Valley Reservoir on Powder River immediately above the valley to be irrigated, with a capacity of 15,000 acre-feet, which will be adequate to provide a full water supply. Unused winter and spring flood waters exceed the proposed reservoir capacity in every year. No other works are contemplated.

LAND AND ITS DEVELOPMENT

All of the lands to be benefited are settled and at present generally farmed to the limit of the available water supply. They have been classified by a representative of the Bureau of Reclamation, who reported a tillable area of 3,200 acres and a pasture area of 2,800 acres, with the balance of 1,400 acres either waste land or lands not served by existing canals from Powder River. A part of the latter may later be added to the indicated tillable area. Tillable lands are now principally devoted to the production of alfalfa and grain which is largely converted locally into dairy products, beef, and mutton. With the augmented water supply, crop production will be materially increased, which will permit a corresponding increase in the number of stock on the farms, now comprising 13,000 sheep, 1,700 cattle, and a few hogs. The pasture lands are unfitted by high-water table and periodic inundation for the production of tilled crops, but constitute a valuable adjunct in the established farming operations. Their usefulness will be increased through the augmented water supply by increase in grazing capacity and the lengthening of the grazing season. The entire area is settled by experienced stockmen in holdings of less than 160 acres of tillable land, and most farms have fair to good improvements. No settlement problem is involved. The increased crop production to result from the supplemental water supply is expected to be reflected in an increase in crop values much larger than the increase in costs of production and in enhanced profit.

FEASIBILITY OF PROJECT

The foregoing data justify the conclusion that the project is feasible from an engineering and economic standpoint, and I accordingly so find and declare.

REPAYMENT OF COSTS

The construction cost is estimated at $60 per acre for the tillable land, if no part of the cost is collected from the pasture lands which will be benefited to a lesser extent than the tillable lands. A proposed contract with the Lower Powder irrigation district, comprising all of the valley lands, provides for repayment of costs in 40 years, requiring an annual payment of approximately $1.60 per acre for construction if the entire cost is borne by the tillable lands alone. Operation and maintenance will be conducted by the district and such costs for the reservoir should be small. Increased annual crop yields to result on the tillable lands are estimated at not less than $8 per acre. These conditions fully justify the belief that construction costs will be repaid as intended. I therefore recommend approval of this project and issuance of authority to this department to proceed with construction. By the act of January 12, 1927 (44 Stat. 959), $450,000 was appropriated for commencement of construction; and subsequent appropriations have kept this amount available to the present time.

ENGINEERING FEATURES

The proposed impounding dam will be a triple arch concrete structure with a maximum height for the central arch of 52 feet from rock foundation to top of dam, and a total length, across the stream, of 380 feet, requiring in its construction 5,500 cubic yards of concrete. This dam will raise the stream level 40 feet. Testing of the foundations by pits and diamond drill indicates good rock at shallow depths. The dam is to be of ample section to withstand overflow to an estimated maximum depth of 10 feet over the central arch, the other arches to be built above flood levels. Release of storage will be controlled by two simple slide gates.

CONSTRUCTION COST (ESTIMATED)

Dam	$135,000
Right of way for reservoir flowage and dam	42,000
Previous investigations and reports	12,000
Foundation testing	5,000
Contingencies	6,000
	200,000

Very truly yours,
RAY LYMAN WILBUR.

Approved, March 18, 1931.
HERBERT HOOVER,
President.

Gradual Expansion of Irrigated Area Not Injurious to Agriculture in Nonirrigated Sections

By John W. Haw, Director of Agriculture, Northern Pacific Railroad

THE 1930 census just completed brings to light startling facts relative to rapid population growth of the States of the Pacific slope. The seven States of this region, consisting of Washington, Idaho, Oregon, California, Utah, Arizona and Nevada had a population at the time of the 1920 census of 6,859,702. The 1930 census announces a population for this identical area of 9,661,900, an increase of 2,802,198, or a percentage increase of 40.8. The United States as a whole increased 16,987,570 during this period, or only 16.1 per cent.

Further emphasizing the rapidity and the character of the population growth in this area as compared with the rest of the country, immigration statistics show a net average increase in population by admission and departure of aliens of 247,778 for each of the last five years, and in the report of the Commissioner General of Immigration, the following statement is found:

"One-half of the new arrivals, or 50 per cent, settled in the States of the North Atlantic group; 21.1 per cent in the North Central States; 1.6 per cent in the South Atlantic States; 12.6 per cent in the South Central States, and only 12.7 per cent in the Western States."

Thus, although growth of population in the United States in the last 10 years from immigration has amounted to approximately 3,000,000, these aliens largely remained east of the Rocky Mountains and settled down principally in the States along the Atlantic seaboard, a very small percentage filtering through to the Pacific Coast States to add to population growth in that area. The 40.8 per cent growth in population, therefore, becomes even more significant as we understand that responsibility for the 16.1 per cent growth in the country as a whole was to an extent dependent upon immigration, of which the Pacific slope had but a small share.

Undoubtedly, this drift of our native population to the Pacific coast in search of better opportunities, more satisfactory living conditions, and a more equable climate, will continue at an accelerated pace since during the decade 1910 to 1920, population growth in the same area was only 30 per cent.

AGRICULTURAL EXPANSION AN ECONOMIC NECESSITY

The problem of expanding agricultural production in this general area to meet the food requirements of its own people resolves itself largely into one of reclaiming arid land by irrigation. It is not a flight of fancy to say that the population of the Pacific Slope States will be close to 20,000,000 in 1950, but such further growth is destined to continue unabated only provided the great staple food requirements of its people can be met from a production reasonably near at hand. Any policy of curtailing irrigation expansion will throttle this growth, just as surely as industrial development is migrating from the East Coast, west and south in search of cheap food.

During the last five years, it has been very evident to students of traffic that the breaking point between west and east bound shipments of the great staple food crops on western railroads is being pushed further east as Pacific coast demands have rapidly expanded. Potatoes and corn, pork and pork products, dairy products, particularly butter, feed grains and an increasing volume of wheat, now move to the Pacific coast markets from States in the Mississippi Valley. The Pacific Coast consumer is thus more and more forced to pay mid-West prices plus transportation costs on many staple food products.

IRRIGATED AGRICULTURE HAS DUAL RÔLE

Irrigated agriculture has a logical dual rôle in provision of this nation's food supply. First it should supply such staples as potatoes, wheat, dairy products, as well as fruits, vegetables, berries, nuts and other specialties to the people residing west of the Continental Divide. Since irrigated agriculture would receive on bulky, comparatively low-value staple products, the eastern market price, less transportation costs, the middle western farmer has nothing to fear from such a program. With a population growth in this area of nearly 3,000,000 in the last decade, and an estimated increase of 4,000,000 or 5,000,000 in the decade just ahead, a very large expansion of production will be necessary merely to provide staple food articles for the local western market. For instance the average American eats 3 bushels of potatoes and 16.9 pounds of butter per annum. If we figure merely a 4,000,000 population increase in the next 10 years, this area will require 12,000,000 additional bushels of potatoes and 67,000,000 pounds of butter. There would be required 400,000 additional cows to provide such butter requirement, and a production from at least 75,000 additional acres of potatoes. Considering the array of other food articles consumed annually by 4,000,000 people, it would seem conservative to estimate that 1,000,000 additional irrigated acres must be brought under cultivation in the next 10 years in this region, if the Pacific slope is merely to be self-sufficient agriculturally.

The second part of the dual rôle of irrigated agriculture concerns the provision of fruits, vegetables, berries, nuts and specialized agricultural products which either it is impossible to produce at all, or which can not be produced at certain seasons in the territory east of the Continental Divide.

YEAR-AROUND AGRICULTURAL PROGRAM

The American's diet now demands a year-around supply of quality products of the character indicated. Irrigation projects interspersed through the valleys west of the Continental Divide, from the Mexican to the Canadian line, with an extensive range of climate and soil conditions, are gradually articulating their production into the general scheme of a year-around supply of such products for the Nation. The handicap of transportation charges practically prohibits competition with the same products of equal quality produced east of the Divide and put on the market at the same time. Thus western irrigation project production of these crops is gradually filling in the seasonal gaps in a year-around program of supplying these present-day indispensable food articles to the American public. There is now an extensive refrigerator-car movement of head lettuce, green peas, asparagus and forced rhubarb from projects located in the Pacific Northwest in off seasons to the large centers of consumption on the eastern coast. There is even movement at certain seasons from this area into Florida and Texas, which at other seasons of the year supplies the market. Such movement would not take place were there no unsatisfied demand for standard, dependable grades, attractively packaged, of certain high-quality products which the balance of the country could not, or at least is not, providing. It is inconceivable that the consuming public of this country desires other than that such production program be gradually expanded to meet the increase in demand occasioned by population growth and tendency of our diet toward increased consumption of such articles. With an

estimated population growth in the next decade of nearly 20,000,000 people in this country, just how is this program of adequate supply to be maintained without extensive further irrigation development? Improved varieties, better culture and efficiency in production methods will accomplish something, but there must be in addition a tremendous acreage expansion if normal consumptive demands are to be met.

What has been said with respect to supplying the country east of the Continental Divide with fruits and vegetables can also be said with respect to both wool and beef cattle. We are definitely on an import basis with respect to both of these commodities. As demands for these products heretofore have increased, the country has been accustomed to look toward the western horizon as it has always been from the great range areas of the Mountain and Pacific Slope States that our supply of these products has originated. But, if production of these commodities is to increase, the area of land irrigated must be expanded, since the large limiting factor in connection with complete utilization of range areas in Western United States is fall and early spring pasturage and available feed for wintering breeding stock in the irrigated valleys at lower altitude, within trailing distance from the range. Alfalfa, hay, beet tops, pulp and molasses, together with barley and oats, constitute such winter feed, but its takes irrigated land in this section to produce these crops.

WESTERN LIVESTOCK MARKETS

As further indicating the manner in which consumption is running away from production west of the Continental Divide, let us take the live hog and dressed pork situation. In 1929, 9,727 carloads of live hogs, consisting of 875,400 head, were moved into the State of California by common carriers, for slaughter. This is 55 per cent of all the live hogs slaughtered in that State. These shipments largely originated east of the Continental Divide and largely in the States of Kansas and Nebraska. In the case of the Oregon markets, 29 per cent of all the slaughter hogs in Oregon originated in Idaho, 9 per cent in Montana and 6 per cent in North and South Dakota. Livestock markets in Washington received 250,000 head of hogs from outside the State, and in addition imported 12,000,000 pounds of green, frozen and cured pork products. It is a known fact that the Pacific coast consumer of pork and pork products pays now and will continue to pay Middle West prices plus carrying charges from Missouri River markets.

There is every reason to feel concern as to whether the irrigated area of this country can be expanded with sufficient rapidity to meet the demand for irrigated farm products. The large, difficult irrigation projects require many years for completion of surveys, economic and engineering, for construction of reservoirs, canals and other structural works, and additional years for securing sound settlement. Experience shows that it requires from eight to ten years in the case of a small project and 20 to 25 years in the case of a large project, before construction is completed, settlement secured and the farmers have found themselves agriculturally and are making any substantial contribution of farm products beyond their own horizon.

In conclusion there is nothing static about agricultural production. It is as migratory as industry, shifting with exhaustion of fertility, population growth, ebb and flow of export demand, changing human food and clothing requirements, transportation facilities, and development in preservation and refrigeration. Close students of economic geography see in all these shifts a necessity for at least a modest program of expansion of our irrigated lands west of the Continental Divide. It would seem far-sighted statesmanship for the Government to adopt a policy that would keep ahead of, certainly abreast of, demand for the products which irrigated agriculture alone can produce and in step with development of its own natural west coast market.

WATER SUPPLY CONDITIONS

March was generally cold and accompanied by light storms, which added but little to the already deficient snow cover. Heavy storms at the end of the month throughout Oregon, Washington, and western Idaho, very materially improved water supply prospects for this region.

Snow cover in the mountain regions at the end of the month was generally much below normal and, being accumulated largely in late winter, lacks the density desirable for maintained stream flow. Heavy shortages in late season will be common except where projects are fortified with storage reserves. Bureau projects are generally so prepared with indications that no heavy shortages are expected, although in some cases waters will have to be conserved to avoid crop losses, while in a few cases such as Yakima and Okanogan, minor crop loss appears unavoidable even with the best of care.

A killing frost near the end of the month did considerable damage to fruit on the Carlsbad and Rio Grande projects.

For reservoirs with concurrent data available, the storage contents on March 31, 1931, were 3,880,000 acre feet, compared with 4,720,000 acre feet for the same date in 1930. These amounts exclude American Falls Reservoir, where storage on hand does not clearly reflect requirements.

OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO
Construction 56 per cent complete

The Reason Why Federal Reclamation Should Be Continued

By Dr. Elwood Mead, Commissioner of Reclamation

NUMEROUS requests have been received recently by the Bureau of Reclamation for a concise statement that will present the economic conditions of the West which appear to justify continuing the present conservative policy of Federal reclamation, particularly in view of the depressed agricultural situation and the agitation for a reduced cropped acreage. Knowledge of western conditions will demonstrate the fallacy of applying a national yardstick to regional problems.

The arid States have necessities of their own, different from the States where moisture for agriculture comes from rain. In these States agriculture and other industries depend on conserving and using the flow of streams. In this region, which embraces nearly one-third of the United States, mining, manufacturing, and the satisfactory use of the grazing land depend on irrigation development.

Irrigated farming has been the chief factor in building up the cities and industries of the arid region. In doing that it has created a market for the manufactured products of the humid States that more than counteracts any competition it may offer to the agriculture of the rest of the country. One has only to think of what this country would be if the whole arid zone were without irrigation, and one has to have only a cursory understanding of what is going on in that country, to know that the cities and towns of that region are growing fast and are creating a larger market for agricultural products than the irrigated region supplies. It has not then, as a region of its own, a surplus of agricultural products, and while it suffers from the prevailing low prices, it does not contribute to the low prices of the East. On the contrary, the very restricted irrigation development going on in the West is contributing to agricultural recovery in the East.

The area supplied with water from Federal irrigation works is less than 1 per cent of the farmed area of the whole country. One good rain in the Mississippi Valley adds more to the surplus than all the products of the little widely scattered oases irrigated from Federal works.

The money for construction of Federal reclamation works comes from payments made by irrigators on completed works, the small amount of money which comes from land sales, and from a part of the leases from Government oil lands. This is not enough to enable the Government to complete in 15 years projects that were under way in 1927. Meantime the economic welfare of the arid region requires the taking on in a conservative way of projects where valuable water supplies are going to waste and where communities are languishing because of the need of an adequate local food supply.

In regard to the increased taxable value of land arising from the construction of reclamation projects, it has to be recognized that the cities and towns on those projects are as much a creation of the irrigation canal as the farm itself. Over a large area of the West, whatever values exist are the creation of irrigation, and that includes the towns as well as the farms. The yearly crop values on reclamation projects now practically equal the entire construction costs. Without irrigation these would be worthless unpeopled deserts. The actual repayment of the money spent by the Government will be completed on some of these projects in two years. It will be repaid on all now building within the next 50 years. No investment of the Government has brought to the Nation a larger social and economic return.

Articles on Irrigation and Related Subjects

Hoover Dam:

Contract to build Boulder (Hoover) Dam is largest ever let by Nation. Illus. Signatures. U. S. Daily, March 12, 1931, v. 6, pp. 1, 9 (pp. 87, 95).

Big figures in the news (Hoover Dam award). Eng. News-Record, March 12, 1931, v. 106, pp. 425, 455.

Award of Boulder (Hoover) Dam contract put through in record time. Southwest Builder and Contractor, March 13, 1931, v. 77, pp. 51–52 (editorial, p. 45).

Construction starts soon on Hoover Dam. Illus. Power, March 17, 1931. v. 73, pp. 432–436.

Bids and engineers' estimates of cost. Tabulation. Western Construction News, March 25, 1931, v. 6, pp. 156–157.

State Engineers:

Status of water development in the 11 Western States. Symposium by Messrs. Bartholet, Malone, Hyatt, Carter, Stricklin, James, Hinderlider, Bacon, Whiting, Yeo, and Trott. Engineering News-Record, March 12, 1931, v. 106, pp. 428–431.

Los Angeles Aqueduct:

Colorado River Aqueduct route selected for metropolitan district of southern California. Illus. Western Construction News, January 10, 1931, v. 6, pp. 21–22, 44.

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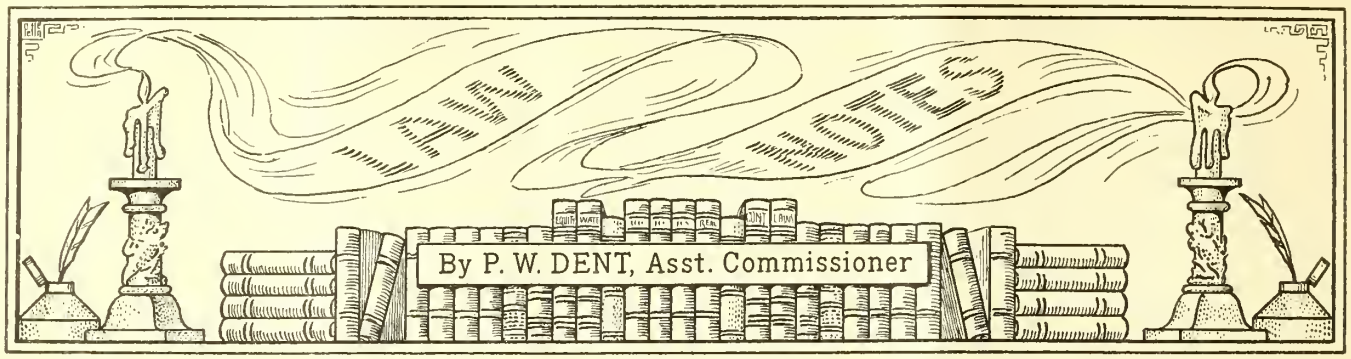


Irrigation District Taxes under California Law
Decision of Attorney General of California

THE following is a copy of a letter from Hon. U. S. Webb, attorney general of California:

San Francisco, *September 27, 1930.*
Hon. Guard C. Darrah,
District Attorney, San Joaquin County, Stockton, Calif.

Dear Sir: I have before me your letter of September 17, reading as follows:

"In the South Side irrigation district in the county of San Joaquin there is considerable property which has been sold and stands in the name of the State of California. This property has a great amount of county taxes and irrigation taxes and assessments against it. The directors, along with their attorney, John Hancock, have called upon this office stating that there is a possibility that a new clover, if planted, will allow the property to be of considerable value, and put it back upon a paying basis, and also make it taxable property.

"However, the county taxes and the irrigation taxes are so great that no purchasers can be secured. The irrigation district directors are willing to enter into a compromise for the amount of the back taxes. Mr. Hancock informed me that about 12 years ago the attorney general's office worked out a compromise of county and State taxes upon property known as the Royal Consolidated Mines in Calaveras County, and pursuant to the suggestions of the attorney general a court action was brought and the tax properly compromised. It would be of considerable benefit to the county of San Joaquin, and also to the public, if some form or manner of means could be secured in order to compromise taxes past due. Could you kindly advise the present writer as to the proceedings or status that were followed in that case. Unless the back taxes are compromised, the county and State will receive no benefit at all and the land will remain perpetually abandoned. This of course is a great detriment to land in irrigation districts."

A recent investigation by this office into the question of the status of lands in irrigation districts and of the relative priorities of tax liens as between the State and the district has forced us to the conclusion that under section 48 of the California irrigation district act, a sale by the district of land acquired by it through delinquent district assessments vests a title in the purchaser free and clear of any lien for county taxes.

In other words, the lien for county taxes becomes merged in the title acquired by the district, and when the district sells the property a clear title is conveyed and the county taxes for previous years are thereby wiped out. Of course, when the property passes into private ownership through the sale by the district it again becomes subject to taxation for county purposes.

On the other hand, a sale by the State under section 3787 of the Political Code does not wipe out or impair a prior or subsequent deed based upon an irrigation district levy, but the purchaser from the State takes title subject to the lien of the district for its assessments. (Bolton *v.* Terra Bella Irrigation District 289 Pac. 678, decided June 9, 1930, by the District Court of Appeal for the Fourth Appellate District.)

The intention of the legislature in so providing may have been to meet such a situation as you have described and to make it possible for property to get a new start, so to speak, as taxable property.

It appears that the assessment levied by the district which is latest in point of time is the assessment under which the property should be offered for sale. (Woodill & Hulse Electric Co. *v.* Young, 180 Cal. 667.)

Applying the foregoing observations to the situation referred to by you it would appear that the only practical way out of the difficulty is for the district to proceed to sell the lands in question for such price as it may obtain and to convey to the purchaser a title free and clear of encumbrances. The property will then again become liable for future county taxes as well as for future assessments levied by the district.

I note your reference to the Royal Consolidated Mines (Ltd.) case, and in that connection will state that under date of July 31, 1915, an opinion was rendered by this office to the district attorney of Calaveras County covering the situation then existing in regard to unpaid taxes by that company.

A transcript of the county records was furnished us from which it appeared that the property of the company was assessed by the proper county officials in 1904; the taxes remaining unpaid, the property was marked delinquent and was sold to the State in 1905, and a certificate of sale executed by the tax collector, and in 1910 a deed to the State was executed. In the meantime the property had been assessed for the years 1905 to 1909, inclusive.

After 1909 the property was not assessed as it had been deeded to the State. Owing to deficiencies and irregularities in the assessment of 1904 this office concluded that the assessment was void and the sale nugatory, and that any action by the State to collect the taxes that had accrued would be defeated.

On the other hand it was held that the property owners were without statutory authority to bring an action against the State to quiet the title.

Certain propositions were made for a settlement but eventually an action was brought by the State comptroller under section 3773 of the Political Code to secure possession of the property and the rents, issues and profits therefrom, upon the allegation that since July 12, 1910 (the date of the deed to the State), the State had been the owner of the property. The trial court rendered judgment for the defendant and in addition found as a conclusion of law that the plaintiff had no right, title or interest in the property.

The case was appealed to the supreme court and its decision reversing the judg-

ment of the trial court may be found in 187 Cal. Reports, at page 343.

I assume that the county taxes to which you refer were based upon valid assessments, and that being the case, I do not know of any statutory authority for remitting the taxes or compromising them. It has been held that attempted cancellation of taxes lawfully levied and assessed upon property not exempt under the constitution are unconstitutional and void. (City of Oakland *v.* Whipple, 44 Cal. 303; Wilson *v.* Supervisors, 47 Cal. 91; Whitney *v.* Town of West Point, 15 L. R. A. 860; Constitution, sec. 13, Art. XI.)

It would appear, therefore, that the only method of procedure is through a sale by the district, as above pointed out. This may result in a great hardship to the county, but perhaps the result will be beneficial in the long run, inasmuch as the property will again become subject to the levy of assessments for county purposes, and the new owner may be more successful in operating the property than former owners have been.

Order to Pioneer Contested by Railroad

An order of the Interstate Commerce Commission (Public Service Commission of Oregon *v.* Central Pacific Railroad Co., et al., 159 I. C. C. 630) requiring the Union Pacific Railroad Co. to pioneer in central Oregon with a line of road through Bend, paralleling its Columbia Gorge line, blazes a trail in the field of law. Heretofore similar orders for spur tracks and short connecting lines have been held to be within the powers of the commission under the transportation act of 1920.

The railroad company, contending the order usurps the power of its board of directors in designating where and how the investment of its stockholders may be expended, has brought an injunction against execution of the order, in which action the Southern Pacific has intervened claiming the proposed new road is not only unjustified by the revenue prospects from the territory to be served, but is so competitive with the lines of the Southern Pacific as to reduce the latter's earnings below a fair return.

The action is now under advisement by the United States District Court for the District of Oregon, argument having been recently submitted before a special court consisting of United States District Judges Bean and McNary, and the late Frank S. Dietrich, a former judge of the Ninth Circuit Court of Appeals. The subsequent demise of Judge Dietrich will doubtless require a new trial.

The final outcome of the case is anxiously awaited by settlers under several of the irrigation projects of eastern and central Oregon and the Riverton project, Wyoming, in particular, as well as by members of the legal profession generally, since it is apparently a case of first impression involving the constitutionality of the transportation act of 1920 under the "due process" clause of the fifth and fourteenth amendments to the Federal Constitution. (B. E. Stoutemyer, district counsel.)

Recently Enacted Legislation

CONTRACT WITH RIO GRANDE PROJECT

[Public Resolution—No. 127—71st Congress]

[S. J. Res. 222]

JOINT RESOLUTION Relating to the authority of the Secretary of the Interior to enter into a contract with the Rio Grande project

That nothing contained in the act approved May 28, 1928 (45 Stat. 785), entitled "An act extending the time of construction payments on the Rio Grande Federal irrigation project, New Mexico-Texas," shall be construed to deny authority to the Secretary of the Interior to enter into a contract with the Elephant Butte irrigation district of New Mexico and/or El Paso County Water Improvement District Numbered 1, of Texas, in accordance with the provisions of the act approved May 25, 1926 (44 Stat. 636), and/or the act approved December 5, 1924 (43 Stat. 672).

Approved, March 3, 1931.

SATURDAY HALF HOLIDAYS

[Public—No. 783—71st Congress]

[S. 471]

AN ACT Providing for Saturday half holidays for certain Government employees

That on and after the effective date of this act four hours, exclusive of time for luncheon, shall constitute a day's work on Saturdays throughout the year, with pay or earnings for the day the same as on other days when full time is worked, for all civil employees of the Federal Government and the District of Columbia, exclusive of employees of the Postal Service, employees of the Panama Canal on the Isthmus, and employees of the Interior Department in the field, whether on the hourly, per diem, per annum, piecework, or other basis: *Provided*, That in all cases where for special public reasons, to be determined by the head of the department or establishment having supervision or control of such employees, the services of such employees can not be spared, such employees shall be entitled to an equal shortening of the workday on some other day: *Provided further*, That the provisions of this act shall not deprive employees of any leave or holidays with pay to which they may now be entitled under existing laws.

Approved, March 3, 1931.

ADVANCES TO RECLAMATION FUND

[Public—No. 822—71st Congress]

[S. 6046]

AN ACT To authorize advances to the reclamation fund, and for other purposes

That the Secretary of the Treasury is authorized, upon request of the Secretary of the Interior and upon approval of the President, to transfer from time to time to the credit of the reclamation fund created by the act of June 17, 1902 (32 Stat. L. 388), such sum or sums, not exceeding in the aggregate $5,000,000, as the Secretary of the Interior may deem necessary for the construction and operation of reclamation projects authorized under said act of June 17, 1902, and now under way, and acts amendatory thereof or supplementary thereto.

Sec. 2. That reimbursement of the moneys so advanced under the provisions of this act shall be made by transfer annually of the sum of $1,000,000 from the reclamation fund to the general funds in the Treasury, beginning July 1, 1933.

Approved, March 3, 1931.

THE State Highway Department of Colorado has nearly completed the road through the Colorado River Canyon, Grand Valley project, which will shorten the present route to Denver by approximately 9 miles. This road is also of interest to the project as it places the Colorado River diversion dam on the main highway.

MAIL inquiries amounting to 107 were received during the month by the Vale-Owyhee Government Projects Land Settlement Association, and 22 interested persons called at the office relative to project lands. A number of inquiries was also received at the project office. Several additional families have settled on the Bully Creek West Bench Unit and preparations are under way for farming the land this season.

THE potato mill of the Otato Corporation on the Minidoka project was given a short preliminary run during the month, with very satisfactory results. A carload of potato flour was shipped east for testing and sampling.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division

Morrison Canyon Siphon, Yakima Project, Washington Design, Construction and Deflection Tests

By Peter Bier, Engineer, Denver Office, Bureau of Reclamation

MORRISON Canyon siphon is one of nine inverted siphons built on the main canal of the Kittitas division of the Yakima project in Washington. It is located about 9 mines east of Cle Elum, at canal station 1262–81, and forms a connection across Morrison Canyon between concrete-lined rock and earth sections. The canyon has very steep slopes overlaid mostly with unstable slide rock and dips down for about 250 feet to its bottom.

DESCRIPTION AND DESIGN DATA

The siphon has a designed carrying capacity of 1,145 second-feet, with a uniform diameter of 12 feet 1 inch throughout its entire length of 992 feet. It is a combination monolithic reinforced-concrete and riveted-steel pipe structure, the concrete pipe being carried down to about 110-foot head. The maximum static head is 234 feet. The diameter of the pipe was determined by the available head of 3.68 feet, or the difference between computed water surfaces of inlet and outlet ends of the siphon. Losses in head at 10 feet velocity and with Kutters $n=.014$ for the pipe, plus transition and bend losses, are approximately equal to the head available.

CONCRETE PIPE AND TRANSITIONS

Figure 1 shows the plan and profile of the siphon, with details of the concrete inlet and outlet transitions and pipe sections. The concrete pipe is monolithic in construction with a mix of 1:2:3.25, dry rodded and a 1½ per cent admixture of diatomaceous silica for heads up to 100 feet. For heads over 100 feet a mix of 1:1.7:2.8 dry rodded was used, without any admixture. Diatomaceous silica was added to the leaner mixture primarily for workability, but it also effected improvement in water-tightness.

Continuous barrel forms were used for both inner and outer forms. The inner form consisted of a number of circular ribs made up of 2-inch boards with a facing of 2-inch tongue and groove staves. The inside forms were supported on concrete cradles placed about 8 feet centers, with the top of each at the invert elevation of the pipe.

The specifications required that the pipe barrel should be poured in sections of the longest practicable dimensions and without horizontal construction joints. As 30 feet of length was found to represent an average day's work for the concrete crews employed on the siphons, construction joints approximately 30 feet apart were provided for.

The pipe barrels are reinforced with steel hoops made in two pieces, lapped 40 diameters at quarter points, two rows of transverse hoops being used for the higher heads. Splices in the longitudinal temperature steel were staggered. The total length of the concrete pipe is 444 feet. The ends are enlarged for the welded steel expansion sleeves, which were used as a form and concreted in when pouring the last sections of the concrete pipe.

After removal of the forms, which was not less than 14 days after pouring, the interior of the siphon was finished with carborundum bricks to remove projections and rough spots caused by imperfections in forms, thus securing a very smooth inside finish.

The inlet and outlet transitions for the siphon were designed and proportioned to conserve head in accordance with the usual practices of the bureau. They are properly reinforced for outside earth pressures and provided with about 0.3 per cent longitudinal steel for temperature stresses.

STEEL PIPE

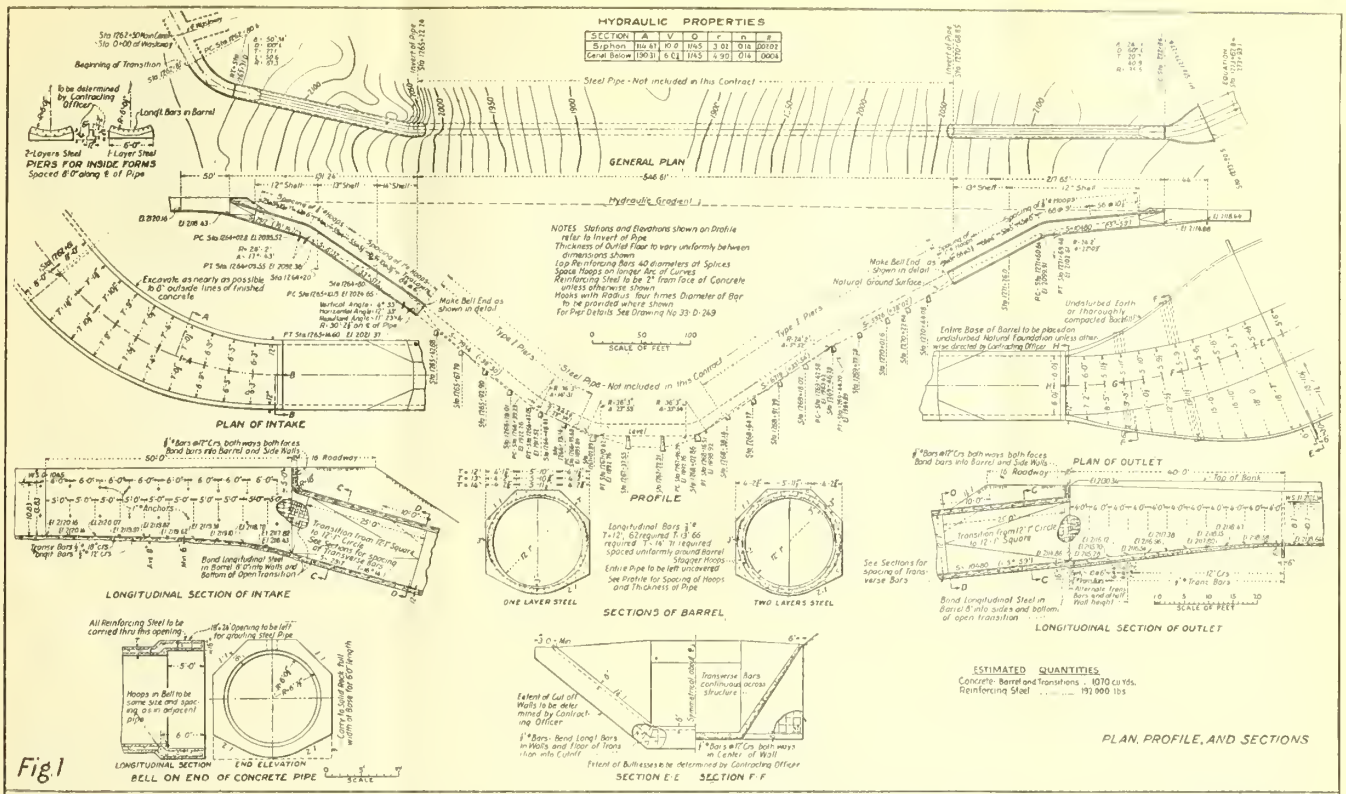
Profile and details of the steel pipe used for the siphon are shown in Figure 2. This steel pipe is 552 feet long and connects at both ends to the concrete pipe by means of sleeve expansion joints. Graphited flax packing, tightened by angle gland rings, is used in the expansion joints to prevent leakage.

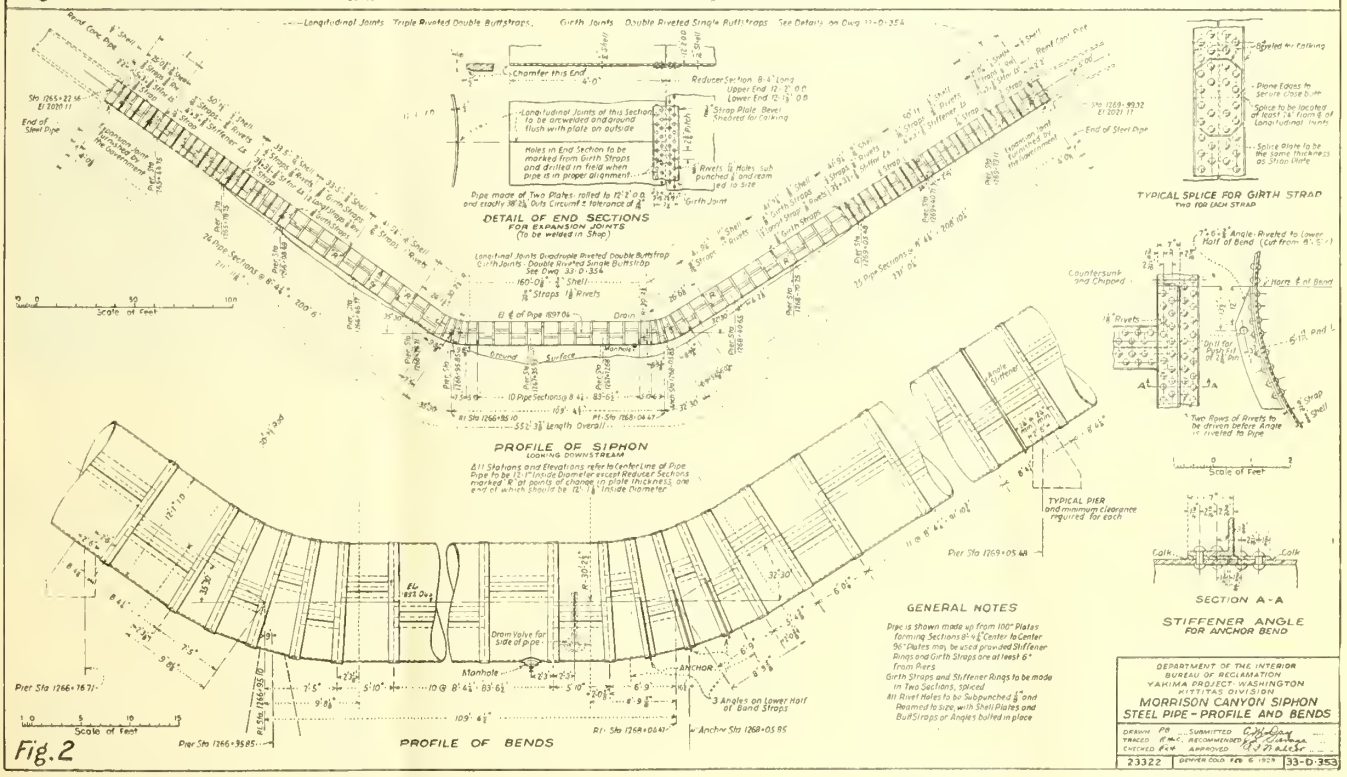
The steel pipe has a uniform inside diameter of 12 feet 1 inch and is made of copper bearing steel plates 100 inches wide, varying in thickness from seven-sixteenths to three-quarters inch, in accordance with the pressure head. The pipe was designed for a working stress of 12,000 pounds per square inch, with a uniform thickness of one-sixteenth inch added for corrosion. All pipe courses are made from two plates, which were sheared, beveled, and drilled for rivet holes. The plates were then rolled in the shop, and reamed, riveted, and calked in the field. All calking was done on the outside of the pipe. The plates were also required to be planed at the longitudinal joints and trimmed to true lines at the ends. All rivet holes were drilled one thirty-second inch larger than rivet diameter in the shop, and reamed to one-sixteenth larger than rivet diameter in the field. The rivets range in size from ⅝ to 1⅛-inches. Triple butt-riveted longitudinal joints are used for the 7/16-inch plates and quadruple butt-riveted joints for all the other plates. All girth joints are double butt riveted with a single outside strap. All plates up to and including nine-sixteenth inch are stiffened against collapse by angle rings.

The siphon can be drained by an 8-inch extra heavy gate valve which is connected to its lowest section. Accumulations of sand deposits in the bottom of the lowest section of the pipe may be removed through the manhole located there after the water is drained.

PIERS AND ANCHORAGE

The steel pipe is supported on concrete piers spaced from 30 to 40 feet center to center. They are provided with graphited steel slide plates to reduce the friction force due to temperature movements of the pipe. The piers are designed for a horizontal overturning force equal to the weight of pipe and water supported on it, multiplied by the friction coefficient which was assumed at 0.50. The piers at the bottom of the canyon are about 18 feet high and it required some 35 cubic yards of concrete, heavily reinforced, to provide safe support for the 275 tons





of vertical load and 80½ tons of horizontal force.

A single concrete anchor is placed at the right hand bend in the lower section. This stabilizes the steel pipe at this point allowing it to expand or contract freely on each side toward the expansion joints. This provision for free movement of the steel pipe is necessary in order to prevent excessive temperature stresses in the steel plate and possible rupture at the girth joints.

The anchor used is a new type developed first for this pipe to reduce concrete yardage in comparison with the typical anchor which is poured entirely around the pipe. It was designed for an unbalanced horizontal force of 160 tons and rests on solid rock, requiring about 60 cubic yards of concrete, using a sliding coefficient of 0.65. The pipe bend is provided with angle rings and heavy bolts for its connection to the anchor. The piers and the anchor were constructed first and grouted to the finished elevations or the bottom of the pipe after erection of the latter. Figure 3 shows the arrangement of the

supporting piers and the concrete anchor at the bottom of the canyon.

CONSTRUCTION

The work on the siphon was done under two general contracts. E. A. Webster & Co., of Seattle, Wash., had the contract for all earthwork, concrete structures, and installation of expansion joints. The Pittsburgh-Des Moines Steel Co. furnished and erected all the steel pipe for the siphon. The expansion joints were fabricated by the Willamette Iron Works, of Portland, Oreg.

The contractors' earnings were as follows:

For all earth and concrete work, including placing of reinforcing bars	$61, 793
For the steel pipe complete in place	40, 545
For placing the expansion joint sleeves	446
Total contract earnings	102, 784

The quantities were as follows:

Cubic yards of concrete	2, 030
Cubic yards of excavation	13, 117
Cubic yards of back fill (of which 286 cubic yards were puddled or tamped)	573
Tons of steel pipe	370

The material for the 2,030 cubic yards of concrete, consisting of cement, aggregate, diatomaceous silica, and 315,060 pounds of reinforcing steel, was furnished by the Government at a unit cost of $10.11 per cubic yard of concrete. The total cost to the Government of these materials, together with expansion joints, painting, etc., was $31,472, exclusive of overhead. The photograph (fig. 4) shows the unstable nature of the slide rock near the siphon. Excavation around the siphon caused some difficulty and was greatly increased due to raveling and sliding of this rock into excavated areas.

All steel was painted after erection, using one coat of bituminous primer followed by one heavy coat of enamel, inside and out. The paint was furnished by the W. A. Briggs Bitumen Co. and was made in accordance with Navy Specification 52–B–10.

The water test of the siphon was made when water for this purpose was available from the main canal.

DEFLECTION TESTS

In order to determine the behavior of the steel shell during the filling process, when the distortive moment is the greatest, a series of measurements were made on the pipe shell. The frames and platforms used for this purpose are shown in Figure 5. One frame was erected in the center of the span nearest the anchor and one over the first pier from the anchor, both on the horizontal pipe section at the bottom of the siphon.

The measurements were taken at two different times, the first series in November and December, 1929, the second series on April 29 and 30, 1930, when the siphon was being filled for the irrigation season of 1930. As the measurements of the second series were taken under better weather conditions and are considered more accurate, reference is made herein only to the figures obtained in these tests. The weather during the two days of testing was clear, with a temperature ranging from 38° to 69° Fahrenheit. The temperature of the water was 50° F.

All water elevations below the top of the horizontal section of the pipe were obtained by the use of a manometer. This consisted of a glass tube inserted in a hose connected to the drain valve in the lower manhole cover and a level rod with zero at the invert elevation of the horizontal pipe section. All readings above the top of the horizontal pipe were obtained by means of a pressure gage, connected likewise to the valve in the manhole cover. The pressure gage readings were converted into pressures on the center of the pipe by the aid of a calibration curve. No movement was detected at the measuring frames as checked by two transits, one set at right angles and one parallel to the center line of the pipe.

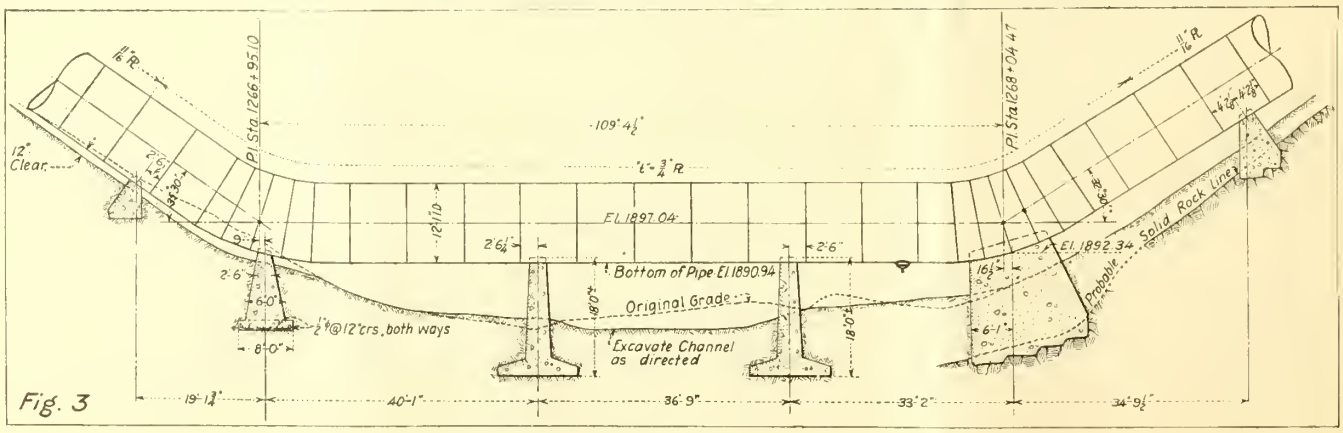
The circumference of the pipe was measured with a steel tape, wrapped around the pipe. The vertical diameter was measured by leveling between the top and bottom surfaces of the pipe at the measuring frames. The horizontal diameter was measured with the aid of two transits, one on each side of the pipe, so they could be sighted between the pipe and the side brackets attached to the measuring frames. The distance from the pipe to the lines of sight was measured with a steel rule. The lines of sight were then transferred to the horizontal timber on the top of the measuring frame, and the sum of the two readings on the horizontal diameter subtracted from the direct reading between the lines of sight.

Set-ups were made at the two piers near the anchor on the horizontal pipe section to measure the longitudinal movement, using the edge of a butt strap as one measuring point and the edge of the pier as the other. The water surface was kept as near constant as possible. Pressure head readings were taken at the beginning and end of each set of micrometer readings.

The results of the measurements are shown graphically in the deflection curves, Figures 6, 7, and 8. Checks on horizontal and vertical diameters indicated an accuracy of about 0.005 feet in the direct measurements of these dimensions. Repeated measurements checked the micrometer readings within 0.0005 feet. Any movement of the frames could not have been over 0.005 feet or they would have been checked by the transits.

Water depth is correct to within 0.05 feet. As only two points were used to establish the gage calibration curve, pressure readings may be several pounds in error. The measurements for circumference were made with an accuracy of 0.003 feet.

The diameters at the head of 1.81 feet were taken as basic dimensions. Measurements of horizontal and vertical diameters of the pipe were made at this head.



Steel pipe-supporting piers and concrete anchor

Fig. 4

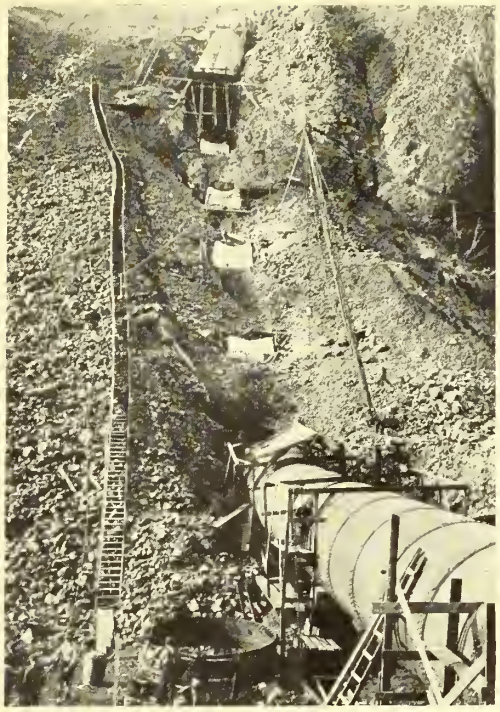


Fig. 5

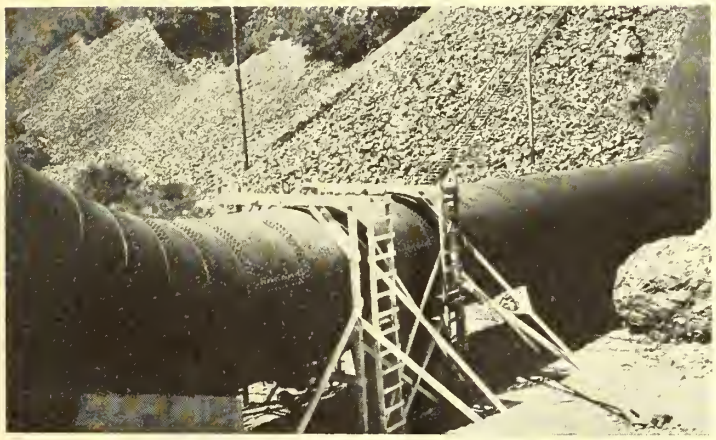
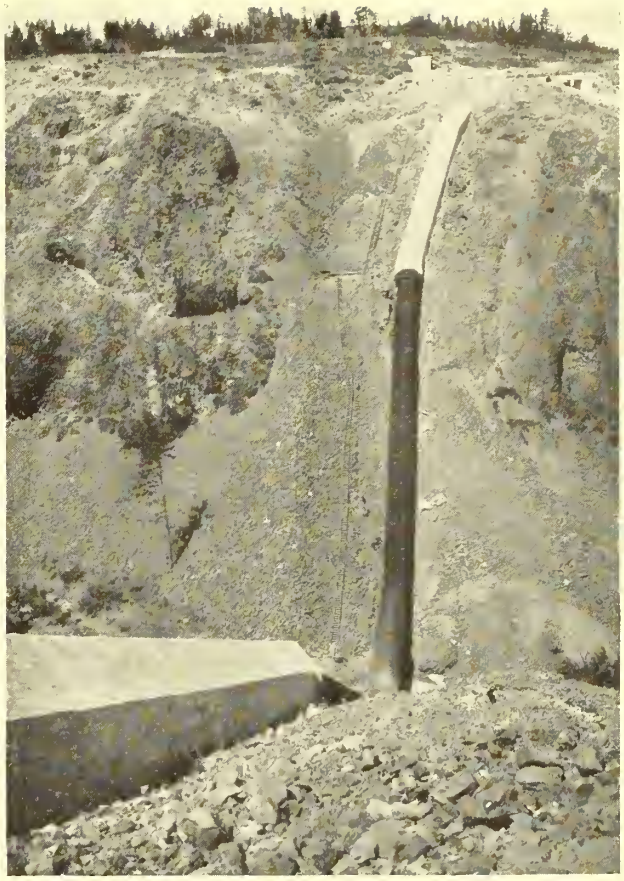


Fig. 9



YAKIMA PROJECT, WASHINGTON

KITTITAS DIVISION

MORRISON CANYON SIPHON

To obtain the diameter at any head or pressure the total change in the two opposite micrometer readings was calculated in feet and added to the basic dimension.

The beam deflection was calculated by assuming that the pipe as a whole moved in a vertical plane. With reference to the center line of the pipe the tendency of this movement was upward as the pressure increased in the pipe. Owing to the greater flattening effect at the piers in comparison with the center of the span, the increase in vertical diameter and corresponding rise of the center line with increased pressure is greater at the piers than in the center of the span. This accounts for the indicated rise of the pipe for pressures up to about 15 pounds per square inch as shown in Figure 8.

The pipe diameter curves are all similar in shape. The pressure heads taken were hardly sufficient to obtain well-defined curves for water depths below full pipe.

With reference to Figure 6, it may be noted that the horizontal diameter at the pier and in the center of the span is greater than the vertical diameter. When the water is turned into the pipe, it tends to flatten out, thereby increasing the horizontal diameter and at the same time decreasing the vertical diameter. As the pressure is increased up to about 30 pounds there is a tendency for the pipe to be forced into a true circle. From 30 to 55 pounds pressure the horizontal diameter at the center of the span shows a slight increase with a corresponding decrease in the vertical diameter. Above 55 pounds pressure, in the center of the span a stable condition apparently existed, as the changes in the horizontal and vertical diameters are very slight. At the pier the pipe continued to be forced into a true circle as the horizontal and vertical diameters continued to approach each other until the siphon was filled. For Figure 7 the variations in horizontal and vertical diameters under heads up to 20 feet, are plotted to a larger scale. Figure 8 shows the changes in the circumference and beam deflection of the pipe under pressures up to 100 pounds per square inch.

CONCLUSIONS

The deflection curves for the pipe diameter established the fact that the distortive moment of the water in this pipe was the greatest at about 12-foot head or when the pipe was just full. As the head increased above this point the two diameters began to approach each other.

The greater difference between horizontal and vertical diameters or the more pronounced flattening of the pipe at the piers may be explained by the greater bending moment at this point. The concentrated reaction of the pier to the uniform pipe and water load produces negative moments which are approximately twice as large as the positive moments in the center of the span.

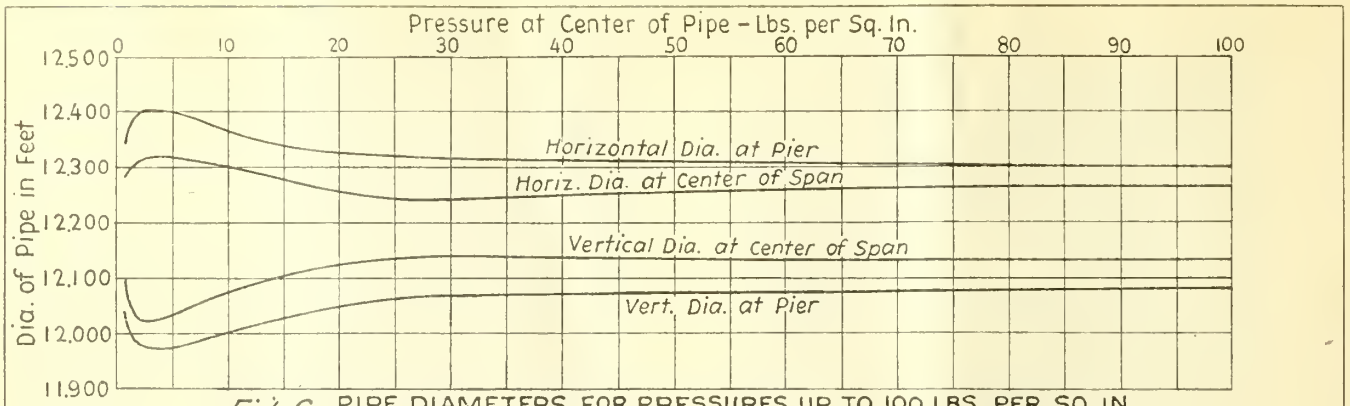


Fig. 6- PIPE DIAMETERS FOR PRESSURES UP TO 100 LBS. PER SQ. IN.

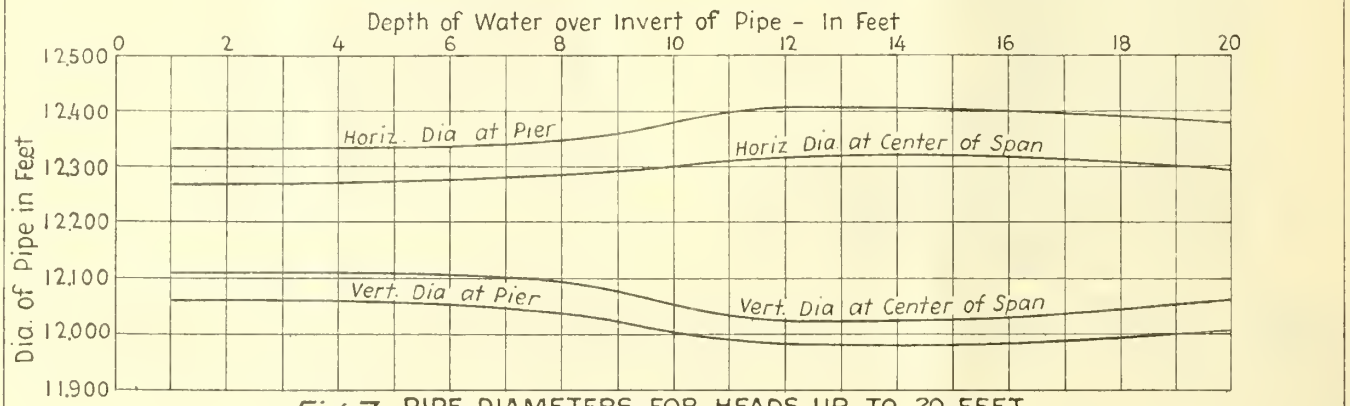


Fig. 7- PIPE DIAMETERS FOR HEADS UP TO 20 FEET

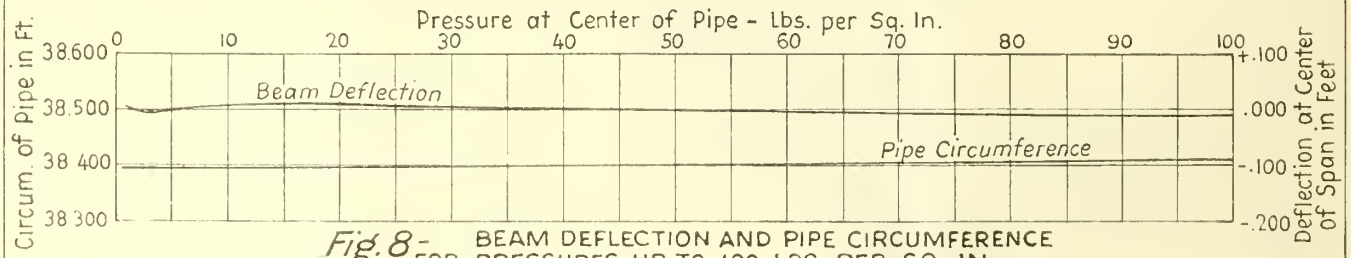


Fig. 8- BEAM DEFLECTION AND PIPE CIRCUMFERENCE FOR PRESSURES UP TO 100 LBS. PER SQ. IN.

It is assumed that for a pipe with a very thin shell the flattening would be much greater when the pipe is just filled, as has been experienced for the heavy Morrison Canyon pipe. The thin shelled pipe should also form a truer circle under the higher heads than pipes made of heavy plates.

According to the beam deflection curve the circumference of the pipe increases from 38.359 feet at zero pressure to 38.415 feet at 100-pound pressure. As the vertical diameter of the pipe increases up to about 40-pound pressure a corresponding rise can be seen in the center of the pipe as shown in the curve at the pier and the middle of the span, all in comparison with elevations at the basic head of 1.81 feet. For pressures above 40 pounds the vertical diameter of the pipe apparently remained stationary and the beam deflection shows positive values, as plotted on the curve.

Considering that all values are relative the above deflections in diameters and beam effect would be of much more interest if they could be compared to similar deflection measurements made on other pipes. Deflection measurements on various large diameter pipes of thin shell and of pipe stiffened against collapse by angle rings should be of especial value in arriving at more definite conclusions regarding safe limits in plate thickness and pier spacing. Figure 9 shows a view of the completed siphon.

The construction and testing of the siphon was under the direction of Walker R. Young, construction engineer and V. W. Russell, division engineer. The deflection measurements were made by George C. Imrie, associate engineer and W. H. Waldorf, assistant engineer. The principal designing work was done under the general supervision of J. L. Savage, chief designing engineer. All engineering and construction work is done under the general supervision of R. F. Walter, chief engineer, with headquarters at Denver and all activities of the bureau are in general charge of Dr. Elwood Mead, commissioner, with headquarters at Washington, D. C.

Secondary Projects

The report on All-American Canal investigations, under a cooperative contract with the Imperial and Coachella Valley districts, has been completed in the Denver office. Studies of storage at the Twin Springs Reservoir site, Boise project, Idaho, are being made at Denver. H. W. Bashore, now stationed at Spokane Wash., in charge of Columbia River Basin investigations, is making an investigation of the Rathdrum Prairie project. The report on the Alcova-Casper project, Wyoming, has been printed and is available for distribution. Engineering and economic reports on the Saratoga project, Wyoming, are completed.

Boulder City Buildings Approved

Secretary Wilbur on April 7 approved preliminary sketches (see back cover) of three of the principal buildings to be erected by the Government in Boulder City, the administration building, post-office building, and the dormitory and guest house. Final plans are now being drawn in the Denver office and construction will be started about June 15. The general construction of the administration building will consist of hollow brick walls stuccoed on the outside, concrete floors for the basement and first floor, and wood for the second floor. The basement will contain a garage for six cars and also a steam heating plant for both the administration building and the dormitory and guest house. An air conditioning plant will be installed for cooling and ventilating purposes. The preliminary floor plan calls for a building 54 feet by 138 feet, two stories and basement. It is estimated that the building will cost $50,000.

In the post office building will be quartered the post office, court room, jail, and offices of the United States marshal, city manager, city engineer, and city clerk. It will be one story and basement and cost about $35,000. All three buildings will follow the Spanish type of architecture.

The dormitory and guest house will be similar in construction to the administration building, except that it will not have a basement or cooling system, but will have slatted doors and large windows to insure proper ventilation. The main building will be 31 feet by 130 feet with two ells each 35 feet by 50 feet. It will cost about $30,000 and will provide quarters for unmarried Government employees and also accommodate visitors to the project.

Six Companies (Inc.) Purchase Materials

A technical publication reports that the Six Companies (Inc.) have awarded a contract to the Ingersoll-Rand Co., totaling approximately $750,000, for furnishing 500 rock drills, compressors, and accessories for use on Hoover Dam construction. The Crucible Steel Co. of America has received from the same contractors what is described as the largest order for rock drill steel recorded in the history of modern engineering construction. Requirements to be filled are approximately 1,000 tons and first shipments are already on the way to the dam site from Pittsburgh. All this material will be required this fall when the contractors start work on the four 50-foot diameter diversion tunnels involving 2,000,000 cubic yards of excavation.

Notes for Contractors

Belle Fourche project.—On April 22, bids were opened at Newell, S. Dak., under specifications 520, for the construction of approximately 43 miles of open drains and drainage structures incidental thereto. The work involves about 923,000 cubic yards of excavation and is to be completed in 220 days.

Boulder Canyon project.—Bids were opened at Las Vegas, Nev., on March 13 for the construction of 12 cottages (specifications 507–D). Alternative bids were received on a number of different types of construction from 17 building contractors. W. W. Dickerson of Lehi, Utah, was awarded the contract for building six 4-room cottages, his bid being $12,655.50. Louis J. Bowers, of Salt Lake City, Utah, with a bid of $10,363.11, was awarded the contract for six 3-room houses. The Government furnishes the materials. These cottages will be of hollow brick wall construction. Bids were received in Denver on February 16 for the furnishing of material for a steel frame warehouse 50 by 150 feet. The contract was awarded to the Edwards Manufacturing Co. of Cincinnati, Ohio, whose bid was $2,775. Bids for the foundations, floor, and erection of the warehouse building were opened at Las Vegas, Nev., on March 31, and the contract awarded to Storm & Mahoney (Inc.), of Las Vegas, Nev., for the low bid of $3,135. Bids were opened in Denver on April 28 for the furnishing of material for two steel frame pumping plant buildings, 16 feet by 30 feet, with stucco and corrugated asbestos walls. Plans and specifications for the construction of Government administration building, post-office building, dormitory, and guest house, and garage will probably be ready for issuance about May 15 and bids requested shortly thereafter.

The Stearns-Roger Manufacturing Co. of Denver, Colo., was awarded the contract for the furnishing of pumps and motors for the Boulder City water-supply system on a bid of $1,174.50. Bids were received in Denver on March 10 for electrical apparatus (specifications 510–D) for the Boulder City water and electric system and awards made to the low bidders as follows: Item 1 to the Wolfe & Mann Manufacturing Co. for $2,668; items Nos. 2, 3, and 4, to the Walthaw Corporation for $4,376.52, $3,533.64, and $2,755.50, respectively; items Nos. 5 and 10 to the Mine & Smelter Supply Co. of Denver, Colo., for $2,411.10 and $42.19, respectively; item No. 6 to American Brown Boveri Co. for $900; and items Nos. 7, 8, and 9 to the Bowie Switch Co. for a total of $850.

Bids were opened in Denver on April 1 (specifications 514–D) for the furnishing of materials for approximately 6.6 miles of high pressure, 10 and 12 inch diameter pipe, for the Boulder City water-supply system. Awards for this were made on April 9 as follows: Schedule 1, items Nos. 1 and 2, to Midwest Piping & Supply Co. of St. Louis, Mo., bid price $11,721.04; Schedule 3, items 5 and 6, to Associated Piping & Engineering Co. of Los Angeles, Calif., bid price $11,198.68; Schedule 4, items 7 and 8, to the Thomas Haverty Co. of Los Angeles, Calif., bid price $20,046.99; Schedule 6, item 10, to the Mine & Smelter Supply Co. of Denver, Colo., bid price $4,285.40. No awards for Schedules 2 and 5 were made. Bids for the construction of the pipe line (specifications 515–D) were opened at Las Vegas, Nev., on April 13. The pipe line will extend from a point on the Colorado River about a half-mile below the site of the Hoover Dam to the receiving tank in the northwest section of the town site. The time allowed for completion is 60 days after date of receipt of notice to proceed. On April 17, bids were received in Denver, under specifications 516–D for the furnishing of pressure-control equipment for the Boulder City water-supply system; and on April 21, bids were opened under pecifications 517–D, for the furnishing of pipe, fittings, valves, and other miscellaneous material for the Boulder City water distribution and sewer systems. Specifications for construction of the Boulder City water distribution and sewer systems are being prepared for requesting bids to be received at Las Vegas early in May. Plans and specifications for street grading, surfacing, paving, and sidewalk construction will be issued and bids opened for this work at Las Vegas, Nev., during May.

Bids were opened at Denver, Colo., on February 25 for furnishing apparatus for the water-purification and sewage-disposal plants at Boulder City, Nev., under specifications No. 505–D. The low bidders were as follows: Items 1 to 5, inclusive, $25,169, Dorr Co. (Inc.), Denver, Colo.; items 6, 7, 10, 11, and 12, $6,960, International Filter Co., Chicago, Ill.; items 13 to 16, inclusive, $884.40, Water Works Supply Co., San Francisco, Calif.; items 17 and 18, $795, Michigan Valve & Foundry Co., Detroit, Mich.; item 19, $59.40, Hendrie & Bolthoff Manufacturing and Supply Co., Denver, Colo.; item 20, $1,831.50, the Paradon Co., Arlington, N. J.; items 21 and 22, $3,593, Vogt Bros. Manufacturing Co., Louisville, Ky. Award has been made to the low bidders at the f. o. b. prices given. No

award was made for items 1–A, 1–B, 2–A, 3–A, 7–A, 8, and 9.

Under invitation No. 3078–B for track material, award has been made as follows: Items 1, 3, and 4, $10,468.05 f. o. b. Minnequa, Colo., Colorado Fuel & Iron Co., Denver, Colo.; items 2 and 9, $132.50, Racor Pacific Frog & Switch Co., Los Angeles, Calif.; item 5, $1,232.50, Woodings Forge & Tool Co., Verona, Pa.; item 6, $612.50, f. o. b. St. Louis, Mo., St. Louis Frog & Switch Co., Denver, Colo.; items 8 and 10, $158, f. o. b. Oakley, Ohio, L. B. Foster Co., Chicago, Ill. No award was made for item 7.

Bids under specifications No. 3–B. C. were opened at Las Vegas on March 31 and contract was awarded to Storm & Mahoney for the erection of a steel warehouse 50 by 150 feet, to be located on the proposed railroad spur at Boulder City.

Yakima project.—Bids for the furnishing of material and erection of a 34-inch diameter continuous wood stave pipe discharge line, 6,212 feet in length (specifications 512–D) for the Kennewick Highlands pumping plant were opened in Denver on March 30. The low bid of $14,500.05 was made by the Federal Pipe & Tank Co. of Seattle, Wash. No award will be made until the contract between Kennewick irrigation district and the Government has been finally consummated.

Plans and specifications for the construction of the Cle Elum Dam are being prepared and it is expected that bids will be opened some time in June.

Work on the construction of the Kittitas division lateral system has been resumed and several specifications have been issued by the local project office for small earthwork and lateral structure contracts.

Baker project.—Plans and specifications are being prepared for a reinforced-concrete slab and buttress-type dam for the proposed Thief Valley Reservoir, Baker project, Oreg., and the bids for this work will probably be opened in June.

Minidoka project, Gooding division.—P. R. Thompson, Twin Falls, Idaho, with a bid of $7,089, was low on Schedules Nos. 1, 2, and 3, and Dan Knight, Gooding, Idaho, with a bid of $4,823 on Schedules 4 and 5, specifications No. 511–D, construction of 4-room cottages, Gooding division, Minidoka project, Idaho.

Klamath project.—Bids were opened at Klamath Falls, Oreg., on March 16 for the excavation of Clear Lake Channel, Langell Valley, division, involving 55,000 cubic yards of excavation. The low bid of $8,800, or 16 cents a cubic yard, was made by Bissonette Bros., of Klamath Falls.

Boulder Canyon Project Notes

The Six Companies (Inc.), a Delaware corporation, has filed articles of incorporation in California. The directors and officials are listed as follows: President, W. H. Wattis; first vice president, W. A. Bechtel; second vice president, H. O. Wattis; treasurer, Felix Kahn; secretary, Charles A. Shea. These are all directors, the others being Allan MacDonald, S. D. Bechtel, H. W. Morrison, Philip Hart, and Henry J. Kaiser.

Newspaper reports indicate that materials and supplies required by the Six Companies (Inc.), for use on the Hoover Dam project will be purchased by competitive bidding. Miscellaneous hardware, pipe, oils, greases, and small tools are to be purchased in the open market. In the purchase of the latter, about $4,622,000 will be expended, principally in Los Angeles. About $5,000,000 will be expended for equipment, including 8 standard locomotives, 70 dump cars, 30 motor trucks, fifteen 2-yard electric shovels, six 4-yard concrete mixers, 10 air compressors each with a capacity of 2,500 cubic feet per minute, 7 cableways, a Diesel electric stand-by plant with 2,500 horsepower capacity, a complete gravel plant with capacity of 700 tons sand and gravel per hour, derricks, hoists, etc.

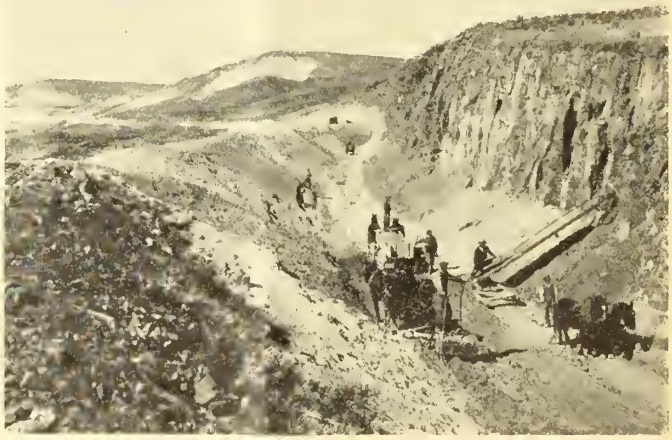
The percentage of participation of the individual companies in the Six Companies (Inc.), is as follows: Utah Construction Co., 20 per cent; Henry J. Kaiser and W. A. Bechtel Co., 30 per cent; MacDonald & Kahn Co. (Ltd.), 20 per cent; Morrison-Knudson Co., 10 per cent; J. F. Shea Co., 10 per cent; Pacific Bridge Co., 10 per cent.

Humidity records were started at the Las Vegas laboratory on March 9, using improvised apparatus until more accurate equipment can be installed. The first results indicated humidity of approximately 38 per cent during the day.

Temporary quarters for the Boulder City, Nev., post office have been established in one of the Six Companies' buildings in the industrial zone of the town site. J. L. Finney is postmaster.

The Lewis Construction Co. expects to have 7 miles of track laid shortly after May 1. On the Boulder City-Hoover Dam highway, good progress is being made by R. G. LeTourneau, subcontractors.

(Continued on page 107)



VALE MAIN CANAL, VALE PROJECT, OREGON
Left: Placing earth lining. Right: Showing earth lining in place, looking downstream

Boulder Canyon Project Notes

(Continued from p. 106)

The Southern Sierras Power Co. completed its telephone line on April 10 which will give direct communication between the substation and San Bernardino and Riverside. It is now expected that power will be available at the substation by June 1, which will be 25 days ahead of the required date.

All contractors on the project are utilizing the services of the United States Employment Service, Department of Labor, Las Vagas, Nev., Leonard L. Blood, superintendent, to obtain labor. However, a large amount of surplus labor continues to flock to Las Vegas, although additional help is not needed at this time.

The following companies acted as sureties on the performance bond for $5,000,000 furnished by the Six Companies (Inc.): Fidelity & Deposit Co. of Maryland, $550,000; National Surety Co., $550,000; United States Fidelity & Surety Co., $550,500; American Surety Co. of New York, $500,000; Hartford Accident & Indemnity Co., $350,000; Maryland Casualty Co., $350,000; Royal Indemnity Co., $300,000; Massachusetts Bonding & Insurance Co., $250,000; New Amsterdam Casualty Co., $200,000; American Employer's Insurance Co., $200,000; the Fidelity & Casualty Co. of New York, $200,000; the Home Indemnity Co., $150,000; United States Casualty Co., $100,000; Firemen's Fund Indemnity Co., $100,000; Great American Indemnity Co., $100,000; the Metropolitan Casualty Insurance Co. of New York, $100,000; Commercial Casualty Insurance Co., $100,000; the Aetna Casualty & Surety Co., $100,000; Glen Falls Indemnity Co., $100,000; Indemnity Insurance Co. of North America, $100,000; London & Lancashire Indemnity Co. of America, $50,000.

The $49,000,000 contract for construction of Hoover Dam, power plant, and appurtenant works was signed in San Francisco on March 25 by W. H. Wattis, president Six Companies (Inc.); at Las Vegas on April 11 by R. F. Walter, chief engineer; and on April 13 by Dr. Elwood Mead, commissioner; and by Secretary Wilbur in Washington on April 20, on which date Mr. Walter sent notice to the contractors to begin work. The specifications require that work shall commence within 30 calendar days after receipt of notice.

The first group of cottages for Government employees in Boulder City, now under construction, comprises six 4-room and six 3-room houses. They are of the Spanish type of architecture, hollow brick walls with 4-inch air space, stuccoed outside, metal lath and plaster inside, with red tile roofs. In the living room, a fireplace and heatilator are provided. Equipment includes electric refrigerator, range, and water heater.

With the completion of the pioneer road to the substation site, the Southern Sierras Power Co. has established a camp at that point and is constructing the substation building, foundations for machinery and other appurtenances. Excellent progress is being made in construction of both the main transmission line and the telephone dispatching line paralleling the route of the electrical tower line. June 1 is the date on which the contractor hopes to have power available at the dam site. The Southern Sierras Power Co. is considering furnishing power to the town of Las Vegas, and if such delivery is undertaken the company will install a substation at Boulder City, which will serve to deliver power to both Boulder City and Las Vegas. If the company does not install this substation, the Government plans to construct a 33,000-volt transmission line from the dam site to Boulder City.

The following letter is being sent by the Six Companies (Inc.) to applicants for positions under the Boulder Canyon project:

"Your application for a position in connection with the Hoover Dam project has been received and noted.

"We regret there is nothing we can offer at present, nor can we hold out much encouragement to you. In case we can use your services later, however, we shall be glad to communicate with you.

"In view of the many hundreds of men now here seeking employment, we strongly advise against any one coming on the chance of obtaining work."

The Southwest Builder and Contractor states that the activities of the Six Companies (Inc.), are in charge of the following committee chairmen: H. J. Lawler, construction; C. D. Bechtel, purchasing; Henry J. Kaiser, Boulder City; S. D. Bechtel, transportation; W. A. Bechtel, insurance and hospitalization. The headquarters of the company are at 510 Financial Center Building, San Francisco, Calif.; and Mr. Lawler's office is in the Phelan Building.

The Hoover Dam consulting board on April 21, 1931, approved the plans and specifications for Hoover Dam on the Boulder Canyon project and submitted a formal report to that effect.

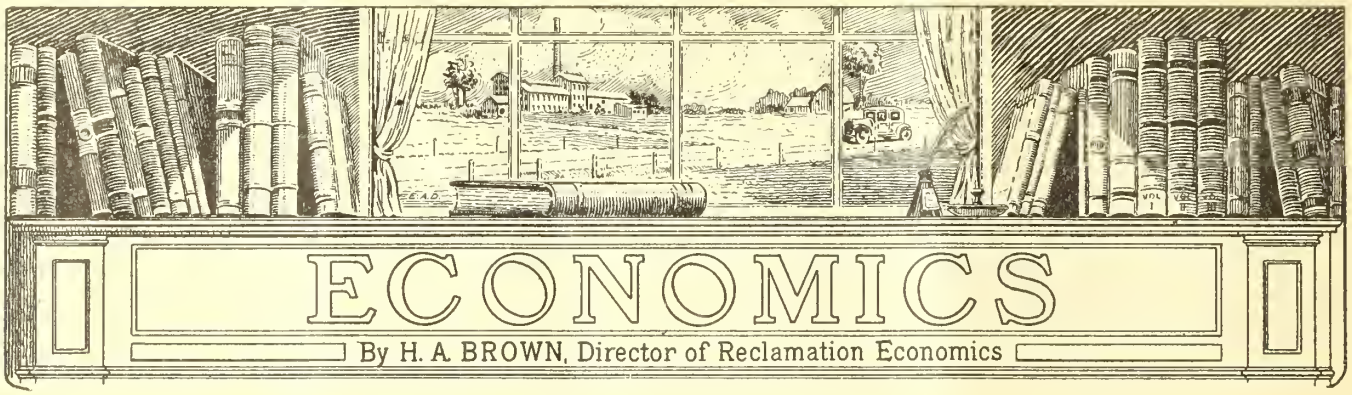
FOUR men whose applications had previously been accepted on the Riverton project made homestead entry during the month. Five prospective settlers visited the project.

Six Companies Begin Work

The Six Companies (Inc.), contractors for the Hoover Dam, power plant, and appurtenant works, are known on the job as the "Big Six." Frank T. Crowe, general manager in charge of construction, has established a branch office in Las Vegas and also has a field office in Boulder City. Thirty houses have been erected in the industrial zone section of the town, which are used as temporary quarters for 350 workmen. This force is concentrating its efforts on the drilling and blasting along the railroad location in the canyon. It is also planned to construct a highway from the main Boulder City-Hoover Dam Highway near Tunnel Ridge along the water line to river level at the lower tunnel portals. The houses, which are of frame construction, can later be moved into the residence section of the town and partitioned and fitted for use in the permanent camp. A mess house has also been built. Mr. George D. Colmesnil, of San Francisco, is preparing plans of the buildings for use by the contractor in Boulder City.

One of the principal jobs for the contractors is the construction of about 22 miles of double-track railroad from the United States section of railroad (Boulder City to Hoover Dam site) down the Hemenway Wash to the river, and then along the Nevada canyon wall to the lower tunnel portals. This railroad will serve the double purpose of taking away excavation material and bringing into the work area materials, supplies, etc. The grade of the railroad through the canyon will be at elevation 720, which is the elevation of the top of the upper cofferdam.

A major problem under consideration by the "Big Six" strategy board is the transportation of gravel from the pits on the Arizona side of the river, about 8 miles above the dam site, to a storage yard near the work area. Two plans for handling the gravel are under consideration, the first involving construction of another railroad from the pits to a storage point in Hemenway Wash above the water line. A second plan involves building an aerial tram. If the railroad plan is adopted, the river must be crossed either by bridge or tramway.



Census Statistics for 1930 Demonstrate Importance of Irrigation in Country's Development

THE agricultural depression of 1930 has been felt on Federal reclamation projects to about the same extent as in the humid farming section. Notwithstanding the severe drought the United States crop report for 1930 shows an increase in the production of all grain crops, except corn, as well as beans, potatoes, sugar beets, apples, pears, and peaches. Cotton fell off about 5 per cent. On the Federal projects there were small increases in the grain crops, with the exception of wheat, which was reduced 8 per cent; beans were increased 33 per cent in area and 100 per cent in yield; potatoes 19 per cent in area and 50 per cent in yield; apples 50 per cent in yield from the same area as in 1929; the sugar-beet area dropped 5 per cent, but the yield increased 9 per cent; and cotton was reduced 29 per cent in area but only 2 per cent in yield. Compared with crop production of the entire country the area on reclamation projects remains 0.4 per cent of the total area and 1 per cent of the total production. The average value per acre of irrigated crops dropped from $58.50 in 1929 to $41.60 for 1930, while for the United States the comparative figures are $23.39 and $17.12.

The accompanying table gives the figures for 1930.

INCREASED YIELDS BUT DECREASED VALUES

On the basis of yields the 1930 crop was one of the best that has been produced on Federal projects, but the value per acre was very unsatisfactory and is the lowest since 1916. The sugar-beet projects came through with the best returns, while the cotton projects in the Southwest and wheat projects in the Northwest suffered heavy shrinkages. The project monthly reports show very little improvement in the price of farm products during the winter months and about the only profitable returns are reported from the sale of feeder lambs.

FAIR PRICES TO PRODUCERS WILL NOT HURT CONSUMERS

Notwithstanding the low price of farm products, the consumer has reason to believe there has not been a corresponding drop in retail prices. The price of bread in Washington remained 10 cents for a 1-pound loaf until Senator Capper began an investigation into the continued high price of bread, milk, and other foods. The defense showed that the cost of wheat was only a very small fraction of the cost of making a loaf of bread and delivering it to the consumer. On our western projects wheat has been selling during the past winter at about 45 cents a bushel, with a freight rate to Minneapolis of 25 cents. It takes about 275 pounds of wheat to make a barrel of flour which can be made into 300 loaves of bread. Of the 10 cents the consumer pays for a loaf of bread, approximately 7 mills goes to the farmer. On this basis flour would have to drop $3 a barrel to make a change of 1 cent per loaf in the price of bread. On the other hand, if the producer were to receive $1 a bushel for his wheat, it would mean an increase in the cost of a loaf of bread of approximately 8 mills, which would not hurt anyone and would give the farmer a living wage. Take the case of the Idaho potato. The selling price for No. 1 potatoes on the project is 50 cents per hundredweight while in the East the retail price is 4 pounds for 25 cents. With prices at their present level the producer is selling potatoes at about $34 an acre under the cost of production. If the price on the farm were doubled, it would result in a small profit to the producer and increase the cost to the consumer one-half cent per pound. These figures show very clearly that we can pay the farmer a fair price for his product without upsetting the economic apple cart.

With the exception of cotton practically all farm products are used either directly or indirectly as human food, and the ordinary stomach has a capacity of about three pints, but, as is well known, it is susceptible of some distention. There is a limit to what the average person can consume, and most of us eat too much. If we eat more of one food we must consume less of something else, and it is a well-known fact that, especially since the war, our diet has changed. We are consuming 40 per cent more sugar than in pre-war days; the con-

A COMPARISON OF AGRICULTURAL PRODUCTION

	Entire United States	Federal reclamation projects	Per cent reclamation projects
Value of crops	$6, 274, 427, 000	$64, 971, 470	1. 03
Acres in crops	366, 507, 000	1, 550, 967	. 42
Bushels of—			
Corn	2, 081, 048, 000	1, 635, 595	. 08
Wheat	850, 965, 000	3, 613, 865	. 42
Barley	325, 893, 000	2, 883, 129	. 89
Oats	1, 402, 026, 000	1, 654, 161	. 12
Rye	50, 234, 000	92, 440	. 18
Alfalfa seed	920, 200	499, 029	54
Flax	23, 682, 000	41, 783	. 17
Tons of—			
Hay	82, 656, 000	69, 024	. 08
Alfalfa	28, 587, 000	1, 312, 415	4. 6
Bushels of sweet clover seed	656, 400	59, 107	9. 0
Bushels of—			
Beans	22, 137, 000	778, 071	3. 5
Potatoes	361, 090, 000	12, 556, 237	3. 5
Apples	163, 543, 000	6, 658, 319	4. 07
Pears	25, 703, 000	1, 423, 211	5. 55
Peaches	53, 286, 000	344, 354	. 65
Tons of sugar beets	9, 175, 000	1, 043, 847	11. 4
Bales of cotton	14, 243, 000	170, 565	1. 19

sumption of cereals has dropped off about 30 per cent, while there has been an increase in the consumption of milk, pork, and lard; beef is still dropping off and corn and rye as breadstuffs have declined tremendously, while fruits and green vegetables have shown a decided increase. On all our projects it is necessary to study the present trends of the human appetite and get ready to furnish the food for which there is the greatest demand. And in this connection it may be well to remember that there is no competition in quality. It costs very little more to produce the best grades than it does the fair to poor grades, but there is a big difference in the demand for high-grade products.

COMPARATIVE SIZES OF IRRIGATED AREAS

Much has been said and written about the unwarranted increase in the irrigated area in the United States and particularly the activities of the Federal Government. The presentation of a few of the facts relating to irrigation will give one a better idea as to what has been done and what is going on. The arid and semiarid sections of the United States comprise about one-third of the total area. Dry-land farming operations can be carried on in semiarid sections having an annual average rainfall of about 12 inches or more, but even here irrigation is a necessary and paying proposition, as it makes possible a better balanced farming program and greater diversification. The 1930 census figures give the irrigated area of the United States, exclusive of rice lands, as 18,329,400 acres. This is an increase of 430,460 acres, or 2.3 per cent more than the figures reported in the 1920 census. Ten of the States have less irrigated land in 1930 than in 1920, while 9 States show increases, California heading the list with 4,731,632 acres, which is approximately 500,000 acres, or 12½ per cent more than reported in 1920. But California shows an increase in population of 65.7 per cent during the same period. Oregon has increased 22 per cent in population while the irrigated area is less than 10 years ago. Washington shows an increase of 15 per cent in population while the irrigated area has decreased 3.5 per cent.

It is undoubtedly true that future expansion in the irrigated areas of the Western States will result largely from the activities of the Federal Government, as the possibilities of combining land and water are becoming more difficult and the expense involved will be such that the construction can not be undertaken by private capital.

It is not easy to grasp the relative size of the irrigated tracts of the Western States, but the following figures will give some idea. The irrigated areas of Arizona, Nevada, and New Mexico are less than 1 per cent of the total area of the State, Washington 1.1 per cent, Oregon and Montana 1.7 per cent, Wyoming 2 per cent, Utah 2.4 per cent, Idaho 4 per cent, California 4.7 per cent, and Colorado 5.1 per cent.

A study of these figures shows conclusively that the expansion of the irrigated areas has not kept pace with the rapid growth in population, and this is especially true of the States west of the Continental Divide, where crop production is dependent almost entirely on irrigation. There is a strong indication that the West is going to continue to grow in the future at a faster rate than it has in the past, and the expanding local markets are going to create an ever-increasing demand for food products that can best be supplied from adjacent farming areas, this being particularly true of the staple food products. The East will continue to be the industrial section of the country and will receive its share of the wealth created on the irrigated farms of the West through the purchase of manufactured products by not only the farmers but by the inhabitants in the cities and towns that have resulted directly from these irrigated areas.

It would be interesting to compile statistics as to just how this wealth is distributed over the country and the disposal of agricultural products from the irrigated farms. Such figures have not been available for all projects, but authentic data have been compiled in a few cases and these figures would be found applicable to most of the projects. In 1930 there were shipped from Pasco, a small private project in Franklin County, Wash., 295 cars of produce, of which 243 cars, or 82.4 per cent, were consumed in Washington and adjoining States, 17 cars, or 5.8 per cent, were delivered to points on the Atlantic seaboard, and 35 cars, or 11.8 per cent, to points in the Mississippi Valley. The following figures give the general location of the shipping points of 666 carloads of manufactured products to one of the 27 Federal reclamation projects. From Colorado 62 cars, or 10.6 per cent, were sent out, while 604 cars, or 89.4 per cent, originated from industrial centers in the Mississippi Valley and points east.

These two cases show conclusively that Federal and private irrigation has been an important factor in advancing the development and prosperity of the entire country and does not enter into serious competition with farming operations in the humid sections.

Products of Federal Reclamation for Paris Exposition

In order that the millions who are expected to attend the International Colonial and Overseas Exposition to be held in Paris, France, this year might have a clearer understanding of the products of Federal reclamation, the projects were requested to arrange, if possible, with canning and preserving factories and other organizations to forward to the bureau samples of their products for an exhibit. The response to this request was gratifying, and as a result a relatively large shipment has already been sent to Paris with the expectation that others will follow as material is received from the projects. The various products were donated and shipped at no expense to the reclamation fund. The following shows the projects so far represented, the names of the donors, and the material donated:

Yuma project, Arizona - California.—F. W. Creswell: Sack of pecans.

Orland project, California.—Geo. W. Sturm, president Orland Water Users' Association and secretary Almond Growers' Exchange: Boxes of Peerless, NePlus, Nonpareil, and Drake almonds and Franquette English walnuts; labels and display advertising material of California Almond Growers' Exchange.

J. E. Faltings, manager Orland Orange Growers' Association (Inc.): Material for orange boxes, labels for Glenora and Orland brands, tissue wrappers, and display advertising.

Marcus Lowry: Kadota figs in sirup, and large variety of containers for fig sirup, fig jam, and candied figs, with additional labels.

Grand Valley project, Colorado.—Currie Canning Co.: Tomatoes, catsup, pimentos, cherries, apple butter, string beans, pumpkin, beets and carrots, with additional labels.

Belle Fourche project, South Dakota.—Squire Dingee Co.: Six quart jars of Ma Brown assorted pickles and gherkins, with additional labels.

Salt Lake Basin project, Utah.—Woods Cross Canning Co., Woods Cross, Utah. Peas: Fancy sweet wrinkled, fancy extra sifted, fancy petit pois, June, June sweet, fancy sugar, sifted sweet early June, ungraded. Beans: Cut stringless green, whole green stringless; tomatoes; asparagus tips; labels.

Utah Packing Corporation, Ogden, Utah: Tomato catsup, tomato sauce, solid-pack tomatoes, tomato juice, green

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Measuring Hay in Stacks

THE Department of Agriculture has recently issued leaflet No. 72 describing a more accurate method for determining the volume and number of tons of hay in a stack.

In an effort to develop a scientific method the department organized a study of this subject in cooperation with a number of the State agricultural experiment stations. The purpose was to ascertain the accuracy of the rules in use and to develop new rules in case the old rules were found to give inaccurate results. Several thousand oblong and round stacks were measured and weighed in the Western and Great Plains States, and these data were studied and tabulated.

OBLONG OR RECTANGULAR STACKS

The volume of a rectangular stack is equal to its length multiplied by the area of the cross section. The length can be measured easily, but the exact area of the cross section is not determined so readily because an accurate formula is necessary for computing the area from the two measurements—width and over—that are usually made for this purpose. The width and over measurements are made easily and for this reason those who buy and sell hay by measure use rules that require only three measurements, namely, width, length, and over. Width is the width of the stack at the ground; length is the average length of the stack; and over is the distance from the ground on one side over the stack to the ground on the other side.

FORMER VOLUME RULES INACCURATE

In the investigations to determine the accuracy of former rules the cross section of each stack was calculated by each of several rules, such as the Frye-Bruhn or rule of two, and the Quartermaster rule, and the results were then compared with the actual cross-section areas of the stacks. This study proved that these rules were not accurate. For certain types and shapes of stacks they gave fairly accurate results, but for other types and shapes the results were very inaccurate.

Cross-section areas determined by the Frye-Bruhn rule averaged only 86 per cent of the actual cross-section areas; the volume of the stacks, therefore, as computed by this rule would be about 14 per cent less than the actual volume. Cross-section areas determined by the Quartermaster rule averaged 96 per cent of the actual cross-section areas, but in some instances this rule gave 25 per cent less and in others 30 per cent more than the actual cross-section area.

NEW VOLUME RULES FOR OBLONG STACKS

Investigations were then conducted for the purpose of developing a new rule or rules that would be more nearly accurate and that would use the same measurements as those used in the old rules. It was found that by dividing hay stacks into three types based on shape, a rule for each type could be developed. The volumes determined by these rules averaged the same as the actual volumes of the stacks, and in no case was the error over 5 per cent.

The three types of stacks (fig. 1), with the rule for each type, are as follows:

For square, flat-topped stacks $(0.56 \times O) - (0.55 \times W) \times WL$.

For high, round-topped stacks $(0.52 \times O) - (0.46 \times W) \times WL$.

For low, round-topped stacks $(0.52 \times O) - (0.44 \times W) \times WL$.

In these rules O equals the over, W equals the width, and L equals the length.

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SUMMARY OF CROP RESULTS ON RECLAMATION PROJECTS IN 1930

NOTE.—These detailed figures are limited to crops covered by census on Government projects proper excluding all crops in areas served with water under the Warren Act, but including nonirrigated crops grown on the project

Crop	Acreage cropped		Yields		Crop value		
	Total	Per cent of cropped	Total	Average per acre	Average per acre	Total	Per cent of total value of all crops
Cereals:			*Bushels*				
Barley	83,285	5.4	2,883,129	34.6	$15.10	$1,257,431.00	1.9
Corn	54,653	3.5	1,635,595	29.9	20.90	1,142,677.00	1.8
Oats	45,401	3.0	1,654,161	36.4	10.10	457,871.00	.7
Rye	5,110	.3	92,440	18.1	9.85	50,268.00	.1
Wheat	135,201	8.8	3,613,865	26.7	16.80	2,274,240.00	3.5
Total	323,650	21.0	9,879,190	30.5	16.03	5,182,487.00	8.0
Other grain and seed:							
Alfalfa seed	22,456	1.4	499,039	22.2	38.75	870,562.00	1.3
Clover seed	14,841	.9	59,207	4.0	36.20	537,084.00	.8
Flaxseed	6,279	.4	41,783	6.7	9.30	58,364.00	.1
Total	43,576	2.8	600,029	13.8	33.60	1,466,010.00	2.2
Hay and forage:			*Tons*				
Alfalfa hay	452,526	29.2	1,312,415	2.9	26.40	11,940,274.00	18.4
Clover hay	15,996	1.0	23,045	1.4	9.40	150,256.00	.2
Other hay	57,704	3.8	69,024	1.2	8.70	502,088.00	.8
Corn fodder	10,201	.7	64,610	6.3	39.50	403,544.00	.7
Other forage	19,324	1.2	10,679	.5	13.60	263,014.00	.4
Pasture	343,454	22.1			10.00	3,444,441.00	5.3
Total	899,205	58.0	1,479,773	1.6	18.57	16,703,617.00	25.8
Vegetables and truck:			*Bushels*				
Beans	28,932	1.9	778,071	26.9	44.60	1,290,178.00	2.0
Onions	2,762	.2	954,430	345.5	333.00	918,788.00	1.4
Potatoes, white	55,752	3.6	12,556,237	225.6	86.60	4,822,241.00	7.4
Potatoes, sweet	884		93,555	105.7	145.50	128,691.00	0.2
Truck	42,982	2.7			111.80	4,809,615.00	7.4
Total	131,312	8.4	14,382,293	109.6	91.20	11,969,513.00	18.4
Fruits and nuts:			*Pounds*				
Apples	24,174	1.5	332,915,952	13,800	163.50	3,950,158.00	6.1
Peaches	3,518	.2	16,528,960	4,700	96.50	339,250.00	0.5
Pears	7,062	.5	68,314,111	9,680	99.70	703,150.00	1.1
Prunes	2,469	.1	18,590,352	7,530	74.60	184,305.00	0.2
Citrus fruit	4,949	.3	63,768,110	12,870	315.50	1,561,015.00	2.4
Small fruit	3,388	.2	24,268,230	7,160	232.00	784,859.00	1.2
Miscellaneous	21,913	1.5	193,400,313	8,820	115.30	2,526,213.00	3.9
Total	67,473	4.3	717,786,028	10,630	148.30	10,048,950.00	15.4
Miscellaneous:			*Tons*				
Sugar beets	79,897	5.1	1,043,847	13.0	94.70	7,575,664.00	11.6
Cotton	192,120	12.4	175,809	[1] .9	59.40	11,398,544.00	17.6
Cottonseed			78,924	.4			
Other crops	47,025	3.0			14.10	662,485.00	1.0
Total	319,042	20.5			61.60	19,636,693.00	30.2
Duplication	233,291	15.0					
All crops for which detailed census was taken	1,550,967	[2] 100.0			41.90	65,007,270.00	100.0
Warren Act projects [3]	1,186,023				44.85	53,206,850.00	
Total	2,736,990				43.19	118,214,120.00	

[1] Bales.
[2] The dry-farmed area of this total amounted to 83,870 acres, with a total value of $588,330.
[3] Totals only available. Acreage, yield, and value not compiled by crops.

Reclamation Organization Activities and Project Visitors

Doctor Mead, Commissioner of Reclamation, after leaving Washington on March 28 went direct to El Paso, Tex., where he met with the water users of the Rio Grande project and the International Water and Boundary Commissioner; from El Paso he went to Yuma and later to Phoenix, where he met a number of State officials; going thence to the Parker-Gila project, which he inspected in company with P. J. Preston, in charge of the Colorado River Basin investigations, R. M. Priest, superintendent of the Yuma project, and local representatives; thence back to Yuma for a conference with the water users. From Yuma he went to Los Angeles, where with P. W. Dent, assistant commissioner, and R. J. Coffey, district counsel, he considered the All-American Canal contracts. Doctor Mead, Mr. Dent, and Mr. Coffey then left Los Angeles for Las Vegas, where they were met by R. F. Walter, chief engineer, Louis C. Cramton, special attorney to the secretary in charge of leasing at Boulder City, and C. A. Dobbel, executive assistant to the Secretary.

From Las Vegas Doctor Mead went to Salt Lake and from there to Cheyenne, where he met and discussed Wyoming's water problems with Acting Governor Clark and State Engineer Whiting. Doctor Mead's next stop was in Denver, where on April 20 he conferred with representatives of the Bridgeport and Northport districts of the North Platte project, and on the 21st with the Hoover Dam Consulting Board and the Concrete Board sitting jointly, returning to Washington on the 24th.

Dr. Hugh A. Brown, director of reclamation economics, on April 3 attended a meeting in Chicago of agricultural and development agents of the railroads of the United States, Canada, and Mexico, to make plans for the exhibits of the results of reclamation agriculture and industry at the World's Fair, A Century of Progress, in 1933.

F. E. Weymouth, former chief engineer of the Bureau of Reclamation, now chief engineer of the Metropolitan Water District of Southern California, with headquarters in Los Angeles, was in the Denver office recently in conference with representatives of other power interests on Boulder Canyon power matters.

Miss Kate McDougall, secretary to Mr. Cramton, who has charge of leasing at Boulder City, left on April 16 for Las Vegas to establish the office.

P. W. Dent, Assistant Commissioner, left Washington on March 14, going direct to Denver for a conference with the Chief Engineer's office regarding the proposed contract with the Imperial Irrigation District for construction All-American Canal. Mr. Dent then paid official visits to El Paso and Yuma and next went to Los Angeles, where he and District Counsel Coffey held various conferences with the attorneys for the Imperial Irrigation District and the Coachella Valley County District concerning the All-American Canal contract. Then following a few days' visit to the Imperial Valley, several conferences were held in Los Angeles which resulted in an agreement concerning a tentative form of contract for the All-American Canal. Mr. Dent's next stop was in Las Vegas, where he met Commissioner Mead and Chief Engineer Walter. He then returned to Los Angeles, where the final conference on the All-American Canal contract was held, and arrived in Washington on April 30.

A. J. Wiley, L. C. Hill, and D. C. Henny, consulting engineers, and Prof. Raymond E. Davis, Prof. Wm. K. Hatt, Prof. Herbert J. Gilkey, Franklin R. McMillan, and P. H. Bates, comprising the members of the concrete research board, held a joint meeting called by the Secretary of the Interior in Denver on April 21, to consider Hoover Dam problems, in which they were joined by Doctor Mead.

We regret to announce that James A. Waldrip, employed as dragline oiler on the Klamath project, was accidentally killed on April 10 while in the performance of duty.

J. L. Finney, of Las Vegas, Nev., has been appointed postmaster for Boulder City. The new post office was established on April 15 in one of the temporary buildings which will give place to permanent buildings to be erected within the next few months. Commissioner Mead was one of the new postmasters first visitors.

Col. B. F. Fly, of Yuma, Ariz., is again in Washington looking after the affairs of the Yuma project.

Fred. G. Gettins, engineer department, National Surety Co., San Francisco, was a visitor on the Kittitas division of the Yakima project.

H. H. Johnson, superintendent of the Milk River project, and Josef Sklower, president of the Malta irrigation district, have returned to Malta from Washington, where they were in attendance on a hearing before the International Joint Commission on the distribution of St. Mary and Milk River water between the United States and Canada.

F. L. Taylor, agricultural agent for the Chicago, Burlington & Quincy Railroad, visited the Riverton project on March 19.

Oliver P. Morton, special assistant to the Attorney General, spent two days at the Orland project office in connection with matters relating to the order from the United States district court for the appointment of a water master to administer the decree in United States *v.* E. C. Angle, et al, during the coming irrigation season.

J. L. Savage, chief designing engineer, and L. N. McClellan, electrical engineer, left Denver on March 23, accompanied by two engineers from the Panama Canal Zone, to inspect the Guernsey Dam at Guernsey, Wyo., North Platte project. They returned to Denver on the 24th.

W. R. Young, chief construction engineer of the Boulder Canyon project, was in Denver from March 1 to 7.

Hobart D. Fox, assistant engineer arrived on the Uncompahgre project on March 23 to take up the construction of the experimental flume to be built at the chute section of the south canal main line for studies in connection with Hoover Dam.

W. F. Kubach, chief accountant in the Washington office, has returned to headquarters after making an official visit regarding accounting matters to the Yuma and Boulder Canyon projects and the Denver offices during the months of March and April.

F. T. Crowe, general manager of the Six Companies (Inc.), spent five days in Denver recently.

Associate District Counsel Spencer L. Baird spent one day recently on the Vale project in connection with legal matters.

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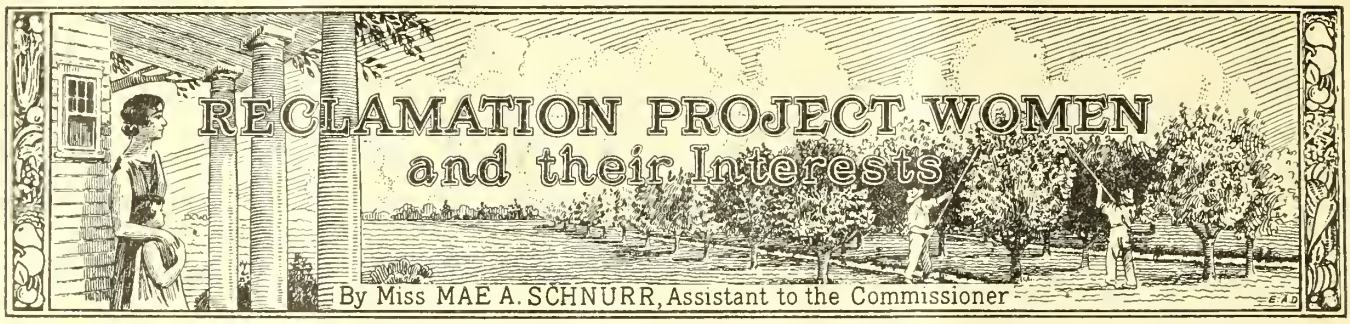

Help in Curtain Problems

ALMOST every home requires curtains of some sort in most of its rooms, either to insure privacy, to modify the light, or to add to the decorative effect. The cost of curtains is one of the leading items in the outlay for household textiles. Even a 5-room house having a total of only a dozen windows will need about 60 yards of material if curtained completely. The expense for curtains must be repeated every few years, because they wear out or fade. It is important, therefore, for the housewife to know how to meet this expenditure advantageously.

Some of the following points should be kept in mind: To be useful, curtains must not conceal an attractive view, prevent adequate ventilation, or shut out too much daylight. They should soften and diffuse the light entering the room and break the severe lines of the wooden casing around the window. Good design requires that curtains have strong lines and pleasing proportions, and that through a careful choice of texture and color they link together the furnishings of the room. Simplicity is the keynote of the best curtain arrangements nowadays, though just how this is carried out must depend on the shape and type of window and the general tone of the room.

In a living room with a pleasant outlook, side draperies and a valance may serve to frame the window and its view and add to its color scheme. For the bedroom, transparent curtains hung close to the window glass are oftentimes sufficient. The bathroom and kitchen curtains must be able to stand frequent tubbing and be so simply made that they can be taken down and put up easily.

DAINTY CURTAINS FOR A GIRL'S ROOM

Here is a charming idea for curtaining a window in a girl's bedroom. Girls are apt to want their rooms daintier and lighter in treatment than boys, although the character of the room depends somewhat on a girl's interests. A hearty out-of-doors sort of girl who enjoys the same things as her brother may want strong colors, straight lines, vigorous patterns and durable materials. But for the girl who likes daintiness, nothing could be more appealing than these ruffled tie-back curtains of cream voile over a glazed chintz shade in a gay pattern.

Other good materials to use for curtains in a girl's room with a figured shade are organdie, marquisette, or net. With plain shade, dotted swiss, or cheesecloth dyed in a color harmonizing with the other furnishings of the room, would be good.

Dainty curtains for a girl's room

If the woodwork is white, curtains may be white, or they may repeat the dominant color in the room. Curtains of these materials may be used alone, or with valance and side draperies of cretonne, taffeta, poplin or glazed chintz. Interesting variations are obtained by hanging two layers of organdie or voile of different color over each other.

CURTAINS FOR THE SUN ROOM

A sun room with its many windows is a special problem in curtaining. Simple curtains are needed to cut down glare, but at the same time let in plenty of sunshine. Curtains are also an excellent way to add color and gayety to the sun room. Shades of bright-colored awning cloth or striped linen mounted on spring rollers are suggested for the sun room. Such shades are decorative enough to take the place of curtains and have all the needed utility features. Also these heavy materials with colors fast to light are likely to be more durable than lighter weight materials. The sun's rays have an injurious effect on many textile fibers as well as on dyes. That is the reason many curtain materials get tender and go to pieces on laundering after they have been up for a comparatively short time. In a sun room curtain materials are put to a particularly hard test.

The sun room in the picture has awning cloth shades. The background of the cloth is natural linen color, and the stripes are blue, green, orange, and reddish violet. These colors blend with the rug in two shades of blue and orange. The cushions on the wicker chairs and the porch swing repeat these same colors in various combinations. An attractive addition over each shade would be a scalloped fitted valance of the same material deep enough to cover the roller. The valance should be made on buckram or beaver board and nailed to a board 4 inches wide resting on top of the window frame.

MAKE GIRLS' SCHOOL DRESSES SIMPLE AND EASY TO LAUNDER

Possibly no task gives a mother more real enjoyment than selecting or making the dresses worn by her small daughter when she is between 3 or 4 and 10. Sometimes the mother herself feels once more like a little girl with a doll to dress, and she takes so much pleasure in planning her "doll's" wardrobe that she allows her imagination to run riot. The little girl, too, has ideas about frills and ruffles and fancy decorations she has seen on other children's clothes. The result is often an elaborate, overtrimmed impractical group of dresses which not only give much work in the making but also in "doing up."

Dresses that are too fussy or too fragile for everyday wear prevent a child from indulging in normal active play, and make her too conscious of herself and her appearance; or else they are soon dirty and

draggled and much less pleasant to look at than plain, sturdy play suits. Another unfortunate point, too, is that the frocks that make a little girl look like a dressed-up doll are not really in good taste except for "dress-up" occasions. If worn to school the child is likely to be criticized rather than admired.

The little girl should have dresses that can be easily made and laundered, that are comfortable to wear, pleasing to look at, and easy to put on and take off. Even a 3-year-old can learn to dress herself if the fastenings are few in number, with large, findable buttons, placed in front.

It is not necessary to choose dull, uninteresting colors, for there are many gay, fast-colored cotton prints available that appeal to any little girl. In wintertime they may be replaced by warm, washable challies in similar designs. Plain colors, too, are good in such materials as broadcloth and poplin.

The fact that little girls grow continually and in all directions should always be kept in mind in selecting patterns for them. Raglan sleeves are the most satisfactory for allowing for chest expansion. Lengthening must be possible by means of wide hems, tucks that can be let out, and loose finishes at neck, wrists, and knees. Waistbands on bloomers or the line where a waist and skirt join should be loosely fitted at first.

BUILT-IN CONVENIENCES

More and more the housewives of the country are arousing the interest of home builders to carry the benefit of their experiences into improvements in new homes, as they are built, making remodeling unnecessary. Arrangement of closets, storage spaces, windows, lights, etc., should all be worked out according to an efficiency plan. Built-in equipment takes the place of heavy pieces of portable furniture which previously took up floor space, had to be bought when furnishing a house, and had to be moved when cleaning.

Another advantage of built-in equipment is that it can be made harmonious, attractive, and easy to keep clean, being efficient at the same time.

Some modern kitchens are so constructed that no furniture is required. The kitchen is the home maker's most important workshop. Size, equipment, lighting, and arrangement are the four important factors in planning a kitchen. They involve the difference between many and few steps and comfort and strain.

For the walls a hard, durable surface should be chosen and a coat of enamel applied which will add much to its wearing quality and washability.

For the floor, linoleum is the most satisfactory. This is especially true if it is laid with a cement base to insure its lying flat so that the edges will not curl and allow water to seep under the linoleum.

Curtains for a sun room

CLOSETS ADD GREATLY TO HOME COMFORT

No matter how large the house, if it lacks plenty of closet room, it never seems to have a place to put things.

Nowadays closets are much specialized. From the one for coats, near the front door, with its hooks and hangers, its hat shelf and umbrella stand and rubber box, to the closet off the back porch where there is space for the garden hose and the lawn mower, as well as Junior's "trike," each closet has its own duty and its own equipment.

Among the new closets to aid home makers are some for the bedroom. There is a compact little hanging closet, just the width of an ordinary door, and just the right depth for a pole filled with clothes hangers. The floor is slightly raised for ease of cleaning, and is sloped up toward the back, with notches to hold shoes. Every bit of space is utilized for taking care of clothing and none is used for standing room.

Another of these new closets is a tray case that any man would be sure to appreciate. Like the hanging closet, it is inclosed by a door of regular size and style, and so can be used to give the room a balanced treatment. The tray case consists of a chiffonierlike arrangement of trays of various depths. They have a half-front, so that the man of the house can see at a glance, and without pulling out the trays, just where his shirts are or which compartment holds his ties and socks. The shallower trays are at the top. The two upper ones are subdivided into smaller compartments for small articles.

CARING FOR FLOORS

If you have a good-sized boy in your family, enlist his help out of school hours to recondition the floors. If they have been varnished, they should be swept with a soft brush, a mop, or a broom covered with a cotton-flannel bag, and then rubbed with a cloth or mop slightly moistened with floor oil or kerosene. The oil gradually dries out of varnish after it has been applied to wood, and unless restored by an occasional rubbing with an oiled cloth the varnish becomes exceedingly hard and brittle. Use only enough oil to moisten the cloth or mop.

In general, varnished floors retain their color and luster better if no water is used on them, but if very dirty they may be wiped with a cloth or mop wrung out of warm, soapy water, wiped dry at once, and polished with an oiled cloth or mop. White spots made by water and light scratches can generally be removed by rubbing with a cloth moistened with floor oil, kerosene, or furniture polish.

Waxed floors should be swept with a soft brush or mop entirely free from oil. Oil softens wax and should never be used on it in any way. About once a week a waxed floor should be given a more thorough cleaning with a cloth wrung out of warm soapy water, or moistened with turpentine or gasoline. Occasionally after cleaning, the entire floor may be given a very thin coat of wax and polished with a weighted brush or woolen cloth. Under moderate use, however, a floor needs

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Forty Million Dollars Repaid by Water Users on Construction Account

THE following tabulations disclose how the reclamation fund has been expended throughout the various Western States for construction and operation and maintenance on reclamation projects and how much of the expenditure has been repaid by the water users. It is noteworthy that despite the difficult situation created as a result of the low prices for farm products which affected the irrigation projects, as well as the country as a whole, 96.6 per cent of operation and maintenance charges and 93.8 per cent of construction charges due had been repaid. Repayments on the construction account show a return to the revolving fund of more than $40,000,000.

Spillway, East Park Dam, Orland project, California

Status of Construction Account Repayments, February 28, 1931

State and project	Construction account, Feb. 28, 1931, repayable	Value of repayment contracts	Amounts of repayment contracts due on Feb. 28, 1931	Balance of repayment contracts deferred (not due)	Amounts paid on amounts due	Amounts uncollected of amounts due	Per cent repaid of amounts due
Arizona: Salt River	$10, 166, 021. 97	$10, 166, 021. 97	$6, 506, 254. 09	$3, 659, 767. 88	$5, 586, 331. 45	$919, 922. 64	85. 9
Arizona-California: Yuma	9, 512, 669. 11	5, 074, 957. 21	3, 823, 569. 44	1, 251, 387. 77	3, 642, 782. 44	180. 787. 00	95. 3
California: Orland	2, 355, 528. 09	2, 474, 446. 35	765, 670. 19	1, 708, 776. 16	729, 937. 75	35, 732. 44	95. 3
Colorado:							
Grand Valley	4. 058, 843. 92	4, 074, 584. 11	160, 219. 93	3, 914, 364. 18	122, 827. 52	37, 392. 41	76. 7
Uncompahgre	5, 466, 485. 80	5, 509, 945. 06	826, 700. 81	4, 683, 244. 25	490, 461. 16	336, 239. 65	59. 3
Idaho:							
Boise	17, 105, 873. 97	14, 698, 000. 12	3, 783, 821. 14	10, 914, 178. 98	3, 765, 349. 37	18, 471. 77	99. 5
King Hill	1, 489, 968. 94	1, 489, 968. 94	42, 550. 00	1, 447, 418. 94		42, 550. 00	
Minidoka	13, 789, 934. 12	11, 614, 415. 80	7, 162, 557. 24	4, 451, 858. 56	7, 066, 490. 13	96, 067. 11	98. 7
Minidoka-Gooding	3, 331, 784. 67	5, 278, 735. 97	278, 735. 97	5, 000, 000. 00	278, 735. 97		100. 0
Montana:							
Huntley	1, 853, 375. 78	1, 806, 752. 19	537, 807. 75	1, 268, 944. 44	537, 650. 56	147. 19	99. 9
Milk River	5, 337, 289. 84	5, 012, 000. 00	3, 002. 76	5, 008, 997. 24	3, 002. 76		100. 0
Sun River	7, 374, 127. 05	10, 012, 693. 49	199, 025. 73	9, 813, 667. 76	197. 463. 73	1, 562. 00	99. 2
Montana-North Dakota: Lower Yellowstone	4, 083, 092. 46	4, 134, 864. 70	251, 853. 21	3, 883, 011. 49	248, 693. 62	3, 159. 59	98. 7
Nebraska-Wyoming: North Platte	20, 976, 764. 74	22, 206, 003. 25	2, 897, 824. 16	19, 308, 179. 09	2, 813, 268. 72	84, 555. 44	97. 1
Nevada: Newlands	3, 484, 999. 52	3, 260, 278. 05	1, 051, 002. 23	2, 209, 275. 82	1, 047, 651. 34	3, 350. 89	99. 7
New Mexico: Carlsbad	1, 420, 867. 61	1, 425, 182. 75	920, 241. 63	504, 941. 12	857, 296. 34	62, 945. 29	93. 2
New Mexico-Texas: Rio Grande	12, 929, 384. 15	13, 639, 075. 00	2, 952, 801. 00	10, 686, 274. 00	2, 554. 444. 15	398, 356. 85	86. 5
Oregon:							
Umatilla	4, 397, 257. 79	3, 818, 252. 93	468, 839. 15	3, 349, 413. 78	389, 145. 44	79, 693. 71	83. 0
Vale	3, 182, 842. 32	4, 500, 000. 00		4, 500, 000. 00			
Oregon-California: Klamath	5, 571, 007. 37	4, 067, 709. 12	1, 091, 820. 05	2, 975, 889. 07	1, 031, 730. 23	60, 089. 82	94. 5
Oregon-Idaho: Owyhee	4, 736, 765. 84	18, 000, 000. 00		18, 000, 000. 00			
South Dakota: Belle Fourche	4, 600, 799. 76	5, 404, 739. 77	617, 789. 39	4, 786, 950. 38	607, 525. 08	10, 264. 31	98. 3
Utah:							
Salt Lake Basin	2, 709, 043. 89	3, 000, 000. 00		3, 000, 000. 00			
Strawberry Valley	3, 342, 028. 55	3, 342, 028. 55	1, 194, 383. 69	2, 147, 644. 86	1, 169, 432. 71	24, 950. 98	97. 9
Washington:							
Okanogan	424, 198. 97	424, 198. 97	141, 217. 39	282, 981. 58	131, 217. 39	10, 000. 00	92. 9
Yakima	14, 158, 897. 49	11, 661, 746. 76	6, 479, 007. 85	5, 182, 738. 91	6, 240, 333. 30	238, 674. 55	96. 3
Yakima-Kittitas	7, 781, 841. 18	9, 000, 000. 00		9, 000, 000. 00			
Wyoming:							
Riverton	3, 902, 595. 38						
Shoshone	8, 032, 376. 81	5, 583, 409. 08	801, 127. 76	4, 782, 281. 32	800, 362. 30	765. 46	99. 9
Total	187, 576, 667. 09	190, 680, 010. 14	42, 957, 822. 56	147, 722, 187. 58	40, 312, 143. 46	2, 645, 679. 10	93. 8

Status of Operation and Maintenance Account Repayments, February 28, 1931

State and project	Amount due	Amount repaid	Charges due and unpaid	Per cent repaid of amounts due
Arizona-California: Yuma	$3,237,402.19	$3,144,382.36	$93,019.83	97.1
California: Orland	488,122.33	467,844.87	20,277.46	95.8
Colorado:				
Grand Valley	159,875.00	159,875.00		100.0
Uncompahgre	1,052,237.70	931,468.44	120,769.26	88.5
Idaho:				
Boise	2,109,717.41	2,109,717.41		100.0
King Hill	60,711.27	60,711.27		100.0
Minidoka	1,800,197.36	1,800,197.36		100.0
Montana:				
Huntley	546,029.25	546,029.25		100.0
Milk River	152,235.24	148,541.00	3,694.24	97.6
Sun River	158,971.46	158,789.64	181.82	99.9
Montana-North Dakota: Lower Yellowstone	304,353.33	304,353.33		100.0
Nebraska-Wyoming: North Platte	1,814,899.22	1,810,085.99	4,813.23	99.7
Nevada: Newlands	1,167,318.55	1,167,318.55		100.0
New Mexico: Carlsbad	815,281.52	774,029.18	41,252.34	94.9
New Mexico-Texas: Rio Grande	2,876,755.87	2,564,613.41	312,140.46	89.1
Nortb Dakota:				
Buford-Trenton	2,317.41	2,317.41		100.0
Williston	34,042.75	34,042.75		100.0
Oregon: Umatilla	369,107.27	369,107.27		100.0
Oregon-California: Klamath	1,111,735.78	1,035,035.05	76,700.73	93.1
South Dakota: Belle Fourche	852,308.18	852,308.18		100.0
Utah: Strawberry Valley	376,875.48	376,875.48		100.0
Washington:				
Okanogan	371,441.72	371,441.72		100.0
Yakima	4,235,372.38	4,058,458.95	176,913.43	95.8
Wyoming: Shoshone	540,783.73	540,669.87	113.86	99.9
Total	24,638,090.40	23,788,213.74	849,876.66	96.6

Measuring Hay Stacks

(Continued from p. 110)

EXAMPLE

To determine the volume of a rectangular stack of the high, round-topped type that is 20 feet wide, 45 feet over, and 50 feet long.

Volume $= (0.52\times45) - (0.46\times20) \times (20\times50)$.

$0.52\times45=23.40$
$0.46\times20=\ 9.20$

14.20

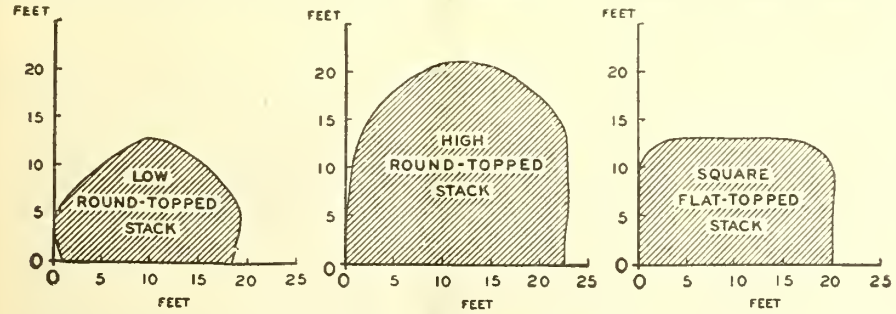
$14.20\times20\times50=14{,}200$ cubic feet

CUBIC FEET PER TON

Many factors affect the density of hay in the stack and therefore the number of cubic feet required for a ton of hay. The factor that causes the greatest variation is probably moisture in the hay at stacking time. Tough or slightly undercured hay will settle and become more compact than very dry or overcured hay. Other factors like texture and foreign material may affect the density also, but probably not to the same extent as moisture. For these reasons there is often a considerable difference in the number of cubic feet required for a ton in different stacks, and, at present, there are no simple methods for measuring variations in density.

The following figures, which are the averages obtained from a large number of stacks, can be used with fairly good results:

Kind of hay	Length of time in stack: 30 to 90 days	Length of time in stack: Over 90 days
	Cubic feet per ton	*Cubic feet per ton*
Alfalfa	485	470
Timothy and timothy mixed	640	625
Wild	600	450



Cross section of typical oblong stacks

When these figures are used with the rules for determining volume herein recommended more accurate results will be obtained than if such rules as the Frye-Bruhn or Quartermaster rules are used with such figures for cubic feet per ton as have been in common use heretofore.

Curtain Problems

(Continued from p. 113)

rewaxing only two or three times a year. Applying too much wax is a common mistake. Rub white spots with a woolen cloth or weighted brush, applying a little wax if necessary. Keep a slip-on cover on the weighted brush when it is not in use. Never allow it to come into contact with oil.

Organization Activities

(Continued from p. 111)

Miss Mae A. Schnurr, assistant to the commissioner, has the honor of being the recipient of a letter mailed out from the newly established post office at Boulder City, Nev., on its opening date, April 15, 1931.

Early in March a settlement conference was held in Great Falls, Sun River project. R. W. Reynolds, commissioner of agricultural development and colonization, Dan Noble, colonization agent, Mr. Ford, livestock agent, and Mr. Randall, freight and passenger agent, all of the C. M. & St. P. & P. Railroad; D. P. Thurber, associate county agent, A. W. Walker, project superintendent, and J. E. Young, banker, were present. The Milwaukee officials were well pleased with the results of their advertising campaign.

W. J. Burke, district counsel, stopped at Great Falls, Sun River project, on March 17, for a short conference with the superintendent. The latter part of the month Mr. Burke spent four days on the Belle Fourche project, where he considered contract confirmation and also tax title difficulties on lands in the district.

B. E. Stoutemyer, district counsel, attended the conference of irrigation district representatives called by the acting superintendent of the Yakima project on March 27 for the purpose of discussing water supply conditions during the coming irrigation season.

ON March 30 the Great Northern Railway Co. started construction work on the line of their amended location between Klamath Falls, Oreg., and Stronghold, Calif. This line crosses the Klamath project, passing through or near the towns of Merrill and Malin.

Photo by Beyer, Bureau of Reclamation.

Water users who were in Washington at the opening of the Japanese cherry blossoms saw this remarkable view at the Tidal Basin

At his attractive home, 60 Elm Avenue, Tacoma Park, D. C., Morris Bien celebrated his seventy-second birthday on April 17. As physical evidence of the fact that his many friends in Reclamation had him in mind, their signatures were affixed to a scroll, which was suitably worded to express our "heartiest birthday greetings," and this was sent to him, together with a beautiful floral offering.

Prof. Alvin Kezer, head of the Agronomy Department, Colorado Agricultural College, spent March 4 and 5 with the local county agent on the Grand Valley project. Mr. Kezer called at the project office several times and was in the field in connection with a contemplated experimental plot of land under the project. The plan contemplates experimenting on about 5 acres of ground with various methods of reclaiming land which has been seeped.

Filemore C. Rodriguez, a student of the Bureau of Public Works of Manila, P. I., spent the month of March in the Denver office studying reclamation methods.

A. J. Hobson, electrical engineer, Richard Randolph, hydraulic engineer, and Bob Fletcher, designer, all of the Panama Canal Zone, spent the entire month of March in the Denver office assisting in the preparation of designs for the Madden Dam.

D. W. Aupperle, director of the Grand Valley Water Users' Association, called at the Denver office on March 12 to confer regarding the sale of power to be purchased at the proposed Orchard Mesa power plant.

Miss Marie L. Hagmuller, clerk to the Committee on the Conservation and Administration of the Public Domain with headquarters for the past several months in the Washington office of the Bureau of Reclamation, has just been elected an honorary member of the National Indian War Veterans, the only woman in the history of the organization to have received this distinction. Miss Hagmuller's father, Matthew Hagmuller, was an old Indian fighter and an active member of the organization for many years.

Pearl of Great Price

COMMISSIONER. I observe that you treat that gentleman very respectfully.

PROJECT SUPERINTENDENT. Yes; he's one of our early settlers.

COMMISSIONER. Early settler? Why he's not more than 40 years of age.

PROJECT SUPERINTENDENT. That may be true, but he pays his bills on the first of every month.

Reclamation Products for Paris Exposition

(Continued from page 109)

Lima beans, early garden sugar peas, sauerkraut.

Kaysville Canning Corporation, Kaysville, Utah: Royal Anne cherries, apricots, peaches, tomatoes, fancy ungraded peas, sifted early June peas, fancy cut stringless beans, labels.

Shoshone project, Wyoming.—Great Western Sugar Co. Six souvenir bags of beet sugar made at the Lovell factory.

OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO

Left: Pouring concrete pipe at Dunaway; mixer and gravel plant in distance. Right: Reinforced concrete pipe in storage yard at Dunaway.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo. Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, 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, Calif
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. Chiseman	do	E. A. Peek	E. A. Peek	R. J. Coffey	Los Angeles, Calif
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	do	Do.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	B. E. Stoutemyer	Portland, Oreg.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
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	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	H. J. S. Devries	El Paso, Tex.
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	B. E. Stoutemyer	Portland, Oreg.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler		do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr		F. P. Greene	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	do	Do.
Salt Lake Basin [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	Wm. J. Burke	Billings, Mont.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	J. R. Alexander	Las Vegas, Nev
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph	do	B. E. Stoutemyer	Portland, Oreg.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	do	Do.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	Wm. J. Burke	Billings, Mont.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] Reservoir, power plant, and Willwood division.

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

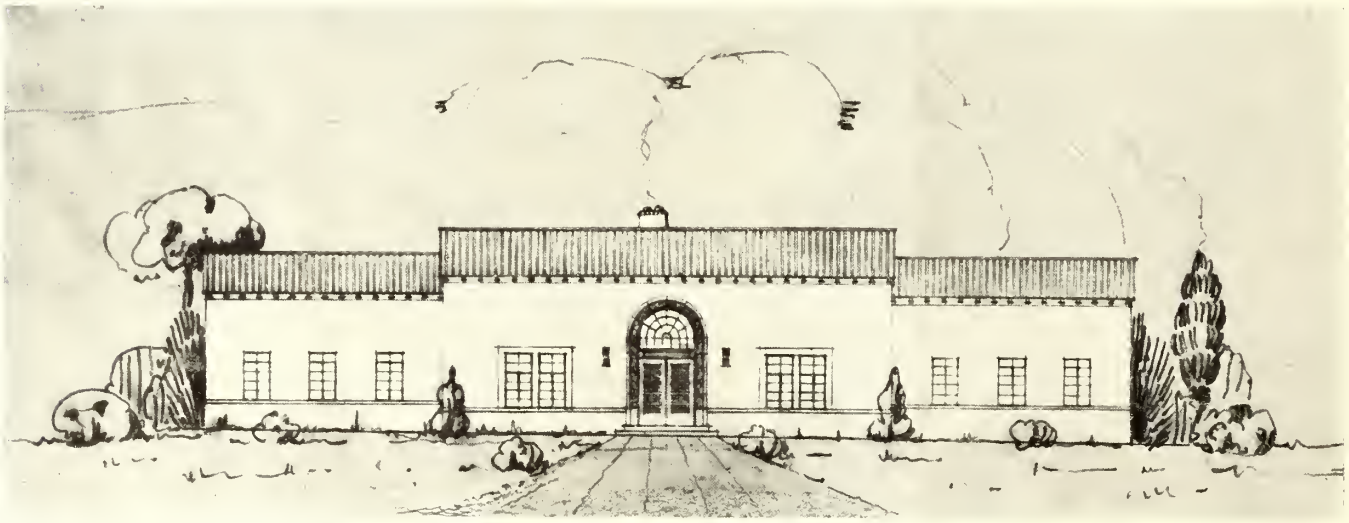
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo	C. W. Tharp	Superinteudent	H. O. Lambeth	Grand Junctiou
Boise [1]	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, 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	Hermistou, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghtou	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	Manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.		Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	J. O. Roach	Irrigatiou supt	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa, Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	C. A. Bissell	State of California.
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.
Boulder Canyon project act, sec. 15	do	P. J. Preston	Colorado, Wyoming, Utah, and New Mexico.
North Platte River power	do	Denver office	None.
Rathdrum Prairie, Idaho	Spokane, Wash	H. W. Bashore	None.

ADMINISTRATION BUILDING



BOULDER CITY POST OFFICE

DORMITORY AND GUEST HOUSE

BUILDINGS APPROVED FOR CONSTRUCTION AT BOULDER CITY, NEVADA, BOULDER CANYON PROJECT

(See page 105)

U. S. GOVERNMENT PRINTING OFFICE 1931

NEW RECLAMATION ERA

VOL. 22, NO. 6 JUNE, 1931

A RANCH HOME ON THE KITTITAS DIVISION OF THE YAKIMA PROJECT, WASHINGTON

NATIONAL BENEFITS FROM RECLAMATION

The Bureau of Reclamation has created over $1,000,000,000 of wealth for the Nation by its score of reclamation projects throughout the West. These have turned deserts into prosperous empires in the Salt River Valley in Arizona, and on the Rio Grande, the Colorado, and on lesser streams. These new American communities consume millions of dollars of eastern products each year, and their own products are of such a character and come on to the market at such a time that there is little competition with the great farming area of the East.

We have begun a plan of local management, operation, and responsibility wherever possible. Reclamation is a wise national policy. It is self-supporting; all construction is financed from a revolving fund which the settlers repay. Ninety-six per cent of all maintenance charges and 94 per cent of all construction charges due were paid last year. To-day we are engaged on the greatest reclamation project of all history, the building of Hoover Dam on the Colorado River. Through sale of electric power, already contracted for 50 years, the falling waters of the Colorado will pay for their own capture.

A river which is now a threat to hundreds of thousands of acres of farm lands in Arizona and California will be converted into a steady stream of about the volume of the Hudson River at Troy. It will carry commerce, water thousands of acres of arid public lands and furnish drinking water to a dozen cities. Power contracts already signed allocate this energy among three States, 12 cities, the great Metropolitan Water District which will build an aqueduct from the Colorado to the Southern California plain, and four utility companies serving the agricultural areas outside the municipalities. A wide regional benefit was sought and obtained.

Arizona and Nevada may claim over 100,000 horsepower each, whenever they can use it, within 50 years. Surplus revenues, of which there will be millions, also are divided among these two States and a fund to build more dams in the Colorado. All the funds used for construction will be repaid by power contracts, with interest. The construction contract for the dam itself was signed on April 21; work has been under way on the railroad, highway, and construction camp for months.

HON. RAY LYMAN WILBUR,
Secretary of the Interior.

NEW 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. 22, No. 6 JUNE, 1931

Interesting High Lights on the Federal Reclamation Projects

ONE of the applicants for the 50 public land farm units on the Riverton project opened to entry on May 1 was accepted; 15 prospective settlers were shown over the project; and 10 parties, all of whom can probably qualify before the examining board, make formal applications for farms.

LARGE numbers of men continue to arrive at Las Vegas from all parts of the country hoping to obtain employment. Approximately 1,000 men are now employed and many idle men are still available in the vicinity. About 300 persons are now camped near the boat landings and more arrive daily. Under the direction of Deputy United States Marshal Claude P. Williams good order is maintained and little trouble has been encountered in this settlement.

THE Holly Sugar Corporation has contracted for approximately 10,000 acres of sugar beets on the Lower Yellowstone project during the coming season.

THE preparation of land and seeding on the Grand Valley project was carried on continuously throughout April. Soil conditions are exceptionally good at this time of the year.

ACCORDING to the local California and Arizona quarantine inspection stations maintained on the highway at Yuma, some 22,000 cars passed through Yuma during April, containing approximately 35,000 passengers. An average of 433 cars daily, or a total of 13,000 cars, were west bound and examined at the California station, and 9,000, or 300 cars per day, were east bound and examined at the Arizona quarantine station. It has been estimated that an average expenditure of $5 per car is made at Yuma for food, lodging, supplies, or repairs. It can be readily seen that the tourist travel through Yuma is the source of a goodly revenue to local business men.

SHIPMENTS of potatoes from the Minidoka project continued heavy during the month. More than 5,000 cars were shipped out during the past year and it is estimated that only 300 to 400 cars yet remain that will be marketed. There was a substantial advance in price in the early part of the month.

BOULDER CANYON PROJECT ACT CONSTITUTIONAL

As the ERA *goes to press, the Supreme Court of the United States announces its decision in* Arizona *v.* Wilbur, *holding the Boulder Canyon project act constitutional. The decision is dated May 18, 1931, and was prepared by Justice Brandeis. The court takes judicial notice of the navigability of the Colorado, and gives effect to the declaration of Congress that one of the purposes of the Boulder Canyon project act is the improvement of navigation. It holds that the Secretary of the Interior need not comply with the laws of Arizona before building the Hoover Dam across the Colorado River where the river forms the boundary of Arizona and Nevada. Arizona's suit is dismissed without prejudice to her right to bring a later action, in case the Boulder Canyon project should later interfere with her interests.*

THE laying of the corner stone of the new Masonic Temple at Powell, Shoshone project, took place on May 1, the ceremony being attended by Masons from the towns of the entire Big Horn Basin.

THE Department of Commerce is planning the erection of a radio broadcasting station at Yuma, Ariz., in connection with the new lighted southern air mail route which passes through the Yuma project.

THERE are 1,800 acres of newly seeded land on the Harper and Little Valley division of the Vale project, and approximately 600 acres on the Bully Creek West Bench unit, 150 acres of which are planted to early peas and onions. A number of grain crops are now above the ground. On the Bully Creek West Bench clearing of sagebrush, plowing and seeding are still actively carried on.

TWENTY-ONE carloads of grapefruit were packed and shipped by rail during April from the Yuma auxiliary project. Prices received during the month ranged from $2.50 to $3.25 per box according to grade of fruit. This is about 15 cents per box increase over March prices. A further increase of approximately 25 cents per box during May, with the remainder of the season's pack marketed, was anticipated.

THE Lower Yellowstone Development Association has continued employing a representative to bring in settlers to the project. He has already interested several good prospects who made a personal visit to the project last month.

THE Mini-Cassia Cooperative Dairymen's Association purchased 61,926 pounds of butterfat in March, of which 41,262 pounds were milk butterfat and 20,664 pounds cream butterfat. The price paid was 30 cents per pound for the milk and 24 cents for the cream fat. The total amount of butterfat purchased is an increase of 1,238 pounds over the corresponding month last year.

WORK was started during the month of April on the construction of about 28 miles of gravel highway between Malta and Hinsdale. The completion of this reach will provide a gravel highway through the entire length of the project.

Business Permits at Boulder City

By Louis C. Cramton, Special Attorney to the Secretary of the Interior

BOULDER City, the construction camp now coming into being in connection with the building of Hoover Dam, can not be the ordinary construction camp. The Boulder Canyon project, involving the creation of the world's greatest dam and largest artificial reservoir, has aroused the interest of the people of the United States to a greater degree than any other construction project of the Government, with the possible exception of the Panama Canal. The new town shares in this widespread interest of the country. Not only because of this interest and the old-time pioneering instinct of our people, but because of existing economic conditions several thousand people have already expressed to the Bureau of Reclamation their desire to go to Boulder City and engage in business there. In hundreds of these letters this desire is expressed in the strongest terms. Some emphasize their desire to see the building of the dam; many stress their lack of employment or the unsatisfactory business conditions at home. Occasionally one stresses the need for change of climate for health conditions. There is no doubt in my mind if the Government desired to do so it could create in Boulder City in the next year one of the most spectacular boom towns of recent history. If the Government were to reply to these inquiries without discouragement and without limitations, simply setting aside the necessary lots for building and residence purposes, I have no doubt a thousand or more would sell out what they have at home and go to Boulder City expecting to make their fortunes in business there. Ruin would inevitably follow any such movement, for the business possibilities in Boulder City are limited. Certainly the Bureau of Reclamation does not desire to have any part in such wholesale business disaster, hence the necessity for limiting in some way the number who will engage in business in the new town in its development days.

In our attempt to work out a program for such limitation of business permits we have been guided by three fundamental principles: First, the town existing for the construction of Hoover Dam, it is important that its business section serve the needs of the town as fully and satisfactorily as possible, thereby contributing to the best living conditions for the construction employees; second, that interested people throughout the country be protected from unwise business ventures so far as can reasonably be done; and third, that so far as is consistent with the other two principles, the ordinary rules of competition in business communities be not interfered with.

Guided by these principles, various plans have been considered in connection with business permits in Boulder City. The system obtaining in the National Parks is in effect a monopoly given to one organization which submits to regulation of its charges and pays the Government a percentage of its net profits. The granting of such a monopoly has been found necessary in order to make possible needed facilities for the public, because of the short season, the remoteness of the areas involved and the limited patronage. These conditions will not obtain at Boulder City, and hence the idea of exclusive permits has not been adopted.

Suggestion has been made that the rental for a business lease of land being determined, and the number to engage in a certain line of business being fixed, such leases be sold at auction and awarded to those paying the largest bonus. A little thought shows that this plan would operate quite contrary to our purposes. The highest bidder might entirely over-estimate the business possibilities of the town, and then to save himself would be obliged to pass on to the public through increased charges wherever possible whatever extravagance there was in his bid. Furthermore, the dealer who expected to comply fully with law and regulations in the conduct of his business would be out-bid by the man who planned to use his business as a cloak for unlawful commerce in drugs and liquor, or for other unlawful practices.

Hence, the revenue from these business permits not being the prime objective for the Government, but desirable and orderly living conditions held more important, the plan set forth in the circular of information, May 18, 1931, has been determined upon. Under this plan there is a fixed charge for the business or residence lots, in accordance with the area and desirability of location. There is no charge for the permit beyond the filing fee of $10, which is returned to the applicant if the application is not approved. There is a determined attempt through the application form provided and through subsequent investigation of the applicant through other sources, to judge his fitness to serve the needs of the town. Thousands seeking permits for the same line of business will be carefully graded in this way by a board of three. The number of permits at first issued will be limited, and those believed to be best fitted to serve the town will be granted permits.

At the present time there is no town in being, and how much of a town will develop there is in considerable degree a matter of speculation upon which opinions greatly vary. The need for present limitation chiefly comes from this fact.

Later, when the town has developed and when any person desiring to engage in business there can come to Boulder City and see for himself the size of the town, the amount of business opportunity and the conditions of competition, this need of limitation will very largely disappear. Hence, it is expected, as stated in the circular, that when conditions in the town shall have become stabilized the limits upon permits will largely be removed, subject always to compliance with needed regulations involving character and financial capacity. Copy of the leasing regulations follows:

U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION

Information regarding permits and leases in Boulder City (Boulder Canyon Project Federal Reservation) for business enterprises and residence purposes

MAY 18, 1931.

GENERAL INFORMATION

1. Boulder City is established as an adjunct to the construction of Hoover Dam, the power plant, and the appurtenant works under the Boulder Canyon project act. It is in effect a construction camp, although, owing to the long construction period, men employed will be encouraged to bring their families and establish homes, and the necessary facilities are provided to make that possible. The town site, heretofore a desert waste, arid and treeless, is 7 miles by highway from the dam site, the mountainous character of the region about the dam site making impracticable any extensive camp development there. The town site is 2,500 feet above sea level and about 1,850 feet higher than the river. It is about 470 feet higher than Las Vegas, Nev., the nearest town, 25 miles distant across the desert. Although the town site is sufficiently exposed to get the benefit of any air currents, the maximum summer temperature will be about 120° in the shade. Those accustomed to milder climates should give consideration to the possible effect of extreme heat upon the health of themselves and their families.

Water for Boulder City use must be piped 6 miles from the Colorado River, raised about 2,000 feet, desilted, purified, and softened, and will be furnished to

users at cost, expected to be approximately 50 cents per thousand gallons.

During the early period of construction of Hoover Dam electricity will be furnished to the Government by the Southern Sierras and Nevada-California Power Co., and will be resold to consumers at rates permitting its use for cooking and refrigeration. The Government will later furnish power from the Hoover Dam power plant.

The Government will not erect any buildings for commercial use or for residence for any but its own employees. Permittees engaging in business in Boulder City will be obliged to arrange for their own business and residence quarters, the plans for all such buildings to be subject to the approval of the Government, as to construction, height, architectural design, and location on the lots. All buildings will be of Spanish design. In the principal business district buildings must be of semifireproof construction, with brick, concrete, hollow tile, or adobe walls and stucco finish. Arcades over the sidewalks must be provided for protection against severe sunlight. Industries which spread dust, create noise, or carry unusual fire hazard or are otherwise objectionable will not be permitted in the central business district or in residential districts.

Buildings in the residential districts can not be used for commercial or industrial purposes.

Six Companies (Inc.), the general contractor for the dam, following the usual practice in large construction operations, will operate a commissary or general store carrying most lines of merchandise and catering generally to the wants of their employees and families, as well as to the general public. The company will also operate the necessary dormitories, mess houses, etc. It may supply credit books to its employees and it may be presumed that it will supply a very considerable share of the local demand in various lines.

Hoover Dam is to be constructed in the Black Canyon of the Colorado River upon the boundary line of Arizona and Nevada. It will raise the water surface of the river 582 feet and will be about 730 feet in height above bed rock. The contract for building the dam was awarded to Six Companies (Inc.), and requires completion in 1938. Installation of power machinery will follow as required. The dam abuts against great natural walls of solid rock on either side of the Colorado. It will create a reservoir about 115 miles in length, with an area of about 145,000 acres and with a capacity of 30,500,000 acre-feet. It will impound the surplus flood waters of the Colorado, protecting the valleys far below and making these waters available for beneficial use in irrigation, water supply for various cities, and for the generation of 663,000 horsepower. None of the irrigation development will be in the vicinity of Boulder City.

APPLICATIONS FOR PERMITS

2. Applications, upon forms provided by the Bureau of Reclamation, will be received until 5 p. m., June 30, 1931, at the office of the Bureau of Reclamation, Las Vegas, Nev., for the grant of permits to engage in business or other service to the public on the Boulder Canyon Project Federal Reservation.

CLASSIFICATION OF PERMITS

3. The various businesses or other lines of service which may be carried on in Boulder City are, with reference to the grant of permits, classified as (A) exclusive, (B) limited, (C) special, (D) personal.

4. It being desired that speculation in supposed opportunities in this new town be prevented and that such living conditions obtain on the project during the construction period at Hoover Dam as will be in the highest degree conducive to the successful completion of the project, the grant of such permits will be limited and controlled as follows:

(A) Exclusive.—Where the permit involves the operation of that which is in effect a public utility or such limitation is clearly in the public interest, an exclusive permit will be granted with such special conditions as to rates and service as necessary. In this class may be included the hospital, telephone system, garbage plant, tourist camp, landing field, etc. The Government may itself operate any item in this class where the public needs make such necessary.

(B) Limited.—In the usual lines of wholesale and retail business or of service to the public not included in classes (A), (C), or (D), at least two competing permits will be granted, the number at first granted being limited to the apparent approximate needs of the town. The Government will later grant further permits as in its judgment the public interest requires.

When conditions in the town shall have become stabilized, the limit upon permits in class (B) will be removed, subject always to compliance with established regulations requiring approval of character and financial capacity.

(C) Special.—This includes (1) automobile sales, (2) gasoline and oil distributors, (3) banks, (4) motor lines to connect with outside points, (5) telegraph and radio companies, (6) construction and rental of buildings, (7) other industries or services requiring special treatment.

The following is proposed as to the classes named:

(1) A sales agency may be established by any automobile manufacturing group, with permit for the sale of all or any of the cars made by that group, upon assurance of maintenance of satisfactory service for its entire line of cars, such service to include adequate stock of parts.

(2) Any responsible oil-distributing company may establish a distributing agency, such permit not of itself including the retailing of its products.

(3) Anyone receiving the approval of the Comptroller of the Currency for the establishment of a national bank will be granted a permit for that purpose.

(4) Any motor line operating under franchise granted by Nevada or Arizona will be permitted to enter the reservation to take on and discharge passengers, express, and freight at a union bus terminal upon compliance with conditions as to the establishment and maintenance of such terminal.

(5) Permit will be granted to any telegraph or radio company to establish an agency for the transmission of messages.

(6) Every facility will be afforded responsible persons who desire to erect business blocks to be sold or subleased to permittees, or to erect homes to be sold or subleased. Since economy in construction and better results as to the appearance of the business section can thereby be secured, it is desirable that each business block fronting upon the plazas be constructed as a single unit, and desired space therein for various shops, stores or offices then be sold or subleased to permittees.

(D) Personal.—Reputable members of the professions where personal service is rendered and no large investment is involved in establishing an office, will be granted permits when in good standing and authorized to practice in the States of which they are residents.

SELECTION OF PERMITTEES

5. In the consideration of classes (A) and (B) above, the applicants will be graded, the factors being (*a*) personal fitness (including character, personality, age, physical condition, etc.); (*b*) financial and service fitness (including type of proposed establishment as compared with the needs of the town and sufficiency of capital and equipment to meet the needs of the proposed business); (*c*) training and experience. In such grading an additional five points will be allowed veterans honorably discharged from the United States Army, Navy, Marine Corps, or Coast Guard. When deemed essential, a personal interview may be required before a final rating is given.

In the event that there are more approved applications for permits for a certain line of business than are to be granted, preference will be given in the order of standing. A register of eligibles will be established and whenever, during the restricted period, further permits are to be granted, the applications of those upon such register will be given preference in the same manner.

Permits will be granted only to citizens of the United States, and will be granted for the period ending June 30, 1941.

No applications for permits will be considered except upon the form provided.

Each application for a permit must be accompanied by a filing fee of $10 in certified check or postal money order payable to the fiscal agent, United States Bureau of Reclamation. No cash should be mailed with any application. If no permit is tendered the applicant, the fee will be returned. If permit is tendered the applicant, the fee will be retained by the Government, whether the applicant proceeds under the permit or not.

As applications for permits may be filed until June 30, 1931, no permits will be issued until after that time.

Upon approval of an application for a permit, the applicant will be promptly notified. Within 20 days after mailing of such notice the applicant must file with the Bureau of Reclamation, Las Vegas, Nev., his acceptance and at the same time may file application for a lease of a lot or lots for business or residence purposes.

Since the laying of water mains and sewers and the paving of streets will be in progress, it is not expected that permittees will be able to begin business or erect necessary buildings before September, 1931, and possibly later.

LEASES FOR BUSINESS OR RESIDENCE PURPOSES

6. The land in the reservation is owned by the United States, and during the period of construction of the dam and until thereafter determined otherwise no land will be sold.

Under conditions approved by the Secretary of the Interior, leases until June 30, 1941, covering the approximate period of dam construction and the necessary adjustment period thereafter, will be granted for business and residence purposes. The approval of an application for a business permit will carry with it the privilege of leasing the necessary land on which to conduct such bsuiness and also land for residence use. Other things being equal, preference will be given to applicants for permits who will establish their homes in Boulder City.

Leases for residence use will be granted to any responsible persons of good character.

The average annual rental for a business lot, approximately 40 by 130 feet, will be about $300, the rental being more or less than that in accordance with the desirability of its location. Water and electricity will be additional. For residence lots the average annual rental will be about $120. Rentals will be payable quarterly in advance. Land may be used only for the purpose stated in the lease, and assignment or subletting will be permitted only with the approval of the Government.

Upon expiration of leases on June 30, 1941, they may be extended or the land may be sold as may hereafter be determined by the Government, through legislative action or otherwise.

Each lease will provide for its forfeiture upon violation of the penal laws or of the regulations, including the laws and regulations against gambling, manufacture or sale of alcoholic liquors and narcotics, prostitution, etc., or upon use of the premises for any such purpose.

No lease for business purposes will be granted until after the granting of a permit for the business.

WARNING TO ALL INTERESTED PERSONS

7. All persons interested are warned:

(*a*) That the probable population of Boulder City is more limited than is popularly imagined.

(*b*) That, as the surrounding country is undeveloped desert, there is no outside population from which patronage may be expected.

(*c*) That the contractor will, through its commissary and other facilities, furnish goods and services in competition with permittees.

(*d*) That the amount of business to be derived from tourists or other visitors to the town is uncertain.

(*e*) That the future of the town after 1938 is likewise uncertain.

(*f*) That climatic conditions may not be suitable to everyone.

The Government does not represent to anyone that a profit can be made under any business permit it may grant at Boulder City. Although the Government will temporarily place limits upon the number of permits granted, it does not represent and can not know that all or any of the permittees will be able to conduct their business at a profit. Later, when the limit on the number of permits in class B is removed, ordinary conditions of competition will largely prevail.

Each applicant should carefully investigate and consider before submitting an application, and a personal inspection of the town site will give a much better understanding of conditions. But because of the expense involved in such a trip, no one living at any considerable distance should go to Boulder City depending upon any expected grant of a permit and expecting to remain. Already more than 3,000 persons in all parts of the United States have expressed a desire to engage in business at Boulder City, and it is apparent that only a small per cent can be granted permits or could possibly succeed if all were granted permits. The purpose of the Government in limiting the number of permits at this time is to guard against the wholesale bankruptcy which would otherwise result from the extravagant overdevelopment of the business district because of nation-wide interest in the project and plans based in many cases upon hopes rather than information. But it can not assure anyone that the limit is sufficiently low to guarantee success to all permittees or any.

If an application is approved, the applicant will then have opportunity to go to Boulder City before finally committing himself, and this will be advised. It is to be noted, however, that, although the permits may in many cases be granted in July, the permittee will not be able to get on his business or residence location until the following September or later.

Applications for permits and leases must be submitted directly by persons desiring such permits and leases, and all are warned to beware of all persons pretending to possess special influence in securing such permits or leases and seeking to obtain money, directly or indirectly, for such pretended influence. Any applicant known to have paid anyone for use of supposed influence in this connection will not be favorably considered.

REQUESTS FOR FURTHER INFORMATION

7. All requests for further information and correspondence with reference to permits and leases in Boulder City should be addressed to Louis C. Cramton, Bureau of Reclamation, Las Vegas, Nev.

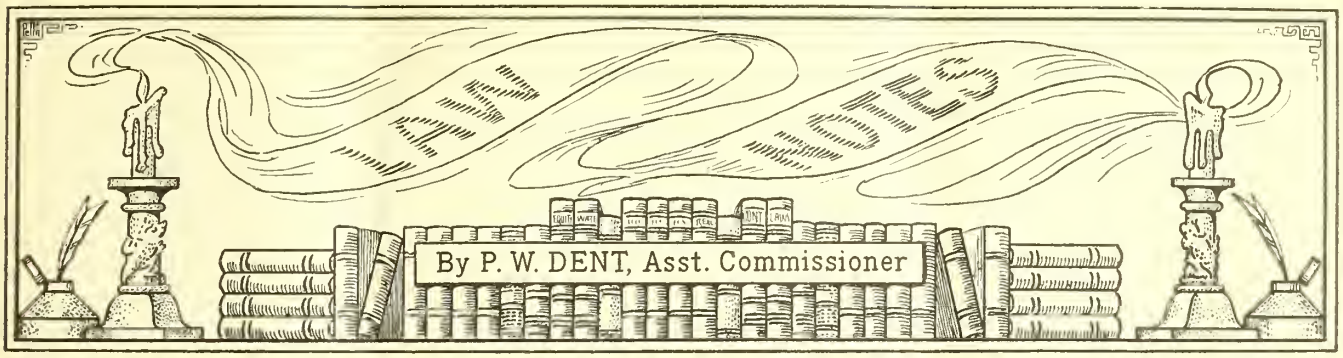
LOUIS C. CRAMTON,
Special Attorney to the Secretary.

Approved.

ELWOOD MEAD, *Commissioner.*

THE Yakima Dairymen's Association recently completed a new plant in Yakima at a cost of $150,000, fully equipped. This is the most complete and up-to-date plant of its kind in the Pacific Northwest. The association handles approximately 1,500,000 pounds of butterfat a year and does an average annual business of $750,000.

OWING to the increasing area of bearing trees on the Yuma auxiliary projects present indications are that the 1931 crop will show an increase of approximately 100 per cent locally.



Use of Milner Dam for Gooding Project

THE United States entered into a contract with American Falls Reservoir district No. 2 to construct an irrigation system for the Gooding division of the Minidoka reclamation project, the district agreeing to pay the construction cost in instalments as provided by the Federal laws. Among the works to be constructed was a canal diverting water from Snake River above Milner Dam, a part interest in which was owned by Twin Falls Canal Co. The diversion was to be effected from the backwater above Milner Dam.

The contract between the United States and the district contained article 21 reading as follows: "The district agrees to assume and pay and herein and hereby now assumes and agrees to pay, all obligations and claims of every kind, nature and description, if any, which may arise and accrue in favor of any or all the legal or equitable owners of the Milner Dam by reason of the diversion of water through the main canal as herein provided, and to keep the United States harmless therefrom."

The Twin Falls Canal Co. brought an action in the Federal court of Idaho against the district, claiming damages for the use of the plaintiff's dam. The memorandum opinion of District Judge Cavanah upon the interesting point so raised is given in full below:

OPINION OF DISTRICT JUDGE C. C. CAVANAH

This suit involves a determination of the question from the evidence as to the right of plaintiff to recover from defendant a proportionate part of the initial construction cost and operation expenses of the Milner Dam, upon the theory that the defendant is using the dam in diverting into its canal from Snake River 1,700 second-feet of storage water without contributing its part of such costs. Upon the demurrer to the amended complaint, it was thought that as it was specifically there alleged that the defendant had entered upon and was using the reservoir and dam of the plaintiff without acquiring the right to do so, it should compensate the plaintiff for such use as the entry and use of the plaintiff's property appeared within the scope of the fifth amendment. The inquiry now is, Does the evidence sustain the allegations upon which that conclusion was reached? A review of the testimony presents not only the question thus referred to but others which the defendant now urges should defeat a recovery by plaintiff.

The first is that the action is brought against the wrong party, for the reason that the defendant district does not own nor has it constructed or operated the canal system in the Gooding reclamation project which it is now constructing, and the diversion of the storage water by it will not take place until some future time, and will remain under the control and direction of the United States until the project is turned over to the defendant after it is completed by the United States Under the reclamation act, the title to and the management and operation of the works remain in the Government until otherwise provided by Congress. (32 Stat. 389, sec. 6.) In a recent case decided by the Supreme Court of Texas, where an action was brought against an irrigation district which had entered into a contract with the United States, pursuant to the provisions of the reclamation laws, it was held that the action could not be maintained against the district as the United States was still operating the project which had not been turned over to the district. The court said:

"Petition in suit for damages by reason of breaks in irrigation canal banks due to negligence in maintenance and operation against irrigation district organized under Revised Statutes, 1925, articles 7622–7807, which by article 7653 was authorized to contract with United States for construction, operation, and maintenance of irrigation works, *held* to state no cause of action against such district, in view of section 6 of Federal reclamation act (43 U. S. C. A., secs. 491, 498), and provisions of contract constituting the district fiscal agent of the United States in connection with the project but reserving to the United States control of maintenance and operation until certain payments required are made—to 'maintain' meaning to hold or keep in any particular state or condition; to support; to sustain; to uphold; to keep up; to keep possession of; not to surrender; to bear the expenses of (citing Words and Phrases, 'Maintain').

"Duties and powers given irrigation districts under Revised Statutes, 1925, article 7653, authorizing contracts with Federal Government for construction, operation, and maintenance under Federal reclamation act (32 Stat. 388), are not to be confused with authority given irrigation districts generally by articles 7656, 7765, which operate and maintain irrigation works themselves, whereas districts organized under article 7653, neither operating nor maintaining works, can not be charged with negligence of Federal Government in such operation or maintenance." (Malone *v.* El Paso C. W. I. D., 20 S. W. (2d) 815.)

But the plaintiff asserts that should it be held that the United States is the one who is now using the dam in diverting the water from the river, yet article 21 of the contract between the United States and the defendant, wherein the defendant agreed to pay all claims which may arise in favor of the owners of the Milner Dam by reason of the construction of the canal in question, and diversion of water through it, grants to the plaintiff the right to maintain the present suit. It will be observed that the contract is one between the Government and the defendant alone, and the provision referred to is one for the protection of the Government in case it is called upon to answer for any such claims. The plaintiff is not a privity to either party thereto and can claim no rights thereunder. The principle applicable is that "a third party can not maintain an action on a sealed instrument to which he is not a party." Cava-

naugh *v.* Gaston, 47 A. L. R. 1; Hendrick *v.* Lindsay, 93 U. S. 143. Therefore it would seem under the evidence, that as the United States is the one, and not the defendant, who has at the present time title to the project and is constructing the canal in question and doing the act complained of, the present action is brought against the wrong party, although it is contemplated that the project will at some future time be turned over to the defendant. Until that time arises and the project is turned over to it in the manner provided by law, and it does some act for which plaintiff is entitled to recover, an action against it at this time would be prematurely brought.

The conclusion thus reached disposes of the case, and a consideration of the other questions becomes unnecessary, but as considerable testimony was taken it would seem proper for the court to consider and dispose of some of the other contentions of the defendants as reasons why the plaintiff should not recover on the present record.

RIGHTS IN THE DAM

The first is that when we come to consider the relative rights and interests in the dam, the evidence discloses clearly that the defendant has acquired from the North Side Canal Co. a one-eleventh interest in the dam, in consideration of it conveying through its canal 1,000 second-feet of storage water for the North Side Canal Co. The Milner Dam now belongs to three parties, the plaintiff, the South Side Canal Co., owning six-elevenths interest, the North Side Canal Co. owning four-elevenths interest, and the defendant district one-eleventh interest. They are tenants in common in the dam, and are entitled to use it in proportion to their interests. The North Side Canal Co. had the right to convey to the defendant an undivided one-eleventh interest in the dam, held in common by it and the South Side Canal Co. The conveyance was not a specified divided interest in the property held in common, but an undivided interest which constitutes the grantee a tenant in common with the grantor. Idaho C. S. sec. 5328, 5372; Powell *v.* Powell, 126 Pac. 1058; Gordon *v.* San Diego, 36 Pac. 18; Verdugo Canon Water Co. *v.* Verdugo, 93 Pac. 1021.

Assuming that the defendant should be required to pay its proportionate share of the initial construction and operating costs, when measured by the standard as to their respective diversion capacities from the river, the plaintiff has 3,600 second-feet, the North Side Canal Co. 3,300 second-feet by its own diversion, and 1,000 second-feet of continuous flow rights in the new canal of the defendant, plus their storage rights, and the defendant 1,700 second-feet in the new canal. Plaintiff's right of 3,600 second-feet equals 7,200 acre-feet per day. Figuring then plaintiff's rights of 7,200 acre-feet times 365 days in the year, it would equal 2,628,000 acre-feet per annum, and in addition to that it has 92,000 acre-feet of storage water rights in Jackson Lake, and 145,000 acre-feet of storage water in American Falls Reservoir, making the total diversion rights 2,865,000 acre-feet per annum. The North Side Canal Co. has 3,300 second-feet per day, or 6,600 acre-feet, or 2,407,000 acre-feet per annum, and in addition to that it has storage water in the American Falls Reservoir of 150,000 acre-feet, making its total diversion right 2,559,000 acre-feet per annum. The right of the defendant is 400,000 acre-feet each season of the storage water of American Falls Reservoir. Thus the total diversion rights at Milner Dam of the three parties is 5,824,000 acre-feet per annum. Figuring then on that basis, the defendant being a tenant in common, it would be entitled to divert or to use the dam up to a diversion capacity of one-eleventh of the total capacity of 5,824,000 acre-feet per annum, which is 529,454 acre-feet, or 129,450 acre-feet in excess of its present stored water right of 400,000 acre-feet which it proposes to divert at its headgate on the river. Therefore it would seem that if the rights of these three owners of the dam are measured according to their water rights, which are raised in the river by the dam to the necessary elevation so that they can be diverted through their canals, then the defendant has already paid more than its proportionate part of the initial cost of the construction of the dam by purchasing the one-eleventh interest in it from the North Side Canal Co. The parties assert that they are willing to contribute their proportionate part of the maintenance and operating costs of the dam.

This then leads to the consideration of the further thought, which is really the difficult problem involved in the case under the constitution and laws of the State, when applied to the evidence, as to the right of plaintiff to require subsequent appropriators above the dam on the stream to contribute to the costs of construction and operation of the dam. The dam was constructed for the purpose of raising the water in the river to a certain elevation above the bed of the river, so that the water rights of the plantiff and the North Side Canal Co. could be diverted through their canals. It was not intended to be used as a reservoir, storing water to be drawn upon whenever desired. Its backwater extended to about 25 miles up the river, and the point of diversion of the canal in question is about 400 feet above the dam. There is a sharp conflict in the evidence as to what effect the water to be diverted through the new canal would have upon the operation of the dam or interference with other rights. Engineers of equal reputation and ability who have testified differ as to that. Some say that the additional 1,700 second feet when placed in the river would cause greater pressure upon the dam, and cause confusion and complications in its operation, while others say no. But however that may be, the extent of the rights of plaintiff is that of an easement limited to the right to the use of the dam, so far as may be necessary for the construction, maintenance and use of its canals and ditches. (26 Stat. 1102, sec. 21.) The easement was granted by the United States upon its public lands (Natoma Water & Mining Co. *v.* Hancock, 35 Pac. 337; Whitmore *v.* Pleasant Valley Coal Co., 75 Pac. 748), and is limited to the purposes specified in the statute. The mere fact that the plaintiff has constructed a dam, and by doing so has raised the bed of the stream to an elevation which it found necessary in order to divert its water through its canal, would not give to it the right to require subsequent appropriators of water from the stream or users of storage water flowing in the stream to contribute to the initial cost of construction of the dam.

RIGHT TO APPROPRIATE WATER

The right to divert and appropriate the unappropriated waters of a natural stream to beneficial uses shall never be denied under the constitution of the State. (Idaho Const., art. 3, sec. 15.) This principle applies to the right to the use of such stream as a highway to carry storage water from a reservoir. (Idaho C. S. sec. 5624.) The regulation of such use is by the statute of the State vested in the Commissioner of Reclamation and the water masters on the stream. (Idaho C. S. secs. 5606, 5607, and 5611.) Thus it will be seen that the right to appropriate water or to use a public stream for that purpose is not an unrestricted one, and must be exercised with regard to the rights of the public. The permission here given to the plaintiff is a mere license to use the method of construction of a dam for raising water to a level so that it can be diverted through its canal for distribution on its lands. To say that it can go further than that and require other appropriators or users on the stream who may be above its dam to contribute to the cost of construction of the dam would result in such a monopoly as to work disastrous consequences to the public. If it can require the defendant to contribute the large amount demanded, then it could go up the stream for a distance of 25 miles and require all subsequent appropriators or those who may use the stream to carry storage water from

American Falls Reservoir to contribute to the construction cost of the dam. Such a right in principle is denied by the Ninth Circuit Court of Appeals in the case of Schodde *v.* Twin Falls Land & Water Co. (161 F. 43), which was affirmed by the Supreme Court, Schodde *v.* Twin Falls Land & Water Co. (224 U. S. 107.) The fact that plaintiff has created an artificial condition in the river by the construction of the dam, which has resulted in backing up the water in the stream for 25 miles, and to an elevation which others may utilize, would not give to it the exclusive right to compel defendant to contribute to the initial cost of the dam, for they have the right to use the stream in the condition they may find it as long as they do not injure or interfere with plaintiff in diverting its water. They have the right in the first instance to use the stream, in its natural condition, and probably would have preferred to install a wheel or adopt other methods to lift the water from the river. Otherwise, the plaintiff would have the exclusive right to dictate to them to accept its dam as the method, regardless of the difference there may be in the cost to them.

The contention of the plaintiff that the defendant should contribute to the original cost of the dam, which was constructed some years ago, but should have no interest therein, runs counter to all legal and equitable principles requiring a conveyance of property to the one paying for the same. Here plaintiff adopts the theory that the defendant pay to it a part of the original cost and operation expenses of the dam, and after doing so it shall have no interest therein or voice in its operation. This would seem inequitable, although plaintiff says the defendant would only be paying for the use of it, and the measure of relief under such circumstances would not be a proportionate part of the initial cost of the dam. Should plaintiff retain the interest in the dam, and the sole right of operation, without transferring the interest represented by the amount defendant is requested to pay for the original cost, it could not expect to retain the dam and at the same time ask the defendant to pay for a part of its cost.

The conclusion reached requires a dismissal of the bill, and that defendant recover its costs.

B. E. Stoutemyer,
District Counsel.

THE Elephant Butte Dairy Association is the name of a recent organization of independent milk producers distributing milk and farm produce in El Paso, Rio Grande project.

Recently Enacted Legislation

Relief Extended to Uncompahgre Project, Colorado

[Private—No. 300—71st Congress]

[H. R. 14916]

An Act For the relief of the Uncompahgre reclamation project, Colorado

That if the Uncompahgre Valley Water Users' Association shall, under the contract of April 8, 1927, between the United States and the association, on or before January 1, 1932, take over the operation, maintenance, and control of the entire Uncompahgre reclamation project, Colorado, the Secretary of the Interior is hereby authorized to enter into an amendatory contract with the said association which shall provide as follows:

First. All construction and operation and maintenance charges (exclusive of any operation and maintenance charges required to be paid by the association for the operation and maintenance of the project for the calendar year 1930) that were or shall be due and unpaid under said contract of 1927 on December 31, 1930, including the then unpaid deferred charges under articles 17 (b) and (d) of said contract (without interest and penalties on such deferred accounts) and the construction charge that becomes due on December 1, 1931, under said contract, may be included in and made payable as part of the project supplemental construction charge hereinafter mentioned. Interest and penalties heretofore paid on deferred charges under articles 17 (b) and (d) shall be remitted and credited against the association's obligation for supplemental construction.

Second. During each of the years 1932 to 1937, both inclusive, the association shall have the right to expend for the construction of a drainage system such portion of the construction charge payable to the United States under said contract of 1927, as said association may consider necessary and as may be provided for by plans prepared by the association and approved by or on behalf of the Secretary of the Interior, the moneys so expended to be secured from construction charge assessments to be made to meet the regular construction charge installments that become due and payable under the said contract of 1927 on December 1 of the years 1931 to 1936, inclusive. The amounts so expended by the association for drainage each calendar year from December 1 to November 30, for six years, beginning with December 1, 1931, shall be credited to the annual construction charge that becomes due annually on December 1 of each year during the period of 1932 to 1937, both inclusive, the payment of the construction charges for which it is so substituted being in each case postponed to be paid later as a part of the supplemental construction charges authorized in item 3 hereof. Should the amounts so expended and credited annually be less than the annual construction charge for the years 1932 to 1937, both inclusive, the balance of each year's charge shall be payable to the United States in accordance with the contract of 1927.

Third. The amounts so expended and credited, the amounts postponed under the provisions of item 1 hereof, and any amounts of primary construction charges applicable to productive lands that shall not have become due and payable by the association under the contract of 1927, on or before December 1, 1961, shall be considered and defined as the project supplemental construction charge and shall be made payable by the association in annual installments of $85,000, the first installment of such supplemental construction charges to be payable on December 1, 1962, and a like installment on December 1, of each subsequent year until the total of the supplemental construction charge indebtedness is reduced to $85,000 or less, which remaining amount shall then be made payable as the last installment on December 1 of the calendar year next following the year in which the indebtedness is so reduced; and

Fourth. No stock assessment levied by the association to raise payments due the Government on construction need be increased more than 15 per centum of the normal yearly per irrigable acre construction installment as provided in section 17 of the contract of April 8, 1927, to meet deficits or estimated deficits due to the failure of some of the association's stockholders to pay their assessments when due, any resulting delinquencies as established after foreclosure of maximum assessment liens in meeting installments of charges due the United States from the association to be paid as a part of the supplemental construction charge authorized in item (3) hereof.

Sec. 2. It shall be provided as a condition subsequent that said contract shall terminate and be annulled unless (1) the General Assembly of the State of Colorado at its twenty-eighth session enacts legistion, which becomes effective (a) authorizing a water users' association to be incorporated for a term of at least seventy-

five years, and (b) amending chapter 76 of Colorado Session Laws, 1929, so as to permit the decree in proceedings to confirm a contract between such association and the United States to constitute as against parties defendant, including owners, lienors, and mortgagees of land in the district, an amendment of existing water-right contracts with individual landowners in the district, so far as the contract confirmed is inconsistent with such individual contracts; (2) the Uncompahgre Valley Water Users' Association thereupon extends its term of incorporation for at least seventy-five years from the date of such amendment of its articles; and (3) the association secures promptly a confirmatory decree, confirming such proposed contract with the United States under said amendment of chapter 76 of the Session Laws of Colorado, 1929.

Approved, January 31, 1931.

Law Notes

In Lingle Water Users' Association *v.* Occidental Building and Loan Association, decided by the Supreme Court of Wyoming March 31, 1931, 297 Pac., 385, it was held that a contract for the purchase of a water right could not be made to run with the purchaser's land, so that the assignee of the purchaser could be held personally liable for the selling price of the water right and for operation and maintenance. The contract of sale, which was recorded, contained article 12, reading in part as follows:

"It is understood and agreed that the terms of this contract shall inure to the benefit and be binding upon the heirs, executors, administrators, successors, and assigns of the parties to this instrument, and * * * this instrument shall be deemed a covenant running with the land to which the water right hereby contracted for is appurtenant, and the successors in interest of the purchaser, whether he becomes such by purchase and covenant, or by operation of law, shall be bound for the fulfillment of the covenants of the purchaser herein contained, as fully as if this contract had been entered into by him in the first instance."

In Smith *v.* Dickerson, decided by the Supreme Court of Idaho, March 19, 1931, 297 Pacific 402, it was held that the receiver of the Payette-Boise Water Users' Association (Ltd.), might levy an assessment of $1.83 against each share of stock of the association, in order to raise a fund to pay off the indebtedness of the association.

Federal Supreme Court Dismisses Seepage Suit

The plaintiff in the case of Spurrier *v.* Mitchell Irrigation District, referred to in the October, 1930, issue of the ERA, page 197, appealed to the Supreme Court of the United States from the Supreme Court of the State of Nebraska. The appeal was dismissed April 20, 1931, for want of jurisdiction, the per curiam decision of the court reading as follows:

Appeal herein is dismissed for the want of jurisdiction, section 237 (a) Judicial Code as amended by the act of February 13, 1925 (43 Stat. 936, 937). Treating the papers whereon the appeal was allowed as a petition for writ of certiorari, as required by section 237 (c) Judicial Code as amended (43 Stat. 936, 938), certiorari is denied for want of a substantial Federal question. Wabash R. R. Co. *v.* Flannigan, 192 U. S. 29; Erie R. R. Co. *v.* Solomon, 237 U. S. 427; Zucht *v.* King, 260 U. S. 174; Sugarman *v.* The United States, 249 U. S. 182; C. A. King & Co. *v.* Horton, 276 U. S. 600; Bank of Indianola *v.* Miller, 276 U. S. 605; Roe *v.* Kansas, 278 U. S. 191.

MANY inquiries are being received from prospective settlers and farmers in regard to lands on the Sun River project.

DURING the month of April a 40-acre partly improved farm 4 miles northeast of Rupert, Idaho, Minidoka project, sold for $6,500. Another 40-acre tract 2 miles east of Heyburn brought $6,000.

Alaska Tour for Government Employees

Arrangement has been made for the third annual trip to Alaska for Government employees, their families and friends. This year's itinerary will be of exceptional interest. With C. E. Harris as tour manager the party will leave Washington, D. C., August 2, returning to Washington at 8.05 a. m. Monday, August 31. The entire trip will require 29 days, with but 22 days and 2 hours annual leave consumed.

The tour will include two full days in Glacier National Park, Mont., with launch trips on St. Mary's and Swiftcurrent Lakes; in Alaska two full days in Mount McKinley National Park, with side trips to Caribou Camp, Inspiration Point, and Sable Pass; the usual side trips in Chicago, Seattle, Juneau, Cordova, Valdez, Anchorage, and Fairbanks, and a cruise through Alaska's famed Inside Passage, Gulf of Alaska, and Prince William Sound, on the two finest ships operating in Alaska waters—the S. S. *Aleutian* and S. S. *Yukon*.

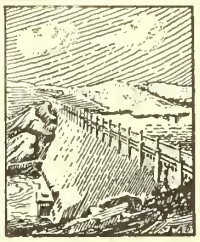
The maximum rate for the complete trip from Washington to interior Alaska and return will be $648; the minimum rate will be $590.50. The tour manager will care for all details of the trip, including the handling of transportation, transfer of persons and baggage, hotel and transportation reservations, side-trip arrangements, and incidental matters.

Requests for descriptive booklet containing complete information should be addressed to C. E. Harris, Traffic Manager, United States Department of the Interior, Washington, D. C.

Roswell dairy herd and first project silo on the Belle Fourche project, South Dakota

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Reconstruction of a Portion of the Mabton Pressure Pipe, Sunnyside Division, Yakima Project, Washington

By David E. Ball, Junior Engineer, Bureau of Reclamation, Yakima, Wash.

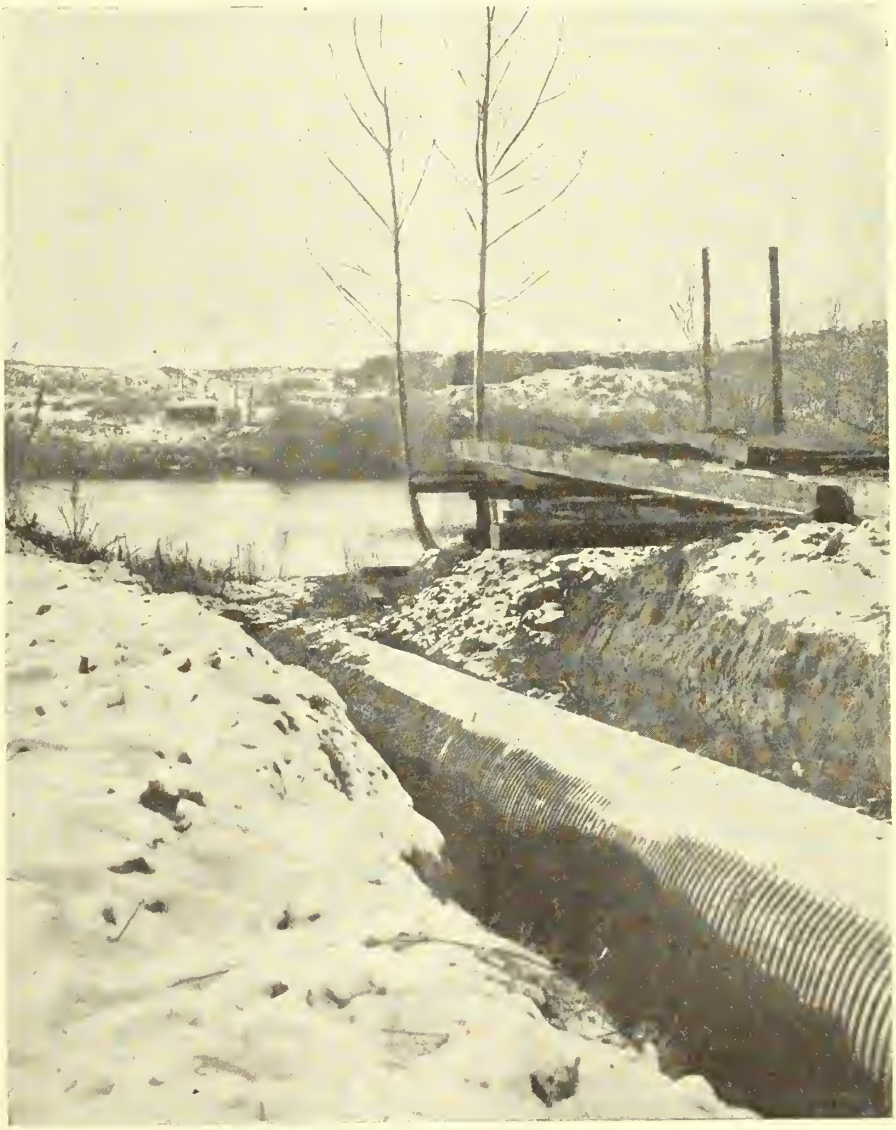
SOME 10,000 acres of irrigable land lying south of the Yakima River and south and east of the town of Mabton depend on the Mabton pressure pipe for their water supply. An article, Replacement of Portion of Mabton Siphon, in the July, 1928, issue of the NEW RECLAMATION ERA, described the replacement of another portion of this pipe. In the early summer of 1929, a leak occurred in the 48-inch wood-stave pipe under the Yakima River. It was fortunately located near the top of the pipe and, after two days' effort, was plugged with a wooden wedge driven from a boat on the river. Because of the hazardous condition of the pipe under the river and the very bad condition of the pipe adjacent to the river on both sides, plans for reconstruction were made in the fall of 1929.

PLAN OF RECONSTRUCTION

As reconstructed, the pipe line crosses the Yakima River overhead and is a ⅜-inch riveted plate-steel pipe, 60 inches in internal diameter and 518 feet long. The supporting structures are 13 rock-filled timber piers. Each pier contains eight driven piles braced above the river bed by timber struts and steel rods. All piers are covered with 3-inch planking to the maximum high-water surface elevation of 650 and filled with rock. Elevation of pier tops is 656.5, and the pipe center line elevation is 660.5. A steel railing provides a walkway the full length of the steel pipe. The end sections of the steel pipe are provided with expansion joints to which the 56-inch creosoted wood-stave pipe is attached. One thousand one hundred and fifty-four feet of 56-inch creosoted wood-stave pipe, supported on reinforced concrete pedestals, complete the reconstruction. Six hundred and sixty-eight feet are north and 486 feet are south of the river. The reconstructed pipe was relocated so that at the river crossing the center line was 20 feet upstream from the center line of the old pipe. This permitted driving of piles without interfering with the old pipe in the river.

PIER CONSTRUCTION

Each pier contains six vertical piles and two nose piles. The vertical piles are driven in two rows of three piles each, at right angles to the pipe center line. The rows are 4 feet apart and piles in the rows are 3½ feet apart. Between these rows and 2½ feet upstream and downstream at the top are driven the nose piles with a 1-in-12 batter. All piles are cut off at elevation 655.5. The batter piles are dapped 12 inches to receive a 12 by 12 inch cap, 12 feet long. Over and at right angles to it are placed the three 6 foot, 12 by 12 inch caps, which rest on top of the



Looking southwest across the Yakima River at site of river crossing. Skids for pile driving being constructed

Looking northeast across river. Planking and rock filling in progress. Note skip for hoisting rock at base of pier

vertical piles and support the pipe cradles. All pile tops are covered with 10-ply of prepared roofing. Pier noses are protected with steel nose angles. All timber in the piers is creosoted. The metal work, except the galvanized boat spikes, was provided with one coat of water-gas tar. All materials for the piers, except rock, were furnished by the Government.

Piles were driven with an Arnott No. 2 double-acting, steam hammer, suspended in 20-foot swinging leads from the 50-foot swinging boom of a stiff-leg derrick mounted on skids 80 feet long. This equipment was skidded over the pile tops.

Rock for four of the piers extended back from the river bank. This rock was obtained near the work, hauled by truck and placed by hand. For the other piers, rock was obtained by blasting from a rock bluff about 500 feet downstream from the pipe line. It was "shot" into a chute from which it was loaded into a scow and towed to the piers with a gasoline launch. For hoisting from the scow into the piers a small skip was used.

STEEL-PIPE ERECTION

The riveted plate-steel pipe was completely shop fabricated in 10 lengths of 45 feet, and 2 lengths of 33 feet 3½ inches. The vertical end sections of the cradles were also completely fabricated in the shop. The handrailing was cut to length and drilled in the shop for field erection and riveting. Butt straps for the circumferential field joints were punched, rolled and scarfed in the shop for assembly and riveting in the field. The steel pipe is provided with three manholes. An 8-inch needle valve provided by the Government was installed to facilitate draining the pipe line. The pipe was shipped to Grandview on flat cars and hauled by truck and trailer to the north end of the river crossing for erection.

A rather unique and very successful scheme was employed for getting the pipe sections into place on the piers. The sections were rolled, one at a time, with a hand winch onto a timber sled and pulled to place over greased skid blocks on the pier caps. The sled runners were 125 feet long, held together by cross members, and braced diagonally for stiffness. Cable straps thrown over the pipe section made a truss of a portion of the light sled and made it possible to carry the heavy load over the 45-foot span between piers. A Fordson tractor mounted on caterpillar treads and equipped with a Hyster double-drum hoist was used for pulling the sled back and forth. A Sullivan 110-cubic-foot capacity compressor furnished air for reaming and riveting. Both edges of the circumferential butt strap field joints were arc welded to the pipe sections.

WOOD-STAVE-PIPE RECONSTRUCTION

The 56-inch continuous creosoted wood-stave pipe of Douglas fir is 2⅛ inches in thickness and has 34 staves to the circumference. It is supported on 143 reinforced concrete pedestals, spaced 8 feet apart. Bands are ⅝-inch in diameter. Except at the river crossing, the replaced pipe was dismantled and the old trench partially back filled. A 3-inch gravel and spall rock blanket was placed under the new pipe and in the shallow drainage trenches provided along the new pipe.

The river crossing was built by contract and the wood-stave pipe and pedestals were built by Government forces. The Pearson Construction and Engineering Co. of Seattle, Wash., was the contractor for the timber piers, and the Johnson-Gardner Co. of Portland, Oreg., had the

COSTS

Following is a tabulation showing detail of costs:

Kind of work	Unit	Quantity	Unit cost	Total cost
Dismantling old pipe and back-filling trench	Linear foot	1, 045	$0. 41	$425. 16
Excavation	Cubic yard	468	1. 08	507. 87
Gravel blanket	do	101	4. 15	418. 83
Piling	Linear foot	4, 266	1. 22	5, 212. 74
Timber	M ft. b. m	27, 971	168. 22	4, 705. 30
Rock fill	Cubic yard	970	4. 42	4, 291. 85
Steel pipe	Pounds	97, 560	. 16	15, 213. 52
	Linear foot	518	29. 37	
Concrete pedestals		143	15. 70	3, 532. 83
	Cubic yard	121. 5	29. 08	
Wood-stave pipe	Linear foot	1, 154	9. 27	10, 773. 49
Repairs to valve house				224. 97
Total field costs				45, 306. 56
Camp maintenance, 1.5 per cent				679. 60
Engineering and inspection, 3.2 per cent				1, 449. 81
Superintendence and accounts, 8.4 per cent				3, 805. 75
General expense, 11.5 per cent				5, 210. 25
Grand total cost				56, 451. 97

contract for the steel pipe. Pier construction was begun December 17, 1929, and completed March 26, 1930. Field erection of steel pipe was begun March 11, and completed April 9, 1930. Work on the wood-stave pipe and pedestals was begun May 9, 1930, but was not completed till December 1930, because of the necessity of using the old pipe during the 1930 irrigation season.

Notes for Contractors

Belle Fourche project.—Contract for the construction of approximately 43 miles of open drains on the Belle Fourche project under specifications No. 520, bids for which were opened on April 22, 1931, was awarded to the George W. Conden Co., of Omaha, Nebr., at a total price of $84,695.50, the unit price for 921,000 cubic yards of drainage excavation being $0.074 per cubic yard.

Boulder Canyon project.—Specifications (No. 521) and invitations for bids have been issued for the street, alley, parking area, and sidewalk grading; street paving; street and parking area surfacing; curbs and gutters; sidewalks; sanitary sewers and the water-distribution system for Boulder City. The principal items and estimated quantities involved are as follows: 120,300 cubic yards of common excavation; 31,000 cubic yards of rock excavation; 20,000 station cubic yards of overhaul; 94,000 linear feet of curb and gutter; 6,000 linear feet of curb; 46,200 square yards of 2-course asphalt-concrete pavement; 43,800 square yards of 1-course asphalt-concrete pavement; 128,000 square yards of oil-treated surfacing; 11,000 square yards of gravel surfacing; 22,000 square yards of parking area surfacing; 180,000 square feet of concrete sidewalk; 190,000 square feet of gravel sidewalk; 59,600 linear feet of excavation of sewer trench; laying 59,600 linear feet of 4 to 12 inch sewer pipe; constructing 165 manholes; 52,000 linear feet of excavation of water-pipe trench; laying 49,600 linear feet of 2 to 12 inch cast-iron water pipe; laying and connecting 60,000 linear feet of copper service pipe. Bids will be opened at Las Vegas, Nev., on June 30.

Contract for the construction of the high pressure pipe line (specification 515–D) from the Colorado River to Boulder City has been awarded to the Wheelwright Construction Co., of Ogden, Utah, at a total price of $38,452.70. The work comprises the laying of 6.6 miles of 10 and 12 inch water-pipe line.

The Pelton Water Wheel Co. of San Francisco, Calif., has been awarded a contract under specification No. 516, for furnishing pressure control equipment for the Boulder City water-supply system, bids opened April 17. On item No. 1, for furnishing 6 hydraulically operated control valves, 2 automatic check valves and 2 automatic relief valves, the low bid was $4,433, f. o. b., San Francisco. The low bid on item No. 2, four automatic air valves, was $1,148.

Completed job. Looking northeast from south end of reconstruction, Yakima project, Washington

Forty-six companies from 15 States submitted bids on the 18 items of pipes, fittings, valves, specials and miscellaneous materials, under specification No. 517–D, for the Boulder City water and sewer systems, bids opened at Denver April 21. Awards have been made to the Pacific States Cast Iron Pipe Co., Provo, Utah, items 1a, 2 and 13, $26,975.87; Kennedy Valve Mfg. Co., Elmira, N. Y., item 4, $2,528.75; Crane O'Fallon Co., Denver, Colo., items 5, 11, 12 and 16, $6,345.19; Los Angeles Valve and Fitting Co., Los Angeles, Calif., items 3 and 6, $2,587.35; Mueller Co., Decatur, Ill., items 7, 10 and 14, $3,370.04; Jas. Jones Mfg. Co., Los Angeles, Calif., item 8, $581.25; Standard Sanitary Mfg. Co., Pittsburgh, Pa., item 9, $54; Pittsburgh Equitable Meter Co., Los Angeles, Calif., item 15, $1,822.40; Salt Lake Pressed Brick Co., Salt Lake City, Utah, item 17, $11,312.06. No award was made for item 18.

Bids were opened at Denver on May 11 (specification No. 523–D) for furnishing, fabricating and erecting riveted, plate-steel surge, sump, and aerator tanks, air-vent pipe and accessories for the Boulder City water-supply system.

Under specification No. 521–D, bids were opened at Las Vegas, Nevada, on May 15, for constructing approximately 6.83 miles of single-circuit 33,000-volt, wood-pole and 0.73 mile of single-circuit 2,300-volt, wood-pole, transmission line. The 33,000-volt line will extend from the Hoover Dam substation of the Southern Sierras Power Co., to Boulder City, and the 2,300-volt line will extend from the Hoover Dam substation to pumping plant No. 1 of the Bureau of Reclamation. The Newberry Electric Corporation, of Los Angeles, Calif., was low bidder at $3,340.

Salt Lake Basin project.—The Sevier Construction Co. of Richfield, Utah, has been awarded the contract, under specification No. 520–D, for building a mile of farm road near Coalville, Utah, on the west side of the Echo Reservoir. Low bid was $10,754.50. The work is to be completed in 50 days.

Yakima project.—Specifications (No. 522) and invitations for bids have been issued for the construction of the Cle Elum Dam. The work consists of the construction of an earth and gravel fill dam 130 feet high, a 14-foot diameter outlet tunnel, 1,800 feet long, a concrete spillway channel, and clearing about 2,700 acres of reservoir site. The principal items and estimated quantities involved are as follows: 22,500 cubic yards of tunnel and shaft excavation; 990,000 cubic yards of excavation in open cut; 35,000 cubic yards of back fill; 1,200,000 cubic yards of earth and gravel embankment; 44,000 cubic yards of riprap and paving; 11,200 cubic yards of concrete in tunnel and shaft lining; 20,900 cubic yards of concrete in other structures; placing 2,390,000 pounds of reinforcement bars; placing 3,800 linear feet of 6 to 3 inch drainpipe; 16,200 linear feet of sheet piling; 575,000 pounds of metal work; 2,700 acres of clearing reservoir site.

BOULDER

CANYON

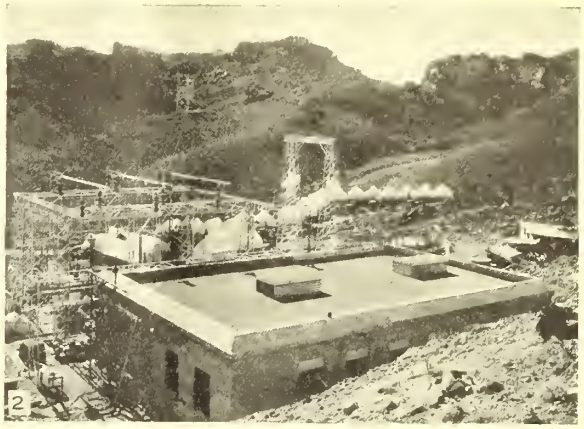
PROJECT

PROGRESS OF CONSTRUCTION AT BOULDER CITY
PLATE 1

1. GOVERNMENT SURVEY CAMP ON RIVER
2. OFFICIALS STARTING ON TRIP THROUGH CANYON
3. RECLAMATION AND U. P. OFFICIALS INSPECTING BOULDER CITY BRANCH LINE IN RAILWAY SEDAN
4. SPUR TRACKS AT EXCHANGE YARDS
5. OFFICE OF U. S. MARSHAL
6. OPENING THE POSTOFFICE
7. BUILDING SPUR TRACK TO WAREHOUSE OF SIX COMPANIES

PHOTOS BY UNION PACIFIC SYSTEM

BOULDER CANYON PROJECT



PHOTOS. BY UNION PACIFIC SYSTEM

PROGRESS OF CONSTRUCTION AT BOULDER CITY
PLATE 2

1. SIX COMPANIES' WAREHOUSE
2. SOUTHERN SIERRAS SUBSTATION AT DAMSITE
3. WATER TANK WITH EXCHANGE YARDS IN THE FOREGROUND
4. HOUSES UNDER CONSTRUCTION FOR SIX COMPANIES' EMPLOYEES
5. HOUSES FOR EMPLOYEES OF SIX COMPANIES
6. HOUSES FOR EMPLOYEES OF SIX COMPANIES
7. CAMP OF SIX COMPANIES AT EXCHANGE YARD

Enlargement of Lost River Diversion Channel, Klamath Project, Oregon

One of the main features in connection with the development of the Tule Lake division is the Lost River diversion channel, whereby Lost River, which originally flowed into Tule Lake, is diverted to the Klamath River. The channel is about 8 miles in length and was originally constructed during the years 1911 and 1912, Lost River being diverted through the channel for the first time on May 1, 1912.

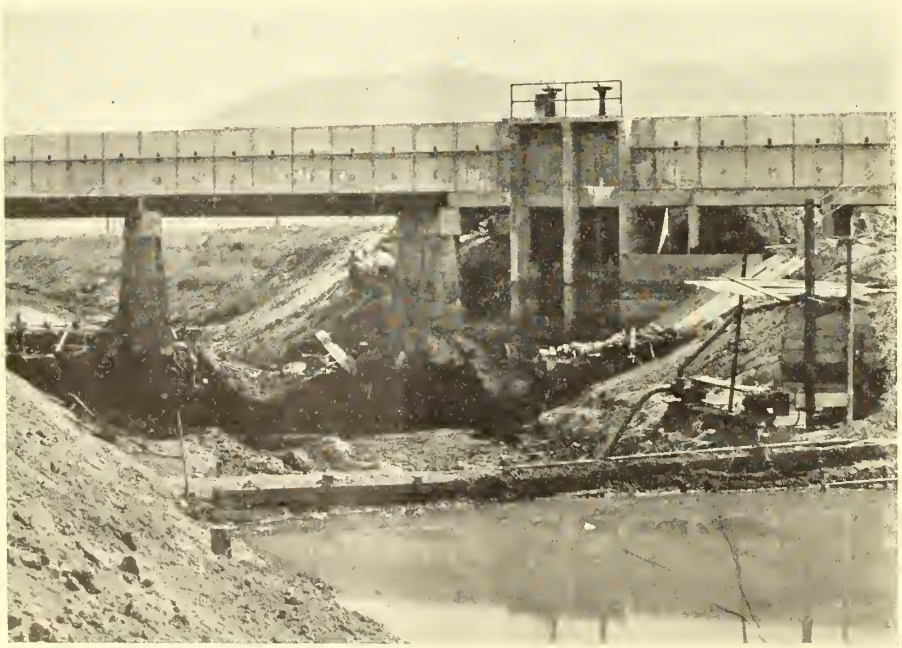
This original channel had a capacity of about 350 cubic feet per second and had carried as high as 500 cubic feet per second. While this capacity was ample for the normal flow of Lost River, it provided only slight additional capacity for flood waters, and later studies and investigations showed that for a development of 33,000 acres in the Tule Lake division, the Lost River diversion channel, should have a capacity of 1,200 cubic feet per second.

Work on the enlargement of the channel was started in April, 1929, and was in progress until December 10, 1929, when it became necessary to divert the flow of Lost River to the Klamath River. On June 12, 1930, when it was again possible to turn the flow of Lost River to the project canals, work was resumed. The enlarged channel was completed and the flow of Lost River was again diverted to the Klamath River on November 14, 1930.

The new channel has a bottom width of 22 feet with side slopes of 2 to 1, and a designed maximum water depth of 12 feet. This section required the deepening of the old channel approximately 7 feet, which involved the excavation of about 429,000 cubic yards of material. In addition to the canal excavation, the enlargement necessitated alterations to or reconstruction of a number of structures, the more important of which were 5 county highway bridges, 1 State highway bridge, 3 culverts under the channel, the headworks structure, the "C" Canal concrete flume crossing and 1 railroad crossing.

The railroad crossing structure, which is about one-half mile up the channel from the Klamath River, was modified and radial gates were installed in the structure. This permits shutting off the Klamath River backwater from the rest of the channel, which makes it possible to utilize this 7½ miles of the channel as a deep drain during the summer months when the entire flow of Lost River is being diverted to the project canals.

Excavating equipment used on this job consisted of one Bucyrus class 9½ dragline, and one P. & H. class 206 dragline, assisted during the latter part of 1930 by a P. & H. class 775 dragline. The major portion of the channel excavation was done by the Bucyrus class 9½ dragline. The P. & H. class 206 dragline was employed on the excavation of a drain in the bottom of the old channel, used to drain the channel, so that the Bucyrus dragline could be operated from the bottom of the old channel, and also on leveling the canal banks behind the Bucyrus dragline.



Extending piers supporting "C" Canal concrete flume, Klamath project, Oregon-California

Alterations to existing structures and the building of new structures were done under contract. The accompanying illustration shows work on "C" Canal concrete flume crossing.

E. L. Stephens,
Office Engineer, Klamath Project.

Engineers Approve Hoover Dam Plans

The Board of Consulting Engineers on Hoover Dam on April 20, made the following report to Commissioner Mead:

"Your board has been furnished with copies of the contract and specifications covering the plans for the design and construction of the Hoover Dam, and the members have individually and in conference, given careful consideration to the same. They have furthermore been in contact since their organization as a board, with many of the chief problems involved in this undertaking and have therefore approached this study with the advantage of these earlier contacts.

From this study we are of the opinion that these plans and specifications provide for the construction of a safe and efficient structure and we hereby express our approval of the same for contract purposes.

The contract designs and plans, following usual practice, have been made general and must naturally be supplemented by numerous detail designs and considerations relating to matters of secondary importance. We are of the opinion that the terms of the contract provide adequately and fully for such developments and variations in detail as further study may suggest or changing conditions require."

The report was signed by W. F. Durand, D. C. Henny, Louis C. Hill, and A. J. Wiley.

Irrigation

Successful irrigation farming is the joint product of the engineer and the farmer. To the engineer is given the heavy and responsible task of constructing properly a permanent system of dams and canals from which water may be drawn; to the farmer belongs the apparently humble but unending and difficult task of using the water in the best manner for crop production. Both workers are essential for success; but the work of the farmer determines the permanence and extent of agriculture under irrigation.—*Dr. John Widtsoe.*

Rio Tercero Dam

The accompanying photograph shows the Rio Tercero Dam at Cordoba, Argentina, South America, now under construction by the Government. It is a rock-fill structure, faced with reinforced concrete on the upstream side, 164 feet high, and has a crest length of 1,200 feet. Storage capacity at spillway level will be 500,000 acre-feet and the reservoir will comprise an area of 18,000 acres. Water will be available for the irrigation of 150,000 acres, and the development of 30,000 horsepower. Mr. S. E. Fitz-Simon is construction engineer on the project. He visited the Washington office in June, 1930, and spent several months visiting Federal and private irrigation systems in the United States.

RIO TERCERO DAM, ARGENTINA
(*a*) Employees quarters; (*b*) Home of construction engineer; (*c*) Power substation; (*d*) Workshops

Boulder City Water-Supply System

Water for the new town of Boulder City will be taken from the Colorado River at a point about one-half mile downstream from the site of the Hoover Dam, 1,800 feet below and 6.6 miles from the town site. The average water-surface elevation at the intake is 646. Three horizontal pumps will lift the water 100 feet to a presedimentation tank at elevation 746, and located about 100 feet from the river. From this tank the water will flow by gravity to a 30,000-gallon sump tank, and the first set of booster pumps, comprising three 450 gallons per minute, 1,200-foot head, centrifugal pumps. Here there is a lift of 1,015 feet to an intermediate station at elevation 1,745 through 10,900 feet of 10 and 12 inch pipe.

At this intermediate station there is a duplicate pump installation which carries the water through 10 and 12 inch pipe a distance of 22,100 feet to a 100,000-gallon tank at elevation 2,557. The treating and filter tanks are located at this elevation, and the three domestic water pumps, each designed for 500 gallons per minute at 170-foot head, take the water after being filtered and deliver it through 750 feet of 10 and 12 inch pipe to a 2,000,000-gallon storage tank, the storage reservoir for the town, at elevation 2,665.

With proper leveling, timely and wise use of irrigation water, a proper crop rotation and with the best varieties, the crop returns of irrigated farms can be multiplied by four and the expense of such increase almost negligible.

Boulder Canyon Project Notes

Six Companies (Inc.) are to spend $600,000 for construction of buildings in Boulder City. Geo. de Colmesmil, San Francisco, Calif., is architect. A main office building, dormitory, 1,000-man mess house and machine shop, are among the principal buildings now under construction. At the terminal yards, a warehouse of sheet-iron construction, 40 by 250 feet, has been completed, which will be used for a transfer and storage space for materials and supplies.

A. H. Baer, purchasing superintendent, is making all purchases for the Six Companies (Inc.) His office is in the Clark Building, Las Vegas, Nev.

Bids were opened at Carson City, Nev., on April 29, by the State highway department, for construction of 11.01 miles of highway, the second section of the Las Vegas-Boulder City highway. Patrick Cline (Inc.), of Las Vegas, Nev., was awarded the contract at $84,642.25. Ten miles at the Las Vegas end are under construction and the contract now being awarded will complete the 21-mile highway, which will be opened to travel in the early fall.

The Westinghouse Electric & Manufacturing Co. has been awarded a contract by the Six Companies (Inc.) to furnish all electrical equipment to be used by the contractors in building the dam, power plant, and appurtenant works. The award, said to be worth about $2,000,000, includes furnishing motors and control for electric shovels, hoists, pumps, conveyors and compressors; electric locomotives, switching equipment, circuit breakers, switchboards and metals. It is understood that most of this equipment will be manufactured at the Oakland, Calif., plant.

The Six Companies are planning some road construction on the Arizona side, so that access may be had to the summit of the cliffs for men, materials, and equipment.

The first Union Pacific passenger train from Las Vegas to Boulder City was operated on April 26. Regular twice-a-day service is now being maintained between the two points.

Progress being made by the Lewis Construction Co. on the Government section of railroad, and by R. G. LeTourneau (Inc.) on the Boulder City-Hoover Dam highway indicates that both jobs will be completed on schedule time—September 1 and July 1, respectively.

The Southern Sierras Power Co. will lease four lots in the town on which to build residences for substation employees.

Survey parties of the Six Companies have located a railroad from the Arizona gravel pits to "3-Way Junction" in Hemenway Wash, at which point it will connect with a line to the Government railroad, and to a line down the canyon. This railroad is to be constructed at once.

The Lacy Manufacturing Co. completed the erection of both the regulator and 2,000,000-gallon storage tank, early in May, well ahead of the end of the contract period.

Construction of the railroad through the river canyon on the Nevada side, to be used by the Six Companies for the excavation of the Nevada diversion tunnels and the dam foundation is being pushed on a three-shift basis. Adits are being excavated in each cliff to the elevation of the top of the diversion tunnels. These adits will serve as openings for the working of two faces in each tunnel on a top heading, which the contractors propose to drive through the entire length before the full section excavation is started.

A contract has been let for the construction and gravelling of a new road from Mack, Grand Valley project, west to the Utah State line. On the completion of this contract the highway through the valley will be practically all gravel and oiled road.

Loading potatoes at Powell, Shoshone project, Wyoming.

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- New program in administering resources of Nation developed (description of all bureaus under Interior Department including Bureau of Reclamation with creation of $1,000,000,000 of wealth). U. S. Daily, May 4, 1931, v. 6, p. 2 (p. 532).

Mead, Elwood:
- Facts about Hoover Dam, the world's largest irrigation structure. Illus. The Earth, May, 1931, v. 28, pp. 1–2.

Hoover Dam:
- Work on Hoover Dam gets under way. Illus. Plans and portraits of Messrs. Wattis and Bechtel. The Constructor, April, 1931, v. 13, No. 4, pp. 38–42 and 53.
- Six Companies (Inc.) (long article with portraits). Western Construction News, April 10, 1931, v. 6, pp. 173–9.
- Committees will coordinate work on Hoover Dam. Southwest Builder and Contractor, April 3, 1931, v. 77, p. 46.
- Hoover Dam work will begin soon, contract forwarded for signature of Secretary Wilbur. U. S. Daily, April 17, 1931, v. 6, p. 2 (p. 392).
- Electric work on dam two years distant. Illus. Journal of Electrical Workers and Operators, April, 1931, v. 30, p. 178 and 221.
- Contract signed for Boulder Dam. (By Secretary Wilbur.) U. S. Daily, April 21, 1931, v. 6, pp. 1 and 4 (p. 421 and 424).
- Six Companies (Inc.), starts Hoover work. Illus. Western Highways Builder, April, 1931, v. 13, p. 34.
- Nevada labor laws apply at Hoover Dam. U. S. Daily, April 28, 1931, v. 6, p. 1 (p. 481).
- Hoover Dam construction starts, Federal engineers designed world's greatest construction project. Illus. The Federal Architect, April, 1931, v. 1, pp. 12–13.
- Water supply of Boulder City. Diagram. American City, May, 1931, v. 44, p. 7.
- Rush preliminary operations to speed Hoover dam building. Illus. Excavating Engineer, May, 1931, v. 25, p. 237.

Utah Riverbed Case:
- United States Supreme Court defines navigable waters. Eng. News-Record, April 23, 1931, v. 106, p. 704.
- Utah sustained in claiming title to beds of navigable rivers (full text of Supreme Court decision, original No. 14). U. S. Daily, April 17, 1931, v. 6, p. 6 and 7 (pp. 396 and 397).
- Contested titles to river beds in Utah are settled, Colorado, Grand, Green, and San Juan Rivers (case No. 14, original). U. S. Daily, April 14, 1931, v. 6, p. 6 (p. 364).

Madden Dam:
- Madden dam, power plant and works, maps and plans. Western Construction News, March 25, 1931, v. 6, pp. 146–149.

Grunsky, C. E.:
- Comments on a few dams and reservoirs. Illus. Series of five articles, concluding in May–June issue. Military Engineer, v. 23, pp. 220–228.

Freeman, John R.:
- National Hydraulic Laboratory, Progress report, with plans, Senate Document 308, 71st Congress, 3d session. February 17, 1931, 16 pp., 13 drawings.

Yakima Siphon:
- Yakima River pressure tunnel. Illus. The Constructor, April, 1931, v. 13, No. 4, pp. 31–33.

Burkholder, Jos. L., Chief Engineer:
- Conservancy laws adapted to irrigation development, Colo., New Mexico and Ohio. Eng. News-Record, May 7, 1931, v. 106, p. 758.
- Progress on Rio Grande Conservancy Project. Illus. Eng. News-Record, May 7, 1931, v. 106, p. 759.

Holmes, J. D.:
- 24,000,000-cubic yard flood control, irrigation and drainage project, under way in New Mexico. Illus. Excavating Engineer, May, 1931, v. 25, pp. 223–225 and 233.

Statistical Research in the Bureau of Reclamation

STATISTICAL research and the application of statistical methods in reaching basic conclusions are recognized as essential to the proper functioning of the Bureau of Reclamation in its work of reclaiming arid and semiarid lands in the West and providing an opportunity for men of small means to make a home on irrigated land under conditions such that they will be afforded a reasonable chance to succeed.

ENGINEERING STRUCTURES INCREASING IN MAGNITUDE

The engineering problems of the bureau to-day are distinctly different from those of only a few years ago. The magnitude and difficulties of construction have steadily increased, and with them the problems that must be solved before construction can safely begin. The height and volume of dams for the storage of irrigation water have increased almost over night. Yesterday the 349-foot Arrowrock Dam on the Boise River, Idaho, visited annually by thousands, was acclaimed as the "highest in the world." To-day the 730-foot Hoover Dam to be built in Boulder Canyon holds the attention of construction engineers.

Plans for the erection of this vast block of concrete masonry totaling 3,600,000 cubic yards in the dam itself and 4,500,000 cubic yards in the dam, power plant, and appurtenant works, involve an immense amount of statistical research and the application of statistical methods in the calculation of factors entering into the question of the safety and stability of the dam. These comprise, for example, intricate statistical analyses of twisting moments in the horizontal and vertical sections, tangential shearing stresses, corresponding vertical shearing stresses in the radial sections, the determination of displacements of the cross-sections of the arches relative to the corresponding cross-sections of the cantilevers, the contributions of the shearing stresses to the radial deflections, the twists of the cantilevers, the tangential deflections of the cantilevers and many other highly technical computations involving the application of statistical methods.

ECONOMICS GROWING IN IMPORTANCE

In the economic work of the bureau, the compilation and application of statistics are becoming increasingly more important. Even since water was available for the irrigation of the first farm units on the early Federal projects statistics have been

Flour mills, Belle Fourche project, South Dakota

compiled and analyzed showing the results obtained by the settlers in growing crops, raising livestock, and in meeting their needs through the purchase of agricultural implements and machinery. These statistics have been elaborated from year to year until now they afford an accurate cross section of this phase of the economic condition of the water users. From the basic figures of acreage, yield, and value of crops, by projects, derivitive tables of per-acre yield and value of individual crops are readily obtained and the relationship of these crops to the ultimate success of the water users on a project made a subject of study.

For example, wheat is grown only to a limited extent on the Federal reclamation projects, the less than 4,000,000 bushels being barely sufficient to meet the local needs for this grain and of no significance as one of the surplus crops. However, a study of the crop statistics shows that although wheat is not grown in excess of the demand of the projects as a whole, on one or two individual projects the growing of wheat should be subordinated to other crops affording larger annual returns and better adapted to that particular locality. It is believed, for example, that part at least of the wheat acreage on the Greenfields division of the Sun River project, Montana, might, with greater advantage to the water users, be planted to sugar beets. The collection of an ever widening range of statistics dealing with the problems of reclamation economics points the way to a solution of these problems with a view not only to increasing the water user's chances of success but to safeguarding the investment of the Government in the irrigation works.

STATUS OF RECLAMATION FUND

In the field of reclamation accounting the statistics compiled by the bureau reflect not only the status of the reclamation fund, the cost of construction and of operation and maintenance, the repayments of the water users, but the financial status of the projects, showing inexorably whether they are operating on a sound financial basis or drifting to a point where corrective measures will have to be adopted to protect their own and the Government's interests. There is a close correlation in the studies thus made possible of a project's financial condition as shown by statistics dealing with this phase of the work and the economic status as disclosed by the statistics of crops, livestock, and other data relating to farm operations and social betterment.

Knowledge of conditions must be the basis of any adequate solution of a problem. Statistical research and the application of statistical methods in the work of the Bureau of Reclamation provide one means of supplying the knowledge essential to the proper functioning of the Bureau.

IRRIGATION AND CROP RESULTS ON GOVERNMENT RECLAMATION PROJECTS, 1930 [1]

State and project	Lands on projects covered by crop census					Other lands served by Government works, usually by a partial water supply through private canals under Warren Act or other water service contracts				
	Irrigable acreage [2]	Irrigated acreage	Cropped acreage	Crop value		Irrigable acreage	Irrigated acreage	Cropped acreage	Crop value	
				Total	Per acre				Total	Per acre
Arizona: Salt River	246,130	223,013	216,723	$16,540,314	$76.32	[3] 90,000	67,802	67,003	$5,092,000	$76.00
Arizona-California:										
Yuma	65,895	55,074	52,992	2,994,020	56.50	240	213	170	26,650	154.49
Valley division	49,625	43,573	42,121	2,453,402	58.25					
Reservation division	14,275	10,310	10,089	411,003	40.74					
Yuma auxiliary (Mesa)	1,995	1,191	782	129,615	165.81					
California: Orland	20,770	14,091	12,454	578,706	46.47					
Colorado:										
Grand Valley	30,380	15,804	15,099	472,185	31.27	18,400	14,000	13,400	956,000	71.34
Uncompahgre	75,655	59,998	59,875	1,606,250	26.83	1,650	1,550	1,545	38,625	25.00
Idaho:										
Boise	170,575	167,242	154,059	4,057,819	26.34	139,600	133,800	129,300	3,306,500	25.60
New York irrigation district	17,025	16,505	15,099	326,977	21.66					
Nampa-Meridian irrigation district	40,065	38,926	37,101	958,016	25.83					
Boise-Kuna irrigation district	48,345	47,514	43,240	1,077,242	24.91					
Wilder irrigation district	56,665	55,882	50,449	1,470,990	29.16					
Bib Bend irrigation district	1,600	1,660	1,571	39,785	25.32					
Black Canyon irrigation district	6,875	6,755	6,599	184,809	28.01					
King Hill	8,000	6,941	6,853	197,932	28.88					
Minidoka	120,155	107,200	99,990	3,206,284	32.07	780,710	667,180	641,565	24,023,520	37.50
Gravity division	71,235	61,561	57,724	1,837,510	31.83					
Pumping division	48,920	45,639	42,266	1,368,774	32.38					
Montana:										
Huntley	32,540	23,488	23,488	1,110,523	47.28					
Milk River	134,285	49,021	48,039	959,385	19.97					
Malta division	56,652	17,067	16,645	290,243	17.44					
Glasgow division	22,133	5,495	5,378	71,577	13.31					
Chinook division	55,500	26,459	26,016	597,565	22.97					
Sun River	55,875	33,274	33,274	442,918	13.31					
Fort Shaw division	13,900	7,312	7,312	133,820	18.34					
Greenfields and Big Coulee division	41,975	25,962	25,962	309,098	11.91					
Montana-North Dakota:										
Lower Yellowstone	47,450	28,681	28,681	957,756	33.39					
District No. 1		19,467	19,467	697,227	35.82					
District No. 2		9,214	9,214	260,529	28.28					
Nebraska-Wyoming:										
North Platte	235,840	191,519	190,378	6,679,563	35.09	129,440	111,050	111,050	4,286,240	38.60
Pathfinder irrigation district	113,100	90,518	89,715	2,836,374	31.62					
Gering and Fort Laramie irrigation district	55,030	50,908	50,752	2,267,945	44.69					
Goshen irrigation district	51,540	37,983	37,983	1,296,747	34.14					
Northport irrigation district	16,170	12,110	11,928	278,497	23.35					
Nevada: Newlands	87,500	53,563	50,917	1,000,920	19.67					
New Mexico: Carlsbad	25,055	24,738	23,695	1,297,378	54.33					
New Mexico-Texas:										
Rio Grande	155,000	144,607	139,707	8,184,665	58.58	75,000	50,145	50,145	1,609,690	32.10
Elephant Butte irrigation district	88,000	78,449	77,607	4,417,911	56.93					
Rincon Valley, N. Mex	16,000	12,702	12,407	403,563	32.53					
Mesilla Valley, N. Mex	72,000	65,747	65,200	4,014,348	61.57					
El Paso County Water Improvement District No. 1	67,000	66,158	62,100	3,766,754	60.66					
Mesilla Valley, Tex	11,000	10,626	10,545	736,865	69.88					
El Paso Valley, Tex	56,000	55,532	51,555	3,029,889	58.77					
Oregon:										
Vale	4,010	1,412	1,189	17,189	14.43					
Umatilla	17,740	11,252	10,874	240,792	22.14	640	590	590	15,140	38.00
East division	11,750	7,462	7,214	160,597	22.26					
West division	5,990	3,790	3,660	80,195	21.91	640	590	590	15,140	38.00
Oregon-California:										
Klamath	55,385	47,011	45,781	1,727,147	37.72	63,910	36,445	35,655	824,595	23.15
Main division	41,525	34,051	33,471	1,328,049	39.70					
Tule Lake division	13,860	12,960	12,310	399,098	32.40					
South Dakota: Belle Fourche	61,190	38,844	[4] 53,803	1,204,293	22.38					
Utah:										
Strawberry Valley	39,550	36,798	36,798	1,059,500	28.78	7,020	6,990	6,990	172,890	24.60
High Line division	18,770	16,636	16,636	369,100	22.00					
Mapleton division	3,840	3,775	3,775	157,785	42.32					
Spanish Fork division	13,890	13,555	13,555	425,100	31.50					
Springville division	3,050	2,832	2,832	105,515	37.20					
Washington:										
Okanogan	5,850	3,970	3,503	462,871	132.15					
Yakima	204,920	120,054	113,155	8,087,025	71.47	166,720	128,610	128,610	12,855,000	100.00
Sunnyside division	102,656	83,012	79,515	4,638,820	58.34					
Tieton division	30,264	26,250	23,000	3,104,575	134.98					
Kittitas division	72,000	10,792	10,640	343,630	32.30					
Wyoming:										
Shoshone	73,640	46,008	44,665	1,323,197	29.63					
Garland division	41,648	32,946	32,946	1,130,957	34.33					
Frannie division	20,062	9,025	8,923	163,695	18.34					
Willwood division	11,930	4,037	2,796	28,545	10.21					
Riverton	20,000	1,207	1,105	10,308	9.33					
Total with irrigation	1,993,390	1,504,810	1,467,097	64,418,940	43.91	1,473,330	1,218,375	1,186,023	53,206,850	44.86
Cropped without irrigation (areas on Milk River, Sun River, Lower Yellowstone and Klamath projects)			83,870	588,330	7.00					
Total for projects proper	1,993,390	1,504,810	1,550,967	65,007,270	41.90					
Totals for Warren Act	1,473,330	1,218,375	1,186,023	53,206,850	44.86	1,473,330	1,218,375	1,186,023	53,206,850	44.86
Grand totals for projects proper and Warren Act	3,466,720	2,723,185	2,736,990	118,214,120	43.19					

[1] Data are for calendar year (irrigation season) except on Salt River project, where data are for corresponding "agricultural year," October, 1929, to September, 1930.
[2] Areas for which bureau was prepared to supply water in 1930.
[3] Warren Act figures on Salt River project are estimated.
[4] Of this area, 38,844 acres were irrigated, the remainder being cropped without irrigation.

Irrigation Developments in Egypt

By United States Consul J. Rives Childs, Cairo

On January 29, 1929, a comprehensive 10-year program, involving the expenditure of $120,000,000, was adopted to take care of Egypt's irrigation needs for the next 25 years, following recommendations of an international commission appointed to study the subject.

In addition to strengthening various Nile barrages, the principal projects include the heightening of the Aswan Dam, the construction of a dam at Gebel-Aulia above Khartum, and other works leading to the ultimate perennial irrigation of 1,245,600 acres. The objective of the program is the inclusion of all cultivable land in the valley of the Nile within the irrigated area.

The last quarter of 1930 witnessed two important developments in connection with the program. On December 10, King Fuad inaugurated the new Nile barrage at Nag-Hamadi, 367 miles to the south of Cairo. This barrage forms an important link in the chain of irrigation works and is expected to result in the supply of water to about 519,000 acres.

The second irrigation work of major importance, which has been under construction for some time, is the heightening of the Aswan Dam by approximately 29 feet. Owing to certain difficulties experienced by the company holding the contract, work was suspended, and a new contract for completing the work at a cost of $10,500,000 was subsequently awarded to a British firm.

Commerce Reports, May 11, 1931.

Sale of Town Lots Tule Lake Town Site

On April 15, pursuant to departmental order of March 17, 1931, an auction sale of town lots in Tule Lake town site, Klamath project, Oregon-California, was held with the following result:

On the first day of the sale 121 lots were sold, bringing a total of $14,142. The sale was continued on April 18, when 9 lots were sold for a total of $945. At the close of the auction 130 lots, which had an appraised value of $11,285, had been sold for a total of $15,087.

The total appraised value of the 79 lots remaining to be sold is $5,815. As stated in the April issue of the ERA, payment for lots may be made in cash at the time of purchase, or one-fifth cash and the balance in four equal annual installments with 6 per cent interest on deferred payments.

Willwood settlers just arriving with truck autos and trailer loaded with furniture, etc.—Shoshone project Wyoming

PUBLIC LAND OPENINGS ON IRRIGATION PROJECTS

The Secretary of the Interior has announced openings of public land on the Willwood division of the Shoshone project, Wyoming, and the Greenfields division of the Sun River project, Montana.

Part 4 of the Willwood division, which is to be opened on June 1, comprises a total irrigable area of 1,451 acres and includes 31 farm units ranging in size from 56 to 101 acres.

The 87 farm units to be opened on June 10 on the Greenfields division embrace a total irrigable area of 5,949 acres and range in size from 17 to 104 acres.

As at all public land openings ex-service men of the recent war will be granted a 90-day prior right of entry at these openings, at the expiration of which other duly qualified citizens of the United States may file applications for any units still unentered.

Requests for public notices and application blanks should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C., or to the respective project superintendents at Powell, Wyo., and Fairfield, Mont.

The Antiquity of Irrigation

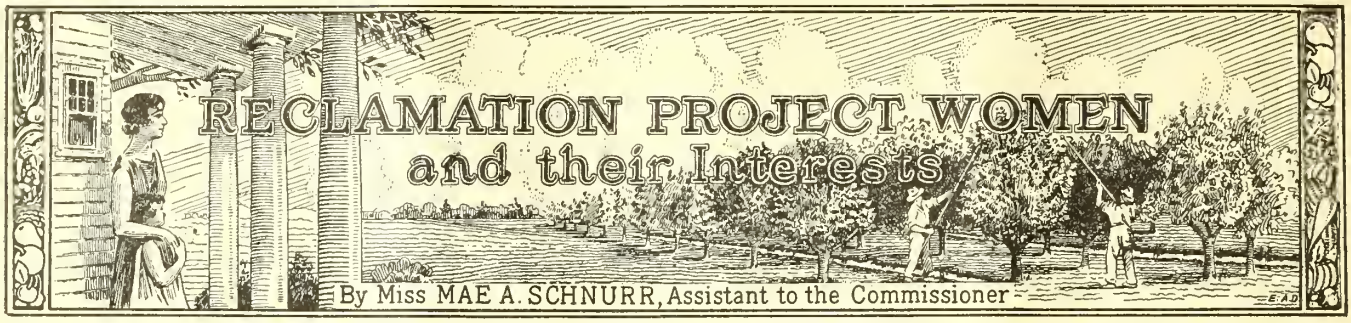
The practice of irrigation antedates recorded history in every country of antiquity. Whether it originated in Asia, Africa, Europe, or America, no man can tell. Beyond question where man first appeared, there, not long after, irrigation began to be practiced. Together with the stirring of the soil and the sowing of the seed, irrigation is one of the first agricultural practices of mankind.—*Dr. John A. Widtsoe.*

CONGRESS has appropriated $190,000 for the erection in Yuma, Ariz., of a new post office building, on a site to be selected.

Kingman-Hoover Dam Highway

A press report states that the board of supervisors of Mohave County, Ariz., has authorized an expenditure of $32,000 for improvement of the highway from Chloride to Black Canyon, where crossing of the river can be made by ferry. The road is scheduled to be completed to the ferry landing by September 1, 1931. This route will be an important tourist artery for it means that travelers from the east over the Old Trails Highway will be able to travel over the Hoover Dam route into Los Angeles without adding any distance to the trip, the Kingman-Black Canyon-Las Vegas route into southern California being approximately the same mileage as the Topock-Needles route.

HIGH school students at Orland, Calif., constituting the dairy cattle judging team, in competition with 54 teams from all sections of the State of California, at the university farm picnic, University of California at Davis, won the El Dorado Ayreshire farm trophy. The team was composed of Wilmer Macy, Carrol Sherrod, Delbert Youtesey, and Everett Schmidt. In judging all classes of dairy cattle the Orland team placed fifth, qualifying the members to compete in the State finals at San Luis Obispo early in May. The Orland agronomy team was awarded second place in the identification of seeds, plants, and agricultural products; 26 teams were entered in this contest. The Orland students participating were Carrol Kolousek, William Gilmore, Hans Bjorklund, and Wayne Muchow.



The following statement is made for readers of the ERA by Mrs. D. L. Carmody, wife of one of our engineers assigned to the Boulder Canyon project. Judging from Mr. Carmody's previous assignments in the bureau, Mrs. Carmody has lived in typical sage-brush desert country of the Northwest and, of course, the trip to the site of the Hoover Dam would be a marked contrast.

IMPRESSIONS OF AN ENGINEER'S WIFE ON HER FIRST TRIP TO THE SITE OF HOOVER DAM

As soon as we knew that my husband was to be one of the engineers employed by the Bureau of Reclamation at the site of the great dam we came to Las Vegas, Nev., and at that time it seemed to me as if the whole world was converging at this point, so that we were considered very fortunate in securing a completely furnished little house the second day after we arrived.

My first adventure was a trip to the dam site. Our road wound through the desert; and let me here remark that my preconceived idea of a desert and the real thing as seen here in Nevada are as different as the wooden horse of Troy and a wild horse of the plains. I had always visioned a desert as being a clean sandy waste stretching on and on into infinity, broken at long intervals by oases, round green spots where a few tall palm trees waved their dusty heads and there was always the inevitable well. And in reality the desert here is apparently covered by a pebbly subsoil where lots of weeds and many wild flowers have their roots and now and then clumps of gnarled mesquite trees are grouped close together like old, old men huddled there to keep out the wind.

DESERT "TREASURES"

It was late in October when I made my first trip and the vegetation had all turned a sort of sandy gray; keeping my eyes on the ground alert for glimpses of scorpions and lizards I observed something glistening in the sunlight and saw a small heap of broken glass half hidden by the brush; some of this glass was a lovely purple color and I learned that it is dear to the hearts of collectors and that it takes 15 or 20 years for the sun's heat to burn it to a pure amethystine tint. But in case you, in an unwary moment, should be tempted to acquire these desert treasures, you will at once discover to your sorrow that these weeds are equipped with invisible but very poisonous barbs and arrow-like spikes which are strong enough to penetrate a heavy woolen coat and will rankle and even fester if not removed.

On either side of the road for some distance out were small white surveyor's flags indicating the presence of "town lots," and some facetious soul had placed a sign reading "City Limits of Los Angeles." A service station had sprung up in the loneliness like a big yellow mushroom and small piles of rocks in chimney form showed where prospectors had staked out mining claims. Low mountains lay to the north and south of us and, while of no great height they had all the rugged grandeur of the far-famed Rockies. About 25 miles from Las Vegas we passed the survey camp of the United States Bureau of Reclamation, a long row of neat tent houses, where our beautiful flag was proudly waving; it always thrills me and gives me a feeling of belonging when I see our flag in remote places like that.

After passing the survey camp our road became more winding, the mountains were much higher and seemed to be pressing in upon us as if moving of their own volition inexorably determined to protect their magnificent isolation. About seven miles from the survey camp we came to the Gateway, so called because at a time in the unknown past two enormous boulders slipped down into the flat, doubtless the bed of the river then, and stood there like pillars of a giant gate. The road wound through it and just beyond was a wide sandy flat and then the river.

I was disappointed! Who hasn't read of the mighty Colorado River with its treacherous rapids, its deadly quicksands, its everlasting tragedies? But this broad and apparently stagnant stream crawling between the sands on the Nevada side and a low bare "bench" on the Arizona shore gave no hint of romance; I do not know what I expected to see, but surely not this. There was a boat landing here where for a small sum one could take passage and travel down the river to the site of the dam. The only other sign of activity was a pack of burros for hire and a curio shop backed up against the

Sagebrush desert of the Northwest with which Mrs. Carmody was familiar

rocky walls of the mountains which now began to infringe upon the road which made a sharp turn here to the right. We decided not to take the boat but to follow the road as far as possible. The frowning masses of black rock rising sheer above us on our right filled me with anxiety, then glancing to our left I began to realize that we were in what seemed to me a ticklish position, for to the left the ground fell precipitously to the muddy waters below and it was apparently an even chance that we would either splash or crash. I held on tight and offered many silent prayers which may have been beneficial because we soon came to another boat landing which marked the end of the road. We now embarked on a 30-foot motor boat and from her comfortable deck could form some idea of the many twists and turns of this most temperamental of rivers.

THE MIGHTY COLORADO

In almost the twinkling of an eye the scene changed; the grim and sinister walls of the canyon had suddenly risen to great heights and were closing in upon us; proudly they reared their crests to the skies guarding with their lives, if need be, the river goddess flowing with royal unconcern between her eternal sentinels. Silently they seemed to look down on us, remote in an unfathomable quiet unbroken even by the putt-putt of our motor boat, as though we were in the emptiness of a vacuum. It was so tremendous that it set me to marveling what any body of men could hope to accomplish against this malignancy; what sop would be fed to these monsters which like Cerberus guarded this unknown hell? I was reminded of the legends I had read of the mysteries of the Colorado, of the adventurous couples who had embarked in boats especially constructed to withstand its greedy jaws, of the tragedies in their wake; some drowned at the outset, others finally cast ashore, only their bones left to spell their fate, and others who had disappeared leaving no shred to show that they had ever existed. While I was letting my fancy wander the boatman pointed out the body of a mountain sheep lying a hundred feet up on a ledge of rock; the thing had been there for years, dead no doubt of slow starvation, probably caught on this inaccessible shelf with a broken leg, feebly crying for help till its strength was gone. The dry air of the desert had preserved it more perfectly than a taxidermist's art could ever have done, and it looked as if it were alive and watching us from its aerie. It will be lying there till it is swept away into the great lake which the dam will form.

COMMENCEMENT OF CONSTRUCTION AT HOOVER DAM

At this time it was comparatively quiet at the site of the dam; ladders clinging like lichen to the perpendicular sides of the canyon went up for about 150 feet to be climbed by the engineers in charge of the work there, and a strong cable extended across the river with a steel basket swinging from it in which trips of inspection were made daily. The preliminary work of building the dam was just beginning at this time, and some of it consisted in the taking of cores from the rocky sides of the canyon for the purpose of ascertaining the amount of pressure it could withstand; for this work a diamond drill was used and parts of the machinery were ensconced high up in some of the natural caves that perhaps once sheltered venomous snakes and prowling animals.

It seems to me that the building of a dam is at least half preliminary work and upon due consideration that is exactly as it should be. A gigantic undertaking rests upon the shoulders of a small body of men who are aware that there must be no possibility of failure and who know that the way to achieve perfect success is to attend each step with meticulous care and thought so that there will be nothing left to chance.

PANORAMA INCREASING IN GRANDEUR

The weather had been perfect all day and we ended with a dinner at the mess hall served in comfortable style and most appetizing. On the way home we stopped at the curio shop and bought postal cards and bits of colored glass; I also saw a tarantula—Oh, no, not alive, but in a little glass dish with a top on it. It was not nearly so large as I expected, just a black hairy spider which could have been covered by an ordinary-sized teacup, legs and all. It really seemed to me as if things had not come up to any of my expectations and an intangible sense of disappointment vexed me; a sort of feeling of depression and danger. Those strange mountains, that oily river, those masses of black rock, those deep crevasses—what could mere man hope to accomplish against that overwhelming fortress built by nature—what dangers, what tragedies lay ahead of their pigmy efforts at mastery? And the scenery! Ah, so different from the colorful mountains of my former home; wonderful no doubt but to me only hideous—and then—the setting sun threw a rose-colored veil over everything and a golden mist lay all about us; the mountains took on an unearthly beauty, the nearer peaks standing out in jagged lines of purples and mysterious blues, the farther ones paling to pastel tints of orchid and rose and delicate pink; a nebulous haze seemed to separate them from the desert floor so that they gave the effect of floating like the spires and minarets of a mirage.

"Oh" I gasped "they are floating—something is happening—what can it be?" The colors deepened and glowed like fire; every tiny ravine and irregularity was etched in purest gold—never have I seen anything so lovely. I was still gasping when suddenly the sun vanished, the colors faded, the "dream" was gone.

They said it is like that every day at sunset, that it isn't any phenomenon, just a usual sunset to which they scarcely vouch a glance. Just as we seldom give an upward glance to the magic of a passing plane, so these people of the desert were so familiarized with its wonders they saw nothing of the panorma which nature daily held up for their eyes.

Site of Boulder City, Nev. A Nevada desert

Cost Accounting, Bureau of Reclamation

COST accounting, as a factor of economic, efficient and successful administration has been practiced in the Bureau of Reclamation for many years. A standard system of cost accounting has been prescribed and is in use on all projects being constructed, operated, and maintained by the bureau.

The search for economy and efficiency in construction and operation and maintenance methods followed on irrigation projects assumes many phases. It involves a study of plant location, new and better types of machines, and the application of different types of modern machines and equipment to the work peculiar to the construction and operation and maintenance of these irrigation projects, and economics in producing and using power, etc. It is not only necessary to analyze machine and equipment efficiency, but also component parts of the motions and operations of labor, with a view of eliminating those which are not essential, wasteful and costly.

Cost accounting has been found very essential to the operations of the bureau. It is established as a branch of general accounting. Its function is to analyze and record the cost of the various items of material, labor and indirect expenses incurred in the construction, operation and maintenance of irrigation projects, and to so compile these elements as to show the total cost of a particular piece or class of work, and present them in such form for the engineer and administrative offices for guidance in economic and efficient administration, and for the purpose of making cost studies and estimates of new projects being considered for construction. With the cost books once established, the best modern usage is to incorporate the cost records in total in the general financial books, controlling the cost ledger detailed by principal and physical features, clearing and apportionment accounts, etc. In this manner the cost accounting system builds up an interlocking series of accounts for detail study of the construction and operation results for an irrigation project.

The standard classification of the interlocking series of cost ledger accounts has been prescribed by principal features as follows:

(1). Examination and surveys; (2) storage system; (3) pumping for irrigation; (4) canal system; (5) lateral system; (6) drainage system; (7) flood protection; (8) power system; (9) irrigable lands; (10) permanent improvements; (11) telephone system; (12) operation and maintenance.

While all the costs of construction and operation and maintenance of a project will be grouped under one or more of the above general principal features, a further division of each is made into physical features and classes of work, and for the convenience of compiling costs a further classification is made into the following general classes: Clearing accounts; reimbursable accounts; plant accounts; detail accounts; summary costs reports.

This brief outline of the component parts of the bureau's cost accounting system is merely to show that when costs of a project or a division thereof are published the amounts disclosed are obtained through an accurate system of cost keeping and are backed by detail incorporated in total in the general financial accounts. As an illustration of cost finding practiced by the bureau, automobile operations are used. All charges and operating data for each automobile operated are assembled monthly under the following detail items and as the result it is possible to furnish fleet operation as shown by the accompanying statement.

When the reclamation job is done enormous taxable wealth will have been added to that of the Nation, as well as areas that will produce much new wealth each year.—*Joseph A. Swalwell, President Columbia Basin Issigation League.*

New farm home of F. A. Kern on Vantage Ferry Road, Yakima project, Washington

Cost of passenger motor-vehicle operations, calendar year 1930

Project	Class 1						Class 2						Class 3					
	Number of cars	Miles traveled	Cost		Miles per gallon		Number of cars	Miles traveled	Cost		Miles per gallon		Number of cars	Miles traveled	Cost		Miles per gallon	
			Total	Unit	Gas	Oil			Total	Unit	Gas	Oil			Total	Unit	Gas	Oil
Belle Fourche	7	16,089	$469	$0.029	10.9	244	7	53,959	$2,380	$0.044	15.2	469	3	18,368	$535	$0.029	15.8	706
Boise	1	2,002	96	.048	15.1	501	5	45,544	2,176	.048	16.4	498						
Carlsbad	1	3,112	91	.029	16.4	377	2	15,409	629	.040	18.8	434						
Grand Valley	7	53,009	1,556	.029	17.6	360	1	8,764	502	.057	19.6	730						
Klamath	4	31,114	892	.029	13.2	465	10	114,303	4,410	.039	15.3	594						
Lower Yellowstone	3	19,676	932	.047	11.8	337	3	26,989	1,433	.053	15.3	519	1	11,039	353	.032	16.4	761
Milk River	3	1,076	134	.125	11.0	183	2	18,863	609	.032	17.0	571	1	10,611	446	.042	15.0	530
Minidoka	3	5,775	331	.057	11.2	340	4	42,993	2,024	.047	14.8	414	1	10,207	541	.053	12.0	400
Minidoka-Gooding	5	12,458	600	.048	11.5	271	16	156,986	9,024	.057	13.8	342						
North Platte	4	21,105	542	.026	16.3	406	5	50,023	1,826	.037	17.7	705	2	14,718	681	.046	15.7	550
Orland	2	4,240	184	.043	14.1	303	2	13,715	494	.036	20.2	319						
Owyhee	1	4,950	295	.060	11.6	171	14	78,793	4,775	.061	14.5	385	1	1,524	68	.045	7.3	381
Rio Grande	11	111,313	3,786	.034	14.0	320	6	48,113	2,227	.046	17.0	605	3	71,738	1,547	.022	18.6	624
Riverton	1	650	27	.042	11.0	216	18	198,494	9,592	.048	13.7	448	3	39,305	1,714	.044	16.3	600
Shoshone	6	17,701	2,261	.128	9.6	157	5	41,109	1,955	.047	15.7	405						
Salt Lake Basin							2	15,701	914	.058	14.8	490	3	21,392	1,434	.067	12.7	563
Sun River	6	27,780	1,093	.039	13.8	246	5	49,137	3,057	.062	14.0	344	2	18,847	1,013	.054	18.5	679
Uncompahgre	7	45,478	2,312	.051	13.9	387	2	8,274	587	.071	15.8	571						
Umatilla-McKay							1	11,410	399	.035	17.2	456						
Vale	9	58,791	3,598	.061	9.2	232	6	64,141	4,539	.072	12.1	247						
Yakima	11	63,410	2,221	.035	15.3	257	10	61,367	2,815	.046	16.8	406	1	8,974	375	.042	18.1	480
Yakima-Kittitas	12	88,125	3,389	.038	14.1	368												
Yuma	23	166,524	8,421	.051	12.1	224	13	106,260	5,310	.050	15.5	381						
Total	127	754,380	33,230	.044	13.1	281	139	1,230,492	61,677	.050	14.9	417	21	226,687	8,707	.038	16.2	421

Cost of passenger motor-vehicle operations, calendar year 1930

Project	Class 4						Other classes (5–9)						Total all passenger cars			
	Number of cars	Miles traveled	Cost		Miles per gallon		Number of cars	Miles traveled	Cost		Miles per gallon		Number of cars	Miles traveled	Cost	
			Total	Unit	Gas	Oil			Total	Unit	Gas	Oil			Total	Unit
Belle Fourche	1	5,415	$123	$0.023	11.7	387							18	93,831	$3,507	$0.037
Boise	2	12,137	717	.059	16.1	379							8	59,683	2,989	.050
Carlsbad	1	2,928	206	.070	19.2	680	(5) 1	12,625	$386	$0.031	24.4	647	5	34,074	1,312	.038
Grand Valley	1	9,096	458	.050	14.3	465							9	70,869	2,516	.036
Klamath	1	9,829	649	.066	13.1	459							15	155,264	5,951	.038
Lower Yellowstone	1	13,902	772	.056	13.6	431							8	71,606	3,490	.049
Milk River	1	14,282	460	.032	13.0	277							7	44,832	1,649	.037
Minidoka	1	15,792	923	.059	17.0	500							9	74,767	3,819	.051
Minidoka-Gooding													21	169,444	9,624	.057
North Platte	1	12,029	426	.035	16.0	529							12	97,875	3,475	.036
Orland	2	15,906	589	.037	17.3	266							6	33,861	1,267	.037
Owyhee							(6) 1	10,781	1,012	.094	13.9	245	17	96,048	6,150	.064
Rio Grande	1	12,362	832	.067	17.0	989							21	243,526	8,392	.034
Riverton	2	14,703	477	.032	13.3	368							24	253,151	11,810	.047
Shoshone													11	58,810	4,216	.072
Salt Lake Basin	1	7,974	391	.049	15.1	332							6	45,067	2,739	.061
Sun River	1	8,135	336	.041	11.0	335	(7) 1	17,732	1,025	.058	15.8	367	15	121,631	6,524	.054
Uncompahgre	1	9,046	423	.047	14.9	548							10	62,798	3,322	.053
Umatilla-McKay													1	11,410	399	.035
Vale	1	14,210	989	.070	12.2	392							16	137,142	9,126	.066
Yakima	4	23,355	1,294	.055	13.8	343	(8) 1 (9) 1	8,186 928	390 69	.048 .074	20.7 10.4	415 186	28	166,220	7,164	.043
Yakima-Kittitas	1	7,522	477	.063	14.0	614	(8) 10 (9) 1 (5) 1	117,149 1,630 11,035	4,554 91 688	.039 .056 .062	18.1 12.9 16.2	330 296 317	25	225,461	9,199	.041
Yuma	1	11,017	1,093	.099	14.5	254							37	283,801	14,824	.052
Total	25	219,639	11,635	.053	15.2	387	(5) 2	23,660	1,074	.045	19.7	438	329	2,611,264	123,465	.054
Do							(6) 1	10,781	1,012	.091	13.9	245				
Do							(7) 1	17,732	1,025	.058	15.8	367				
Do							(8) 11	125,335	4,944	.039	18.3	335				
Do							(9) 2	2,558	160	.063	11.9	232				

NOTE.—All costs shown above include depreciation.

CONSTRUCTION was started during April on the airways administration building which is being erected at Fly Field, Yuma project, by the Air Corps at a cost of $5,000. This building will be used to house a permanent staff of service men for Army and Navy planes landing at Fly Field, as well as temporary quarters for Army or Navy pilots while stopping at the field. This field, which has clay surfaced run ways and a steel and concrete hangar, as well as the latest type gasoline servicing equipment, will, when equipped with field lights for use in connection with the new air mail route, be one of the most modern fields in the State. It has a very desirable location, along a paved highway with no natural or artificial obstructions surrounding the field, and is within 3 miles of the center of Yuma.

APPROXIMATELY 5,000 acres of sugar beets have been contracted for the season on the Milk River project, or an increase of about 1,500 acres over the 1930 contracted area. On the Malta and Glasgow divisions about 1,800 acres will be seeded as compared to 1,019 acres during 1930. This crop continues to increase in importance on our northwestern projects.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, is planning to leave Washington on June 20 on an extended western trip. On June 22 he will give an address at the meeting in Ames, Iowa, of the American Society of Agricultural Engineers. At 11 o'clock p. m., June 22, Doctor Mead will join the members of the Appropriations Committee of the House of Representatives and Hugh A. Brown, director of reclamation economics of the Bureau of Reclamation, and together they will proceed on a trip through a number of the Western States, devoted largely to an inspection of national parks and Federal reclamation projects under construction or proposed, their first stop being at Kearney, Nebr. A day will be spent at Hoover Dam site and several days in a careful examination of irrigation conditions in the San Joaquin and Sacramento Valleys. On July 10 the commissioner will address the regular weekly meeting of the Commonwealth Club of California in San Francisco on "Building the Hoover Dam."

During the course of the trip it is expected that the party will be accompanied by the State authorities and Representatives in Congress of the various States in which the projects are located.

At the invitation of President Hoover a number of officials of the Interior Department, including Dr. Elwood Mead, Commissioner of Reclamation, on May 16 and 17 visited the President's camp at the Rapidan to discuss expenditures in the Interior Department.

Louis C. Cramton, special attorney to the Secretary, left for the West on May 22, after spending a couple of weeks in the Washington office in the preparation of the regulations for issuing permits and leases to carry on business and for residence purposes at Boulder City. Mr. Cramton attended the annual convention in Los Angeles of the California Bankers Association, May 21–23, and delivered an address on the subject of "The Importance of Hoover Dam to Business in California," after which he returned to his post in Las Vegas.

Miss Mae A. Schnurr, assistant to the commissioner, on May 17 addressed the members of the Chi Sigma Delta Sorority of the Columbia "Tech" School at the American Association of University Women's Clubs, Washington, D. C., her subject being "Opportunities for Women in the Business World and the Attractions of the Federal Service."

Secretary Wilbur has invited the governors of States in the Colorado River basin, excepting California, to send representatives to a conference to discuss the scope and character of investigations to be undertaken by the Bureau of Reclamation under section 15 of the Boulder Canyon project act, for which there is an appropriation of $150,000 available. This conference is called for June 9 at Denver, Colo., and Porter J. Preston, superintendent of the Yuma project, will act as the representative of the Bureau of Reclamation.

Porter J. Preston, in charge of the Colorado River Basin investigations, with headquarters in Denver, left the Denver office on May 24 to join William S. Post, Director of Irrigation, Indian Service, and Lieut. John Dean, Corps of Engineers, War Department, at Winslow, Ariz., where they will examine the situation regarding the Little Colorado River's encroachment upon the Luepp Indian Agency building.

On April 16 L. J. Foster, superintendent of the Uncompahgre project, and nine members of the Uncompahgre Water Users' Association visited the Grand Valley project for the purpose of inspecting the drainage systems as constructed in the valley.

C. A. Bissell, chief of the engineering division, has tendered his resignation, effective June 30. Mr. Bissell has been with the bureau since 1908 and is resigning to take a position as assistant chief designing engineer with the Metropolitan Water District of Southern California with headquarters in Los Angeles.

H. P. Fulkerson has been transferred from the Sun River project to act as construction inspector on drainage work on the Belle Fourche project.

H. H. Atkinson, attorney general for Nevada, called on Doctor Mead and Mr. Cramton during the early part of May to discuss the status of Boulder City.

J. T. Whitehead, who has been closely connected with matters relating to the interstate division of the North Platte project and for 20 years has served as president of the board of directors of the Pathfinder irrigation district, has resigned and will devote his time to private matters.

On June 20 representatives of the agricultural development departments of the transcontinental railroads traversing the Federal irrigation projects will attend a conference in the Washington office to discuss plans for the reclamation exhibit at the Century of Progress World's Fair in Chicago in 1933.

Representatives Addison T. Smith of Idaho, William W. Hastings of Oklahoma, Frank Murphy and wife of Ohio, Don B. Colton of Utah, Dennis Chavez of New Mexico, and William Duval, clerk to the committee, S. M. Dodd, finance officer, Hon. Charles J. Rhoads, Commissioner of Indian Affairs, A. H. Demaray, assistant director of national parks, and Frederick J. Bailey, budget officer, spent two days on the Carlsbad project the latter part of April, during which a visit was made to the Carlsbad Cave.

S. O. Harper, general superintendent of construction, Denver office, spent several days during the latter part of April on the Grand Valley project, where he discussed with the board of directors of the Grand Valley Water Users' Association the proposed power contract with the Public Service Co.

Robert B. Smith, chief clerk of the Riverton project, was transferred to the Owyhee project, effective April 21.

D. W. Cole, for many years one of our project managers and the construction engineer during the construction of Shoshone dam, was a recent visitor on the Shoshone project.

Roger R. Robertson, assistant engineer on the Lower Yellowstone project, has been transferred to the Rathdrum Prairie investigations with headquarters at Spokane. Donald D. Brooks, levelman, has been transferred to the Hoover Dam.

T. S. Martin, master mechanic, was at the Shoshone Dam during the entire month of April, supervising the installation of the third unit in the Shoshone power plant and the repairs to the balanced valves at the Shoshone Dam.

F. L. Kent, regional agricultural statistician from Portland, Oreg., called at the Yakima project office on April 17 for the purpose of securing information for a report on the production of peppermint.

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ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Engineer J. L. Savage, Chief Designing Eng., E. B. Debler, 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	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, Calif.
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. Chiseman	do	E. A. Peck	E. A. Peck	R. J. Coffey	Los Angeles, Calif.
Uncompahgre	Montrose, Colo.	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Owyhee, Oreg.	F. A. Banks	Constr. engr	Robt. B. Smith	F. P. Greene	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	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	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Lower Yellowstone	Savage, Mont.	H. A. Parker	do	N. O. Anderson	Denver office	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	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	H. J. S. Devries	El Paso, Tex.
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	B. E. Stoutemyer	Portland, Oreg.
Klamath [6]	Klamath Falls, Oreg.	B. E. Hayden	do	N. G. Wheeler		do	Do.
Owyhee	Owyhee, Oreg.	F. A. Banks	Constr. engr	Robert B. Smith	F. P. Greene	do	Do.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	do	Do.
Salt Lake Basin [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	Wm. J. Burke	Billings, Mont.
Yakima [8]	Yakima, Wash.	John S. Moore	Acting supt.	R. K. Cunningham	C. J. Ralston	J. R. Alexander	Las Vegas, Nev.
Yakima Cle Elum Dam	Cle Elum, Wash.	R. J. Newell	Constr. engr	C. B. Funk	do	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash.	R. B. Williams	Constr. engr	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent		Denver office	do	Do.
Shoshone [9]	Powell, Wyo.	L. H. Mitchell	do	W. F. Sha	do	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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] Reservoir, power plant, and Willwood division.

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

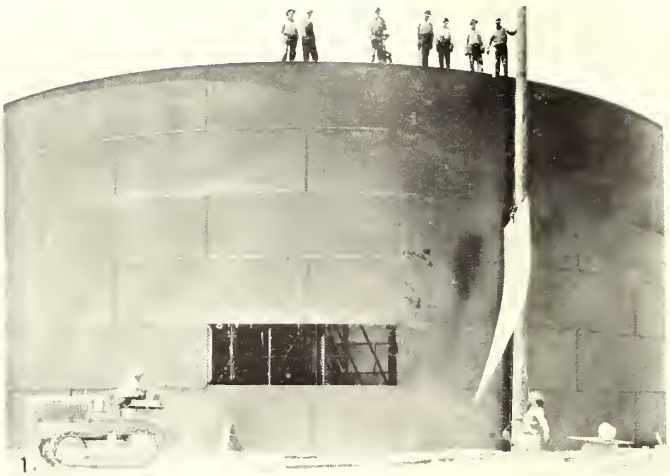
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A.	Phoenix, Ariz.	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Palisade, Colo.	C. W. Tharp	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, 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.	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do.	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A.	Provo, Utah	Lee R. Taylor	Manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.		Superintendent	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.	Sydney J. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa, Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts

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.
North Platte River power	do	Denver office	None.
Rathdrum Prairie, Idaho	Spokane, Wash.	H. W. Bashore	None.

SALLIE A. B. COE, *Editor*.



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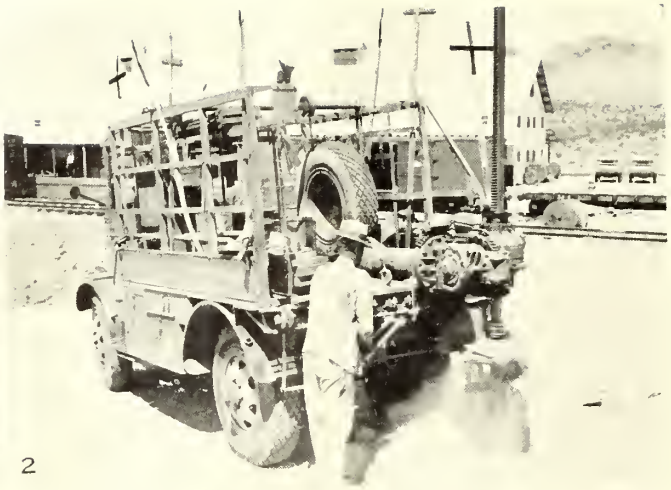

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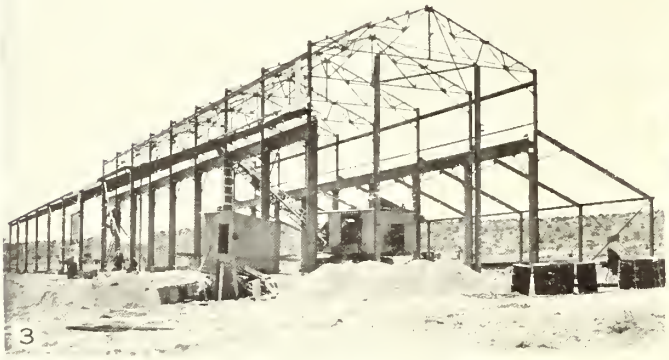
BOULDER CANYON PROJECT



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4

CONSTRUCTION ACTIVITIES

5

6

1. THE [illegible]-GALLON STORAGE TANK FOR BOULDER CITY WATER SUPPLY. 2. THIS MACHINE BORES AS HIGH AS 168 TELEPHONE POLE HOLES IN 7 HOURS. 3. SIX COMPANIES ARE ERECTING A LARGE MACHINE SHOP. 4. SIX COMPANIES ARE CONDUCTING AN OPEN-AIR CARPENTER SHOP WHERE A BAND SAW CUTS MATERIAL TO PROPER DIMENSIONS FOR BUILDINGS UNDER CONSTRUCTION. 5. WORKING ALONG THE CANYON SIDE A SHOVEL IS CUTTING A ROAD TO THE LOWER END OF THE NEVADA DIVERSION TUNNELS; THIS WILL CONNECT WITH THE HIGHWAY ON TOP OF THE CANYON. 6. HALFWAY BETWEEN THE UPPER END OF THE DIVERSION TUNNELS AND THE DAM SITE THE SIX COMPANIES ARE OPERATING A DRILL SHARPENING SHOP ON THE ARIZONA SIDE IN A LARGE CAVE WHICH AFFORDS A COOL SPOT FOR SUCH WORK

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22, NO. 7 JULY, 1931

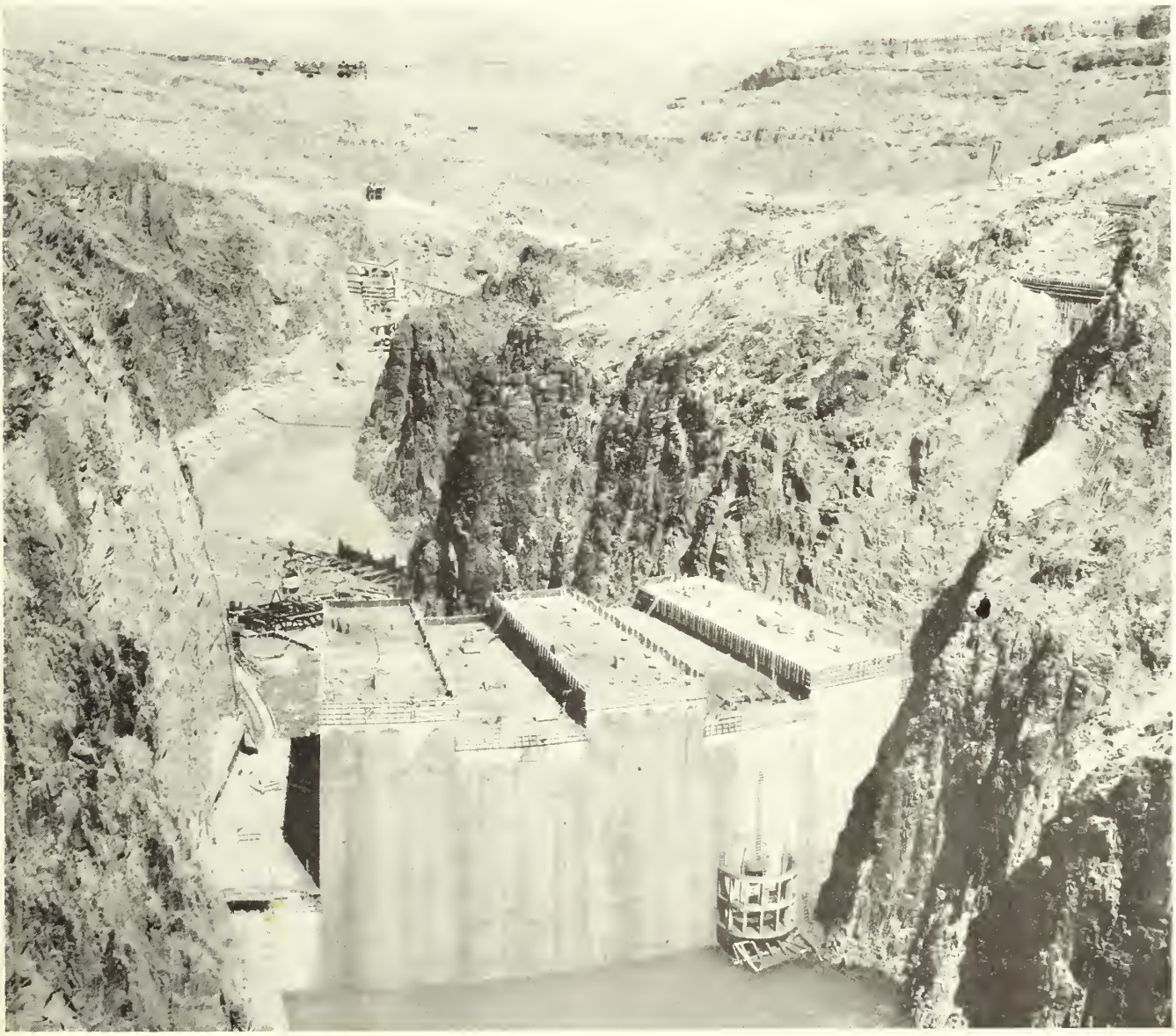


Photo by C. A. Betts

OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO. CONSTRUCTION 66 PER CENT COMPLETE, MAY 31, 1931

RECLAMATION
A PROVEN EXPERIMENT

~

The reclamation activities of the United States Government form a huge experiment in the reclamation and settlement of lands under irrigation. The lessons of this governmental work are of fundamental character and may be applied everywhere for the reclamation and settlement of lands under a low rainfall. It is extremely fortunate that such work, which in retrospect constitutes an experiment in the reclamation and settlement of arid and semiarid lands, was undertaken with the unlimited means of a governmental agency.

A great era of reclamation and colonization awaits our country. An increasing population and changing economic needs and social ideals will make new demands upon our vacant lands from shore to shore. This coming work should be done faithfully, by the use of our best knowledge. This is a day of reclamation, not waste. The chapter in reclamation, now opening, should be written in the full light of the luminous chapters already written into our national experience.

—John W. Widtsoe, Ph. D., LL. D.

NEW 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. 22, No. 7 JULY, 1931

Interesting High Lights on the Federal Reclamation Projects

THE proposed new Federal building in Yuma, Ariz., to be erected on a suitable site, for which $190,000 have been appropriated, will probably house the post office, Customs Service, Immigration Service, and other local Government agencies at present located in leased quarters. The work will be under way in the immediate future.

THE Veterans' Memorial Building at Orland, Calif., was recently dedicated with appropriate exercises under the auspices of the Orland Tommy A. Thompson Post, of the American Legion. A flower show was held by the agricultural vocational instruction corps of the Orland High School in cooperation with the Women's Improvement Club; the show also embraced contests of residence lawns and rock gardens.

A PROGRAM is now under way to establish a dairy cooperative on the Uncompahgre project.

IT is reported that a site approximately 2 miles east of the local airport and 7 miles southeast of Yuma on a paved highway over the Yuma Mesa has been procured for the proposed 2,000-watt Department of Commerce Airways Radio Station. The station will be operated 24 hours daily, and meteorological observations will be taken several times each day, when weather data will be broadcast to various stations in the United States, and will also be available to planes equipped with receiving sets flying over this route.

THE 1931 graduating class of the Yuma Union High School held its commencement exercises the first week in June. This class, consisting of 83 students, was the largest in the history of the school.

WORD has been received that on 5 acres near Artesia, Eddy County, N. Mex., in the vicinity of the Carlsbad project, W. T. Haldeman gathered 17 bales of cotton in 1930. This large crop, which was grown under irrigation, establishes a new record in Pecos Valley for the production of cotton.

ALFALFA looks unusually well on the Sun River Project.

THE improvement of farms on the Milk River project continues. Much work is being done on new farms in leveling and otherwise improving lands which will not be irrigated this year. A marked improvement in irrigation practice is evident, especially on the Malta division. In many cases the old check method has been replaced by the border system of irrigation, resulting in much more efficient use of water and decided benefit to mosquito control.

THE Minidoka and Cassia County wool pools, Minidoka project, offered for sale early in June the year's clip of wool. The quality of wool is reported to be exceptionally high and considerable competition for its purchase was anticipated.

ALL livestock on the Lower Yellowstone project is in excellent condition. Shearing was completed at the end of May. The lamb crop was exceptionally heavy, many farm flocks averaging 150 per cent. Range conditions outside of the project are very serious owing to lack of rain.

THE entrymen on the 24 farm units recently opened on the Tule Lake division of the Klamath project have made a very satisfactory showing. Practically all of the area is under crop.

FORMATION of the Hermiston Cooperative Creamery on the Umatilla project was completed recently, with a sign-up of 1,200 cows. One director was elected from each of the following districts: Stanfield, Hermiston, Westland, Umatilla, Irrigon, and Boardman.

THE cucumber acreage on the Belle Fourche project will be increased about 50 per cent over that of last year as a result of the Squire Dingee Co.'s instructions to its field man that more contracts in this vicinity would be acceptable.

R. B. Williams, construction engineer of the Kittitas division, Yakima project, reports that on June 7 the concrete-lined tunnel under the Yakima River was successfully tested and placed in operation. Owing to the urgent demand for water for the irrigation of crops on the north side of the river, full leakage tests were not completed, but the short-time test that was made showed the tunnel to be in good condition. This is one of the major structures built by the Bureau of Reclamation and is fully described in the New Reclamation Era of December, 1930.

THE construction of the $5,000 Airways Administration Building at Fly Field, on the Yuma Mesa, has been completed. This building was erected by the Air Corps to house a permanent staff of service men for Army and Navy planes, as well as to provide quarters for their pilots when staying over night.

EQUIPMENT has been purchased for an alfalfa leaf meal plant to be located at some point on the Boise project. This plant will be installed by a company operating a chain of these plants throughout the West and marketing their product in prepared chick and calf feeds.

Filing System for Application for Leases and Concessions at Boulder City

By Jesse W. Myer, Chief, Mails and Files Section, Washington Office

ABOUT the last of March I was instructed by Commissioner Mead to proceed to Las Vegas, Nev., for the purpose of devising and installing a filing system to care for the correspondence and preliminary applications for leases and concessions being received for different types of business in Boulder City.

Owing to the publicity that had been given the proposed city by the press, people from all sections of the country were showing great interest in obtaining permits to conduct various businesses there. Although most of the letters of inquiry were from men, many letters were also received showing that women were interested. About 3,000 letters of inquiry were received up to May 18, and they were still coming in at the rate of about 15 a day. About the same number of persons were calling at the Las Vegas office daily for personal interviews and before departing they would leave their names and addresses so that a formal application blank could be mailed to them.

It had been decided to consider only applications made upon one of the formal application blanks, so it was necessary, therefore, to mail to each of the applicants who had filed letters or preliminary applications one of these formal application blanks. This necessitated addressing about 3,000 envelopes, which task was completed prior to the time the formal application blanks were received from the Washington office so there would be no delay in getting the blanks into the hands of applicants.

THE FILING SYSTEM IN BRIEF

A brief description of the filing system installed in the Las Vegas office follows:

The files of the Washington and Denver offices were shipped to Las Vegas and all letters and preliminary applications in the three files consolidated.

The file was arranged alphabetically by kind of concession wanted, and the applications were filed alphabetically under the name of the applicant within the proper folders. To accomplish this it was necessary to read and classify each of the approximately 3,000 letters or preliminary applications. As a result of this classification it was found that there were on file requests for permits to conduct 74 different kinds of businesses as follows: General; air lines and landing fields; automobile accessories; automobiles, rental of (see bus and motor transport); automobile sales agencies; bakery and confectionery; banks; barber shop and beauty parlor; boarding houses; boats and ferries; book store; bottling plants; bus and motor transport; chiropractors and osteopaths; churches; cigar and news stand; commissary; contracting and building; curio stores; dairy; delicatessen; dentists; drug stores; electrical contracting—stores and supplies; electrical refrigeration; filling stations; furniture and house furnishings; garbage disposal; garage and service stations; gas manufacturing plants—illuminating, cooking, etc.; general store; grocery and meat market; hardware; hospital; hotel; ice-cream manufacturing plant; ice manufacturing plant and cold storage; industrial plants (small)—metal and machine shops; investment building—houses and stores for sale or rent; jewelry; landing fields (see air lines); laundry and dry-cleaning plants; lawyers; lots, lease of, for residential purposes; lumber and building materials (coal yards); lunch stands; markets, public; men's furnishings; newspapers—printing and advertising; pawnbroker and loan office; petroleum products, distribution of (wholesale); physicians; photography; plumbing and heating; radio and music stores; real estate and insurance; recreation, indoors; recreation-outdoors; restaurants; shoe shop and shoe repair; signs and painting; sightseeing tours, auto (see bus and motor transport); soft-drink stand; stage lines (see bus and motor transport); tailoring—cleaning and pressing; taxi service (see bus and motor transport); telegraph and radio service (communications); theaters; telephone service; tires and batteries; tourist camp; undertakers; vendors (slot machines); women's wear.

APPLICATIONS SUBDIVIDED

The applications were further divided into the four classes provided for in the circular of information of May 18, issued by Mr. Cramton: A, exclusive; B, limited; C, special; D, personal. These classifications were made the main headings for the file. For example, applications for permits involving the operation of what is in effect a public utility, or where such limitation is in the public interest, as the hospital, telephone system, garbage plant, landing field, etc., may be granted an exclusive permit. Folders containing this class of applications are filed alphabetically behind a guide card containing the heading "(A), exclusive." Back of a guide card "(B), limited," are filed the folders containing the bulk of the applications, as this classification contains the usual line of wholesale and retail business where at least two competing permits will be granted. Under "(C), special," will be found industries or services requiring special treatment such as automobile sales, gasoline and oil distributors, banks, motor lines to connect with outside points, telegraph and radio companies, etc., and under "(D), personal," will be found the applications from reputable members of the professions where personal service is rendered and no large investment is involved in establishing an office. Under this heading will be found the applications from doctors, dentists, etc.

A separate folder was established for each kind of concession requested except in cases where, in a review of the applications, there was found a certain business so closely related to another business that it was probable that one permit would be granted that would authorize conducting both businesses as one. For example, applications are on file for permits to conduct groceries and others to conduct meat markets, but it was found that a greater number had made applications for a permit to conduct a grocery and meat market combined. Therefore it was advisable to combine all three kinds of applications in one file and call it "Grocery and meat markets." There were other similar cases where combinations of this kind were made.

CONCESSIONS CARD INDEXED

A card index of all the various kinds of concessions for which application had been made was prepared. These cards are filed alphabetically and in the upper right-hand corner appears the classification. For example, take the grocery and meat market file. There is a card "Grocery and meat market" and a cross card "Meat market." This card index furnishes a convenient record of all of the concessions for which applications have been received and also locates those that have been combined with others. The classification "B, limited," appearing in the upper right-hand corner tells the file clerk under which classification in the file the folder "Grocery and meat market" will be found.

No attempt was made to prepare a card index by names of the applicants, but it is proposed to prepare this index when the formal applications are received. In addition to the name and address of the applicant, the card will also show the kind of concession wanted. This alphabetical index by name of the applicant

will enable the file of any applicant to be located when the name of applicant is the only information available. The preparation of this index was delayed until receipt of formal applications as it was thought that many who had filed the preliminary applications in the form of letters would not complete and file formal applications.

A duplicate set-up of the file used for the preliminary applications was prepared for the formal applications. As a formal application is received any correspondence from the same applicant in the preliminary application file will be withdrawn and attached to the formal application and then filed in its proper file. After the closing date for receipt of applications, June 30, 1931, the file of formal applications will become the active file and the file containing the preliminary applications will be closed and of no value but will be retained as a matter of record.

In addition to the file established to care for the applications a file by subjects was established to care for the correspondence relating to questions of administration and policy in connection with Boulder City.

Colorado River Planning Commission Holds Meeting

A conference of the Colorado River Planning Commission, called by the Secretary of the Interior, was held in Denver on June 9. The following delegates were in attendance: Arizona—Thomas Maddock, secretary, Arizona Colorado River Commission, and Clifton Mathews; New Mexico—George M. Neel, State engineer, and Judge E. R. Wright, counsel; Utah—W. W. Ray, attorney, and W. D. Beers; Nevada—George Malone, State engineer; Wyoming—John A. Whiting, State engineer, J. A. Greenwood, attorney-general, and R. J. Jackson, assistant attorney general; Colorado—M. C. Hinderlider, State engineer, R. J. Tipton, assistant State engineer, and C. L. Ireland, attorney general; Bureau of Reclamation—R. F. Walter, chief engineer E. B. Debler, engineer, and Porter J. Preston, engineer.

An allocation of funds among the six States was discussed and it was decided that no allocation should be made. Each of the six States is to submit a list of projects which they wish investigated. It was the desire of the delegates that investigations be started in Wyoming at once and in Utah as soon as practicable.

A second meeting of the commission is to be held within 60 days to discuss the plan of investigations to be outlined by the bureau.

Committees will Coordinate Work on Hoover Dam

THE Six Companies (Inc.), which has the contract for construction of Hoover Dam, is rapidly working out the details of organization to carry on the work. A committee plan has been adopted for the supervision of the various functions which must be exercised in executing the contract, such as construction, purchasing, housing and feeding workers on the job, transportation, and insurance and hospitalization.

H. J. Lawler, of the Utah Construction Co., is chairman of the construction committee which will decide upon all policies and details in connection with construction. His headquarters are in the Phelan Building, San Francisco. Other members of this committee are E. O. Wattis, of the Utah Construction Co.; Charles A. Shea, of the J. F. Shea Co.; W. A. Bechtel, jr., of the W. A. Bechtel Co.; and H. W. Morrison, of Morrison-Knudson Co.

C. D. Bechtel, of the W. A. Bechtel Co., 603 Stock Exchange Building, San Francisco, is chairman of the purchasing committee. His aides are Allen Macdonald, of Macdonald & Kahn Co. (Ltd.), and L. S. Corey, of Utah Construction Co. This committee will have charge of all purchasing and is now determining policies and compiling lists of concerns with which it expects to deal. According to the chairman, it prefers to deal with large manufacturers and distributors. Later a branch purchasing office will be opened at Las Vegas, Nev.

Henry J. Kaiser, of Kaiser Paving Co., 603 Stock Exchange Building, San Francisco, is chairman of the Boulder City committee. Other members are Felix Kahn, of Macdonald & Kahn; K. K. Bechtel, of W. A. Bechtel Co.; and Frank T. Crowe, superintendent of construction for the Six Companies. This committee will supervise the housing of workers on the project.

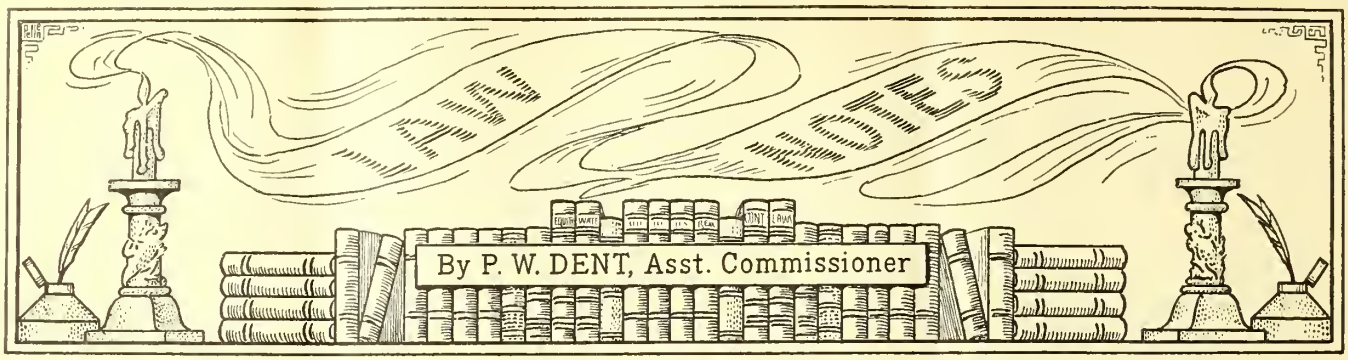
S. D. Bechtel, of W. A. Bechtel Co., 603 Stock Exchange Building, San Francisco, is chairman of the transportation committee. Other members are Felix Kahn, K. K. Bechtel, Henry J. Kaiser, and Frank T. Crowe. This committee will supervise the transportation of all materials and equipment to and from the dam.

W. A. Bechtel, sr., vice president of the Six Companies, will for the present have charge of insurance and hospitalization on the project.

Headquarters of the Six Companies are at 510 Financial Center Building, San Francisco. W. H. Wattis, of the Utah Construction Co., is president.—*Southwest Building and Contractor, Los Angeles, Calif.*

A recent survey shows that in Argentina nearly 3,700,000 acres of land are under irrigation.

UNITED STATES CUSTOM HOUSE, DENVER, COLO.
New fireproof home of the Denver office, Bureau of Reclamation.



Court Upholds Secretary's Power to Allocate Warren Act Profits

IN Wilbur, Appellant, *v.* Minidoka Irrigation District, Appellee, the Court of Appeals of the District of Columbia, upheld the power of the Secretary of the Interior to allocate profits arising from the sale of water under the Warren Act on the Minidoka Project.

The decision in full follows:

APPEAL FROM THE SUPREME COURT OF THE DISTRICT OF COLUMBIA

Before MARTIN, Chief Justice, and ROBB VAN ORSDEL, HITZ, and GRONER, Associate Justices

AN APPEAL FROM A DECREE OVERRULING A MOTION TO DISMISS PLAINTIFF'S BILL OF COMPLAINT FOR WANT OF EQUITY, AND, IN THE ABSENCE OF AMENDMENT, GRANTING RELIEF TO PLAINTIFF AS PRAYED IN THE BILL

The case arises under the act of Congress of June 17, 1902 (32 Stat. 388), known as the reclamation act. The appellant is the Secretary of the Interior. The appellee, plaintiff below, is the Minidoka irrigation district, a corporation formed under the provisions of the reclamation act.

The reclamation act provides generally that the funds obtained from the sale of public lands in certain Western States shall be set aside and appropriated as a special fund in the Treasury to be known as the reclamation fund, to be used in the construction and maintenance of irrigation works for the reclamation of arid lands in such States, and that the cost of each project shall be charged against the lands irrigated, and as rapidly as such charges shall be paid back by the landowners into the reclamation fund the money shall be used again for the construction of like works. The act authorizes the Secretary of the Interior to perform any and all acts to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of the act into full force and effect. The Secretary is also authorized by the act of February 21, 1911, known as the Warren Act (36 Stat. 925), to sell excess water from such storage at charges to the fixed by him; and it is provided by the act of December 5, 1924 (43 Stat. 672, 703), that all moneys or profits as determined by the Secretary derived from the sale or rental of surplus water under the Warren Act shall be credited to the project or division of the project to which the construction has been charged.

BILL OF COMPLAINT

The bill of complaint filed below sets out that the Secretary of the Interior, under authority of the act, planned and constructed an irrigation project on Snake River, in Idaho, known as the Minidoka project, consisting of a storage dam with canal systems supplying water to the lands within the project, together with a storage dam and reservoir constructed at Jackson Lake, Wyo.; that the land within the project on the north side of Snake River, comprising 71,000 acres, has been known as the gravity division of the Minidoka project, and now constitutes the Minidoka irrigation district, while the land on the south side of the Snake River, comprising 49,000 acres, has been known as the pumping division of the Minidoka project, and now constitutes the Burley irrigation district; that the storage dam at Jackson Lake was built at an elevation of 6,752 feet, and the storage capacity thereof, when completed, was approximately 380,000 acre-feet and that the entire cost of its construction, to-wit, the sum of $440,424.90, was charged against the two units aforesaid; that afterwards the Secretary of the Interior sold a capacity of 102,000 acre-feet of excess water from the storage dam aforesaid under the Warren Act, supra, and realized therefrom the sum of $492,412.50, which has been deposited in the United States Treasury to the credit of the reclamation fund, and also that rentals for excess water have been collected by the Secretary in the sum of $161,106.65, all of which, under subsection J of the act of December 5, 1924, supra, should have been credited to the two units against which the costs of construction had been charged, namely, the plaintiff and the Burley irrigation district; but that the Secretary had failed and refused to credit the proceeds as aforesaid, and had wrongfully credited 27.7 per cent thereof to certain so-called "new divisions" which, in fact, were not part of the Minidoka project, and had never been charged with any part of the cost of the Jackson Lake Dam; that plaintiff appeared before the Secretary and objected to this procedure, but the Secretary had refused to correct the same; wherefore plaintiff prayed for a mandatory injunction requiring the Secretary to credit the entire proceeds aforesaid to the two districts so entitled to them.

COMPLAINT DENIED BY SECRETARY

In the statement of its case the plaintiff appended to the bill of complaint an exhibit entitled "Exhibit G," whereby it appeared that plaintiff and the Burley irrigation district had theretofore filed a joint protest with the Secretary, setting out the same demands as those contained in the bill of complaint; that this was heard by the Secretary upon briefs and oral hearings submitted by their counsel, and that the Secretary had held in part as follows: That in fact, as appeared from the records, the entire cost of the construction aforesaid had not been charged against the two districts as alleged by plaintiff, but that 27.7 per cent of such costs had been charged against certain "new divisions," the construction of which as a "north-side pumping division" had been contemplated by the department since the year 1908; and that accordingly 27.7 per cent of the proceeds realized from the sale and rental of excess water, as aforesaid, had been rightfully credited to such "new divisions," leaving the balance of the proceeds to be credited to plaintiff and the Burley irrigation district, which had been done; and that accordingly the

claim of the two districts to be credited with the entire sum so realized had rightfully been denied, and a rehearing afterwards refused.

The motion to dismiss plaintiff's bill of complaint was directed against the entire bill, including the exhibit attached to it. The bill when thus considered consists of two parts, first, a statement of facts upon which the plaintiff relies as a ground for relief, and, second, an exhibit showing that the same statement had theretofore been submitted to the Secretary and by him found to be untrue, and that the Secretary had denied the relief therein sought by plaintiff.

It is clear that the Secretary in the former hearing was acting within his jurisdiction in a quasi-judicial capacity, and that the issue presented by the plaintiff in the present bill of complaint was considered and decided by him upon the law and the evidence; that his decision was not arbitrary or capricious, and that the present case is no more than an attempt to appeal from that decision in order to secure a retrial of the same issues of fact and law by a court of equity. Moreover, the remedy which plaintiff seeks is in substance and effect a judgment in mandamus directing the Secretary to act contrary to the facts and law of the case as found by him. Such an appeal will not be entertained by the courts.

In *Louisiana* v. *McAdoo* (234 U. S. 627, 633) it is said by Mr. Justice Lurton for the court:

"There is a class of cases which hold that if a public officer be required by law to do a particular thing, not involving the exercise of either judgment or discretion, he may be required to do that thing upon application of one having a distinct legal interest in the doing of the act. Such an act would be ministerial only. But if the matter in respect of which the action of the official is sought, is one in which the exercise of either judgment or discretion is required, the courts will refuse to substitute their judgment or discretion for that of the official entrusted by law with its execution. Interference in such a case would be to interfere with the ordinary functions of government." See Work *v.* Rives (267 U. S. 175), and authorities there cited.

The motion to dismiss the bill for want of merit should have been sustained by the lower court. The decree is therefore reversed and the cause is remanded for further proceedings not inconsistent herewith.

(Signed)

George E. Martin,
Chief Justice, Court of Appeals,
of the District of Columbia.

Mr. Justice Van Orsdel concurs in the judgment.

Recently Enacted Legislation

Wages for Laborers and Mechanics Employed on Public Buildings

[Public—No. 798—71st Congress]

An Act Relating to the rate of wages for laborers and mechanics employed on public buildings of the United States and the District of Columbia by contractors and subcontractors, and for other purposes.

That every contract in excess of $5,000 in amount, to which the United States or the District of Columbia is a party, which requires or involves the employment of laborers or mechanics in the construction, alteration, and/or repair of any public buildings of the United States or the District of Columbia within the geographical limits of the States of the Union or the District of Columbia, shall contain a provision to the effect that the rate of wage for all laborers and mechanics employed by the contractor or any subcontractor on the public buildings covered by the contract shall be not less than the prevailing rate of wages for work of a similar nature in the city, town, village, or other civil division of the State in which the public buildings are located, or in the District of Columbia if the public buildings are located there, and a further provision that in case any dispute arises as to what are the prevailing rates of wages for work of a similar nature applicable to the contract which can not be adjusted by the contracting officer, the matter shall be referred to the Secretary of Labor for determination and his decision thereon shall be conclusive on all parties to the contract: *Provided,* That in case of national emergency the President is authorized to suspend the provisions of this act.

Sec. 2. This act shall take effect thirty days after its passage but shall not affect any contract then existing or any contract that may thereafter be entered into pursuant to invitations for bids that are outstanding at the time of the passage of this act.

Approved, March 3, 1931.

Relinquishment of tract of land to Rupert, Idaho

[Public—No. 642—71st Congress]

An Act To provide for the relinquishment by the United States of certain lands to the city of Rupert in the county of Minidoka, in the State of Idaho

That the Secretary of the Interior is hereby authorized to quit claim to the city of Rupert in the county of Minidoka, in the State of Idaho, all of the right, title, and interest of the United States in or to that certain tract of land in the Government town site of Rupert on the Minidoka reclamation project, more precisely bounded and described as follows: Beginning at the northeast corner section 29, township 9 south, range 24 east, Boise meridian; thence south six minutes west twenty-one and one-tenth feet along the section line; thence south forty-five degrees twenty-two minutes west along the Oregon Short Line Railroad right of way three thousand seven hundred and thirty and eight-tenths feet to a point on the east and west center line of said section 29; thence south eighty-nine degrees fifty-six minutes west along said center line one hundred and fourteen feet; thence north forty-five degrees twenty-two minutes east three thousand eight hundred and ninety-one and three-tenths feet to a point on the section line between sections 20 and 21; thence south six minutes west along said section line ninety-one and five-tenths feet to the point of beginning as shown on the official plat of the town site of Rupert, Idaho, said tract of land containing seven acres more or less.

Approved, February 14, 1931.

Sale of Power, Grand Valley Project

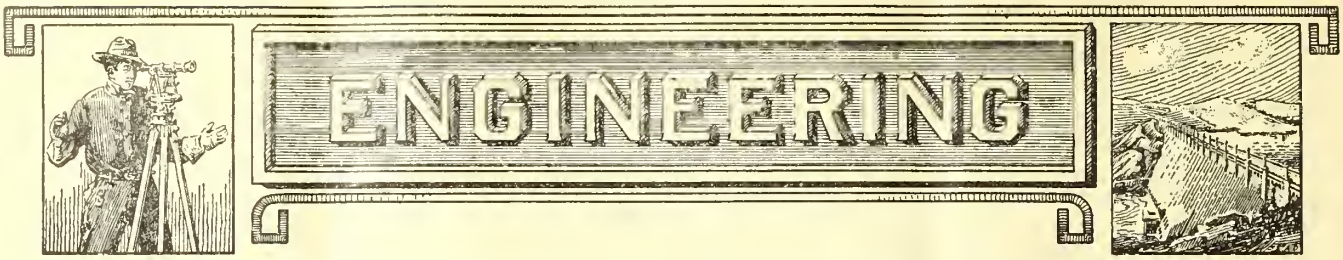
[Public—No. 708—71st Congress]

An Act Authorizing the sale of surplus power developed under the Grand Valley reclamation project, Colorado

That whenever a development of power is necessary for the irrigation of lands under the Grand Valley reclamation project, Colorado, or an opportunity is afforded for the development of power under said project, such development of power to be without expenditure of money from the reclamation fund or from the Treasury of the United States, the Grand Valley Water Users' Association, with the approval of the Secretary of the Interior, is authorized to enter into a contract or contracts for a period of not exceeding twenty-five years for the sale or development of any surplus power or power privileges in said Grand Valley reclamation project, Colorado.

Approved, February 21, 1931.

About 120,000 fingerling pike have been placed in Orman Reservoir, Belle Fourche project, by the State fish hatchery as a means of furthering the interest of that section as a pleasure resort.



All-American Canal to Serve a Million Acres

A Review of Report on All-American Canal Investigations

By H. J. Gault, Engineer, Bureau of Reclamation

THE All-American Canal, authorized for construction under the Boulder Canyon project act, will be 80 miles in length, and the branch canal to the Coachella Valley 130 miles long, according to a report on "All-American Canal Investigations" by H. J. Gault, dated May, 1931. These investigations have been carried on since May, 1929, by the Bureau of Reclamation in cooperation with the Imperial irrigation district and the Coachella Valley County water district.

GENERAL DESCRIPTION

It is planned to divert from the Colorado River at a point about 5 miles above the Laguna Dam of the Yuma (Federal) irrigation project, in section 9, T. 15 S., R. 24 E., S. B. M. The proposed diversion dam will be of the floating or Indian weir type, with a crest 1,700 feet long, providing floodway capacity of 170,000 second-feet without overtopping the gate structure. Total flood capacity of the works would be 259,000 second-feet, besides the canal diversions. Six desilting basins are provided, any five of which are to be used for diversion to the canal, while the sixth basin is being sluiced. The dam will raise the river water surface about 22 feet.

Capacity assumed for the main canal is 15,000 second-feet from the dam to Siphon Drop on the reservation division of the Yuma project, where 2,000 second-feet are diverted for this project; 13,000 second-feet from Siphon Drop to Pilot Knob, and 10,000 westward from Pilot Knob for the Imperial and Coachella Valleys. The Coachella Canal would carry 2,000 second-feet at the head and 1,000 where it enters Coachella Valley. It is estimated that the diversion dam, desilting works, All-American Canal, and Coachella Canal can be built for something less than $34,000,000. The Imperial Dam—Siphon Drop section of the All-American Canal—will have a bottom width of 130 feet, a water depth of 22 feet, and will carry an amount of water equal to 70 per cent of the average flow of the Colorado River at the Hoover Dam.

CANAL LOCATION

The route of the canal follows the river closely to Laguna Dam and then parallels the present Yuma main canal to the Siphon Drop. Several washes must be crossed by culverts or siphons. From the Siphon Drop to Pilot Knob the canal follows the foothills, and bridges for the Southern Pacific Railroad, the Inter-California Railroad, the State highway, and county road will be required. Beyond Pilot Knob, at three different points and for a total distance of 14.8 miles, the canal is located near to and parallel with the international boundary.

For 10½ miles the canal line passes through the sand hills, a region covered with dunes except for a few bare spots. The deepest cut in the sand-hill area is over 100 feet and the dune sand is about 80 feet in depth. Instead of lining the canal with concrete in this sand-hill area, it appears advisable to leave it unlined and prevent sand blowing into the canal as much as possible, and to remove the sand by suction dredges if necessary. The canal section through the sand hills is designed with a mean velocity of 4.5 feet per second at full capacity, which is intended to be nonscouring and nonsilting. Portions excavated in finer sand for the water section and liable to scour are to be overexcavated to a depth of 1½ feet and the space refilled with screened gravel to form a scour-resisting lining. Means of preventing sand from being blown into the canal may be by one or more of the following methods: (*a*) Growing vegetation on the sand in a zone on each side of the canal by irrigation from small pipe lines; (*b*) spraying the sand with crude oil; (*c*) covering the dune sand with material from the canal excavation in the mesa formation which is too coarse to be blown by the wind; (*d*) excavating a berm 15 feet wide on each side of the canal at the mesa floor level. By adopting these methods in operation it is expected that the quantity of sand blown or drifted into the canal will be small.

From the sand hills the canal line runs west across the east mesa to the present east high line canal of the Imperial district distribution system, and then through the extreme southern portion of the Imperial Valley, where it crosses 17 principal ditches and passes through the town of Calexico before it reaches its terminus, the present West Side main canal. Here the water surface is −6.7, and at this point the canal has capacity sufficient to supply lands under the West Side canal and also to furnish water for additional lands on the west side mesa.

COACHELLA CANAL

About 16 miles west of Pilot Knob the Coachella branch canal will take out of the All-American Canal and run in a northwesterly direction across the east mesa. The location crosses the Southern Pacific Railroad near Iris, passes east of the Salton Sea and the Coachella Valley to a point near the town of Coachella, where it again crosses the Southern Pacific and runs southwesterly across the valley, and then south to the Riverside-Imperial county line. There are more than 160 washes crossing the Coachella Canal line, ordinarily dry, but at times of heavy rains or cloudbursts, carrying floods of short duration, heavily loaded with sand and silt; these must be crossed with siphons or culverts. By combining these washes in groups by the use of training levees and diversion channels, the number of structures can be reduced to about 90. The last 47 miles of the canal will be lined with concrete.

SURVEYS

Soil surveys of 1920 in the Imperial Valley have been reviewed and a soil reconnaissance was made of the Pilot Knob mesa, lying east of the sand hills. The lands within the present Imperial irrigation district have been classified. Topography was taken of a zone along the All-American Canal covering a width of 1,000 feet and along the Coachella Canal of a zone 800 feet wide. The following additional field work is necessary: (1) Completion of topography along the

Coachella Canal; (2) relocation of first 10 or 15 miles of Coachella Canal; (3) studies and surveys of minor revisions of location; (4) studies for wasteways, surveys of washes, and location of training levees. Final location of turnouts for new lands can not be made until the lateral ditches are located, which in turn should follow topographic mapping and investigations of the irrigable areas.

The Imperial irrigation district, comprising 512,000 acres, is supplied with a complete system of lateral ditches, with about 425,000 acres in cultivation. In the Coachella Valley about 16,300 acres are now under cultivation, being supplied by pumping from wells. There is no general canal or lateral system in the Coachella Valley. The east and west mesas, the Dos Palmas area east of the Salton Sea, Pilot Knob mesa, and the greater part of the Coachella Valley are desert lands with no improvements. It is contemplated that the boundaries of the Imperial irrigation district will be extended to include lands in the Coachella Valley irrigable from the canal when constructed.

The accompanying table shows the irrigable lands west of Pilot Knob as determined by the Imperial irrigation district.

These areas may be materially changed after irrigable area surveys have been made.

There are opportunities for development of power at Pilot Knob and at several points on the canals, but such development must be financed by the irrigation district and other interested agencies. Where canal drops are planned for power development, chute drops will be built by the Government, but it is expected that power plants will eventually be constructed by the district. Before any money is appropriated for construction of this canal a repayment contract must be made with the irrigation district, and negotiations are now under way. This contract will provide for the delivery of stored water from the Hoover Reservoir and the Colorado River in accordance with allocations yet to be made.

All-American Canal project—Summary of irrigable lands west of Pilot Knob

Lands	Acres gravity	Acres under pump lifts					Total
		50 feet	100 feet	150 feet	200 feet	235 feet	
Imperial irrigation district	521,600						521,600
East mesa	195,432			950	1,484		197,866
Dos Palmas	10,450						10,450
Coachella	115,025		27,315	2,200	8,500		153,040
West mesa		29,500		85,289		11,000	125,789
Total, west of sand hills	842,507	29,500	27,315	88,439	9,984	11,000	1,608,745
Pilot Knob mesa					22,334		22,334
Grand total	842,507	29,500	27,315	88,439	32,318	11,000	1,031,079

NOTE.—Pumping lifts are approximate for the various areas and are representative of maximums.

Notes For Contractors

Baker project.—Specifications (No. 523) and invitations for bids have been issued for the construction of the Thief Valley Dam on the Baker project, Oregon. Bids will be opened at Nyssa, Oreg., on July 27. The dam will be of the buttressed type with reinforced concrete face slabs. It will be about 380 feet in length at the crest, of which about 270 feet will be occupied by an overflow spillway. The maximum height will be about 66 feet above bedrock. The outlet works will consist of two 4.8 by 6 foot openings controlled by cast-iron slide gates. The principal items and the estimated quantities involved are as follows: 8,000 cubic yards of all classes of excavation; 4,775 cubic yards of concrete; 200 cubic feet of grout; drilling 1,750 linear feet of grout holes; placing 390,000 pounds of reinforcement bars; installing 50,000 pounds of structural steel and metal work; diversion and care of river and unwatering foundations.

Boulder Canyon project.—Specifications and invitations for bids have been issued for the construction of the administration, dormitory, and municipal buildings at Boulder City, Nev. The grading, foundation excavation, and concrete foundations for the administration and dormitory buildings were included in separate specifications, bids under which were opened on June 17, 1931.

Specifications have been issued for the construction of the second group of three and four room residences to be conconstructed at Boulder City. This group of residences will be of the "All-Rolok" Flemish bond, hollow brick, outside wall type of construction. Plans and specifications are being prepared for a group of larger residences.

Plans have been completed and invitation for bids issued for the construction of the water-treating plant and sewage disposal plant for Boulder City and also for the electrical distribution system for the city.

Minidoka project, Gooding division.—Plans and specifications are being prepared for the construction of the last 8 miles of the Milner-Gooding Canal on the Gooding division. The specifications will cover the earthwork and the construction of structures.

Yakima project.—The Federal Pipe & Tank Co., of Seattle, Wash., has been awarded the contract for furnishing 6,212 feet of 34-inch continuous wood-stave pipe for the Kennewick Highlands low-lift discharge line (Specifications 512-D).

Specifications and plans for machinery for the Prosser power plant and the Kennewick Highlands pumping plant are nearing completion in the Denver office and will be advertised for bids in July.

Yakima project, Kittitas division.—Specifications have been completed for the construction of the remaining portion of the lateral system on this division. The work is divided into 11 schedules, 5 of which cover the earthwork excavation and 6 the construction of the lateral structures. The principal items and the estimated quantities of work involved are as follows: 412,000 cubic yards of lateral excavation, all classes; 16,600 cubic yards of excavation, all classes, for structures; 11,000 cubic yards of back fill; 1,780 cubic yards of concrete; 1,050 square yards of dry rock paving; 40 square yards of grouted paving; 40 cubic yards of riprap; placing 118,000 pounds of reinforcement bars; placing 77,000 feet board measure of lumber in bridges and flumes; placing 7,378 linear feet of all sizes of concrete pipe; placing 30,600 pounds of gates and gate lifts; placing 125 linear feet of No. 72 metal flume.

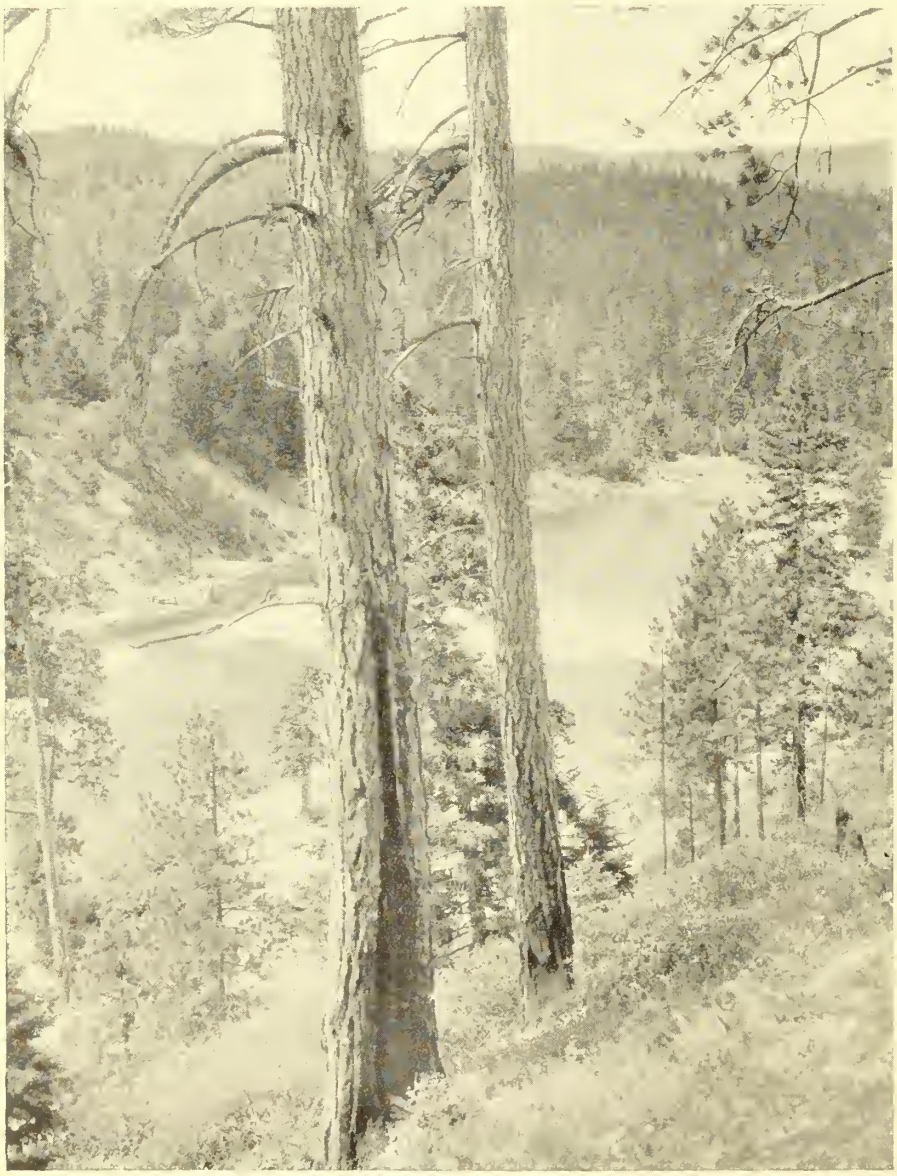
Yakima project, Cle Elum Dam.—Bids will be opened at the office of the Bureau of Reclamation, Yakima, Wash., at 10 a. m., on July 10, for the construction of the Cle Elum Dam and appurtenant works (Specifications No. 522). The main dam is to be a sprinkled and rolled earthfill embankment approximately 750 feet long on the crest and with a maximum height of 135 feet above stream bed.

Cle Elum Dam Advertised for Construction

The last one of the six storage reservoirs on the Yakima (Federal) irrigation project, in the State of Washington, is about to be constructed at an estimated cost of $3,500,000. The Bureau of Reclamation has asked for bids for clearing the reservoir site and constructing the Cle Elum Dam, bids to be opened at Yakima, Wash., on July 10.

OLD DAM TO BE REPLACED

There is at the present time a dam of rock-filled timber crib at the dam site, which will be replaced by a sprinkled and rolled earth-fill embankment, approximately 750 feet in length along the crest and having a maximum height of 135 feet above the stream bed. The downstream slope will be covered with gravel and cobbles and the upstream slope with a 12-inch layer of gravel and a 30-inch layer of dumped riprap. Above the dam the stream bed and side slopes for a distance of about 750 feet will be covered with an earth blanket, while below the dam a gravel and cobble blanket will be placed over the stream bed and a portion of the side slopes of the canyon for a distance of about 900 feet. The placing of about 1,200,000 cubic yards of material is required. About 1,000,000 acre-feet can be stored in the reservoir and this will provide ample water for the ultimate proposed development of the project.



Cle Elum dam site, showing old crib dam to be replaced by 135-foot earth-fill dam, Yakima project, Washington

The work is located on the Cle Elum River near its present outlet from the south end of Lake Cle Elum, about 8 miles northwest of the town of Cle Elum and 100 miles southeast of Seattle, on the Northern Pacific and Chicago, Milwaukee & St. Paul railways.

A concrete-lined tunnel will be constructed through the right or south abutment for diversion of the river during construction and afterwards used for release of storage. This tunnel will be 14 feet inside diameter and about 1,800 feet in length. Control of the outflow will be by tandem cylinder gates, 18 feet in diameter, located in a vertical shaft about midway in the tunnel. These cylinder gates will be protected by two butterfly gates 11 feet in diameter.

The spillway will be an open concrete-lined channel adjacent to the dam in the south abutment, discharging into an excavated channel leading to a stilling basin at the lower end of the outlet tunnel.

The river channel will be straightened, deepened, and enlarged for about 4,700 feet below the outlet. A main dike about 850 feet in length and 40 feet in maximum height, together with three smaller dikes, will be required. There are about 2,700 acres in the reservoir site to be cleared and grubbed.

The contractor must complete the dam and appurtenant works in 870 days from the date of receipt of notice to proceed, the penalty being $200 a day for each calendar day's delay. R. J. Newell will be construction engineer for the Bureau of Reclamation, with headquarters at Ronald.

Irrigation Dam in Morocco Completed

The public works department of the Protectorate Government of French Morocco has recently completed the first dam to be utilized for irrigation purposes only. The dam is situated near Casablanca, about 12 miles from the mouth of the Oued Mellal River. It is 65 feet in height, exclusive of foundations, 131 feet in width at the river bed, 394 feet wide at the top, and will impound about 12,000,000 cubic meters of water, providing irrigation for approximately 1,235 acres of truck farms in the region of Casablanca.

This dam is the first and smallest of four irrigation projects under development by the Protectorate Government.—*Commerce Reports.*

A LOCAL company on the Grand Valley project has contracted for about 200 acres of cantaloupes this season, mainly as an experiment.

Boulder Canyon Project Notes

The Western Construction News recently carried the news item that the purchasing committee of the Six Companies (Inc.), has awarded the following contracts for equipment, materials, and supplies: Atlas Imperial Diesel Engine Co., Diesel engines; Ingersoll-Rand Co., compressors and air drills; Marion Steam Shovel Co., power shovels; St. Louis Power Shovel Co., Conway muckers; Linde Air Products Co., oxygen, acetylene and calcium carbide; Chapman Lumber Co., lumber; Westinghouse Electric and Manufacturing Co., electrical equipment; General Electric Co., electrical supplies.

About 200 cottages, mostly four and five rooms, will be built in Boulder City by the Six Companies (Inc.), for their married employees. They will be of wood frame, stuccoed, and are to be placed on 50-foot lots. The first group of these cottages is being erected in block 29.

Electric power for construction purposes is now available at the dam site. June 25 was the date for availability of power under the contract, and the Southern Sierras Co. beat this by several days. The distance from the Victorville, Calif., substation is 193 miles, and an additional 32 miles of line was required for connection with the San Bernardino power plant. A substation has been built at the dam site and 1½ miles of road construction through solid rock were necessary in order to reach the substation site with materials and equipment. The power company has built a telephone line paralleling the transmission line.

The Six Companies (Inc.), have a camp of 400 men at "Cape Horn," a local name given to the bend in the river, just above the dam site. This force is working on the canyon railroad, roads, and tunnel adits.

The contractors for the dam have decided to erect a hospital at Boulder City suitable for their needs, and a portion of block No. 8 has been set aside for the purpose. In order to have hospital facilities available at an early date, the Six Companies will first build a 20-bed, 1-story building and appurtenant conveniences, with heating and cooling facilities, estimated to cost about $20,000. This first unit can be added to as the need for additional hospitalization develops. The building will be of frame construction with stucco on metal lath.

What may be expected in the way of tourist travel through Boulder City after the Hoover Dam is finished may be judged from present conditions at Yuma, Ariz. During the month of April an average of 433 autos daily were west bound and 300 cars east bound, or a total of 22,000 for the month. With an average of 1,200 tourists in Yuma each day, the tourist trade is worth considerable to the business man.

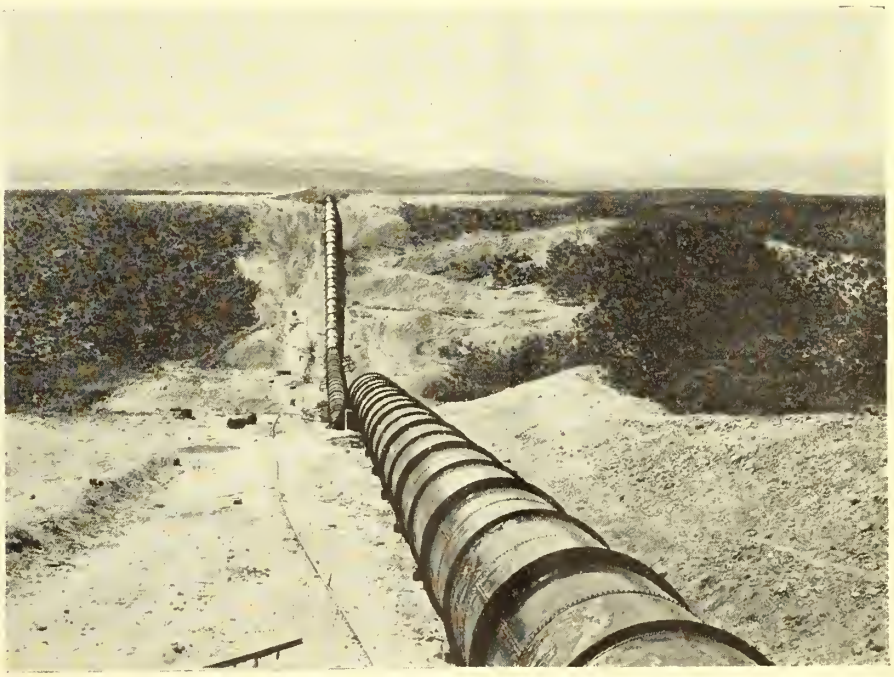
The new dormitories being built by the Six Companies in Boulder City are 2-story buildings shaped like the letter H. On each of the four wings are single rooms, 7 by 10½ feet, in two rows on each floor. Large screened porches reach the full length of the building on the outside, one on each floor. These porches will be occupied by reading tables and lounging chairs. A 1,000-man mess hall, with a huge concrete refrigerating basement, has been completed in which the Anderson Boarding & Supply Co. is serving meals to Big Six employees. The new office building is U-shaped, with the engineering division located in the west wing and accounting division in the east wing.

It is reported that the State highway department of Arizona has budgeted $20,000 for a survey of an 85-mile highway from Kingman to the Hoover Dam site, the survey to be commenced in July.

Extent of the Columbia River

Maybe some of our people would have more respect for the Columbia River if they knew how big it is. The Columbia drains 259,000 square miles of territory. This watershed extends from Glacier and Yellowstone National Parks to the Pacific and from the Fraser on the north to the Klamath on the south, excluding only the small section which drains directly into the Pacific. At The Dalles the Columbia has a run-off equal to that of the St. Lawrence or the Danube. At Pasco, before it receives the waters of the Snake, it is larger than the Fraser, the Missouri, or the Nile. At Trail, British Columbia, above the mouth of Clark Fork, it carries more water than the Yukon, and the Clark Fork alone discharges more water into the Columbia than the Colorado carries at the site of the great Hoover Dam.

TWO cars of 563 lambs were sold on a recent date by the Minidoka County lamb pool on the Minidoka project. The lambs averaged about 84 pounds each, and the total amount received for them was $3,773, or about 8 cents per pound. Later the Cassia County lamb pool shipped 278 lambs, in addition to some ewes and wethers. The price received for these lambs was $9.25 per hundredweight in Ogden. Other shipments of lambs will probably follow in the near future.



Fairman Coulee siphon looking toward the inlet, Vale project, Oregon

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BOULDER CANYON PROJECT

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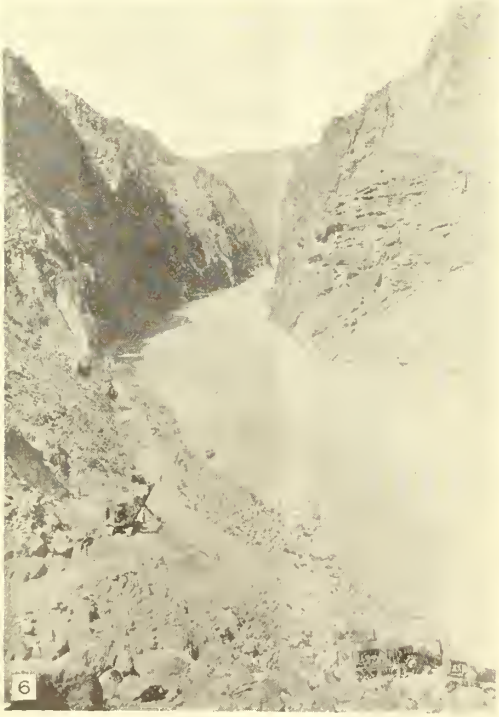

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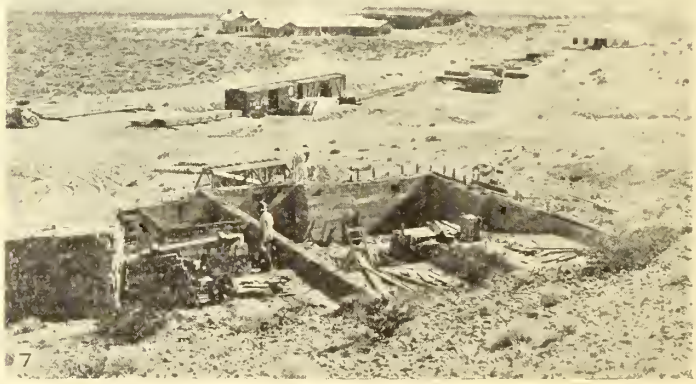

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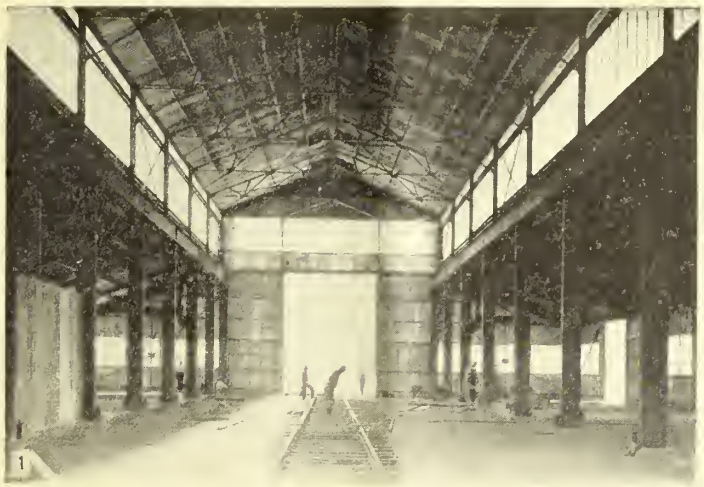
Photos by Orin G. Patch

1. Footbridge across the Colorado River and Arizona adit: 2. Excavation on United States construction highway, R. G. LeTourneau (Inc.), subcontractor; 3. Government warehouse interior, Boulder City; 4. View toward Dry Lake from Water Tank Hill, Boulder City; 5. Government warehouse exterior, Boulder City; 6. Highway to Nevada tunnel outlets. Note footbridges in Black Canyon; 7. View toward south from Water Tank Hill, Boulder City; foundation for Government residence in foreground



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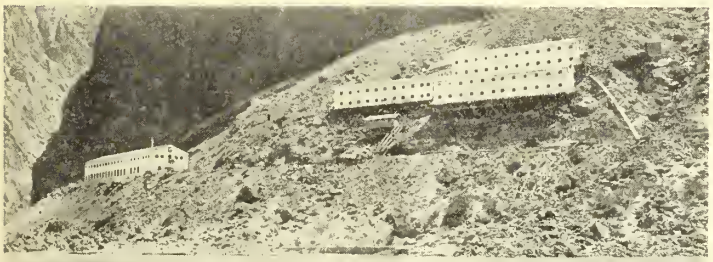

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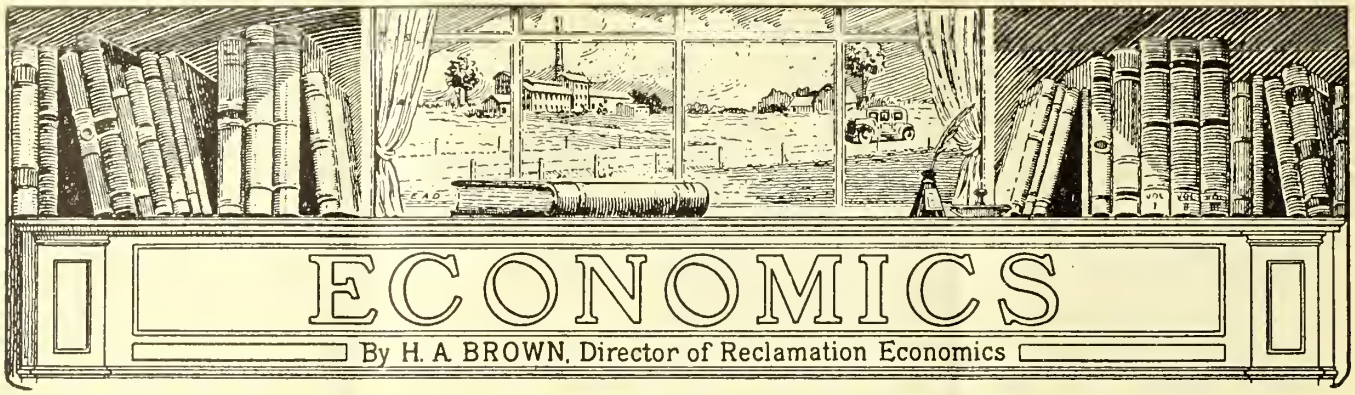
Photos by Orin G. Patch

1. Inside of Six Companies' machine shop; 2. Framing for Six Companies' dormitory, Boulder City; 3. Six Companies' Adit to Arizona diversion tunnels ;4. Six Companies highway to Nevada tunnel outlets; 5. Six Companies' camp in Black Canyon at Cape Horn; 6. First 4-room house built by Six Companies, Boulder City



Yuma Auxiliary Project

UNLIKE other reclamation projects, the Yuma auxiliary project, generally referred to as the Yuma Mesa, was not constructed with funds appropriated from the reclamation fund. This project, which occupies approximately 45,000 acres of land of the lower Colorado River delta, lying directly south of the city of Yuma, in Arizona, was authorized for reclamation under the provisions of the act of Congress approved January 25, 1917 (39 Stat., 686), and as amended by the act of February 11, 1918.

The first public notice was issued by the Secretary of the Interior on October 3, 1919, and provided for the sale at public auction of all the unentered public lands shown on approved farm unit plats situated in the first mesa unit. A reasonable value of the land was fixed at $25 per acre, with a water right charge of $160 per acre for the irrigation works to be constructed, plus a $40 per acre charge for the proportionate part of the cost of the irrigation works previously constructed for the Yuma project and made available for the mesa lands. The sale of these lands was started on December 10, 1919, and continued every day thereafter, except Sunday, until all of the land in this unit had been offered for sale, and as a result 518 farm units, comprising about 6,000 acres, were sold, producing a contractual value of approximately $1,350,000. No qualifications or limitations were required from any of the purchasers, except that they be citizens of the United States and that no sale would be authorized with a corporation.

As a condition precedent to proceeding with the construction of the irrigation system, the act above referred to provided that the construction work should be paid for from the money obtained through the sale of the land and water rights, and as it was further provided that 10 per cent of the bid price be paid on the date of sale, plus 15 per cent 60 days thereafter, with a condition that the balance or 75 per cent be paid over a period of three years at a rate of 25 per cent per year with 6 per cent interest on the deferred amounts, it was determined that sufficient funds were in hand and forthcoming to safely justify construction. Accordingly on June 8, 1920, the Secretary of the Interior issued an order authorizing the Bureau of Reclamation to begin the construction of the first mesa unit. On September 27, 1920, actual work was started on part one of unit B, containing about 6,318 irrigable acres, and was carried on with the available funds to the extent that the bureau is now prepared to serve irrigation water to a total of 3,810 acres of land. The system consists of 10 miles of concrete pipe lines, 29 miles of earth and concrete lined canals, 1½ miles of metal flume, 148 minor structures, such as turnouts, checks, culverts and bridges, and the B lift pumping plant.


Bird's-eye view of Yuma, Ariz., in 1876, looking toward the southwest from Indian Hill

PROJECT DEVELOPMENT SLOW

Development of these lands has been slow, largely because many of the purchasers were not financially able to meet their second and third construction instalments, owing to the general depression that existed in that locality for several years after the opening of this project. As a result more than 4,000 acres of land of these purchasers reverted to the Government. This condition, coupled with the high cost paid for electrical energy necessary to operate the pumping plant, created a deficiency in the Yuma auxiliary fund, so that it became essential to seek financial aid to carry out the approved construction and operation and maintenance program. This was obtained through an act of Congress approved March 4, 1925, authorizing a $200,000 appropriation from the reclamation fund. Although this legislation was important and of great benefit to the project, it was apparent that the funds thus obtained would serve merely as a temporary relief for a number of years, as the operation and maintenance costs were greatly exceeding the repayments. The costs were exceptionally high on account of the necessity of procuring electrical energy for pumping purposes at a high rate per kilowatt hour. It was decided that this discouraging situation

could be overcome only by advancing the operation and maintenance charges or by the development of a power plant at Siphon Drop on the main canal of the Yuma project. The power plant was built, predicated upon certain principles set out in an open letter to the water users of the Yuma project, providing for an increase in their construction cost in the sum of not to exceed $5 per acre. The power system, consisting of a 2-unit, 2,000-kilowatt-ampere, power plant, 33,000-volt transmission line, substation, and operators' living quarters, was completed in July, 1926. In consequence thereof the Yuma auxiliary project is now enjoying the benefits of very cheap power This is reflected in their operation and maintenance charges to the extent that the established annual rate is sufficient to carry on the project operations, although there are only 1,986 acres under water-right applications.

TERMS OF REPAYMENT HIGH

With the inception of this project it was generally conceded that the terms of repayment for the land and water right were somewhat high for an individual to meet unless he were blessed with sufficient capital or backing. A concerted effort was made therefore to have the original act amended. This was done by the passage of the act of March 4, 1925, heretofore referred to, in regard to the $200,000 appropriation. This act provided that the purchase price of the land and water right sold should be repaid in 10 equal annual instalments with interest at a rate of 6 per cent per annum on deferred payments.

The annual operation and maintenance charges per acre are high, as it is necessary to divert the water from the Colorado River at Laguna Dam, whence it is carried a distance of approximately 20 miles through the main canal system of the Yuma project, lifted 70 feet by pumps to the mesa, and distributed through an elaborate irrigation system to each 40-acre unit. The assessments for several years past have been $15 per acre, regardless of use of water, which has permitted the delivery of not to exceed 3 acre-feet of water per acre, with a condition that additional water, if required, could be purchased at $3.50 per acre-foot.

CLIMATIC AND SOIL CONDITIONS

The entire area of this project, except for a few isolated spots, is quite smooth and devoid of plant life. Therefore the land can be cleared and leveled at a very low cost per acre. The soil is mostly a fine sand containing considerable lime and other mineral elements necessary for plant food, but is deficient in organic matter and must therefore be built up by extensive fertilization to mature crops of commercial value.

There is probably no other section in the United States that is so highly advertised for no other reason that its climate, which, contrary to the general belief, is the greatest asset of the entire lower Colorado River Valley, and particularly so to the Yuma mesa, which is situated in a frostless belt. It is during the long hot summer months that the record-breaking crops — grapefruit, oranges, lemons, and other citrus fruits— are grown, without equal, and consideration is given to the fact that this area is frostless, low in humidity and rainfall, with a growing season of 365 days each year and a percentage of sunshine not surpassed anywhere in the United States. It is not hard then to realize that the fruit grown in this semitropical region is of a superior quality and is sold at a premium in the open market.

During the year 1930 there were 1,404 acres of land under cultivation, of which 470 acres were nonbearing; that is, the citrus groves were not sufficiently matured on this area to produce crops. The producing area, however, consisting of 954 acres, brought a gross return of $156,264.68 or an average per acre return of $164.75. The significance of this splendid average is that it covers several hundred acres of citrus trees at the age of 5 years and

AERIAL VIEW OF YUMA TAKEN IN 1930

1. Bureau of Reclamation headquarters office and grounds; 2. Colorado River flowing into Mexico; 3. Colorado River siphon intake; 4. Colorado River siphon outlet; 5. Yuma project Main Canal; 6. Yuma Indian Agency, under Government operation and control; 7. Colorado River and overflow area; 8. Remains of the old Federal and State prison; 9. Southern Pacific Railroad depot; 10. Southern Pacific roundhouse; 11. City of Yuma, Main Street; 12. City and county building and grounds; 13, 14, and 15. Grammar School; 16. High-school buildings and campus; 17. Municipal swimming pool; 18. Yuma Mesa citrus groves. Area shown north of river in California; area south of river in Arizona.

younger, on which the per acre return is considerably below $100. Outside of approximately 50 acres planted to dates, grapes, alfalfa, etc., the cropped area is planted to citrus fruit, with grapefruit predominating. In reviewing the progress of these groves for the past year it is interesting to note the increase in the productive value from year to year.

Plantings	Per acre return
4-year old	$49. 55
5-year old	93. 65
6-year old	163. 13
7-year old	279. 94
8-year old	350. 00

The productive cost per acre of the groves in cultivation varies somewhat with the age of the trees and depends largely on the methods employed by the individual grower as to fertilization, cultivation, application of water, etc. These costs will range from approximately $90 to $125 per acre, and when compared with the returns given above it is disclosed that the plantings after the fifth year begin to produce a very substantial return on the investment.

The cost of bringing an acre of land to the productive age, or the fifth year, will also vary, as there are numerous factors to consider, such as the preparation of land, kind of water distribution system, cost of trees, growing cover crops, and many other incidental items, so that no definite amount can be stated. Some of the existing groves have been brought into bearing at a cost as low as $800 per acre, whereas others have been recorded at a cost of $1,200 per acre. This wide range can be attributed in a large measure to the extent of the distribution system; that is, whether the earth open ditch is resorted to or the underground concrete pipe line has been constructed. There are other items of lesser importance that will affect these costs, but it can be conservatively estimated that $8,000 to $10,000 will be required to develop a 10-acre unit. In consideration of the high productive and development cost, this project can not be placed in the home builders' class similar to other reclamation projects, but rather must be placed in an investment class, and as such it has no equal in citrus culture in the United States.

The Yuma mesa is not merely an experiment but demonstrated fact, and there are many hundred acres of raw land awaiting the development of the citrus culturist with a little vision and capital who may now benefit from the experience of the pioneers of this project, as well as the expert knowledge it is now possible to secure from the University of Arizona experimental farms, located on the Yuma and Yuma auxiliary projects, and the Government experimental farms located at Indio, Riverside, and Bard, Calif., the last named being located on the reservation division of the Yuma project.

The natural advantages of this project for citrus development can not be too strongly expressed. It is without question one of the most attractive industries in the entire Southwest. There are many highly advertised sections in the southern and southwestern States, but none has the natural advantages of the Yuma mesa, which is frost free, has no citrus disease or insect pests, has an ideal soil for citrus culture, and raises fruit surpassed by none.—*H. R. Pasewalk, Assistant Chief Accountant, Bureau of Reclamation.*

Cotton Grown on the Projects in 1930

The four projects on which cotton was grown commercially in 1930 were the Salt River, Ariz.; Yuma, Ariz.,-Calif.; Carlsbad, N. Mex., and Rio Grande, N. Mex.-Tex.

Cotton was grown on 192,120 acres, yielding 175,809 bales of lint, or an average of 0.91 bale per acre, and 78,924 tons of seed. The total value of lint and seed amounted to $11,398,544, or $59.33 per acre. As in 1929, the Rio Grande project reported the largest acreage, yield, and value in this crop, the 94,865 acres producing lint and seed valued at $5,734,350, or $60.45 per acre. The highest value per acre of $62.52 was on the Salt River project, Ariz. Detailed figures are given in the accompaning table.

Cotton grown on reclamation projects in 1930

Project	Area	Yield				Value	
		Lint		Seed		Total	Average per acre
		Total	Average per acre	Total	Average per acre		
	Acres	*Bales*	*Bales*	*Tons*	*Tons*		
Salt River, Ariz	49, 631	43, 553	0. 88	21, 777	0. 44	$3, 103, 152	$62. 52
Yuma, Ariz.-Calif	28, 073	25, 163	.90	12, 204	.43	1, 538, 454	54. 80
Carlsbad, N. Mex	19, 551	16, 963	.87	6, 949	.36	1, 022, 588	52. 30
Rio Grande, N. Mex.-Tex	94, 865	90, 130	.95	37, 994	.40	5, 734, 350	60. 45
Totals and averages	192, 120	175, 809	.91	78. 924	.41	11, 398, 544	59. 33

Citrus Fruit Grown on Reclamation Projects in 1930

The three Federal irrigation projects on which citrus fruits are now grown are the Salt River, Ariz.; Yuma, Ariz.-Calif.; and Orland, Calif.

In 1930 the crop was grown on 4,949 acres, producing 63,768,110 pounds of fruit, valued at $1,561,015, or $315.42 per acre.

Seventy-seven per cent of the total bearing acreage in citrus fruit was on the Salt River project, which also accounted for 86 per cent of the yield and 88 per cent of the total value. This project also reported the highest value per acre of $360. Most of the crop on the Yuma project was produced on the Mesa division. Detailed figures are given in the accompanying table.

Citrus Fruit Grown on Reclamation Projects in 1930

Project	Yield			Value	
	Bearing area	Total	Average per acre	Total	Per acre
	Acres	*Pounds*	*Pounds*		
Salt River, Ariz	3, 823	55, 051, 200	14, 400	$1, 376, 280	$360. 00
Yuma, Ariz.-Calif	797	7, 396, 910	9, 280	131, 935	165. 54
Valley division	16	60, 750	3, 797	1, 620	101. 25
Reservation division	32	120, 000	3, 750	3, 525	110. 15
Mesa (auxiliary)	749	7, 216, 160	9, 634	126, 790	169. 27
Orland, Calif	329	1, 320, 000	4, 012	52, 800	160. 49
Totals and averages	4, 949	63, 768, 110	12, 885	1, 561, 015	315. 42

Summary of livestock and equipment on Federal irrigation projects, 1930

	Number	Value	
		Each	Total
Horses	69,953	$48.24	$3,278,817
Mules	10,085	80.00	822,597
Beef cattle	65,368	41.78	2,731,223
Purebred sires	682	99.18	67,639
Scrub sires	192	46.00	8,870
Dairy cattle	137,570	63.36	8,715,381
Purebred sires	1,485	126.08	187,227
Scrub sires	1,038	52.14	54,722
Sheep	462,774	5.20	2,407,406
Hogs	78,404	8.80	689,513
Brood sows	12,026	19.49	234,474
Goats	480	5.00	2,354
Rabbits	1,900	1.18	2,243
Fowls	2,116,481	.95	2,016,163
Bees (hives)	36,312	5.64	204,980
Total stock value			21,423,609
Value of equipment			[1] 15,900,155
Motor vehicles			8,622,337
Other equipment			7,277,818
Total stock and equipment			37,323,764
Increase or decrease in value over 1929:			
Stock			−4,943,581
Equipment			−943,979
Total decrease			−5,887,560

[1] Value of equipment on Salt River project estimated.

Dairy herd on canal bank. Farm of Thomas Taylor, Belle Fourche project, South Dakota

MANY new families of beet workers who are potential farm owners and renters have appeared on the Belle Fourche project this spring. Further settlement is needed, but progress is slow because of the lack of buildings. There is evidence, however, that unoccupied farms are gradually being absorbed into the larger holdings of successful farmers as a means of providing feed and pasture for stock. Ranchers are also looking for places with alfalfa in order to assure their winter hay supply which is becoming more scarce because of drought and reduced alfalfa acreage on the project.

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- Hoover Dam construction notes (illus.). Western Construction News, May 10, 1931, v. 6, pp. 239–240.
- Boulder (Hoover) Dam site employs 700 Men; pay roll about $100,000 a month. U. S. Daily, June 1, 1931, v. 6, p. 2 (p. 760).
- Designs for Government buildings at Boulder City approved; illus. Southwest Builder and Contractor, v. 77, pp. 48–49.
- A competent art. (Editorial on concrete at Hoover Dam.) Eng. News-Record, June 4, 1931, v. 106, p. 915.
- Hoover Dam notes (illus. temporary foot bridge). Eng. News-Record, June 4, 1931, v. 106, pp. 943–944.
- Activities and conditions at Boulder (Hoover) Dam, Las Vegas, frontier town, construction, Boulder City, Climate. Illustrations and maps. Eng. News-Record. May 28, 1931, v. 106, pp. 895–897.

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- Colorado River Aqueduct bond election soon (short). Western Construction News, May 25, 1931, v. 6, p. 274.

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- Estimate on All American Canal reduced five million dollars. Southwest Builder and Contractor, June 5, 1931, v. 77, p. 48.

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Savage, J. L., and Ivan E. Houk:
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Rohrer, J. K.:
- Drilling bridge truss, spanning canal serves Mittry Bros. on rock excavation for Minidoka project canal. Illus. Construction Methods, April, 1931, v. 13, pp. 36–38.

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- Enlargement of the Panama Canal facilities. The Engineers Bulletin, Colo. Soc. of Engrs., April, 1931, v. 15, pp. 9 and 32.

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- Hoover Dam plans stagger imagination. Illus. Salt Lake Tribune, Sunday, May 3, 1931, pp. 6 and 7.

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- Drag lines excavate large irrigation canal, Minidoka project, Idaho; illus. Eng. News-Record, May 14, 1931, v. 106, pp. 813–816.

Rose, Howard B.:
- Hoover Dam construction work now in high gear; illus. Western Highways Builder, May, 1931, v. 13, pp. 40–41.

Ellis, Willard D.:
- Problems of financing land reclamation. Agricultural Engineering, May, 1931, v. 12, pp. 167–168.

The June issue of the Era carried a story of first impressions of a visit to the site of Hoover Dam in Black Canyon on the Colorado River of an engineer's wife whose husband is assigned to the Boulder Canyon project, and this month is offered the vivid story of an engineer's daughter whose privilege it was to observe, step by step, the construction of the Deadwood Dam, concrete arch type, 160 feet high, on the Deadwood River in Idaho, with her father, R. J. Newell, at the helm as construction engineer. To these engineers and their interesting and interested families each structure undertaken is another engineering romance.

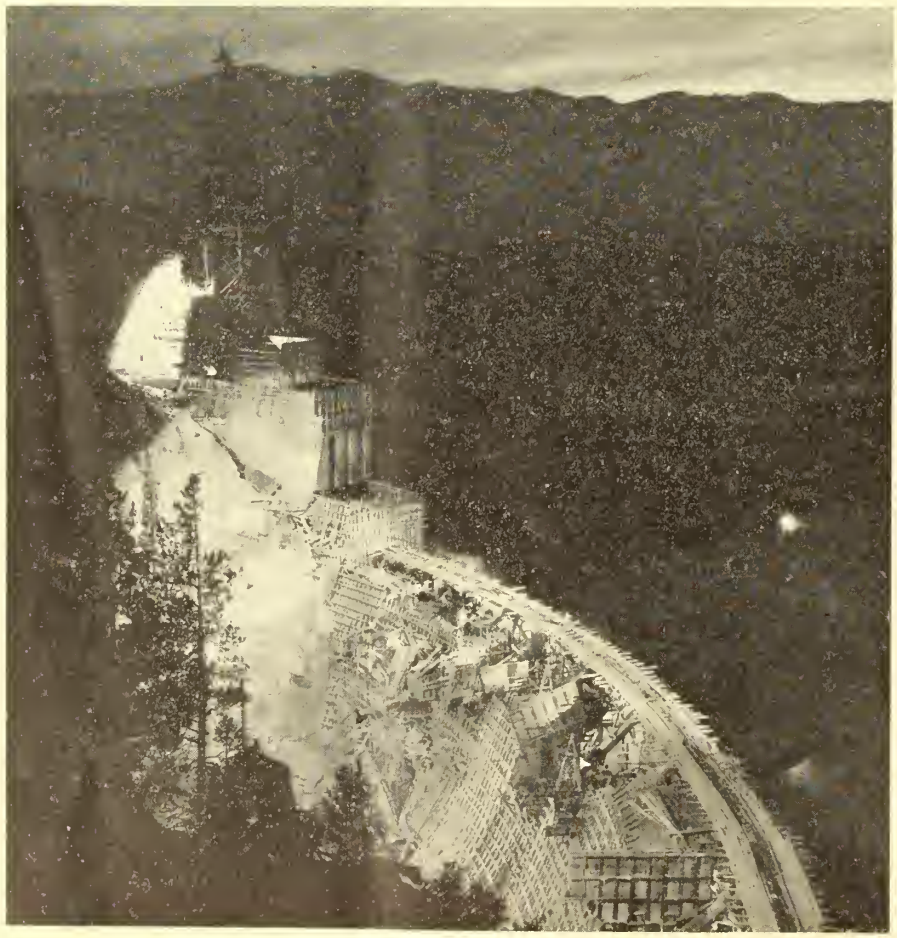
From where I sit I can observe and say authoritatively that a construction engineer has a truly interesting life. Interest is never lagging for the dam builder. He moves from structure to structure, leaving monuments to his skill in his path. Each dam has a new set of problems which he attacks with confidence. The hustle and bustle of the construction camp and at the works are music to his ears.

I have often heard the version of engineers, and now it seems good to have that of the women who share these experiences.

The Dam Goes Up

By Miss Helen M. Newell, Boise, Idaho

WHICH of the Wills, Shakespeare or Rogers, was responsible for the division of all mankind into the hay pitchers and the straw chewers? No matter. The satisfaction for work well done goes to the man with the fork; I grant that. But to him who was born lazy there is no pleasure so great as watching work accomplished by other hands than his while he lies upon the hillside moving his jaws rhythmically upon an oat straw. I contend that he is as necessary to the scheme of things as his hay-pitching brother. How is the ambitious one to measure his ambition unless he contrasts himself with the idler? And what is the use of great activity if there is no one to observe it?



Night scene at the Deadwood Dam. There were three shifts of eight hours each

I am a straw chewer. I watch. So, through the long, lazy, sunny days I sat on "The Point" at Deadwood and inspected the works. Away up yonder, silhouetted on the horizon, the gravel trucks paused to dump their loads, then sped away again. They were like bees delivering honey at the hive. There came the solemn undertones of the rock crusher, "Gar-r-rump! Grump! Thump!" and then the rattling thunder of the screening plant, as of water rushing through a canyon. Separated for size, the gravel rose to the bins on belt conveyors; a visiting Russian engineer delightedly remarked: "Just like mechanical restaurant in Boise."

CONSTRUCTION ACTIVITY INTERESTING TO ONLOOKER

The cement house was the scene of the greatest activity. Men rushed about in the cement-befogged air, mouths and nostrils protected by little white masks that resembled pigs' snouts, hauling cement, folding sacks, turning in water and gravel. It was a frightful bedlam of

A means of communication for workers on Deadwood Dam

noise—the deafening crash of cobbles on iron and the grinding of the levers that released the gravel.

Beneath the cement house the mixer rotated, rumbling incantations as it prepared a magic potion that would build a dam. From time to time it lowered cumbrously to disgorge its potent mixture into the waiting chute. The sloppy, cobbly mass poured into a hopper on the trestle and was hauled away by a little locomotive, to be emptied into its proper section. Ankle deep in the concrete the laborers stood, and spread it with their shovels; their occasional efforts to extricate themselves would have made Rumpelstiltskin ashamed of himself.

A load of lumber swung across the sky bearing gods who rode upon it in nonchalant attitudes, gazing with lordly amusement at our ridiculous little world below.

The man who signaled down the skip must surely have been an orchestra leader in disguise. With what grace and mastery did he extend his arms, hold them a moment—one, two, three, four! One could fairly see the violins coming in—down, down—one, two, three, four; grand finale! Crash! It had landed.

Back up among the trees the little sawmill sang. It had cut the lumber for all the preliminary carpentering on the dam and for the building of the camp; now it hummed busily away sawing lumber for forms.

To those who suffer from jaded appetites an inspiring sight was offered when the noon whistle blew. It was well, however, to view the rush from some high point out of danger. Almost before the first shriek had escaped the throat of the whistle, tools were thrown aside, everything stopped all at once, so that the unaccustomed stillness beat upon your ears, and one grand stampede for the mess hall followed.

The only other times I can remember seeing the works deserted were early in the season when blasting or "shooting" was a daily occurrence. Then the powder man's warning "Fire–o–o–o–o!" sent the workmen scattering for shelter like ants, and in a moment the view was cleared of every living thing.

LIFE IN A CONSTRUCTION CAMP

The camp was a little village, quite complete. Groceries and work clothes from the commissary, meat from the mess hall; a vegetable man visited us weekly; mail was brought in each day on the cement trucks. There was a laundry in camp and a dairy; a doctor held forth in a tar-papered hospital, close to the works. Boots and shoes were repaired by a Macedonian who cobbled in Athens not so long ago and who worked in the concrete by day. There were two barbers, one a mechanic, the other an assistant in the cement-testing laboratory. What more could one require? It was curious to think that where the tents and tar-papered houses now clustered were only solitude and wild things a couple of years before, and soon there will extend a vast and peaceful lake. Whoever it was that spoke of the shifting sands of civilization must have lived in a construction camp.

Most of our 48 United States were represented there and many foreign countries as well. One became a fair linguist trying to understand all the dialects, the brogues, and the broken attempts at English.

Scarcely a day passed without someone being hurt on the dam, but no lives were lost. There were escapes so miraculous that the workmen nodded wise heads and said that it was a "lucky dam."

Coleman trucks were used for transporting the cement from Cascade. These noble old dragons, with their nine forward speeds, went roaring up the Big Creek, Warm Lake, and Deadwood summits, each over 7,000, feet making two round trips a day. They arrived at the dam at noon and again at midnight. With the additional loads of their trailers, they carried three carloads of cement on the twice-daily trips.

Thirty-three hundred acres of lodgepole pine were cleared from the reservoir site. The first question of almost every visitor was: "But where will they get the water to fill all this?" In the summer,

Trucking materials to Deadwood Dam

the Deadwood River is hardly more than a brook. If these same visitors could have visited Deadwood in the long winter season, when the buildings were buried to the eaves in snow, and there was snow, only snow, as far as the eye could search; if in the spring they might have seen the water rushing down the draws in the mountain sides, then the filling of this reservoir would have seemed less inconceivable. On the 1st of April, when alfalfa was greening the Boise Valley, there still remained 115 inches of snow on the Deadwood summit. It was May 18 before the roads were cleared so that cars could get through the 70 miles from Cascade. Until then those who wished to come in traveled by plane, dog sleds, sleds dragged behind the caterpillar tractors, or afoot. You paid your money and you took your choice.

The trees were felled in windrows by those clever Swedish axmen from the coast. Seeing them so, one thought of rolling meadows of new-raked hay. The burning was gorgeous at night. The lesser fires that smouldered here and there on the hillsides resembled distant cities twinkling through the darkness. The most magnificent burning covered a thousand acres, spread along the river, and the camp turned out en masse to view it. The whole countryside and the heavens were aflame with scarlet and orange. A peculiar stillness made the ominous crackle and snap of the flames yet more ominous. When a flame-surrounded area emptied itself of hot air, cold rushed in to take its place, thundering angrily. As the fire met an occasional tree left standing, it enveloped it all at once, in a single skyward leap, and for an instant the tree stood silhouetted in silver, every needle white against the night. It was like a poem, that fire, a proud, splendid poem that etched itself unforgettably upon the memory.

The Deadwood, 170 feet high, is not a very big dam. Its erection, however, at a cost of $1,350,000, was a source of constant wonder to me as I watched the concrete growing up from the river bed and reaching out from the rock cliffs on either side to fit at last into a complete whole as perfectly as did ever the most complicated Chinese puzzle, with no yawning gaps and no pieces left over.

Products of Irrigation Lower Yellowstone Project

The ditch shown in the accompanying illustration irrigates a small garden owned by William A. Hulse on the Lower Yellowstone project, Montana-North Dakota. In 1930 Mr. Hulse produced vegetables which sold for $76, in addition to 52 bushels of potatoes, horseradish, strawberries, and a hedge of raspberries, which he reserved for family consumption. From the same garden 300 quarts of vegetables and 2 bushels of carrots and parsnips were stored in the cellar. Without irrigation this land would have been worthless.

Project Completes Payments Under Refunding Contract

The Salt River Valley Water Users' Association contracted with the United States for the refunding of its obligations to the Government under which the association agreed to pay approximately $2,000,000 on or before June 15, 1931.

During the period from February 4, 1931, to June 3, 1931, the association paid to the United States the total sum of $1,928,776, thus having met the obligations under the contract prior to the limiting date in the contract.

THE frost experienced this spring on the Grand Valley project did not seriously damage the fruit crop, and from present indications the Palisade district will turn out the largest peach crop in its history. This increased production is caused mainly by increased acreage on East Orchard Mesa.

RECLAMATION "PRODUCT"

IRRIGATION DITCH ON FARM OF WILLIAM A. HULSE, FAIRVIEW, LOWER YELLOWSTONE PROJECT, MONTANA-NORTH DAKOTA.

Darlene, infant daughter of Mr. Hulse, in ditch; in background left to right: Billy Goar, Phylis Wellman, and Betty Hulse

Conservation of Water

Irrigation projects are experiencing another year of water shortage, although the indications early in June were that the Federal projects would go through the season with very little damage to crops because plans had been adopted on many of the projects to make the most efficient use possible of the available supply and to take such measures as might be necessary to prevent waste and excessive use of water. On the Orland project in California a committee of water users has been making frequent inspection trips over the project for the purpose of locating farms where water was being wasted and adopting means to bring about a more economical use. The following article, taken from the Orland Register of May 26, describes the work of the committee and sets an example that could be followed to good advantage on several Government projects:

EDUCATION EFFECTS SAVING

Conservation of storage water to a most satisfactory degree has been accomplished during the past six weeks by the campaign of education in the elimination of wastage in the irrigation of the lands of the Orland project. The special committee, appointed by the unanimous vote of the board of directors of the Orland Unit Water Users Association, to check up on wastage of water, has been on the job day and night and because of their efforts and the whole-hearted cooperation of a large majority of the water users, a decided saving in storage water has resulted. Only in rare instances have they met with opposition in their efforts to see that the waters stored in the two great reservoir-lakes are used conservatively and beneficially.

Cooperating with R. C. E. Weber, project superintendent, these committeemen, without one cent of compensation, have made 109 inspections in the project of irrigated farms. These inspections have been at all times, some during the night and some with and some without the knowledge of the water users. The committee was always composed of at least two members and often of four members.

During May, as a result of these inspections, 57 written notices were sent to water users where it was found that there was a wasting of water in the county roads or in the sloughs. Four water users have been served with notices that their water has been discontinued until they can prove to the committee and the board of directors that necessary remedies have been made to retain and not waste the water on their farms. These water users appeared before the meeting of the board of directors on June 6 and were notified that no more water would be delivered unless they could give satisfactory evidence that further wastage would not be made.

The board of directors are well within their rights in this action, as the water user has a right to water only as long as it is beneficially used.

The campaign of education has resulted in a decided saving in water, the exact amount being small in many individual cases but large in the aggregate. As a result of the campaign, many sloughs throughout the project, which formerly carried waste waters throughout the irrigation season, are now completely dry or run water for very short intervals. The lands along these sloughs, which were formerly waterlogged, are now dry and capable of cultivation.

In a vast majority of cases the committee has found the water users ready and anxious to cooperate in the work, as they realize that conservation of water in every manner possible means a complete irrigation season with an irrigation late in September when it will be especially beneficial to orchards.

The committee will continue its work during the entire season and hopes to make this only the initial season in a series of years of education among the water users on the beneficial use of storage waters.

A PUBLIC weed-killing demonstration was held on June 9 on the farm of Paul Phillips on the Shoshone project near Powell. The local farmers were well informed in advance of the demonstration and considerable interest was taken.

Mexican Repatriates Colonize Don Martin Dam Project

The Don Martin Dam project, which is designed to eventually place 160,000 acres of semidesert land into farms, is being gradually colonized by Mexican repatriates from the United States. Though the dam was completed only some nine months ago, it is understood that about 14,500 acres are in prosperous crops raised by about 1,000 families, who have already erected homesites near the dam. About 9,250 acres are in corn, about 1,000 acres are in beans, and about 4,250 acres are devoted to various crops, such as Sudan grass, milo, and malt barley.

Most of the land in this section is divided into small farms. There are 41 farmers having 12½ to 25 acres; 24 with 62½ to 125 acres; 16 with 125 to 187½ acres; and 22 with 187½ to 250 acres.

It is understood that the land is granted to farmers at very reasonable figures, averaging from $50 to $75 an acre, and that it may be secured by making contract with the Government or by direct purchase. If the Government furnishes the seed and implements, 30 per cent of the crops must go to the Federal agencies. Farmers furnishing own seed and equipment may farm land, paying a rental amounting to 20 per cent of the crops. Outright purchases may be made by paying 5 per cent cash and the rest over a period of 25 years.

Although this project is within the confines of the Nuevo Laredo consular district, the principal distributing center adjoining the irrigated zone is Monterrey, and it is understood that merchants and bankers of that city are showing great interest in its development and are studying the possibility of organizing a farm loan bank to finance the settlers.

There are about 100 American tractors in use at Don Martin at this time, and the project as it develops will continue to offer a good market for all kinds of American agricultural machinery.—*U. S. Department of State.*

Boulder City Business Applications

Up to June 13, sixty-six formal applications to enter different classes of business in Boulder City had been received by Hon. Louis C. Cramton, special attorney to the Secretary of the Interior, at Las Vegas. These spplications were from residents of 21 States and represented 28 different kinds of business.

California led the States with 21 applications, followed by Utah with 9 and Nevada with 7; 4 each were received from Arizona and Colorado, 3 from Texas, 2 each from Kansas, New Mexico, and Wyoming, and 1 each from Florida, Idaho, Kentucky, Massachusetts, Montana, Michigan, New Jersey, North Carolina, New York, Oregon, Pennsylvania, and Washington.

The applications among different businesses were distributed as follows: Barber shop, 7; chiropractic, 2; dentist, 2; drug store, 8; electric and radio repair, 1; general store, 1; grocery and meat market, 2; gasoline station, 1; indoor recreation, 6; jewelry, 2; ladies ready-to-wear, 1; lumber yard, 2; men's furnishings, 2; motor express, 1; news stand, 1; pack train and curio, 1; plastering and materials, 1; photo supplies, 1; restaurant, 6; shoe repair, 3; soft drinks, etc., retail, 4; soft drinks wholesale, 2; trucks, 1; telephone exchange, 1; tourist camp, 1; theatre, 4; tailor and cleaning, 1; telegraph, 1.

It was anticipated by Mr. Cramton that by the end of June fully 500 applications would be on file.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, entertained the representatives of six railroads traversing the projects at an informal luncheon on June 20, leaving shortly thereafter for the West. His guests included H. L. Ford, agricultural development agent, Burlington; John W. Haw, director of agricultural development, Northern Pacific; R. A. Smith, superintendent of agriculture, Union Pacific; R. W. Reynolds, commissioner, agricultural development and colonization department, Chicago, Milwaukee, St. Paul & Pacific; C. L. Seagraves, general colonization agent, Santa Fe; and E. C. Leedy, general agricultural development agent, Great Northern. These men were in Washington to confer with the commissioner on the reclamation exhibit at the Century of Progress World's Fair in Chicago in 1933.

During the absence of the commissioner in the West, Porter W. Dent, assistant commissioner, is in charge of the Washington office as acting commissioner.

Hon. Scott Leavitt, Representative in Congress from Montana, was the principal speaker at the big annual celebration of the Norwegians in Fairfield, Sun River project. Nearly 1,000 persons were in attendance.

R. F. Walter, chief engineer, has filed at Carson City plat of the Boulder Canyon project reservation with the Governor of Nevada. On Mr. Walter's return to Denver he stopped by the Minidoka project to review the progress of work locally.

U. B. Gilroy, of the Bureau of Fisheries, United States Biological Survey, and Mr. McDonald, superintendent, Fish and Game Commission, State of Montana, with several others from Great Falls, Mont., conferred recently with A. W. Walker, superintendent of the Sun River project, relative to the installation of a fish screen on the Pishkun and Sun River Slope Canals.

J. W. Myer, chief of the mails and files section in the Washington office, returned on June 1 from Las Vegas, Nev. where he had installed a filing system for Boulder City leases and concessions.

E. B. Debler, hydrographic engineer, spent several days at Mackay, Idaho, as a member of an engineering board convened by the Big Lost River Reclamation Association; later, with the State engineers of Wyoming and Utah and other interested parties, he made an inspection of reservoir sites on the Bear River and tributaries in Wyoming, and then went to Salt Lake City, Utah, in connection with the Salt Lake Basin investigations. Following this, he was in Wyoming in connection with the North Platte River power investigations at Seminoe and North Gate reservoir sites.

H. J. Gault, engineer, is located at Hawthorne, Nev., in charge of construction of the Cat Creek Dam, which is being constructed by the Navy Department.

E. S. Randolph, chief designing engineer, Charles Voetsch, hydroelectric engineer, and Bob Fletcher, designer, all of the Panama Canal Zone, spent a month in the Denver office where they assisted in the designs for the Madden Dam, which are being prepared in that office.

S. O. Harper, superintendent of construction in the Denver office, spent a few days on the Grand Valley project, during which he inspected the entire project.

E. H. Neale, manager, and D. H. Blossom, engineer, for the Aberdeen-Springfield Canal Co., were recent visitors on the Minidoka project in connection with their application to lease additional storage.

J. L. Savage, chief designing engineer, spent two days at Fort Collins, Colo., in attendance on a committee meeting on irrigation hydraulics of the American Society of Civil Engineers, following which he made a general inspection trip, including the Boulder Canyon project; the Cat Creek Dam at Hawthorne, Nev., being constructed by the Navy Department; Cle Elum Dam, and the Yakima River crossing on the Kittitas division of the Yakima project.

Joseph Talla, associate engineer on the Minidoka project, has been transferred to the Boulder Canyon project, and Gary E. Brown, a new appointee, has reported to the Minidoka project office to assume the duties formerly performed by Mr. Talla.

W. J. Burke, district counsel, and Irving J. Courtice, agricultural development agent for the Northern Pacific Railway Co., both of Billings, Mont., were on the Lower Yellowstone project recently to confer with the irrigation district boards and the representatives of the banks in regard to the prospects for financing farmers during the present crop season.

Porter J. Preston, in charge of Colorado River Basin investigations, spent some days at Winslow, Ariz., serving on an engineering board to report on river protection work at the Leupp Indian Agency on the Little Colorado River.

The services of Miss Marie L. Hagmuller, clerk to the committee on the conservation and administration of the public domain, who has been located in the Bureau of Reclamation offices for a number of months, were discontinued on June 15 owing to the closing out of the work of the committee.

The subcommittee for the Interior Department of the House Appropriations Committee visited the Yuma project recently. The members of the committee comprised the following: Representatives Frank Murphy (Ohio), William W. Hastings (Oklahoma), Don B. Colton (Utah), and Addison T. Smith (Idaho). They were accompanied on the trip by F. J. Bailey, of the Bureau of the Budget; William A. Duvall, clerk of the House Committee on Appropriations; S. M. Dodd, jr., of the Bureau of Indian Affairs; and A. E. Demaray, senior assistant director of the National Park Service.

J. R. Iakisch, engineer at large, was on the Uncompahgre project recently for the purpose of studying in a preliminary way the drainage problems of the project.

E. W. Lane, research engineer of the Denver office, spent several days on the Uncompahgre project in charge of the tests on the model of the Hoover Dam spillway, which is being constructed on a scale one-twentieth the size of the actual structure.

Norton Ware, chief engineer of the Sutter Butte Canal Co. at Gridley, Calif., was a recent visitor on the Yuma project.

U. S. GOVERNMENT PRINTING OFFICE: 1931

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Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

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

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Engineer; J. L. Savage, Chief Designing Eng.; E. B. Debler, 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	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 Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Do.
						J. R. Alexander	Las Vegas, Nev.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Los Angeles Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Las Vegas, Nev.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr		F. P. Greene	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	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	H. H. Berryhill	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		do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	F. P. Greene	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 [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	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, Kittitas	Ellensburg, Wash	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent		Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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	Plaisade, Colo	C. W. Tharp	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Waugeu	Fairfield, 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, Nev.
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	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Kenneth Borg	Superintendent	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.		do	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	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa, Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

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.
North Platte River power	do	Denver office	None.
Rathdrum Prairie, Idaho	Spokane, Wash	H. W. Bashore	None.

SALLIE A. B. COE, *Editor.*

Photo by Ray-Bell Films (Inc.)

HARVESTING ALFALFA ON FARM OF GEORGE PINTLER, 3 1/2 MILES NORTHEAST OF FAIRVIEW, MONT., LOWER YELLOWSTONE PROJECT

NEW
RECLAMATION ERA

VOL. 22, NO. 8 AUGUST, 1931

Photo by J. E. Stimson

IRRIGATING AN ALMOND ORCHARD ON THE ORLAND PROJECT, CALIFORNIA

GOVERNMENT OF THE UNITED STATES

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PAN AMERICAN UNION

AMERICAN NATIONAL RED CROSS

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DISTRICT OF COLUMBIA GOVERNMENT

COMPILED BY W. I. SWANTON, AUG. 1931 BUREAU OF RECLAMATION NO. 24244 DRAWN BY A. M. SMITH

NEW 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. 22, No. 8 AUGUST, 1931

Interesting High Lights on the Federal Reclamation Projects

PHOENIX, headquarters of the Salt River project, Arizona, has a large municipal program calling for an expenditure of nearly $3,000,000. A new municipal water system costing $2,100,000 is about completed, to which will be added a new sewage disposal plant for which bonds amounting to $817,000 have been voted. A new 12-story hotel to cost $500,000 is also in prospect.

THE shipping of the 1931 clip of wool from the farm flocks on the Shoshone project totaled 86,923 gross pounds, netting the farmers $12,218.15. The gross weight exceeded last year's weight by 6,198 pounds. This is the largest shipment of wool in the history of the Powell Wool Growers' Association.

AT a special election held on the Vale project the board of directors of the Vale Oregon irrigation district was authorized to enter into a supplemental contract with the United States to increase the liabilities of the district to an amount not in excess of $500,000, for the construction of the Agency Valley Reservoir on the North Fork of the Malheur River, resulting in a vote of 58 in favor of and only 1 in opposition to such increase.

DURING the month of June, 28 prospective settlers visited the Riverton project and were shown the public land included in the recent opening. Eight applications for farm units were received and accepted and the advance water rental charge for 1932 was paid. One of these men filed homestead entry.

MESILLA Valley, lying within the Rio Grande project, has prospects of a bumper apple crop this season. The apples were not hurt by the late freeze in the spring. The early varieties of apples mature in August in this valley.—*The Earth.*

ON June 10 a tract of public land comprising 5,949 acres (87 units) was opened to entry on the Greenfields division of the Sun River project. During the first 20 days 34 applications were received from qualified entrymen, and 30 farms were allocated by the examining board. Practically all applicants were believed to be considerably above the average.

ON July 1 the contract for the Owyhee Dam, Owyhee project, was 72 per cent completed.

THE Hermiston Cooperative Cannery, Umatilla project, has been unusually active this season. Farmers are growing much more produce for home consumption than heretofore. The canning of home-butchered meat alone has doubled over that of last year, which was the first year of the operation of the cannery.

ON the Lower Yellowstone project activity continues by the Lower Yellowstone Development Association in cooperation with this bureau in an attempt to get settlers for the project. Several prospective purchasers were brought in during the month of June and reports indicate that a large number have signified their intention of making a personal inspection of the project and its opportunities.

ALL crops on the Minidoka project have made a good growth and are generally in excellent condition. The first cutting of alfalfa hay is in the stack and the yield and quality are good.

ON the Belle Fourche project corn is in good condition, particularly that under irrigation. Beets are also in fairly good condition, and those that have been properly cared for are more advanced than usual for this time of the year. Potatoes are also doing well.

CONSTRUCTION figures released by the city building inspector at Yakima, on the Yakima project, bring the building totals in the city of Yakima during the first six months of this year to more than $1,000,000. The total construction to July 1 amounted to $1,151,265, compared with $718,365 during the same period last year.

AS a result of recent rains the Shoshone project reports that range conditions have greatly improved and that all livestock on the open range are in excellent condition.

THE Minidoka County Wool Pool recently sold 18,000 clips of wool weighing over 176,000 pounds at 12¾ and 10 cents per pound for 136,000 and 40,000 pounds, respectively. Payment for the entire lot totalled $20,841. The Cassia County Wool Pool also disposed of the year's clip, amounting to 11,950 fleeces and weighing 105,000 pounds, at prices ranging from 10½ to 12½ cents per pound. The total receipts from the sale were $12,105.

The Minidoka County Lamb Pool shipped 7 cars containing 2,177 lambs and 20 wethers. The lambs weighed 175,780 pounds, an average of 80.7 pounds per head, and brought 6¾ cents per pound, or a total of nearly $12,000. A third lamb pool, containing 870 lambs, was shipped from Cassia County, the lambs weighing about 80 pounds each and netting the growers $5.70 per hundredweight, or a total of about $4,400.

IT is estimated that approximately 2,500 date off-shoots of standard commercial varieties were planted in the Salt River Valley this spring. With plantings averaging from 43 to 45 off-shoots to the acre, this means an addition of 55 acres to the valley's date industry. About 60 acres were planted to dates last year.—*The Earth.*

Hoover Dam and Its Influence on the Southwest

Address by Dr. Elwood Mead, Commissioner of Reclamation, before the Commonwealth Club, of San Francisco, Calif., July 10, 1931

THE destiny of the Southwest will be shaped by building Hoover Dam. If it is built, the cities of that region will continue to grow. If it is not built, they must stagnate. They need and must have the water which will be stored in the great lake it will create. If it is built, the people of the Imperial Valley will be secure. If it is not built, their homes and towns will almost certainly be submerged. Already it has exercised a wholesome influence on water laws and policies. The primitive conception that a man could acquire ownership of water by posting a notice in some lonesome bend of a cottonwood-bordered stream is being discarded. The riparian doctrine does not meet the economic needs of advancing civilization and constantly increasing population. The popular interest in Hoover Dam rests, however, not in its economic but in its engineering features.

MAGNITUDE OF UNDERTAKING

The first is size. Almost every dimension is a superlative. It will be 730 feet high. That is not only the highest dam in the world, but is nearly twice the height of any yet built. The lake which the dam will create will be 115 miles long and 580 feet deep. It will hold two years' flow of the river, or enough water to cover the State of New York to a depth of a foot. It will be not only the largest artificial lake in the world, but has thirteen times the capacity of the great reservoir on the Nile, to which reference is frequently made.

The four tunnels which will carry the river around the dam during construction have a combined capacity equal to the average flow of the Mississippi River at St. Louis. There is only one other tunnel in the world that can serve as a precedent.

The power machinery behind this dam will be the largest single installation in the world, and its dynamos will be larger than any yet built.

In its construction there will be 70 miles of grouting holes.

The contract for construction is for the largest sum of any signed by the Federal Government.

The dam will be an arch gravity, placed in a bottle neck of the canyon where the walls are only 300 feet apart. One end of its arch will rest against a mountain in Arizona and the other against a mountain in Nevada. One State or the other must move before the dam can fail.

If it should be overturned, it would still be the highest dam in the world, for its base is 650 feet wide.

RAPID PROGRESS ESSENTIAL

The next outstanding feature of the construction is speed. The machinery being installed for excavating the tunnels has a capacity never equaled. It will move nearly 2,000,000 cubic yards in less than two years. Over a million and a half cubic yards of material will have to be placed in the cofferdams that control the river at the two ends of the tunnels. That material will have to be placed under conditions of extreme difficulty, and the job will have to be completed between the end of one flood season and the beginning of another. This will be an unparalleled performance.

The dam must be built in the bottom of a narrow canyon with almost precipitous walls. Three and a half million yards of concrete are to be placed in this dam in two years. It will require 300 carloads of material a day, and the operation of one of the greatest elevators ever constructed.

ADVERSE CLIMATIC CONDITIONS

Among the obstacles which will confront the contractor is the climate. For eight months in the year it is all that could be desired, but for four months, what it is may be illustrated by a story. To help overcome the drawbacks of the climate, the Government is spending $2,000,000 to build a construction town 2,000 feet above the level of the river. Here workmen will eat and sleep. Here there will be trees and grass and flowers and a livable climate.

On the occasion of the recent visit of the congressional party they ate their breakfast in comfort in the contractor's mess hall, where 1,000 laborers are now fed daily. The manager of the dining hall said that before he came there he thought going so far from the work was insanity, but every time he came out of the sizzling heat of the canyon into the breezes and relative coolness of the construction town he felt it was the project's salvation.

Representatives of two bonding companies said at first that they had no interest in the enterprise, although the premium promised to exceed $1,000,000. Their representative had sizzled in the canyon one day. His report was enough. But when they had learned what was being done to improve living conditions they gave to this project a far lower rate than has been charged on many enterprises of much smaller size.

MIRACLES ALREADY ACCOMPLISHED

This project was inaugurated on July 3, 1930, when President Hoover approved the first appropriation. One year later, on July 3, 1931, Secretary Wilbur, a congressional party, and other officials of the Reclamation Bureau visited the project to see what had been accomplished.

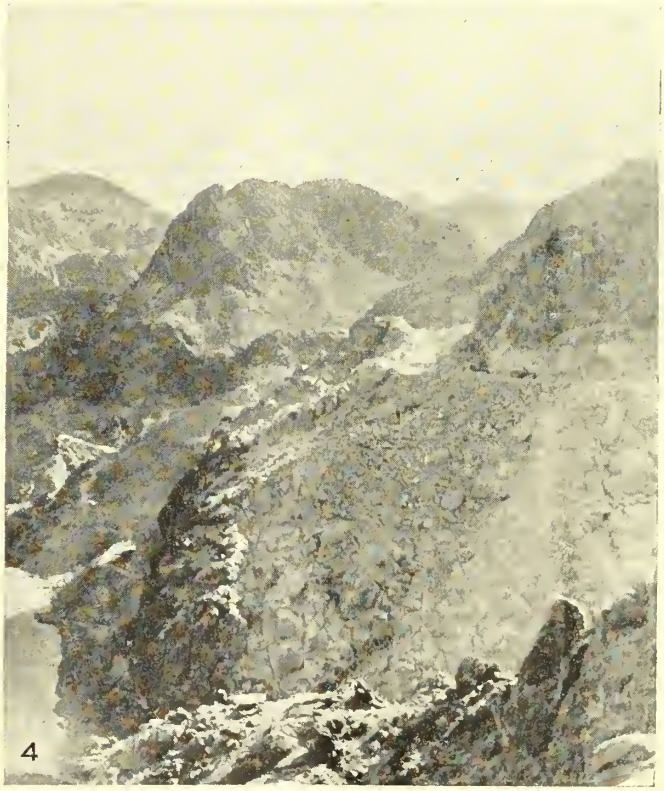
The train which carried the party arrived in the night. It had left the main line of the Union Pacific and traveled 23 miles over a branch line, built within the last six months. The cars rested in front of a railway station and in the midst of sidings ample for the needs of a city of 25,000 people, also built in less than six months.

In the morning the visitors saw a steel water tank holding 2,000,000 gallons. They looked on large dormitories built by the contractors, capable of housing 1,700 workers, with each man having a separate room, and on individual homes for several hundred married workers. They looked on the houses and administration buildings of the Reclamation Bureau, many of them nearing completion. They saw the 9-mile pipe line of a water system to provide for 5,000 people and pumps being installed to lift that water 2,000 feet.

The Government is building 75 residences and offices to house the engineering and administrative staff. The contractor is spending on an average $140 a man to promote right living conditions for his workers. This is three or four times the usual expenditure made. Up to the present, everyone—Government engineers, contractors, and their workers—has had to work under conditions of discomfort and hardship, which could not be avoided, but by September or October it will be an organized construction town with paved streets, an ample water supply, sewerage, and electric lights, and a location which will go far to overcome the discomfort of its climate during the summer months. The rest of the year the climatic conditions are ideal.

The party traveled from Boulder City to the canyon rim over a paved highway 7 miles long, which will be completed in a few weeks. They saw a railroad 10 miles long being built from the construction city to the canyon rim and 20 miles

PROGRESS OF CONSTRUCTION
BOULDER CANYON PROJECT



1. Excavation for sedimentation tank, Boulder City water supply. 2. Constructing presedimentation basin and water supply intake. 3. Excavation at outlets of Nevada diversion tunnels. 4. Highway at canyon under construction.

of railroad being built by the contractor—in all, 50 miles of construction railway.

They saw power being supplied over a line 250 miles long that had been built through an unbelievably rough desert. This was built in less than six months. They entered tunnels and saw the most powerful tunneling machine ever installed.

Within the year the plans and specifications for this work had been prepared and contracts let. Some of the equipment had to be carried in on pack mules, some by men. Water has yet to be hauled 50 miles. But the visitors found roads, railroads, houses built, a contract for streets, paving, and sewerage of the town let, and a water system nearly finished. All the work of six months.

Let us now consider the service which Hoover Dam will render.

The Colorado River, without regulation, is a turbulent torrent in early summer, but only a shadow after the mountain snows have melted. It has carried 200,000 cubic feet a second during flood, and only 1,200 cubic feet a second at its low stage. All the irrigated areas in its lower valley are menaced by drought this year. To use the river its floods must be stored. Within a brief period all this water will be needed.

HAZARDS OF EARLY CONSTRUCTION

The search for a suitable site for this dam went on for many years. Its history is filled with dramatic incidents. The early explorations were fraught with unknown dangers. Lives were lost, and there was always present a grave possibility that those who dared to traverse the gloomy canyons would never live to report their findings. Lieutenant Ives, exploring the river in 1857, gave up with the conclusion that the Colorado River, along the greater part of its way, should be forever unvisited and undisturbed.

The survey of the dam site and reservoir was of unprecedented magnitude and difficulty. It involved coping with a river which, in the highest floods, rushed through the canyon with the speed of a railway train; of taking topography in more than 100 miles of canyon where precipitous cliffs 1,000 feet high and of indescribable ruggedness had to be scaled. Three lives were lost in this hazardous undertaking. Every phase of the work involved great danger, but the dimensions of the possible dam and reservoir had to be known. Then there had to be a topographic map.

Anyone who views the canyon either from the top of the rim or from the river at the bottom, has a sense of the peril and hardship involved in fixing locations and making measurements on its cliffs. To have done this work by the old methods would have delayed beginning construction six months to a year. Resort was had to aerial surveys. This involved great hardship because of the intense summer heat and in making observations at great differences in elevation.

DETAILS OF CONSTRUCTION

The construction work now under way is the diversion of the river. This will be done by four tunnels, each 56 feet in diameter and 4,000 feet long. There is only one tunnel of equal or greater size. The Rove Tunnel in France, completed by the French Government in 1927, has a width of 78 feet 6 inches and a height of 54 feet 4 inches.

The four tunnels and the two cofferdams are to be completed within two years. After the dam is built these tunnels will be used in regulating the discharge from the reservoir. The two nearest the river will carry water to the power wheels, and the two outer ones will carry away flood waters if at any time there should be an overflow.

The gates needed to operate these tunnels will have greater size, greater weight, and greater strength than any hitherto built, because they must open and close apertures 50 feet in diameter under a 600-foot head. They will be 63 feet wide, 58 feet high, 21 feet thick, and weigh 13,200,000 pounds. These great dimensions do not cause us any concern, because we have at the Guernsey Dam gates similar in character, 50 by 50 feet, which have been operated successfully for several years.

In case there should ever be need for a wasteway, this is provided by an inclined shaft starting from the highest water level of the reservoir and connecting with the two outside tunnels. It is not expected that there will ever be a flood discharge of 250,000 second-feet, the estimated flood discharge in 1884, but, being ultraconservative, the outlet works will have a capacity of 400,000 second-feet.

NEW PROBLEMS CONFRONT THE ENGINEER

The water in this wasteway will drop down an inclined shaft 600 feet. This will give rise to a velocity of 175 feet a second, which is higher than any known in existing concrete structures. All known precedents stop at 100 feet. To be sure of what will happen, tests have been going on for months. Concrete blocks have had jets pointing directly at them with a velocity of 175 feet a second, and concrete drops have been subjected to a sliding velocity, such as would exist in the spillways. In neither case has there been any appreciable erosion, and in the case of the drops, which correspond to conditions at the dam, there has been nothing more than a discoloration of the surface.

With the river diverted, the solid foundation uncovered, with the loose rock of the side walls removed, and the grooves cut into the walls so that the arch dam will abut squarely against them, the placing of 3,500,000 yards of concrete will begin. It will be the largest single mass of concrete ever placed.

This creates a construction problem which has for months engrossed the attention of some of the leading civil engineers and concrete experts of the country. When concrete sets, a large amount of chemical heat is generated. With present-day cements it causes a rise of temperature of as much as 70° F. As this heat disappears, shrinkage occurs, causing cracks. In dams of ordinary size, this heat is dissipated at about the rate the dam is completed, but in the case of the Hoover Dam the mass is so enormous and the distance the heat has to be conducted is so great, that if it were built as a solid mass it would take 100 years for all of this chemical heat to be lost. To hasten this cooling the dam is to be built in a series of columns 50 feet square. These columns will be cooled by the insertion of pipes filled with a cooling solution. None of these columns will be carried up more than 30 feet at one time. They will be carried up so that the working surfaces will be unequal. After they have been carried up 30 feet, the space between them will be filled with grouting.

Hoover Dam will create important precedents in engineering. It has vitally modified previous conceptions of water law and water policies. Neither the riparian doctrine nor the doctrine of prior appropriation met the requirements of this development. This great work will utilize the entire flow of the river, but none of the four States above it was willing that its rights should be subordinated under the doctrine of prior appropriation. Equally, the doctrine of riparian rights was unsuited to the necessities of this region, which required a large part of the water to be carried across a mountain range and delivered to the coast counties of California.

The result was the calling of a conference at Santa Fe, N. Mex., with President Hoover as chairman, and the formulation of a new water policy which will in time be applied to the development of all the important rivers of the West. Under it the river was divided into two sections. Practically half of the water was allotted to the upper section and the other half to the lower section, and the division between

the States is to be determined by investigation, the intention being that the water should be applied where it would render the greatest service. Arizona objected to this and said, "This is our water because the river flows through our State," but the Supreme Court, in three epoch-making decisions regarding water, has shown that in the future this great resource will be controlled by the doctrine of the needs of civilization and the most urgent needs.

PROVISION FOR FINANCING

Hoover Dam and the All-American Canal are to be built with money taken from the Federal Treasury. All money spent on Hoover Dam and related works is to be repaid with interest. All spent on the All-American Canal is to be repaid without interest. This legislation also sets a new precedent.

No single State of the seven States interested in this river had the financial resources to carry out the work alone, and it is not believed that an agreement between the different States for teamwork could have been secured.

It is fortunate, therefore, that power could be generated and sold for enough to pay the entire cost. The greatest economic benefits will come from irrigation in Arizona and California, and in supplying water to meet the growing need of Los Angeles and other coast cities, but the money to pay for storing the water will come from power.

The entire output of the power wheels has been sold, and payment for it underwritten by two California agencies, the Southern California Edison and the Department of Water and Power of Los Angeles. The States of Nevada and Arizona are entitled to receive, if they ask it and agree to pay for it, 36 per cent of the power output, but if they do not ask for any, the two contracting agencies will take it all and pay for it all. The estimated income from power within the 50 years of the contract period is $361,000,000. This will pay for the works, with 4 per cent interest, and leave a net profit of $66,000,000.

The entrance of the Government into a development of this character caused every individual and locality within the field of operations to consider how they could get the most out of it. Some climbed on the band wagon and some sought to keep it from starting. No Secretary of the Interior was ever faced with more difficult questions, and no one could have faced them with a greater clearness of vision or greater desire to make this development a pattern which could be followed on other great rivers of the arid region.

Boulder Canyon Project Celebrates Anniversary

In celebration of the first anniversary of the passage by Congress and the signing by President Hoover of the bill appropriating the first $10,660,000 for construction of Hoover Dam, on the evening of July 3, the Las Vegas Chamber of Commerce tendered a banquet to Secretary Wilbur, Commissioner Mead, Chief Engineer Walter, and the visiting members of the subcommittee of the House Appropriations Committee of the Interior Department.

Secretary Wilbur delivered an address recounting the primitive methods of dam building and irrigation development on this continent, and giving a picture of the future to be made possible by the construction of the Boulder Canyon project.

Following breakfast the party was loaded into busses furnished by James Cashman, the Union Pacific, and numerous private cars, and was taken to the substation of the Nevada-California Power Co. The station was inspected and the party walked about a quarter of a mile to the rim of the canyon. Here the Secretary and other members of the party described the progress of the work for sound cameras.

PARTY TAKES TRIP THROUGH CANYON

The party then was taken to the survey camp, where a very appetizing luncheon was served. After luncheon they were taken to the boat landing at Williamsville and served delicious cold punch, after which they proceeded in four boats on a trip through the canyon.

At the lower portal of the diversion tunnels on the Nevada side a blast of T. N. T. had been prepared. Secretary Wilbur and party landed on the Arizona side and discharged the blast by electric contact. Thus was begun the first direct excavation on the lower portal of the diversion tunnels.

Returning to the site of the dam abutment the party inspected the adit tunnel being driven into the Arizona side as a working and ventilating tunnel through which to drive each of the diversion tunnels both north and south. The adit meets the location of the diversion tunnels at the top of the 50-foot diameter, the excavation to be made below in a succession of steps. The great magnitude of this work is better understood when it is known that four of the diversion tunnels are each 50 feet in diameter, their combined length being 16,000 feet, or more than 3 miles.

The party walked across the river on the frail suspension bridge hung 50 feet above the rushing current, and then made the voyage by river, returning to Las Vegas at 7 o'clock to partake of a banquet served in the Methodist church. Louis C. Cramton, special attorney to the Secretary of the Interior, served as toastmaster, carrying out his duties in a delightful way, and referring affectionately to the members of the committee who were his former colleagues during his 12 years as head of that committee.

ADDRESSES BY MEMBERS OF THE PARTY

The speakers, beginning with Secretary Wilbur, were in happy mood and expressed delight and amazement at the wonders shown them during a memorable day.

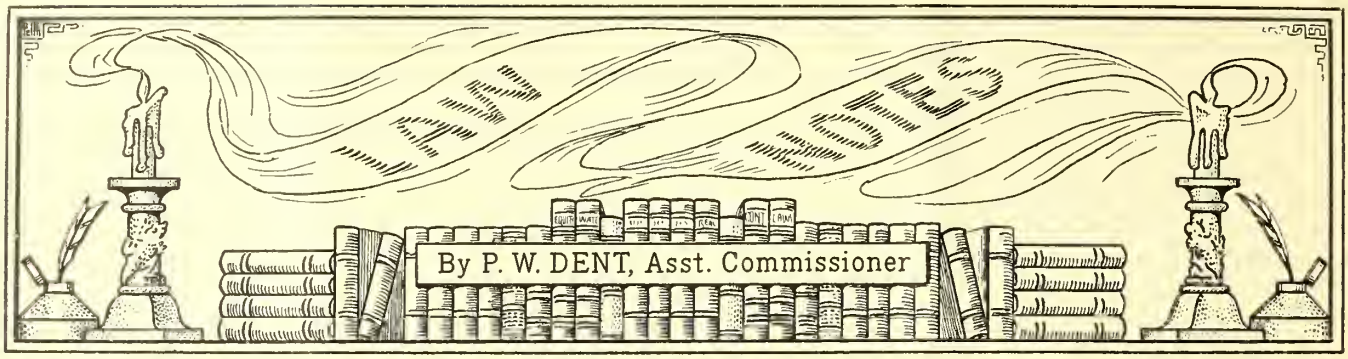
Representative Sam Arentz, of Nevada, gave a fine address to his colleagues in Congress, in which he welcomed them to Nevada, and described some of the interesting features of the State.

George W. Malone, State engineer of Nevada, welcomed the guests on behalf of Governor Balzar, who was unable to be present.

Among others who spoke briefly were Horace M. Albright, Director of the National Park Service; Representative Burton L. French, of Idaho, member of the Appropriations Committee; Dr. Elwood Mead, Commissioner of Reclamation; Representative E. T. Taylor, of Colorado; F. J. Bailey, member of the budget committee for the Interior Department; Representative William W. Hastings, of Oklahoma; Representative Frank Murphy, of Ohio; and E. F. Scattergood, chief engineer of the Los Angeles Power Department.

Doctor Mead took occasion to thank the chamber of commerce and the people of Las Vegas for their courtesy, President Carl Gray and other officials of the Union Pacific for their splendid cooperation, and those who furnished cars for the party. Referring to Boulder City, Doctor Mead said: "We are there laying a permanent foundation for a real addition to the population and welfare of the State of Nevada."—*Las Vegas Age.*

ON the Riverton project crops in general are in good condition. The first stand of alfalfa has been cut.



"Final Settlement" Under Act of February 24, 1905

THE question of "when final settlement was made with Government contractors" within the purview of the act of February 24, 1905, chapter 778 (33 Stat. 811; sec. 270 title 40, U. S. C. A.)—authorizing suit by material men, and laborers upon the contractor's performance bond, has become so persistent that the case of Lambert Lumber Co. *v.* Jones Engineering and Construction Co., decided by the Eighth Circuit Court of Appeals, and reported in 47 Fed. (2d) 74 is of timely interest to the officers of the Reclamation Bureau to whom such question is being directed, and of peculiar interest to the laborers and material men making such inquiry, as well as of such general interest to the readers of the NEW RECLAMATION ERA as to entitle the reported case to be briefly reviewed.

The claim for which the contractor's surety was being sued in the case to which reference is made was first presented by a material man more than a year (*a*) after completion of the Government contract, and (*b*) after approval of the voucher for final estimate by every department (of the Government) interested in the construction, but within a year after the final voucher had been referred to the Comptroller General for examination, settlement, and approval for payment in the amount found due to the (claimant) and by that officer certified as having been examined and settled.

The court, in an exhaustive opinion, related the evolution of the general accounting system of the United States, distinguished the case of Illiniois Surety Co. *v.* Peeler (240 U. S. 214, 60 L. ed. 609), criticised several decisions following the Supreme Court case, and finally constricted the operation of the decision to the sole proposition that "final settlement" within the purview of the act of Congress herein cited was made by the Comptroller General under the facts of that case without purporting to "pass on the question of whether all settlements of claims and demands for or against the Government must be made by the Comptroller General to be final settlements under section 270, title 40, U. S. C. A."

The facts as stated in the syllabus were as follows:

"In suit against Government contractor and sureties, material man filed petition in intervention under 40, U. S. C. A., section 270, which court dismissed on ground that it was filed more than year after final settlement under contract. A jury was waived, and trial court made certain findings of fact regarding terms of contract relating to settlement, release executed by contractor, date thereof, determination of certain administrative officers of Government, and various steps taken to determine amount due under contract. The trial court, in effect, stated that from the findings of fact so made the conclusion followed that final settlement occurred more than year before petition in intervention, was filed and therefore same was barred.

"As a result of correspondence between proper department of the Government and the contractor under contract for construction of Government hospital, Government procured release from contractor in consideration of payment of stipulated sum in full of amount due under contract. Voucher for such stipulated sum was approved by every department of the Government interested in the construction, including the Director of the Veterans' Bureau and the Chief of the Bureau of Yards and Docks of the Navy Department. Thereafter voucher was sent to the General Accounting Office, accompanied by letter referring same to such office for 'examination, settlement, and approval for payment' from designated appropriations. After due examination the Comptroller General of the General Accounting Office certified that he had 'examined and settled the claim * * * for final payment.' "

The circuit court of appeals reversed the district court and held that—

"Certification by Comptroller General of General Accounting Office of amount due under contract for construction of veterans' hospital held 'final settlement' within statute governing material man's right to intervene in suit on contractor's bond (Lambert Lumber Co. *v.* Jones E. & C. Co., 47 Fed. (2d) 74)."

B. E. STOUTEMYER,
District Counsel.

Water Right Agreements Yakima Project

In West Side Irrigation Co. *v.* United States, 246 Fed. 212, decided October 15, 1917, the Circuit Court of Appeals Ninth Circuit, upheld the agreements executed by the United States with owners of prior water rights, Yakima project, by which the priority holders stated definitely the amounts of water they were entitled to divert and use.

Another of these so-called "limiting agreements" has recently been before the same court in the case of United States *v.* Union Gap Irrigation District, decided March 17, 1930, 39 Fed. (2d) 46. The Union Gap Irrigation District, successor to the Fowler Ditch Co., which executed one of these limiting agreements in 1905, claimed a right to divert 3 second-feet more water than fixed in the agreement, on the ground that C. Z. and Martha Cheney had independent carriage rights in the district's ditch to the extent of 3 second-feet. The claim of the district was that the Cheney water right was not affected by the limiting agreement, and hence that the district could divert the Cheney water in addition to the amount fixed in the limiting agreement. The United States brought a suit to enjoin the additional diversion, the Cheneys not being made parties. The trial court entered a decree enjoining the district from diverting more than the amount specified in the limiting agreement, with a proviso that until such time as the question should be adjudicated between the United States and the Cheneys, the district should be privileged to divert an

additional amount sufficient to satisfy the Cheney right.

The proviso being unacceptable, the Government appealed. The decree was reversed with directions to set aside the decree, to take appropriate proceedings to bring in the Cheneys, if feasible, and ultimately with or without the Cheneys to determine the issues unconditionally.

A retrial of the case was then had in the lower court, the Cheneys being made parties (United States *v.* Union Gap Irrigation District in the United States District Court for the Eastern District of Washington).

Prior to 1928 the defendant and its predecessors had limited its river diversions to 23 second-feet, the amount fixed in the limiting agreement of 1905. In 1928, for the first time, the district diverted more than 23 second-feet into its canal, claiming that it was entitled to the 23 second-feet designated in its limiting agreement plus the 3 second-feet which it was under contract to deliver to the Cheneys, who had not executed the limiting agreement.

On the retrial the district court entered an injunction restraining the defendant from diverting more than 23 second-feet. The court considered the practical interpretation of the contract for the period between 1905 and 1928 as very persuasive as to the proper interpretation of the agreement. The decision, if final, will become a precedent of great value to the Yakima project.

SPENCER L. BAIRD,
Associate District Counsel.

State Taxation of Federal Power Development

In Alabama *v.* United States, decided February 24, 1931 (282 U. S. 502), the Federal Supreme Court held that the Court of Claims was without jurisdiction to entertain a suit brought by the State of Alabama to recover a tax attempted to be imposed by State law upon the privilege exercised by the United States of manufacturing and selling hydro-electric power at Muscle Shoals, Ala. The court held the claim was not based upon a contract implied in fact, nor was it within the jurisdiction of the Court of Claims as established by United States Code, title 28, section 250. The failure of the State's attempt to tax Government production of hydro-electric power is an important precedent in connection with the Hoover Dam power plant on the Colorado River. See NEW RECLAMATION ERA for August, 1930 (p. 151), for a note upon this litigation when before the Court of Claims.

Recently Enacted Legislation

Foreclosure of Mortgage Upon Real Estate

[PUBLIC—No. 862—71ST Congress]

AN ACT To permit the United States to be made a party defendant in certain cases.

That, upon the conditions herein prescribed for the protection of the United States, the consent of the United States be, and it is hereby given, to be named a party in any suit which is now pending or which may hereafter be brought in any United States district court, including those for the districts of Alaska, Hawaii, and Porto Rico, and the Supreme Court of the District of Columbia, and in any State court having jurisdiction of the subject matter, for the foreclosure of a mortgage or other lien upon real estate, for the purpose of securing an adjudication touching any mortgage or other lien the United States may have or claim on the premises involved.

SEC. 2. Service upon the United States shall be made by serving the process of the court with a copy of the bill of complaint upon the United States attorney for the district or division in which the suit has been or may be brought and by sending copies of the process and bill, by registered mail, to the Attorney General of the United States at Washington, District of Columbia. The United States shall have sixty days after service as above provided, or such further time as the court may allow, within which to appear and answer, plead or demur.

SEC. 3. Any such suit brought against the United States in any State court may be removed by the United States to the United States district court for the district in which the suit may be pending. The removal shall be effected in the manner prescribed by section 29 of the Judicial Code (title 28, sec. 72, U. S. C.): *Provided,* That the petition for removal may be filed at any time before the expiration of thirty days after the time herein or by the court allowed to the United States to answer, and no removal bond shall be required. The court to which the cause is removed may, before judgment, remand it to the State court if it shall appear that there is no real dispute respecting the rights of the United States, or all the other parties shall concede of record the claims of the United States.

SEC. 4. Except as herein otherwise provided, a judicial sale made in pursuance of a judgment in such a suit shall have the same effect respecting the discharge of the property from liens and encumbrances held by the United States as may be provided with respect to such matters by the law of the State, Territory, or District in which the land is situated, provided that a sale to satisfy a lien inferior to one of the United States shall be made subject to and without disturbing the lien of the United States, unless the United States, by its attorneys, consents that the property may be sold free of its mortgage or lien and the proceeds divided as the parties may be entitled: *And provided further,* That where a sale is made to satisfy a lien prior to that of the United States, the United States shall have one year from the date of sale within which to redeem. In any case where the debt owing the United States is due, the United States may ask, by way of affirmative relief, for the foreclosure of its own lien or mortgage and in any case where property is sold to satisfy a first mortgage or first lien held by the United States, the United States may bid at the sale such sum not exceeding the amount of its claim with expenses of sale, as may be directed by the chief of the department, bureau or other agency of the Government which has charge of the administration of the laws in respect of which the claim of the United States arises.

SEC. 5. If any person shall have a lien upon any real or personal property, duly filed of record in the jurisdiction in which the property is located, and a junior lien (other than a lien for any tax) in favor of the United States attaches to such property, such person may make a written request to the officer of the United States charged with the administration of the laws in respect of which the lien of the United States arises, to have the same extinguished. If after appropriate investigation, it appears to such officer that the proceeds from the sale of the property would be insufficient to satisfy, in whole or in part, the lien of the United States, or that the claim of the United States has been satisfied, or by lapse of time or otherwise has become unenforceable, such officer shall so report to the Comptroller General who thereupon may issue a certificate of release, which shall operate to release the property from such lien.

SEC. 6. No judgment for costs or other money judgment shall be rendered against the United States in any suit or proceeding which may be instituted under the provisions of this Act. Nor shall the United States be or become liable for the payment of the costs of any such suit or proceeding or any part thereof.

Approved, March 4, 1931.

Riverton Project, Wyoming

THE Riverton project embraces an area of approximately 100,000 acres of land located in central Wyoming on the ceded portion of the Wind River Indian Reservation, lying north of Wind River and west of the Big Horn. Irrigation possibilities were first investigated in 1904. The land was ceded by the Indians in March, 1905, and shortly thereafter the Wyoming Central Irrigation Co. was organized for the purpose of constructing a canal system to bring water to the arable land, and about 25 per cent of the project was entered at that time with the expectation that water would be made available at an early date. No construction work was accomplished by this company, and in 1913 the rights acquired by them were transferred to the State of Wyoming, and in turn assigned to the United States in 1919.

This project was first started as an Indian irrigation project in 1917, but was placed under the jurisdiction of the Bureau of Reclamation by the act of June 5, 1920. Construction work was started in 1918, and good progress has been made, nearly 200 miles of canals and laterals having been built. Water can now be delivered to about 32,000 acres of land. The Government has invested approximately $4,000,000, but in view of the slow progress in settlement and development of the project, construction work was temporarily suspended in 1930.

On the upper portion of the main canal, where a part of the water is dropped into Pilot Butte Reservoir, a hydroelectric power plant has been built with an initial capacity of 1,100 horsepower, with provision for enlargement when required. The power generated at this plant will be used for completing the project and electric current is now available at reasonable rates for use by the settlers.

PUBLIC LAND OPENINGS

The first Government homestead land was opened in 1926, and was located near the town of Pavillion, about 25 miles from Riverton, the nearest station on the Chicago & North Western Railroad. Lack of transportation facilities has retarded the settlement of the project, but notwithstanding this handicap there are now 31 farms paying charges and using water. About a year ago the Public Service Commission of Wyoming filed a petition with the Interstate Commerce Commission asking that either the Chicago & North Western or the Chicago, Burlington & Quincy be directed to build a branch line into the project. Hearings were held last winter, but no decision has been reached.

Under date of May 1, 1931, 50 farm units in the Pilot division, with an irrigable area of 3,600 acres, were opened to homestead entry. This area contains some of the best land on the project and is only 10 miles from Riverton. These farms may be taken under the homestead law, but entrymen must have, in addition to a homestead right, good health, at least two years' farming experience, and $2,000 in cash or its equivalent in livestock and farming equipment. As the land was formerly a part of an Indian reservation, entrymen must pay the Indians $1.50 per acre, 50 cents at the time of entry and 25 cents an acre each year for the following four years. Water will be delivered in 1932 on a rental basis on payment in advance of $1 per acre for the irrigable area, which will entitle the settler to 2 acre-feet of water for each dollar. Payment for the season of 1932 is due May 1 of that year, and additional water, if desired, will be delivered at 50 cents per acre-foot payable December 1.

REPAYMENT OF CHARGES

Under a contract recently signed between the Government and the Midvale irrigation district, which has been organized on the project, the cost of water is to be paid in 40 annual installments without interest beginning December 31, 1935, and continuing until December 31, 1974. The first of these payments will be 1 per cent of the total, which will be gradually increased to 5 per cent in 1973. It is estimated that the actual total cost per acre will be $90, which covers the delivery of water to each farm and the cost of such drainage as may be found necessary. In no case will the settler repay to the Government more than the actual cost without interest.

At present the Bureau of Reclamation is operating the canal system, but it is expected that the irrigation district will take over this task beginning with the season of 1935.

SETTLEMENT OPPORTUNITIES

The Riverton project now offers an excellent opportunity for persons who desire to make homestead entry on an irrigated tract of land. The soil is fertile, and even during this period of wide-spread drouth there is an adequate supply of water, climatic conditions are favorable for the production of all staple crops, and stock raising promises profitable returns. Parties who desire additional information should address inquiries to the Project Superintendent, Bureau of Reclamation, Riverton, Wyo., or the Commissioner, Bureau of Reclamation, Washington, D. C.

Dedication Ceremonies—Milner-Gooding Canal

On June 14–15 the Idaho Reclamation Jubilee in celebration of the completion of the Milner-Gooding Canal, Minidoka project, was held at Shoshone, Idaho. The special feature of the celebration was the formal canal dedication at the spillway at Little Wood River on June 14, which was attended by a crowd of approximately 200 persons. Mrs. Catherine Crouch, of Jerome, used the following words in dedicating the structure: "We dedicate this spillway to Mrs. Frank R. Gooding, who helped her illustrious husband in his great work."

Addresses were made by United States Senator John Thomas, of Gooding, one of the staunchest promoters of the project; Governor C. Ben Ross, of Idaho; E. B. Darlington, superintendent of the Minidoka project, representing the Bureau of Reclamation, who was introduced by Senator Thomas as the man who had done more than any other to locate a satisfactory route for the canal; C. H. Spencer, superintendent of construction of the canal east of the big dam; and J. K. Rohrer, superintendent below the drop.

The dedication was a colorful service lasting more than an hour, and this was followed by a parade in the city of Shoshone which was even more colorful and which was attended by six to ten thousand persons gathered from all parts of the State, but more particularly from the central Idaho section, to which the coming of the canal means a surcease from water shortage.

The Milner-Gooding Canal was constructed to carry water from Milner Dam on the Snake River to the Little Wood River, where it will add to supplies which have been inadequate to irrigate the 300,000-acre project.

Land Settlement Progressing Under Kittitas Division

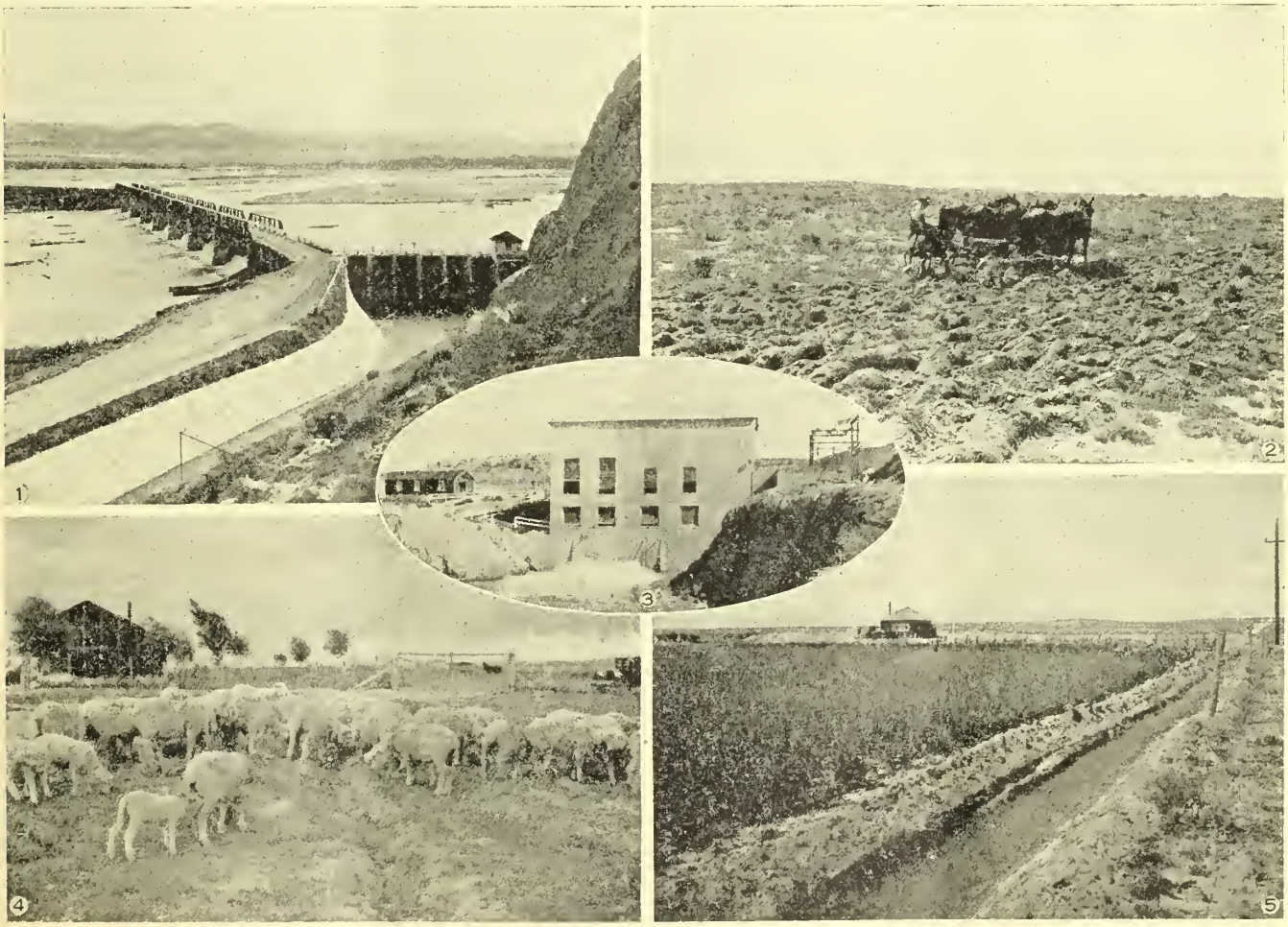
Settlement of lands under the Kittitas unit, Yakima reclamation project, near Ellensburg, Wash., is progressing in a splendid manner, according to word received from the Ellensburg Chamber of Commerce. Practically all of the privately owned land appears to be in permanent hands, and most of the 6,700 acres of railroad lands are sold. One tract of State land was purchased recently and another tract is now advertised for sale.

The Kittitas unit serves about 30,000 acres of improved farm lands which have been farmed for many years from creek water rights and about 40,000 acres of undeveloped lands are included, or rather lands which *were* undeveloped as the clearing, fencing, and seeding operations are keeping pace with construction.

"The good reputation which Kittitas Valley has regarding its prosperous agriculture, good homes, fine roads, splendid schools, and churches, the very good transportation offered by two main railroads, and nearness to big markets, all creates an intense interest in land settlement," reports the secretary of the Ellensburg Chamber of Commerce.

THE local chapter of the Veterans of Foreign Wars at Yuma, Yuma project, recently completed the construction of a new clubhouse by remodeling one of the adobe buildings of the Old Arizona Territorial prison which was moved to Florence, Ariz., about 1907. This organization held an elaborate Fourth of July celebration on the old prison grounds to dedicate their clubhouse. The program included a barbecue, several boxing matches, and a sham airplane battle with a proposed airplane crash. Dances were held in the evening for old and young.

ON June 30 the irrigation district boards on the Lower Yellowstone project awarded a contract for the erection of an office building in Sidney, Mont. It is expected that the project headquarters will be moved to Sidney when the districts take over the operation of the project early in 1932.



DEVELOPMENT ON RIVERTON PROJECT, WYOMING

1. Wind River diversion dam. 2. Breaking light sagebrush near Pavilion, Wyo. 3. Pilot Butte power house. 4. Sheep. 5. Farm home and crop (first year)

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Sugar Beets on the Federal Irrigation Projects

In 1930 sugar beets were grown on a commercial basis on 11 Federal irrigation projects, the crop being raised on 79,897 acres, producing 1,043,847 tons of beets, or an average of 13.06 tons per acre, valued at $7,575,664, or $94.82 per acre. In 1929 the yield per acre was 11.3 tons and the value per acre $81.36.

The North Platte project, Nebraska-Wyoming, reported nearly half the acreage and more than half the tonnage and total value. The highest average yield per acre of 15.4 tons was reported by the Gering and Fort Laramie district on this project. Where the crop was grown on a commercial basis, the highest average value per acre of $111 was on the Huntley project, Montana, closely followed by $109.32 on the Gering and Fort Laramie division.

Assuming a 15 per cent sugar content, the beets grown on the projects in 1930 yielded 313,000,000 pounds of sugar, or more than 2½ pounds per capita for the population of the United States.

Sugar beets grown on reclamation projects in 1930

Project	Area	Yield		Value	
		Total	Average per acre	Total	Average per acre
	Acres	*Tons*	*Tons*		
Grand Valley, Colo	1,136	9,731	8.56	$75,822	$66.74
Uncompahgre, Colo	3,803	31,182	8.20	225,424	59.27
Minidoka, Idaho	6,489	62,563	9.64	469,222	72.31
Gravity division	3,191	29,254	9.17	219,405	68.75
Pumping division	3,298	33,309	10.10	249,817	75.74
Huntley, Mont	4,988	70,488	14.13	556,857	111.63
Milk River, Mont	3,176	39,023	12.00	288,770	90.92
Malta division	985	11,875	12.05	87,875	89.18
Glasgow division	4	68	17.00	503	119.00
Chinook division	2,187	27,080	12.39	200,392	91.65
Sun River, Mont	42	498	11.86	3,486	83.00
Fort Shaw division	39	481	12.30	3,367	85.78
Greenfield and Big Coulee division	3	17	5.67	119	39.67
Lower Yellowstone, Montana-North Dakota	7,424	91,965	12.38	665,961	89.70
District No. 1	5,649	68,501	12.10	496,454	87.88
District No. 2	1,775	23,464	13.21	169,507	95.50
North Platte, Nebraska-Wyoming	38,989	566,588	14.53	4,024,066	103.21
Pathfinder irrigation district	13,582	194,005	14.30	1,377,435	101.40
Gering and Fort Laramie irrigation district	13,881	213,722	15.40	1,517,426	109.32
Goshen irrigation district	9,572	132,242	13.80	940,210	98.19
Northport irrigation district	1,954	26,619	13.60	188,995	96.72
Belle Fourche, S. Dak	7,060	87,044	12.30	631,071	89.31
Strawberry Valley, Utah	3,286	40,634	12.36	291,010	89.00
High Line division	865	11,024	12.74	78,898	91.21
Mapleton division	463	5,191	11.21	37,263	80.50
Spanish Fork division	1,683	20,969	12.45	150,150	89.21
Springville, division	275	3,450	12.54	24,699	89.81
Shoshone, Wyoming	3,504	44,131	12.60	343,975	98.17
Garland division	2,756	34,272	12.44	268,063	97.28
Frannie division	748	9,859	13.18	75,912	101.49
Total and average	79,897	1,043,847	13.06	7,575,664	94.82

Applications for Business Permits Accepted for Filing at Boulder City

By Louis C. Cramton, Special Attorney to the Secretary

Two hundred and ninety-five formal applications have been filed for business permits in Boulder City. These applicants average very highly in apparent capacity to serve the needs of the people in the new community. Very generally they appear to have very satisfactory plans for business development and to have the experience, financial strength, and character to make them desirable additions to the town. In numerous lines the number of applications received is materially larger than the probable business in the town would support. It being the desire of the Bureau of Reclamation to prevent excessive development of the business section in Boulder City in the beginning, selections will be made in these overcrowded classes of applications, the effort being to secure those best fitted to give the best service to the town. It is interesting to note that these applications come from nearly every State in the Union, testifying eloquently to the widespread interest of the country in the Boulder Canyon project.

While applications filed not later than June 30 have priority of consideration, applications may still be filed for any line of business and will be given such consideration as is possible under the circumstances; that is to say, if sufficient number of satisfactory applications were not received prior to the close of filing, June 30, applications hereafter received will be considered, but not otherwise.

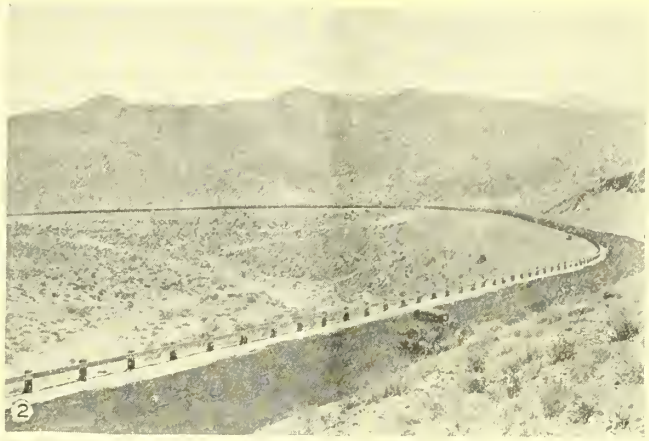
BY STATES

Arizona, 17; California, 76; Colorado, 17; Florida, 2; Georgia, 1; Idaho, 4; Illinois, 2; Iowa, 1; Kansas, 8; Kentucky, 1; Maryland, 1; Massachusetts, 2; Michigan, 3; Mississippi, 1; Missouri, 2; Montana, 1; Nebraska, 1; Nevada, 65; New Jersey, 2; New Mexico, 11; New York, 2; North Carolina, 1; Ohio, 4; Oklahoma, 4; Oregon, 6; Pennsylvania, 4; Rhode Island, 1; Tennessee, 1; Texas, 12; Utah, 23; Virginia, 2; Washington, 1; West Virginia, 1; Wisconsin, 1; Wyoming, 12; District of Columbia, 2. Total number, 295. Number of States represented, 36.

BY KINDS OF BUSINESS

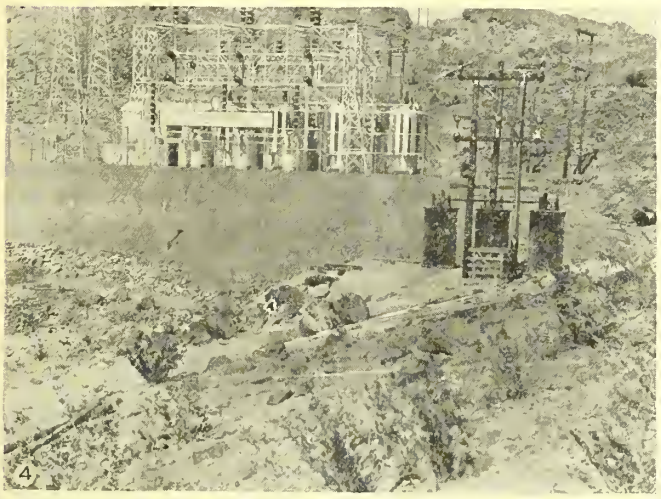
Auto sales and service, 8; bakery, 1; barber shop and beauty parlor, 16; boxing arena, 3; brokerage, general, 1; building materials, 9; cement tile, manufacture of, 2; chiropractic, 2; curio shop, 2; dairy, 4; dentist, 5; drug store, 31; dry cleaning, 1; dry goods, 1; electrical equipment, sales, repair and contracting, 5; fruits and produce, 1; furniture, 1; garage, 2; garbage collection, 6; gas for fuel manufacture, 1; gasoline, retail, 14; gasoline, wholesale, 4; general store, 11; grocery and meat market, 8; groceries, wholesale, 1; hardware, 2; hospital, 2; hotel or boarding house, 5; ice, manufacturing of, 4; ice cream, wholesale, 1; indoor recreation, 23; insurance, 2; jewelry, 5; landing field, 1; laundry, 3; laundry agency, 3; law and collections, 1; ladies' ready-to-wear, 2; leather work, 1; men's furnishings, 5; motor transportation, 6; newspaper, 1; news stand, 4; photo supplies, 2; physician, 2; restaurant, 14; shoe shine and hat cleaning, 1; shoe repair, 6; shoe store, 6; soft drinks, manufacture, 1; soft drinks and confectionery, retail, 12; soft drinks, wholesale, 1; tailor and cleaning, 4; telegraph, 2; telephone exchange, 1; theater, 16; tourist camp, 7; undertaking, 2; variety store, 3; water, bottled, 1; welding, 2. Number of kinds of business, 62.

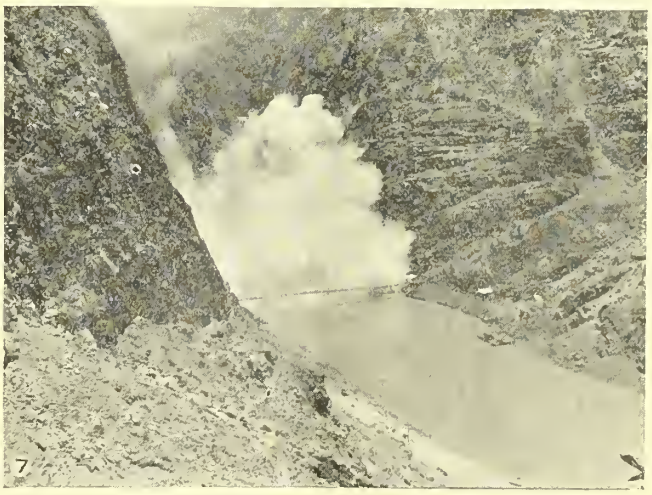
GRADING of the new highway between Burley, Minidoka project, and American Falls via Rupert and Montgomery Bridge, thence along the east shore of Snake River, is practically completed. This road will materially shorten the distance between the two termini and will provide easier grades and curves than those on the present highway.



PROGRESS OF CONSTRUCTION

BOULDER CANYON PROJECT





1. Construction highway near Government survey camp. 2. Boulder City-Hoover Dam Highway. 3. Six Companies' 1,000-man messhouse and dormitories, Boulder City. 4. Power company substation and United States transformer station. 5. Government employees' cottages under construction. 6. Switching yard, Boulder City. 7. Blast at dam site from above outlet, Nevada tunnels

THE following article has been written by the wife of one of our engineers assigned to the Boulder Canyon project. An article giving first impressions, written just after her arrival at Las Vegas, Nev., and after making her first trip to the Hoover Dam site, appeared in the June issue of the ERA, in this section.

A Visit to the Hoover Dam Site

By Mrs. D. L. Carmody

Many changes have taken place at the site of Hoover Dam since my first visit there last October. We drove there again one day in May and I noticed that the dull browns and drab grays of the desert growth had turned to lovelier colors, soft hazy greens, and where the desert and mountains met, a wonderful sea blue; the grease-wood and yucca had yielded to the lure of spring and even the thorny cactus hid its cruel barbs beneath masses of gorgeous blooms. The day was warm and miniature cyclones whirled their dust all about us as we sped along; the sky was the color of larkspur and against it the jagged peaks of the low lying mountains made me think of the painted drop curtain of a theater.

VEHICULAR TRAVEL FROM PRIMITIVE TO MODERN

The road which on our former trip was almost deserted was now crowded with vehicles of every description; large, powerful cars carrying tourists to view the dam site, smaller cars speeding into Las Vegas, old fashioned touring cars filled with camping paraphernalia, Government-owned cars, depot wagons, trucks loaded with everything imaginable from intricate-looking machinery to thriving families with their household goods surrounding them, and amid all this confusion an old man drove an archaic vehicle with superb indifference to the noise and movement surrounding him. He sat hunched on the board seat of a rickety spring wagon drawn by two lean and wiry burros and at the tail end of the ancient carryall there trotted another burro with a pack strapped to his back; the bed of the wagon was loaded with mesquite wood valuable for fuel and as this queer cavalcade passed us I am sure I heard one burro emit a loud and scornful bray. That old man is the incarnation of all the desert rats of fiction and most probably he has spent his best years searching the sands and foothills for

Panoramic view of

a paying location; perhaps he once found a vein of gold and spent it royally in one of the "ghost" towns of Nevada, drinking at some long-forgotten "bar," dancing to the lilting music of fiddles long since stilled; now he has only his memories of a glamorous past which wrap about him like an invisible armor and, living in his dreams, he harks back to the land of nevermore.

BUSINESS ACTIVITIES

All along the way were service stations, hot-dog stands, cool drink emporiums and lunch houses with attractive if deceptive titles. One "The Spot of Shade," sat exposed to the full glare of the sun and it was in vain that I searched for even one tiny spot of shade. These places lined the road till we came to the tracks of the new railroad which now connects Boulder City with the outside world. At the survey camp of the Reclamation Bureau, where once had been just one row of tents, there were now several additional rows, also an immense Government warehouse, and a huge machine shop belonging to the Six Companies, by which is meant the six great contracting companies which, under Uncle Sam's supervision are preparing to build Hoover Dam.

Just above us on a beautifully situated plateau Boulder City is beginning to assume proportions and already the tremendous water tank for the city's water supply has been planted on a high knoll; a road winding up to the town was an invitation hard to resist but being pressed for time we contented ourselves with a view from the car. Arriving at the "Flat" we stopped a few moments and it was interesting to observe the changes which six months had wrought there. Where once the curio shop held full sway were now tents and board shacks as thick as fallen leaves; a sort of general store overlooked the river and at a little distance was the office of the deputy marshal whom the United States Bureau of Reclamation has placed in authority over the settlement.

OPPORTUNITY SEEKERS IN CAMP

Nestling under every rock, mound, or mesquite bush, whatever offered a modicum of shade were people—in cars, in dog tents, in portable houses, and even camping frankly in the open, their beds neatly made and their week's wash swinging on a line. It was the noon hour and the residents were taking their ease, chatting with their neighbors, doing a bit of cooking, shepherding the numerous children rolling and tumbling in the sand; a home-like atmosphere prevailed and there was an appearance of permanence that belied the fact that in a brief space of time all of this would be the bed of a lake formed by the dam. I thought of the lost Atlantis and the glittering horde that had sunk to the ocean's bed countless ages ago and whose mysterious disappearance has been the theme of a thousand and one romances; but this is the age of reality and efficiency; nothing is ever lost and nobody ever disappears completely, at any rate long before the dam is completed these gypsies of the road will have sought other fields. As we drove past an old car parked in the torrid glare of the sun, its only shelter a rock that emitted heat like a stove, all of us agreed that we never should have selected that particular spot for a successful outing, but later, when I got to thinking about it I could understand that there might be a fascination about this grotesquely beautiful scenery more satisfying to the seeker after change than lush green meadows and wooded hills. Here was change indeed and human interest seldom found outside a large city.

There is still another explanation for this unique assembly. The prospect of work has lured them to the dam site and most of them are forced by failure to remain. Above and surrounding them every draw and arroyo shelters contractors' tents and workshops, there before their eager eyes is work—work, yet like the feast of the Barmecide it is not for them; but they stay on and on, prisoners of hope.

WORKERS FOR SIX COMPANIES FORM TENT COLONY

As on a former trip we turned to our right on the way to the boat landing and even here the road had changed—lifted to a higher level, it was more terrifying than before; a more acute drop to the oily waters of the river, sharper angles, more pitfalls so that I repressed a sigh of relief when we came safely to the end. Down

oat landing

close to the river was quite a colony of tent houses belonging to one of the Six Companies, and all about us were bunk houses, mess tents, machine shops, and men—always men. From the boat we could see them on either side of the river appearing no larger than ants, looking so tiny that it was with amazement that I realized what had already been accomplished. Long narrow bunk houses hung like orioles, nests on the granite sides of the canyon making me think of the toy Noah's arks which used to gladden my childish heart, and I had a sort of a feeling that if the peaked roof were lifted the inside would be filled with the little painted wooden animals which represented the fauna of the earth. From their great height these houses looked as if a stiff wind would tear them from their moorings but we were assured that they are fastened so firmly to the rocky wall that nothing short of an earthquake can disturb them.

PERILS OF RAILROAD BUILDING

A railroad has been begun about 100 feet above the water and with the aid of blasting and machinery they have carved several miles of a good roadbed and were boring tunnels as we passed. Looking up at the thread like trail it seemed as if the trucks lumbering over it were in momentary danger of toppling over to destruction, but this is in reality quite a wide road and there are many places where two cars may pass each other. The keynote to this part of the canyon is "Activity"—constant motion; men climbing perpendicular ladders five or six hundred feet to the top; men clustered about the mouths of embryo tunnels; men swinging across the turgid stream in little cars attached to strong cables; men and machinery going into places where even a mountain goat would hesitate to climb. As we neared the dam site where the walls of the mountains draw so near together that the sun's rays hardly ever filter in, it chanced that a patch of sunlight illuminated one side with a golden mist like a halo and over there in the shadow was the blackness of that outer darkness of which we know nothing but think of with a shudder.

I was fortunate this time in having a longer boat ride than ever before; we went far below the site of the dam to where on the Nevada side engineers were busy on a pumping station by which the river water will be conveyed to the tank at Boulder City; here we landed to put off the night crew of men—for on this work Uncle Sam slumbers not nor sleeps—and to take on the day shift who eagerly climbed aboard.

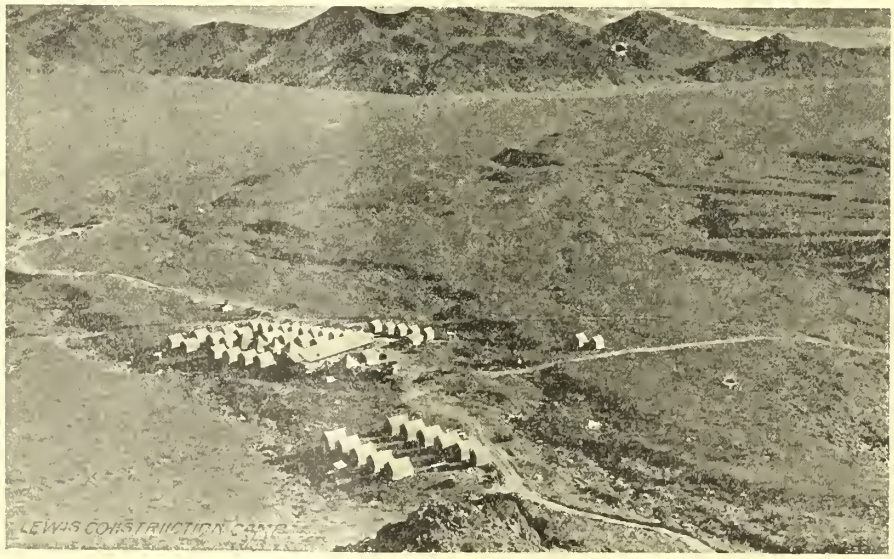
BLASTING IN THE CANYON—CONQUERING NATURE

On our return trip I considered myself lucky to get an idea of what blasting in the canyon was like. At first there was a long shrill whistle like a siren and our boatman slowed down while we all looked up at a cavelike spot on the Arizona side about 150 feet above us and 200 feet ahead of us. Suddenly I heard a thud like distant thunder, saw a lightninglike flash that darted out like a snake's tongue, there was an ear-splitting crash and with a roar like the bellow of a thousand mad bulls masses of rock and sand shot out as if from a cannon's mouth, splashing and hissing into the water, striking against the rocks on the opposite side, rolling, pitching, tearing, beating down everything in their path; blast followed blast till the whole world seemed to rock, six blasts in all, and each time I caught a glimpse of a sort of preliminary shudder of the mountain as if quivering with rage at this further indignity. I thought it must be my imagination but was informed of a scientific reason for this phenomenon which I don't believe I can explain. Just as these echoes began to subside we heard again the siren whistle and once more rose the din of battle, this time behind us; rocks and débris flew through the air like feathers and the echoes clamored all about us like great wings beating angrily; it was war, war to the knife between man, a creature of the moment, and nature in her dreadful immutability. I was spellbound; and long after the last rock had buried itself in the water, the last bit of sand had returned to the earth I could hear shrieks and cries like the tumult of a battlefield; could feel the canyon shudder and hear a noise like distant thunder; and this is only the beginning.

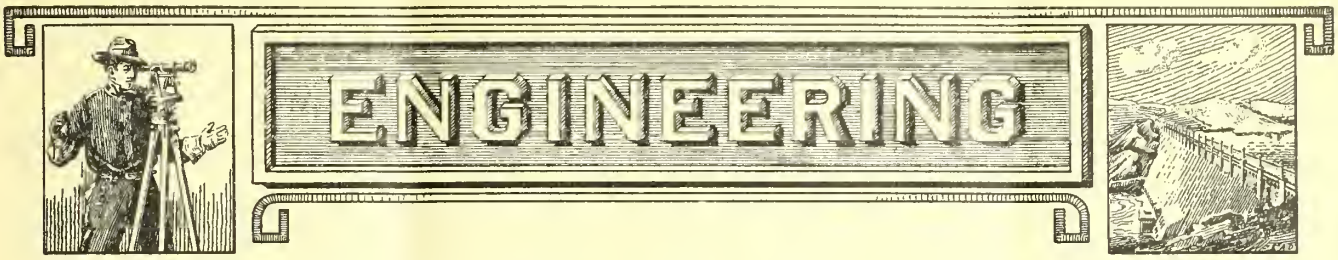
These tunnels are all connected in some way with four immense tunnels which are to be bored, two on either side of the river about a mile above the dam site for the purpose of deflecting the water from its bed, leaving it dry for the workers on the dam itself, and a mile below the dam site the river will again return to its course to flow on its way without further interruptions. When one sees the obstacles to be surmounted it is easy to understand the apparent confusion, the feverish activity, the tireless energy necessary to combat the insensate forces of nature. And we know that in the end man will conquer; but by some alchemy hard to understand the scene remains unchanged and this advance of men and machinery seems but surface activities like the clouds passing over a landscape. The roads are but scars on the mountain's sides, the wild gorges still loom darkly giving glimpses of mysterious valleys in between, the river flows serenely while the jagged peaks that guard her show like giant's teeth against the blue bosom of the sky; and the desert, though dotted with tents, buildings, and other evidences of civilization remains as untamed as a caged tigress biding her time.

A GLIMPSE INTO THE FUTURE

Some day the Hoover Dam will be completed, an accomplishment of such magnitude as to place it among the wonders of the world, the waters of the Colorado will have been turned aside from their course and a great lake will be formed covering the scene of the present activities; but in the years to come, the countless thousands of years which may lie ahead of us, what of this man's work will remain? What will another generation, a strange race of men, glean from the mighty dam stretching across the stream? What will these mountains tell the unknown future of the forgotten past? I wonder!



Lewis Construction Camp



Deadwood Dam, Boise Project, Idaho

By R. J. Newell, Construction Engineer, Bureau of Reclamation

THE Deadwood Reservoir is a feature of the Payette division of the Boise project in Idaho. The site is located on the Deadwood River, a tributary of the South Fork of the Payette River, and is about 90 miles upstream from the Black Canyon diversion dam. The storage capacity of the reservoir is 160,000 acre-feet and the area submerged at high water is 3,300 acres.

Water stored in this reservoir will be utilized to augment the power generated at Black Canyon during the low-water season, until it is eventually needed for irrigation of the Payette division lands. The plan was set out in detail in the NEW RECLAMATION ERA for September, 1929.

THE SITE

The Lower Deadwood Basin is for the most part densely wooded and surrounded by a precipitous mountain country. The country rock is granite, and bare cliffs and crags are visible through the trees in all directions. A rather unique feature for a mountain reservoir is met in the fact that the site is reached from the upstream side.

The tributary watershed is small but unusually productive. One hundred and eight square miles of mountainous area, ranging in altitude from 5,200 feet at the dam site to a maximum of 10,000 feet, forms the catchment area for the basin. Recorded total annual snowfall at the Bunker Hill and Sullivan mine, 15 miles above the dam, reaches a maximum of 40 feet. The only improvements found when the site was surveyed were the cabins and fenced pasture at the national forest ranger station, and a cabin and pasture belonging to an association of cattlemen.

WORK PRIOR TO CONSTRUCTION

Surveys for the reservoir were first made in 1925 when the originally preferred site at Big Payette Lake on the North Fork of the Payette River was removed from consideration. The granite bedrock at the dam site was found to be practically exposed in the river bed. Open shafts were sunk in the foundation and the abutments were explored by drifts. In such a formation, core drilling was not considered necessary. The exposed rock on the surface was somewhat soft and disintegrated.

Tests were made of the sand and gravel in the basin to determine their suitability for concrete aggregates. The material was mainly granite and occasionally soft pieces were encountered. Exhaustive surveys of the various groups of mining claims were made under the direction of mineral inspectors of the General Land Office. On the basis of their report, the claims were compromised.

CONSTRUCTION WORK

Feasibility of the project was declared in October, 1928, and after the settlement of the right-of-way claims, bids were called for construction under specification No. 494, the opening date being July 16, 1929. Clearing the reservoir site was set out as a separate schedule. Four bids were received on the dam and road work and three on the clearing. The Utah Construction Co. of Odgen, Utah, submitted the low bid on the dam and construction road, and was awarded the contract. All proposals on the clearing schedule were rejected and the work readvertised. Bids were again received on August 26, 1929, with Holmberg and Norman of Port Orchard, Wash., the lowest bidder.

It was required that both schedules be completed in time to store the spring runoff in 1931. Snow generally blocks the roads to the site for six months of each year and limits the construction season to eight months after the basin is reached. The clearing contractor decided to continue operations throughout the winter, while the Utah Construction Co. shut down for the four months season of deepest snow.

ROADS

A Forest Service highway leads from Cascade, Idaho, the nearest railroad point, over a circuitous route to a point within 11 miles of the dam site. The maximum grade is 8 per cent, the width small and the curvature high. Three mountain summits are crossed at elevations from 6,800 to 7,400 feet. The road material of disintegrated granite stood up under heavy traffic very well. Under a cooperative agreement with the Forest Service and other interests the forest highway was much improved during 1928 and 1929.

The building of 8½ miles of construction road through the Deadwood Narrows from the nearest point on this Forest highway to the upper end of the reservoir basin at the expense of the United States was provided for in the contract for the dam. The remaining section of 3 miles through the basin to the dam site was graded up for temporary use by the contractor. The construction road was the first feature taken up after the contract was awarded. It was made roughly passable in two weeks, and completed promptly at a cost of about $4,000 per mile. During 1930, a permanent light-traffic road skirting the flow line from the upper end to the dam site and descending into the canyon to the valve house at the toe of the dam, was built by the same contractor.

DESIGN OF DAM

Preliminary plans.—Although the foundation rock and the shape of the canyon made the site particularly suitable for the concrete arch overflow type of dam, preliminary consideration was given to the rock-fill type with upstream gravel face, and also to a gravel-fill type with concrete paving on the upstream face, the spillway for both of these latter types to be through the right abutment. Studies were made of these fill types on account of the long haul of 70 miles from the railroad, and the apparent availability of gravel and rock-fill materials in the vicinity of the dam site.

Technical design.—The adopted concrete-arch type was designed by the trial-load method developed by the engineers of the bureau. After excavation of the foundation and due principally to a greater depth of excavation at the right abutment of the arch, the stresses were reanalyzed and as a result a thrust block was designed for location at this abutment. In analyses of stresses by the trial-load method consideration was given to the effects of temperature drop, twist, tangen-

tial shear, and deformation of the foundation rock.

Structural design.—The dam has a maximum height of 160 feet above bedrock and a crest length of about 725 feet. Of this total length, a low tangent wing of gravity section extending back along the right abutment ridge makes up 200 feet. The arch section, ending on the right in the massive thrust block, is less than 500 feet long and has an upstream radius of 290 feet. An open overflow spillway having a maximum capacity of over 10,000 second-feet will discharge over the center of the dam, with a fall of about 140 feet to a concrete apron below. The maximum flood during the short period of record was about 2,000 second-feet in 1927.

Water is drawn from the reservoir through two conduits, each 5.5 feet in diameter, embedded in the section of the dam near the right abutment at elevation 5,205. The upper end of the conduits is protected by a semicircular trash-rack structure and the outflow is controlled by 4.5 by 4.5 foot high-pressure slide gates and 54-inch needle valves. These control works are housed in a reinforced-concrete valve house built into the downstream face of the dam.

The foundation grouting and drainage systems follow the plans of the Gibson Dam in Montana. Grout holes, alternately 25 and 40 feet in depth, and spaced 5 feet apart, were drilled in the bottom of the upstream cut-off trench and grouted through pipes projecting beyond the upstream face, after concrete had been placed in the adjacent foundation of the dam. After the grouting was done, drain holes were drilled into the bedrock through embedded pipes connected to outlets through the dam for the discharge of seepage water. Vertical drains of porous tile to relieve possible water pressure in construction joints in the concrete find an outlet through the same channels. Radial contraction joints through the section of the dam are spaced 25 feet apart at the upstream face. These joints were grouted through pipe systems provided for that purpose after the dam was thoroughly cooled.

CONSTRUCTION OF DAM

Plant.—Excavation for the foundation was done by means of a convertible shovel and dragline, gas-driven, which was moved into the work under its own power from the railroad near Cascade, a distance of over 60 miles. A total of 28,000 cubic yards of material was stripped from the foundation. The excavation was roughed out and the river diverted through a timber flume, 24 by 8 feet in section and based on bedrock, before the work was shut down for the winter in 1929. A sawmill and planer were installed near the contractor's camp, and lumber was cut for camp buildings, plant, and concrete forms. Lumber used amounted to 1,200,000 feet board measure, with a field cost of about $16 per thousand feet board measure.

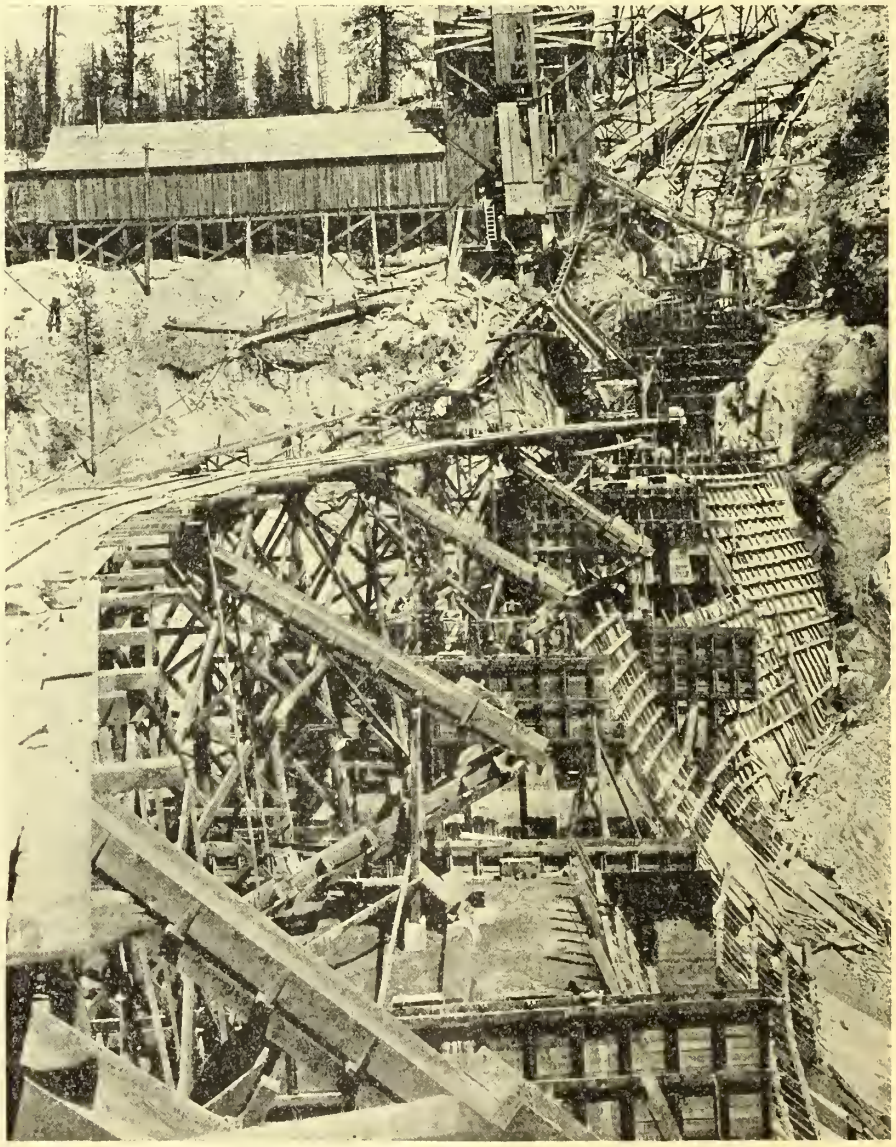
Sand and gravel for concrete were obtained from pits along the river channel through the basin from 1 to 3 miles above the dam site. The material was loaded by a dragline into trucks and hauled to a gravel plant located near the dam site and at an elevation about 50 feet above the top of the dam. Hauling was subcontracted at 40 cents per yard for hauls up to 2 miles and at the rate of 20 cents per mile for overhaul. For 56,000 cubic yards of concrete, about 84,000 cubic yards of pit run gravel were hauled. Much of the extra yardage was wasted in the form of pea gravel and sand.

At the plant the aggregates were dumped from the trucks on a grizzly and the oversize were crushed by two No. 4 gyratory crushers. Material was then conveyed on an endless belt to a revolving screen and separated into five sizes as follows:

	Inches diameter
Sand	Up to 5/16.
Pea gravel	5/16 to 7/8.
Intermediate gravel	7/8 to 1¾.
Coarse gravel	1¾ to 3.
Cobbles	3 to 9.

The sand was washed through the screen and then unwatered in hoppers directly below. These sized aggregates were delivered from the screen to stock piles arranged in a row directed toward the mixing plant and were trapped in turn onto a conveyor operated through a tunnel beneath the stock piles and carried to hoppers over the mixer.

The mixer was fed through a weighing batcher by which the proper proportion of each size of aggregate was determined



Chutes for concrete used at Deadwood Dam

by weight. Cement was added in integral sacks. Water was measured by volume and admixtures, when used, were also measured by volume. The mixing was done by a 2-yard mixer. Concrete was conveyed to the dam by a 5-ton cableway in a 2-yard bucket which was dumped automatically into a suspended hopper with an attached chute ending in an "elephant's trunk."

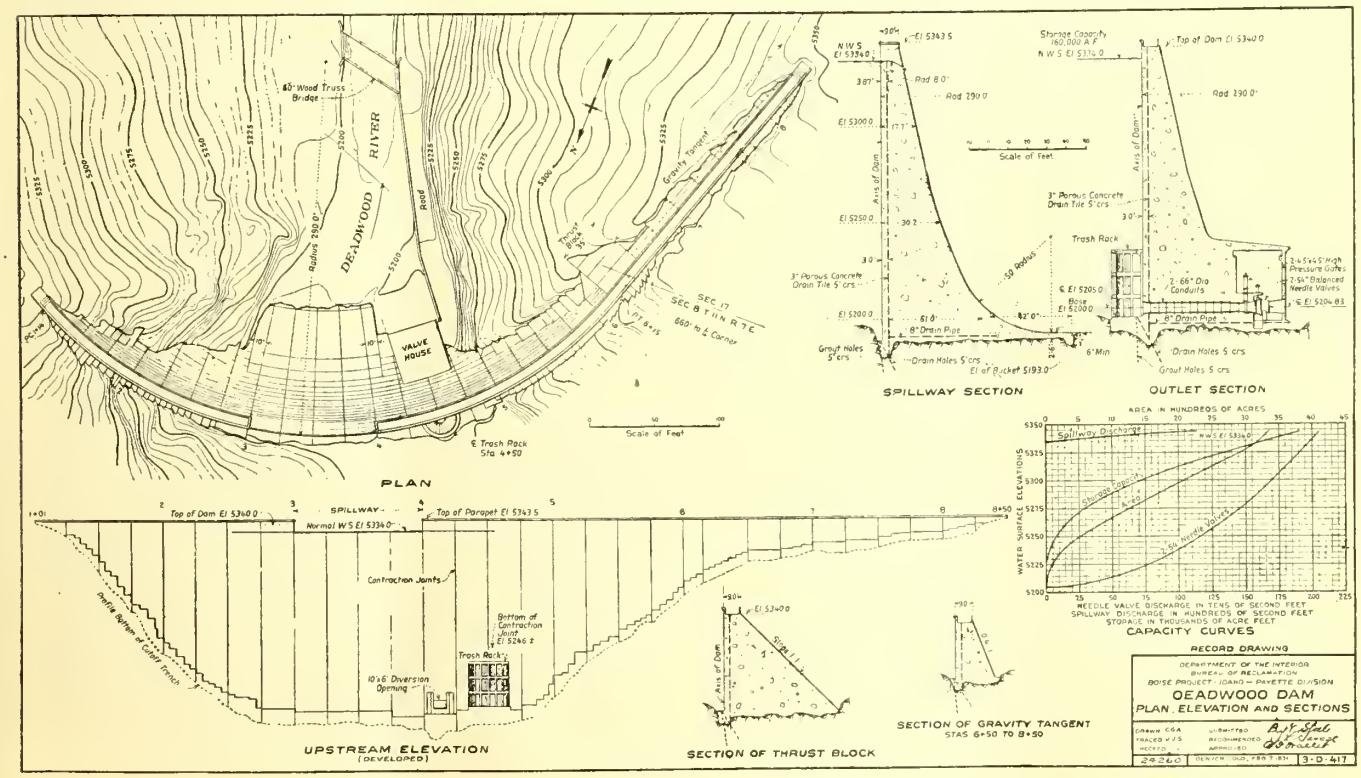
The hopper was suspended from the main line of the cableway and the lower end of the chute suspended from a side line parallel to and 45 feet distant from the main line. Each was provided with a load line and endless and could be moved at will by the cableway operator. This system of placing was developed by the contractor's superintendent, F. T. Crowe, while in the employ of the bureau on the construction of the Arrowrock Dam and has proved rapid and effective.

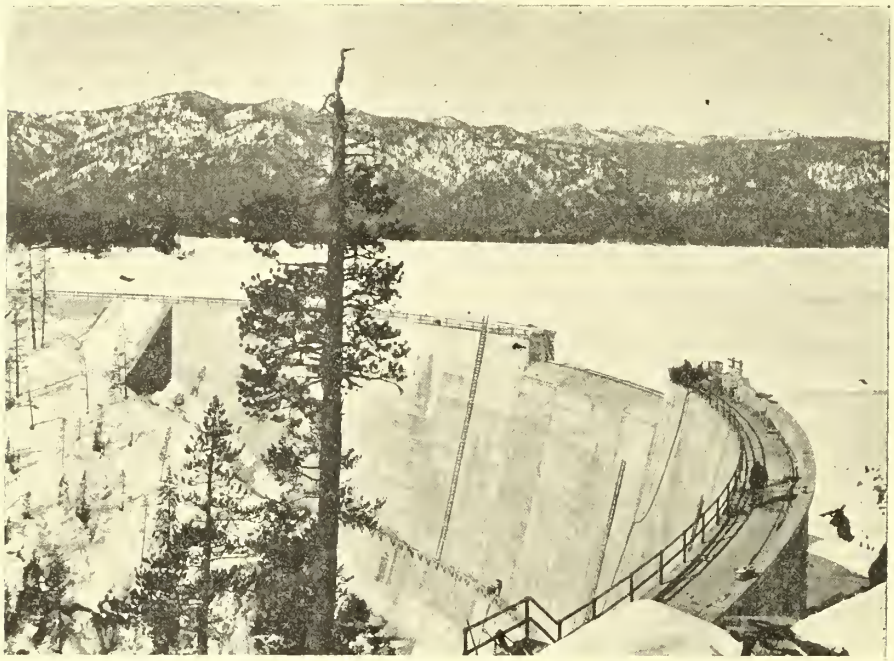
Forms.—Concrete forms were of 1¼ inch matched lagging faced with metal sheets. They were made up in panels 8 by 26 feet in size. One panel would thus span the distance between contraction joints on the upstream and downstream faces, and one lift of forms provided for two 4-foot lifts of concrete. Forms were held in place by ½-inch rods with one end anchored in the previous lift of concrete and the other threaded to engage the drilled and tapped-out end of a 1-inch bolt projecting through the forms. After the bolt was screwed tight, the forms were aligned by wedging under the plate washers beneath the bolt head. To remove forms, the bolts were backed off letting the panel swing free. Forms were raised by shear legs, equipped with hand-power hoists.

Power.—Crushers, screen, conveyors, mixer, and cableway were all driven by electric power generated by two Diesel engine-generator sets with a combined capacity of 265 horsepower. The shovel and most of the compressor units, as well as tractors and trucks, were powered by gasoline. The sawmill and planer were operated by a steam plant. Several teams were worked at the dam throughout construction.

Hauling.—The freighting from the railroad was sublet to Knowles Bros. of Colorado, who operate a fleet of trucks. After the preliminary hauling in 1929, four additional trucks with trailers were built to their order, designed especially for the Deadwood hauling. Motors were rated at 200 horsepower. Trucks were equipped with dual wheels on the rear and on trailers. They were of the 4-wheel-drive type with an auxiliary high gear designed for the ruling grades on the route. Trucks and trailers were controlled by air brakes. They were loaded with 150 sacks of cement on the truck and 100 on the trailer. Thus the four special trucks hauled one 1,000-sack car of cement at a trip. Unloading at the dam was accomplished through tipping the truck by running the wheels on one side up on inclined blocks 24 inches high, after which the cement was easily shoved off the smooth, metal covered decks. One driver would unload 250 sacks in five minutes. During the season from June 1 to October 15 the trucks made two round trips per day practically without a break. This program was so near the maximum possible that back-haul was refused for fear the extra loading time would defeat the schedule. Four smaller trucks, running usually one trip per day, made up the remainder of the hauling capacity. During the season of maximum progress in the pouring of concrete, so delicate was the balance between the delivery and use of cement that the last sack at the dam was used and the mixer shut down for a short interval at both noon and midnight for seven consecutive days before the truckmen were able to pile up a reserve. Cement was hauled for $8.50 per ton, or about 12.7 cents per ton-mile.

Testing.—A well-equipped laboratory was provided and a series of tests of concrete materials and concrete as mixed was continued throughout the construction period. A strength of 2,500 pounds per square inch was desired for the mass concrete in the dam, and to secure this strength it was decided that test cylinders of concrete screened through a 3-inch screen should show a strength of 3,500 pounds at 28 days. Some difficulty was experienced in controlling the mix from rapid fluctuations in the moisture content of the fine aggregate. On this account it was decided not to crowd the minimum limit of required strength too closely and the average mix used for all classes of concrete was 1–2.01–1.07–1.22–1.25–1.54, proportions by weight of moist aggregate. Sand contained an average of 10 per cent of moisture and pea gravel 2 per cent.





Grouting construction joints at Deadwood Dam, Boise project, Idaho

The yield of concrete was 0.75 cubic yards of concrete to 1 barrel of cement. With this mix, 8 by 16 test cylinders showed an average 28-day strength of just 3,500 pounds, and 6 by 12 cylinders containing 1¾-inch aggregate as a maximum tested 3,990 pounds on the average. Sieve analysis showed a mean value of 3.11 for fineness modulus of sand and 6.7 for total aggregate. The water-cement ratio averaged 0.76 and the slump 4.25 inches.

RESERVOIR CLEARING

Timber below the flow line in the reservoir basin was almost entirely lodge-pole pine, ranging usually from 8 to 16 inches in diameter. Plans were studied to salvage some value by the manufacture of railroad ties or telephone poles, but the high cost of transportation to the railroad rendered them infeasible, and the timber was all cut, piled, and burned. Many of the trees had been attacked by the bark beetle and were dead which assisted in early burning.

The contractor decided on handwork and cutting, piling, and burning were done solely by man power. A fire line 300 feet wide was first cleared and burned clean completely around the area. The timber was filled in windrows and roughly limbed, and after a period of drying was burned over. Burning was confined to areas of safe extent by cleared lanes and gasoline driven pumpers. The first fire merely burned the limbs and brush but greatly dried the remaining logs or poles, which were then cut in lengths, that could be handled, and piled closely and burned, then repiled and reburned until finally consumed. Four or five men could cut and roughly pile an acre of standing timber per day and the work was then considered half done. Willow brush in the lower end of the basin was cut with machetes and about the same rate of progress was made, though piling and burning were much easier. Numerous beaver dams and swamps along the creeks made the clean burning of some areas difficult.

During the height of a dry summer, the burning of such great quantities of dry and pitch-laden timber and brush was attended with some uncertainty, even in areas separated by cleared lanes and surrounded by fire lines. On one occasion 1,000 acres were burned over before the fire could be controlled. But on the completion of the job, covering an area of over 3,000 acres, only 15 acres above the flow line had been scorched. Whether the remaining stumps will rot down in place or in some cases float loose will be watched with interest. Curiosity has also been aroused as to the probable movements of the numerous beavers inhabiting the basin when the gates are closed and the water raised.

GENERAL PROGRESS OF CONSTRUCTION

Contract for the dam was awarded in July, and for the reservoir clearing in September of 1929. The clearing contractor moved in during September and worked continuously until the job was completed in a little over 12 months. Roads were blocked with snow for over five months. Rather uncertain communication was maintained by means of airplanes, but the basin was cloud-filled for so much of the winter and the surrounding ridges cloud-capped that no regular schedule of flying could be kept up. The winter was one of comparatively light snowfall, the depth in the basin never being more than 3 or 4 feet, but even this was too much for wood cutters and little was accomplished between January 1 and March 20. The enforced idleness was hard on the morale of the camp, and the determined seeking for diversion on the part of the men led to some stirring times.

The contractor on the dam began work about August 1, 1929. The construction road was completed, camp and plant erected, excavation for the dam roughed out, and the river diverted into a flume before the work was shut down for the winter in December. This shutdown, postponed as long as possible, was finally forced by a protracted storm and much difficulty was experienced in getting the men out to the railroad. The chief clerk of the Bureau of Reclamation organization and five or six of the contractors' men remained all winter to take care of the camp and prepare for the following season's work. Work was resumed at the dam site on March 18, the vanguard of the force reaching camp by means of snowshoes or dog sleds. The remaining excavation of the dam site was then immediately started.

A provision of the contract limiting to 90 days the period in which cement could be stored at the dam site, prevented delivery of cement during the preceding fall and made it vitally necessary to open the road on the earliest possible day in the spring. Work was begun at Cascade on March 1 with a snow plow handled by two "60" caterpillars and a gang of shovellers. Occasional through trips were made over the snow with caterpillar and sled to deliver essential supplies. Work was also started from the dam site end. The road was broken through on May 18 after 2½ months work at an expense of $8,000. It is likely that the snow would have been cleared by the sun unaided, not more than 20 days later, but that 20 days delay would probably have prevented completion of the work during 1930. Concrete pouring was begun on June 3 and completed on November 7. Work generally was completed by November 16, 1930. The contractors' moving out was interrupted by the usual snowstorm and one or two truck loads of equipment remain at the site.

The contractors' camp was built within the area to be submerged and was burned on completion of the work. The permanent buildings in the Government camp were built of logs with fireplaces of stone picked out from the old placer workings in the vicinity. One caretaker and his family remained at the site during the winter of 1930–31, connected to civilization by

means of a radio and a slender and uncertain one-wire telephone line. The contraction joints in the dam were grouted early in March of this year after the dam had cooled and contracted, but before the snow began to move.

COSTS

The cost of the reservoir is itemized as follows:

COST OF DEADWOOD DAM

Description	Quantity	Unit	Unit cost of material and labor by the—		Total cost
			Contractors	Government	
Clearing reservoir	3,300	Acre	$60.22		$198,715.00
Dam—River diversion	(1)				24,000.00
Excavation:					
Base of dam—					
Common	7,661	Cubic yard	1.00		7,661.00
Rock	19,325	Cubic yard	5.00		96,625.00
Cut-off trench	983	Cubic yard	10.00		9,830.00
Roads	12.4	Mile	4,043.28	$238.35	53,092.26
Back fill	554	Cubic yard	1.00		554.00
Drilling:					
Grout holes—					
25 feet or less	2,327	Linear foot	1.00		2,327.00
25 feet to 40 feet	2,062	Linear foot	2.50		5,155.00
Drain holes, 25 feet or less	2,968	Linear foot	1.50		4,452.00
Pressure grouting in foundation	574	Cubic foot	1.00	1.09	1,202.31
Manufacture and placing draintile	11,110	Linear foot	.40	.036	4,841.70
Concrete:					
In dam	55,373	Cubic yard	9.00	3.57	695,866.39
In trash rack	60.5	Cubic yard	24.00	9.59	2,032.28
In valve house	834.5	Cubic yard	24.00	6.10	25,121.38
In parapet and curb	90	Cubic yard	24.00	13.20	3,347.70
Placing reinforcement steel	89,286	Pound	.03		2,678.58
Installing pipe:					
For grouting foundation	6,421	Pound	.08	.068	947.75
For grouting contraction joints	18,312	Pound	.10	.096	3,580.61
For foundation drainage	63,325	Pound	.08	.078	9,986.62
Placing copper expansion strips	5,172	Linear foot	.35	.436	4,066.18
Installing and painting:					
Slide gates, conduits, etc	239,598	Pound	.03	.106	32,549.46
Control pipes and equipment	3,274	Pound	.10	.474	1,879.79
Needle valves	83,748	Pound	.04	.237	23,169.30
Trash-rack bars	64,720	Pound	.03	.037	4,336.66
Handrailing	9,208	Pound	.10	.100	1,841.99
Crane	6,766	Pound	.05	.198	1,677.09
Miscellaneous metal work	4,913	Pound	.10	.152	1,237.92
Extra work	(1)				2,764.72
Total, contract work					1,225,539.69
Examination and surveys					4,663.15
Right of way and lands	3,300	Acre		6.19	20,424.15
Road and dam site [2]					5,241.83
Permanent improvements, buildings					19,338.20
Grouting expansion joints (estimated)					3,500.00
Pending right of way (estimated)					15,000.00
Operation and maintenance, June 30, 1931 (estimated)					500.68
Total					68,668.01
Camp maintenance					574.17
Engineering and inspection					34,216.60
Superintendence and accounts					13,272.20
General expense					10,729.33
Total					58,792.30
Total cost to Dec. 31, 1930					1,353,000.00
Cost per acre-foot					8.45

[1] Lump sum.

[2] Maintenance of road from Cascade, Idaho, to construction road.

Hydraulic Laboratory Under Construction

The Bureau of Standards of the Department of Commerce reports that work was begun on April 26 on the National Hydraulic Laboratory, which was authorized for construction under the Act of May 14, 1930. The main contract was let in April to Stofflet & Tillotson of Philadelphia for $294,887 and the work should be completed next March. The steam-shovel excavation has been finished and the concrete footings of the measuring basin are being poured. Hand excavation for the remaining footings is now under way. Orders have been placed for piping, sluice gates, heat and power ducts, pumps and the main switchboard.

The construction of this laboratory will give to the Bureau of Reclamation an opportunity to work out many of the complex problems that arise in the design, construction and operation of hydraulic structures.

Boulder Canyon Project Notes

The Southwest Builder and Contractor in a recent issue states that the Chapman Lumber Co. of Portland, Oreg., has been awarded a contract by the Six Companies (Inc.), for furnishing 250,000,000 board feet of lumber for use on the Hoover Dam and Boulder City work. The W. H. Chamberlin Steamship Co. (Ltd.), of Long Beach, Calif., and the L. W. Blinn Lumber Co. have subcontracts for transportation and handling from ships to railway cars.

Another "Big Six" contract goes to the United Commercial Co. of Los Angeles for supplying railroad materials, consisting of approximately 20 track-miles of 90-pound steel rail with joints, 125,000 tie plates for 90-pound rail, 20 sets of frogs and switches, and 250 tons of spikes and bolts.

On July 1 the United States Employment Office, Department of Labor, was moved from Las Vegas to Boulder City and will occupy space in the Six Companies' office building. Leonard T. Blood is in charge of the office.

The Arizona gravel pits are situated up river from the dam site about 8 miles. A belt conveyor on a suspension bridge will be used to carry the gravel across the river to the railroad on the Nevada side. About 5,000,000 cubic yards will be required for the "Big Six" contract. Assuming that a yard of gravel weighs 3,000 pounds, and 100,000 pounds the maximum load allowed per car, with each car about 44 feet long, the carloads of gravel if strung out in a continuous line would extend for about 1,300 miles.

Boulder City is beginning to show considerable progress in building construction. The contractors have completed their office building, office dormitory, two 160-man dormitories, clubhouse, machine shop, warehouse, a 1,000-man mess hall, and 30 cottages. A third dormitory, commissary building, and additional cottages are under construction. The Government has completed a warehouse, and 12 cottages are now under construction.

The Six Companies (Inc.) has awarded a subcontract to the John Phillips Co., of San Francisco, Calif., for grading 16 miles of construction railroad, involving 250,000 cubic yards of earth excavation and 10,000 cubic yards of rock excavation.

Clark County, Nev., is even now planning on using Hoover Dam power for pumping irrigation water for the Las Vegas Valley, and raising cantaloupes, peaches, grapes, and pecans to compete with the Salt River, Yuma and Imperial Valleys.

The Boulder City-Hoover Dam highway was practically completed on July 8 by R. G. Le Tourneau of Stockton, Calif., the contractor. A few additional days were required for oiling.

About 1,300 men are now on the pay roll of the Six Companies, or, one-half the estimated force to be required, when construction work is at its peak. Current work comprises excavation of both Arizona and Nevada tunnels.

Notes for Contractors

Baker project, Oregon.—Construction work on this project is being initiated by the building of the Thief Valley Dam, a buttressed type structure with reinforced concrete face slabs, on the Powder River near the town of North Powder. Bids were opened at Nyssa, Oreg., on July 27. There is an appropriation of $250,000 available for work on this project.

Boulder Canyon project.—Bids were opened on June 17, 1931, for excavation, grading, and concrete foundation for the administration and dormitory buildings at Boulder City, Nev. Contract for the work was awarded to the low bidder, Storm & Mahoney of Las Vegas, Nev., at a total price of $29,485.

Specifications and invitations for bids have been issued for the construction of the administration, municipal, and dormitory buildings at Boulder City, and bids will be opened at Las Vegas, Nev., on August 10, 1931. The administration building will be a 2-story building about 58 by 138 feet in size with full basement. The municipal building will be a 1-story building with basement and will be about 40 by 107 feet in size with an L 42 by 82 feet. The dormitory building will be a U-shaped, 1-story building with a developed length of 225 feet and a width of 35 feet. The buildings will be of the Spanish type with outside walls of brick covered with stucco and with mission tile roofs. The installation of the plumbing and heating will be included in the contract for the building.

All materials, including plumbing and heating materials, will be furnished by the Government. The purchase of the materials is not covered by the specifications.

Plans and specifications are being prepared for a third group of residences which will include the larger residences for the construction engineer and his assistants.

Ten bids were received on June 30, 1931, for the construction of streets, sidewalks, curbs, parking areas, and the water and sewer systems for Boulder City. The New Mexico Construction Co., of Albuquerque, N. Mex., was the low bidder, its bid amounting to $273,972. The officials of the company are A. R. Hebenstreet, president, and V. K. Jones, vice president.

Specifications and invitations for bids have been issued for the construction of the water-treating and sewage-disposal plants and also for the electrical distribution system for Boulder City.

Minidoka project—Gooding division.—Specifications and invitations for bids have been issued for the construction of the last 8 miles of the Milner-Gooding Canal and the enlargement of about 4 miles of the present North Gooding Canal on the Gooding division. The principal items and the estimated quantities involved are as follows: 523,000 cubic yards of all kinds of excavation; 300,000 station cubic yards of overhaul; 3,500 cubic yards of back fill about structures; 1,050 cubic yards of puddling or tamping back fill; 150 cubic yards of dry-rock paving; 100 cubic yards of surfacing highway bridge approaches; 330 cubic yards of concrete; placing 20,000 pounds of reinforcement bars; erecting 67,000 feet b. m. of timber in bridges; erecting 3,000 feet b. m. of timber in flumes; laying 1,096 linear feet of 18-inch to 36-inch concrete pipe; erecting 264 linear feet of No. 48 metal flume; and installing 4,200 pounds of gates and gate lifts.

Owyhee project.—Plans and specifications are being prepared for the construction of a portion of the North Canal, formerly called the Mitchell Butte Canal, from Tunnel Canyon to the Owyhee River. The work will include the construction of three tunnels.

Yakima project, Kennewick division.—Specifications (No. 526) and plans are available for hydraulic and electrical machinery for the Prosser power plant and Kennewick Highlands pumping plant. The date for opening bids is September 11.

Yakima project, Kittitas division.—Bids will be received until August 21 at Ellensburg, Wash., under specifications No. 525, for the construction of earthwork and structures on the North Branch Canal lateral system, Wippel pump, gravity and turbine laterals. The principal items and quantities involved are 428,600 cubic yards of all classes of excavation; 11,100 cubic yards of back fill about structures; 1,770 cubic yards of concrete; 1,050 square yards of dry-rock paving; placing 116,500 pounds of reinforcement bars; laying 7,378 linear feet of 12 to 54 inch precast concrete pipe; furnishing and erecting 74,000 feet b. m. timbering in bridges and flumes; installing 30,600 pounds of gates and gate lifts. The work must be completed in 250 calendar days after date of receipt of notice to proceed.

On August 17, bids will be received at the office of the Bureau of Reclamation, United States Custom House, Denver, Colo., for furnishing two direct pumping units (specifications No. 524) for the Wippel pumping plant. All apparatus will be installed by the Government.

Yakima project, storage division.—Bids were opened at Yakima, Wash., on July 10 (specifications No. 522) for construction of the Cle Elum Dam and clearing the reservoir site. Winston Bros., of Minneapolis, Minn., submitted the low bid of $1,311,533.50 for construction of the dam. Siems-Helmers (Inc.) of St. Paul, Minn., with a bid of $291,600 was low on schedule 2 for clearing the reservoir site.

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Mead, Elwood:
- Hoover Dam—World's largest irrigation project. The Architect and Engineer, June, 1931, pp. 69–73.

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- Hoover Dam notes. Eng. News-Record, June 11, 1931, v. 106, p. 937.
- Dismissal by U. S. Supreme Court of Arizona action. Western City (editorial), June, 1931, v. 7, p. 9.
- Hoover Dam work legal, court rules. The Constructor (editorial), June, 1931, v. 13, pp. 22, 49.
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- Cle Elum Dam, Yakima project, Washington; map and plans. Western Construction News, May 10, 1931, v. 6, pp. 238–239.

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Gibson and Echo Dams:
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Gibson Dam:
- Gibson Dam, Part 1, Sun River project, Montana. Illus. with costs. Western Construction News, May 10, 1931, v. 6, pp. 223–227. Gibson Dam, Part 2. Western Construction News, May 25, 1931, v. 6, pp. 253–258 (illus.). (Long comprehensive articles.)

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- Safety limitations of the Hoover Dam. Civil Engineering, July, 1931, pp. 921–923.

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- Features of and deflection tests on Morrison Canyon siphon. Engineering and Contracting, June, 1931, p. 147 (from New Reclamation Era article by Peter Bier).

Lowther, Burton:
- The water system for Boulder City. Western City, July, 1931, pp. 13–16

Rouse, H. M.:
- Discover old (metal) boat that reached Boulder (Hoover) Dam site in 1858; illus. Eng. News-Record, May 28, 1931, v. 106, p. 889.

Imrie, Geo. C. and Whitmore, A. A.:
- Concreting at Easton Dam. Engineering and Contracting, May, 1931, v. 70, pp. 122–123. (Reprint of part of an article in March, 1931, Reclamation Era.)

Lane, E. W.:
- Materials in existing earth dams. Eng. News-Record, June 11, 1931, v. 106, p. 962.

Paul, Chas. H.:
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McLaughlin, W. W.:
- Land reclamation in the eleven Western States. Agricultural Engineering, June, 1931, v. 12, No. 6, pp. 213–214.

Hinds, Julian:
- Features of the Colorado River aqueduct. Western City, June, 1931 (illus.), v. 7. pp. 13–16.

Taylor, P. I.:
- What Hoover Dam means to the Southwest. California Real Estate Magazine, June, 1931, p. 59.
- Boulder Canyon project, questions and answers. Western City, June, 1931, v. 7, pp. 20–21.

Hoover Dam Power Line Completed

Electric power for construction purposes was available at the Hoover Dam site on June 25, at 1 p. m., the delivery date named in the Government's contract with the Southern Sierras Power Co. On Saturday, June 27, the company's substation was dedicated with appropriate ceremonies, which were attended by officials of the company, and about 30 of the leading newspaper proprietors and editors of southern California, representatives of the press, and Bureau of Reclamation officials.

The Hoover Dam line is 222.2 miles long. The transmission conductor is 4/0 aluminum strand cable, steel reinforced. The standard supports are 2-legged, latticed steel structures, spaced 7 to the mile with 34-foot steel angle crossarms. It is insulated with 9 insulator disks on suspension and 10 on deadends. The total weight of steel is 5,000,000 pounds; there are 1,080,000 pounds of cable and 48,840 insulator disks.

Work was started December 16, 1930, at Victorville and the line was tied in at Hoover Dam substation on April 25. This distance is 191 miles so that the work was completed at the rate of 1.45 miles per day, which is believed to be close to a record for this type of construction. Work at the Hoover Dam substation was completed to a point where service could have been rendered on May 15, or 41 days in advance of June 25, the date service was due under contract with the Government.

Before construction could be started on the substation, it was necessary to build a road from the valley leading to the boat landing up to the top of the canyon. Excavation for the substation was begun February 14, but it was March 23 before the road was completed to the site and the building could be started. All heavy equipment was in place May 10, and the first test of the line was made on June 2.

The telephone line constructed from San Bernardino to the substation at the dam site was started February 16, and completed to Boulder City April 30.

The leg of the line from Victorville to San Bernardino, although not essential to the inauguration of service, was completed on June 11. The cost of the completed transmission and telephone lines and substation will approximate $1,500,000.

Capital Outlay for Reclamation Projects

THE accompanying statement discloses the capital outlay for construction of all the reclamation projects in the 16 arid and semiarid Western States. This table of expenditures displays the facts in dollars and cents only and unless one is familiar with the construction activities and the cost-accounting system of the Bureau of Reclamation the significance of the amounts shown fail in their message to the reader. Therefore some of the major results that have been accomplished by this vast expenditure are given below.

Column 1—Examination and surveys.—The amounts in this column cover the cost of reconnaissance, investigation of water supply, soils, trial surveys, borings, estimates, etc., for the purpose of determining the feasibility of projects.

Column 2—Storage system.—The amounts in this column cover the cost of all works incidental to the storage of water. Exclusive of the Hoover and Owyhee Dams, which are now under construction, the storage reservoirs created by the erection of 55 dams have a total capacity of approximately 13,000,000 acre-feet, or about 4 acre-feet of stored water for each acre of land irrigated. In these dams there has been placed about 22,000,000 cubic yards of material such as masonry, concrete, earth and rock fill. The Owyhee Dam, located in eastern Oregon, will be 405 feet in height and impound 715,000 acre-feet of water, while the Hoover Dam will have a maximum height of about 730 feet and will create the largest artificial reservoir in the world, with a capacity of 30,500,000 acre-feet.

Column 3—Pumping for irrigation.—Many thousand acres of the finest agricultural land on reclamation projects are so located that irrigation by gravity from the works constructed is impossible, in which cases water for irrigation is supplied by pumping. The cost amounts in this column cover all works constructed for the development of irrigation water by pumping either from underground wells, irrigation canals, or open streams. There are about 45 important plants or stations being operated on all the projects for this purpose, with a rated capacity of 2,998.9 second-feet.

Columns 4 and 5—Canal and lateral systems.—The distinction between the canal and lateral systems of each project is more or less arbitrary and depends greatly on the particular condition of the broject. No definite line can be drawn, put as a general rule the main feeder canals and structures thereon, including the diversion dams, are chargeable to the canal system, while the lateral system comprises all the smaller canals and structures necessary for the delivery of water to the individual farms. Outside of the storage reservoirs the canal and lateral systems are the most important features of a project, and while the total cost discloses an outlay of over $100,000,000, the extent of work that has been performed can only be described in a summary of construction results:

Canals, over 800 second-feet capacity, 593.8 miles; canals, 301 to 800 second-feet capacity, 744.6 miles; canals, 50 to 300 second-feet capacity, 233.8 miles; canals, less than 50 second-feet capacity, 9,605.1 miles; total, 13,278.3 miles. Canals lined, concrete, 489 miles; canals lined, wood, 4.1 miles; total, 493.1 miles. Number of canal structures, concrete, 60,119; number of canal structures, wood, 101,350; total, 161,469. Bridges, number, 11,864, length, 282,600 feet; culverts, number, 14,675, length, 567,807 feet; flumes, number, 5,260, length, 871,304 feet; total, 31,799, length, 1,721,711 feet. Pipe, linear feet laid, concrete, 1,173,007 feet; pipe, linear feet laid, metal, 497,109 feet; pipe, linear feet laid, tile, 1,899,291 feet; pipe, linear feet laid, wood, 709,842 feet; total, 4,279,249.

Fifty-four diversion dams are also included in these features in which there has been placed over 1,000,000 cubic yards of materials.

Column 6—Drainage system.—Whenever the productivity of the irrigated lands is being impaired by seepage conditions a drainage program is outlined for the construction of open and closed drains on which such conditions exist. To date there has been constructed approximately 3,000 miles of open and closed drains and it has been determined that an area of over 850,000 acres has been relieved to the extent that crops of a commercial value are again being produced on this area. These costs also include the construction of drainage pumping plants and stations.

Column 7—Flood protection.—This feature is provided in the cost accounting set-up to cover the construction of levees, dikes, and other works designed primarily for the protection of the project lands and irrigation works constructed by the United States.

Column 8—Power system.—The amounts in this column cover the construction of 19 and the purchase of 2 power plants for the development of electrical energy required in connection with construction work of the projects and for the pumping of irrigation and drainage water. These plants have a rated capacity of over 68,000 Kva. and develop approximately 190,000 horsepower. In connection with these plants 3,205 miles of power transmission lines have been built.

Column 9—Farm units, irrigable lands.—While a project is in course of construction an examination of the soil and local conditions is necessary, so that a determination may be made of the limit of area per entry, which in the opinion of the Secretary of the Interior may be reasonably required for the support of a family. The work incidental to this action in the main consists of surveys of irrigable areas and the preparation of farm unit and private ownership plats.

Column 10—Permanent improvements.—Under this heading there is summarized the cost of work utilized for general purposes, such as headquarters, offices and grounds, experimental farms, roads, permanent buildings and real estate not properly classed as right of way. These costs cover the erection of 107 offices, 747

(Continued on p. 184)

CONSTRUCTION COSTS BY PRINCIPAL FEATURES TO DECEMBER 31, 1930

State and project	Examination and surveys	Storage system	Pumping for irrigation	Canal system	Lateral system	Drainage system	Flood protection	Power system	Farm units	Permanent improvements	Telephone system	Operation and maintenance during construction	Total original and supplemental construction cost	Miscellaneous	Operation and maintenance and interest funded added to construction	Grand total cost
Arizona: Salt River	$83,939.83	$4,091,952.25	$167,306.38	$2,815,053.02	$620,071.25	$7,673.05		$3,948,066.34	$31,062.53	$763,686.17	$69,734.13	$2,362,719.51	$14,961,264.46	[1]$145,677.64		$15,106,942.10
Arizona-California: Yuma	225,722.77			3,558,160.84	1,501,428.05	780,221.27	$2,729,739.60	317,936.09	32,308.21	205,545.76	14,522.08	724,555.50	10,090,140.17		$2,921.96	10,093,062.13
California: Orland	5,935.90	1,712,111.30		226,713.11	433,208.87		499.72		1,360.59	15,314.19		107,657.23	2,502,800.91			2,502,800.91
Colorado: Grand Valley	73,945.20		102,632.51	3,469,366.11	354,822.22	700,317.87	13,877.77	[2]431.60	40,378.84	22,469.10	11,794.34	557,927.34	5,347,962.86	[1]495.54		5,348,458.40
Uncompahgre	96,541.76	[2]12,698.92		4,030,750.71	2,215,860.86	3,940.63		[2]273.85	39,352.88	31,968.82	6,788.48	1,490,584.06	7,928,760.97		8,238.88	7,936,999.85
Idaho: Boise	213,351.44	6,788,344.69	132,439.39	4,135,073.59	2,712,330.87	1,075,132.64		624,669.80	47,730.99	157,230.07	44,052.70	1,079,208.13	17,009,564.31	[1]13,581.48	875,739.23	17,898,885.02
King Hill	23,798.58			1,579,823.94	248,654.57				6,299.97	34,631.46	8,260.77		1,901,469.29	[1]3,849.51	110,122.51	2,015,441.31
Minidoka	170,984.05	[3]8,728,749.02	547,323.59	1,901,577.51	1,117,984.16	810,873.29		1,375,321.82		146,796.48	28,396.01	339,353.90	15,167,359.83	[1]4,386.25	358,470.72	15,530,216.80
Minidoka-Goodding	40,601.96			3,110,532.98	[2]203.43								3,151,338.37			3,151,338.37
Kansas: Garden City	7,618.72		110,743.74	88,546.17				123,993.69	285.66	7,548.12		52,868.10	391,604.20	[4]4,227.58		395,831.78
Montana: Huntley	5,994.19		144,936.88	624,150.84	403,272.72	322,411.97			18,376.18	17,438.39	8,773.01		1,545,354.18	[1]16,948.81	378,925.79	1,941,228.78
Milk River	154,883.74	3,081,973.63		2,360,435.91	1,014,227.34	27,766.93	38,477.94		46,874.26	59,689.94	15,747.57	669,363.96	7,469,441.22		100,393.62	7,569,834.84
Sun River	61,556.05	2,865,580.58		2,920,484.14	1,064,022.79	189,996.03			24,982.29	81,311.12	33,007.82	235,839.64	7,476,780.46	[1]445.60	102,406.55	7,579,632.61
Montana-North Dakota: Lower Yellowstone	63,368.53		49,970.93	2,467,990.14	451,169.80	573,071.38			2,008.44	40,036.38	22,818.22		3,670,433.82		901,207.63	4,571,641.45
Nebraska-Wyoming: North Platte	92,642.23	4,920,239.14		7,850,375.63	3,664,453.12	1,423,108.04		878,968.11	74,634.30	117,510.21	49,657.73	1,001,280.74	20,072,869.25	[1]136,853.18	1,506,029.29	21,715,751.72
Nevada: Newlands	458,499.64	1,791,817.35		2,300,175.92	1,585,929.30	1,044,343.22	131,821.37	324,793.52	117,766.32	118,319.27	42,642.45		7,916,108.36	[1]40,808.80	20,405.33	7,977,322.49
New Mexico: Carlsbad	41,081.56	720,780.19		347,651.58	70,181.17	129,705.87				155,249.50			1,464,649.87		1,934.00	1,466,583.87
Hondo	4,422.70	154,844.67		93,898.69	38,979.34				19,837.41	23,338.45	4,170.42	42,081.71	381,573.39			381,573.39
New Mexico-Texas: Rio Grande	161,067.18	5,219,663.53		3,462,614.46	2,309,774.35	3,485,636.18	5,995.34		228,288.99	68,532.20	11,778.28	863,217.40	15,816,567.91			15,816,567.91
North Dakota: Williston (North Dakota Pumping)	32,098.44				171,349.37			274,387.87		23,019.48	16,774.93		517,630.09			517,630.09
Buford Trenton					58,406.83			159,166.10		5,850.13			223,423.06			223,423.06
Oregon: Baker	62,674.85	[2]5,659.94											68,334.79			68,334.79
Owyhee	128,946.55	3,450,998.63		819,826.66	2,843.12				15,104.75		10,718.09		4,428,437.80			4,428,437.80
Umatilla	115,210.50	2,922,976.59		946,387.85	989,934.97	118,038.75			3,375.08	33,389.85	2,772.57		5,132,086.16	[1]5,851.04	230,205.34	5,368,142.54
Vale	58,020.49	695,501.24		2,184,632.21	221,099.06				2,035.30			9,225.66	3,170,513.96			3,170,513.96
Oregon-California: Klamath	177,303.69	718,369.55	31,861.11	2,830,969.43	809,467.97	985,498.56	106,581.62	127,357.01	15,814.54	48,644.76	37,235.71	120,985.36	6,010,089.31		3,830.03	6,013,919.34
South Dakota: Belle Fourche	15,998.56	1,808,590.62		1,087,088.13	735,569.14	636,915.71			12,141.36	40,970.86	14,583.67		4,351,858.05		669,943.43	5,021,801.48
Utah: Salt Lake Basin	73,685.91	2,384,900.50		304,202.08									2,762,788.49			2,762,788.49
Strawberry Valley	48,658.27	1,699,597.46		814,705.95	708,402.92			90,069.50	9,025.68	115,223.25	14,051.19	12,511.90	3,512,246.12	[1]7,689.27	82,240.12	3,602,175.51
Washington: Okanogan	4,603.27	768,022.24	155,965.24		435,794.24				1,889.92	74,506.90	6,679.10	4,736.36	1,452,197.27	[1]4,268.54	25,194.37	1,481,660.18
Yakima	356,999.34	7,802,373.62	396,401.12	3,025,319.63	2,480,088.23	11,418.80		1,287.22	22,462.15	329,599.61	53,040.31	10,208.54	14,489,198.57	28,951.58	83,037.87	14,601,188.02
Yakima-Kittitas	137,765.64		[2]93.10	6,725,185.55	737,685.24				4,720.37	9,176.05	15,933.71	28,536.78	7,659,096.44			7,659,096.44
Wyoming: Riverton	112,056.49	359,047.21		2,536,346.30	755,167.69	31,287.10			35,077.75	15,886.27	33,003.71	44,296.77	3,922,169.29			3,922,169.29
Shoshone	92,295.48	1,847,733.09		3,187,099.75	1,228,488.65	2,532,552.29		716,603.46	70,777.28	78,255.15	24,445.84	40,252.33	9,818,503.32	21,462.48	308,679.09	10,148,644.89
All States: Secondary	2,165,913.52												2,165,913.52			2,165,913.52
Subtotal	5,568,187.03	64,552,525.96	1,839,673.99	71,805,138.83	29,140,871.64	14,889,909.58	3,026,993.36	8,963,325.98	923,972.04	2,841,137.94	601,382.80	9,797,410.92	213,950,530.07	435,497.30	5,769,925.76	220,155,953.13
Arizona: Yuma auxiliary [5]	33,736.31		165,204.32	265,959.39	333,394.93		9,020.00	9,749.34	837.00	67,058.48	422.16		885,381.93			885,381.93
Arizona-Nevada: Boulder Canyon	507,465.33	210,033.22											717,498.55			717,498.55
Total	6,109,388.67	64,762,559.18	2,004,878.31	72,071,098.22	29,474,266.57	14,889,909.58	3,036,013.36	8,973,075.32	924,809.04	2,908,196.42	601,804.96	9,797,410.92	215,553,410.55	435,497.30	5,769,925.76	221,758,833.61

[1] Value of materials, supplies, and equipment turned over to water users.
[2] Preliminary work.
[3] Includes $109,426.64 interest on investment (American Falls Reservoir).
[4] Difference between cost and sale price of unused materials, supplies, and equipment.
[5] Expenditures for this project for new construction made from special fund under the act of Jan. 25, 1917.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, and Dr. Hugh A. Brown, Director of Reclamation Economics, left Washington on June 20, to accompany the Subcommittee of the House Appropriations Committee for the Interior Department on a trip of inspection over several of the reclamation projects and national parks. On the way to the Pacific coast they stopped at the North Platte project, the Denver office, Grand Valley, Uncompahgre, and Salt Lake Basin projects, and Bryce and Zion National Parks. The party reached Las Vegas, Nev., on July 2 and visited Hoover Dam site the following day. From Las Vegas they went to Los Angeles, where they spent one day, from which point they continued to Sequoia, General Grant, and Yosemite National Parks, and spent one night in San Francisco. Doctor Brown left the party at San Francisco for a brief stopover at Las Vegas before starting east. He arrived in Washington on July 16.

Doctor Mead proceeded with the subcommittee to the Orland project, Iron Canyon Dam site, Klamath project, Crater Lake National Park, Portland, and Spokane, where he left the party. After an inspection of the Columbia Basin project Doctor Mead started eastward.

R. F. Walter, chief engineer, accompanied the Subcommittee of the House Appropriations Committee when they visited the Grand Valley and Uncompahgre projects, Bryce Canyon and Zion National Parks, and the Boulder Canyon project.

E. B. Debler, hydrographic engineer, recently visited the Semino Dam site, where drilling is in progress, to determine foundation depths, and conferred with the engineer in charge of the surveys to outline the remaining work.

W. I. Swanton, engineer in the Washington office, has returned to his headquarters after a delightful motor trip through New England with brief stops at Brookline, Mass., and around Boston.

B. W. Steele, senior engineer in the Denver office, made a recent inspection trip covering the Boulder Canyon project, the Cat Creek Dam being constructed by the Navy Department at Hawthorne, Nev., and Berkeley, Calif., in connection with the proposed tests at the University of California.

Dr. Ray Lyman Wilbur, Secretary of the Interior, visited the Grand Valley project on June 30 and was entertained at dinner by the local Chamber of Commerce.

On June 18 First Assistant Secretary Dixon appointed a committee comprising H. H. Johnson, Bureau of Reclamation, W. S. Hanna, United States Indian Service, and W. A. Lamb, United States Geological Survey, to consider water supply problems on the Milk River (Federal) irrigation project and the Fort Belknap (Indian Service) irrigation project. The committee will make a preliminary report suggesting a schedule of operation for this season, and then recommend a plan of future operation.

Thomas C. Mead, assistant engineer, and H. F. Bahmeier, associate engineer, of the Denver office, are engaged on field work in the Green River Basin on the Colorado River investigations, under Mr. Porter J. Preston.

Charles N. McCulloch, chief clerk of the Washington office, left on July 3 for a 3-weeks' 3,000-mile automobile trip, including stops at Niagara Falls, points in Canada, Detroit, Mich., Chicago and Rockford, Ill., returning via Asheville, N. C., Greenville, S. C., and Roanoke, Va. The party encountered heavy rains while en route to Asheville and was marooned for a short time in the mountains at Corbin, Ky.

S. H. McCrory, formerly chief of the Division of Agricultural Engineering of the Bureau of Public Roads, Department of Agriculture, has been appointed to the position of chief of the newly created Bureau of Agricultural Engineering of that department. The change became effective July 1.

F. E. Bonner, engineer, who was temporarily assigned to assist C. A. Bissell in the preparation of his report on central California water resources and whose services were terminated on June 30, is enjoying a motor trip through Canada and the Northwest. It is understood that Mr. Bonner will locate in San Francisco, where he will engage in private practice.

Owen J. Olsen, junior engineer, has been transferred from the Salt Lake Basin project to the Denver office.

C. A. D. Young, engineer, and J. B. Kalbfus, assistant engineer, spent some days in Cheyenne, Wyo., inspecting secondhand rails furnished by the Union Pacific system for the construction of the railroad from Boulder City to Hoover Dam.

J. R. Iakisch, drainage engineer, has returned to Denver after making a brief preliminary study of the drainage problems on the Uncompahgre project.

W. J. Burke, district conusel, and Senators John B. Kendrick and Robert D. Carey were among the recent visitors to the Shoshone project.

A party consisting of A. L. Fellows, senior irrigation engineer, H. B. McClure, motion picture director, C. A. Carello, cinematographer, and J. C. Marr, associate irrigation engineer, all of the Department of Agriculture, and R. Kulp, irrigationist, of the University of Idaho, visited the Vale and Minidoka projects for the purpose of taking motion pictures of methods of irrigation.

Senator Wesley L. Jones was a visitor at the Yakima project office, where he conferred with Acting Superintendent Moore in the interest of the Outlook irrigation district.

Reclamation Capital Outlay

(Continued from page 182)

residences, and 579 storehouses, equipment sheds, barns, etc., in addition to which the construction of many hundred miles of improved roads.

Column 11—Telephone system.—This feature covers the permanent telephone lines and installations and does not apply to the telephone lines erected to facilitate construction work. There have been built 4,010.6 miles of telephone lines which are being operated and maintained for the convenience of the projects.

Column 12—Operation and maintenance during construction.—This column covers the cost of operating and maintaining the projects during the period of construction and prior to the issuance of public notice.

General.—In connection with the construction of the various projects the bureau has placed 2,565,000 cubic yards of riprap, laid 1,969,000 square yards of paving, placed 909,000 square yards of gunite, placed 4,392,000 cubic yards of concrete, and used 4,926,000 barrels or 19,704,000 sacks, of cement.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walter, Chief Eng.; S. O. Harper, Assistant Chief Engineer; J. L. Savage, Chief Designing Eng.; E. B. Debler, 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	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 Calif
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 Calif
Uncompahgre	Montrose, Colo.	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr		F. P. Greene	do	Do.
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	H. W. Johnson	H. W. Johnson	Wm. J. Burke	Billings, Mont.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	do	H. H. Berryhill	C. L. Harris	H. J. S. Devries	El Paso, Tex.
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	B. E. Stoutemeyer	Portland, Oreg.
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. P. Greene	do	Do.
Belle Fourche	Newell, S. Dak.	F. C. Younghlutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	do	Do.
Salt Lake Basin [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	Wm. J. Burke	Billings, Mont.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt.	R. K. Cunningham	C. J. Ralston	J. R. Alexander	Las Vegas, Nev.
Yakima Cle Elum Dam	Ronald, Wash.	R. J. Newell	Constr. engr		do	B. E. Stoutemeyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash.	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent		Denver office	do	Do.
Shoshone [9]	Powell, Wyo.	L. H. Mitchell	do	W. F. Sha	do	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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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.
Boise [1]	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield, 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.	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A.	Provo, 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.	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa, Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

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.
North Platte River power	do	Denver office	None.
Rathdrum Prairie, Idaho	Spokane, Wash.	H. W. Bashore	None.

SALLIE A. B. COE, *Editor.*

Photo by J. E. Stimson

STREET SCENE IN RUPERT, MINIDOKA PROJECT, IDAHO

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22, NO. 9 SEPTEMBER, 1931

Photo by J. E. Stimson

ELLENSBURG NORMAL SCHOOL, KITTITAS DIVISION, YAKIMA PROJECT, WASHINGTON

LAND RECLAMATION - - -

A CENTURY AGO landowners of the Atlantic Coast States were making serious objection to development of the Ohio and Mississippi Valleys under the homestead law. They feared that the competition of new lands would create a surplus of agricultural products and thus force prices down and ruin their market. In subsequent years every reclamation project in the West aroused the same fears and protests. It is easy to-day to criticize the lack of vision displayed by these early opponents of immigration, and yet the same cry, in slightly modified form, is now being raised in connection with reclamation projects in the West.

Because agriculture is faced with a serious problem of overproduction, there is a general belief that the reclamation program should be halted until consumption catches up with agricultural output. Such a view is a hasty conclusion that is in no way based on the facts.

While it is true that the United States is producing more wheat, corn, and cotton than it can sell at a profit and that the planting of additional acres in these staples would be unwise, it does not necessarily follow that there is a surplus of arable land. Each year the United States imports enough food to put many thousands of acres to work, and with proper irrigation waste lands proposed for reclamation would be suitable for raising these crops.

America's land problem is not that there are too many acres under cultivation but that too many acres are planted in the same crops and too much poor land is producing poor crops when there are unclaimed acres which, through irrigation, could be made to produce better crops at less cost.

—*LEBANON (Pa.) NEWS.*

NEW 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. 22, No. 9 SEPTEMBER, 1931

Interesting High Lights on the Federal Reclamation Projects

THINNING of apples has been completed on the Yakima project, and there are prospects for a crop of excellent quality. Crop conditions are favorable for the project as a whole.

YAKIMA was recently assured a third cannery when contract was awarded and construction work started on a $12,000 building to be erected for the Ray-Mailing Co. (Inc.), of Hillsboro, Oreg. The cannery, which will be completed shortly, will employ 120 women and 30 men. It was not expected that the plant would be completed in time to can fruits other than apples this year, but the organization will extend its operations next year. The company has been canning Yakima fruit for the past 10 years at its Hillsboro and Woodburn, Oreg., plants, but the improvement in quality of fruits if canned at centers of production instead of being shipped influenced the firm to establish a cannery in Yakima.

AN INDOOR ball league has been formed on the Yuma project and 10 teams composed of employees of the various organizations in the community have assembled. The games will be played on the Union High School athletic field, which has been lighted for night play, and all scheduled games will be played under lights. Funds for installing the lights were raised through the sale of tickets for a game to be played between picked women's and men's teams of Yuma and Imperial Valley. Considerable local interest in base ball has been aroused.

THIRTY prospective settlers visited the Riverton project during July and were shown over the land. Nine applications for farm units were received, five of which were accepted, and the advance water rental charge for 1932 was paid. One of these men filed homestead entry.

WORK has been started in laying 1¼ miles of California pavement on county roads on the Orland project. Installation of new equipment in the gravel plant on Stony Creek north of Orland was in progress with a view to beginning delivery on a 1,500 carload order of gravel for State highway pavement in Colusa County.

THIS season's pecan crop on the Yuma project promises to be a bumper one. A grower in the Valley division, with 23 acres of trees averaging 9 to 10 years old, anticipates a yield of 6 to 7 tons, which will be ready to harvest in October. This is one of the highest valued crops on the project, bringing in the past an average of approximately 50 cents per pound. The acreage of pecans is steadily increasing on the project despite economic conditions, and with the return of normal conditions more rapid development is expected.

THE widening of the John Day Highway between Vale and Lancaster, Oreg., and the grading of the Oregon Central Highway between Harper and Jonesboro have been completed. The W. H. Puckett Co. has practically finished the construction of the Oregon Central Highway between Jonesboro and Peach, bringing this highway to within 8 miles of Juntura. A temporary bridge has been built across the Malheur River near the end of the Puckett contract, so that the constructed portion of the highway could be put into immediate use.

ALL crops other than grain have made wonderful progress on the Shoshone project. The hot weather with plenty of moisture was favorable to potatoes, beans, sugar beets, and alfalfa. On the earlier settled lands on the Willwood division crops compare favorably with those on the previously settled Garland division.

A GRADUAL increase in the price of butterfat on the Yakima project has given encouragement to the dairy farmer. Prices received for apricots range from $20 to $30 per ton, and pears are selling at $20 for No. 1's and $10 for No. 2's, the average being about $12 per ton.

CROPS on the Rio Grande project are reported in excellent condition, and harvesting of melons, pears, and peaches is well under way. The shippers are optimistic on returns for the season's market on melons and fruit.

MANY inquiries continue to arrive from prospective settlers on the Sun River project. At the end of July, 60 applications for farms had been received and 42 farm units had been definitely allotted.

A DECIDED change for the better has occurred in the appearance of crops on the lower Yellowstone project. This is particularly true with respect to sugar beets, which have made remarkable growth. About 10,100 acres of beets have been thinned. The latest estimate of the sugar company places the average yield at 10 tons per acre.

THE Vale project reports that the Vale-Owyhee Government Projects Land Settlement Association received 49 inquiries by mail, and that 19 interested persons called at the office seeking information relative to opportunities for settlement on the project.

THE 24 entrymen on the farm units recently opened on the Tule Lake division of the Klamath project have made a very satisfactory showing both in crops and improvements on their farms.

Activities at Hoover Dam

A description of work now in progress and life in Las Vegas

By C. H. Pease, Editor Hidalgo County Independent, Edinburg, Tex.

OUR automobile party left Zion Canyon on the morning of May 18 and headed for Los Angeles, about 560 miles distant. The trip through the desert was interesting and the roads good, which made fast travel possible. Construction work was in progress in Utah, where we found a good detour, and also in Nevada, where there is a short, very bad detour. As it was, we reached Las Vegas, a distance of 185 miles, in time for lunch. As we neared the outskirts the desert was staked out to town lots, and real-estate offices were in evidence. There was some building, but most of the houses were very cheap and modest in size. Las Vegas is a boom town right now. The commencement of construction of Hoover Dam, where more than $150,000,000 is to be expended, has had its effect. People from all over the continent have flocked to Las Vegas for work, and although there is evidently a great deal of work going on, there is a large excess of labor supply, and jobs are as hard to get there as anywhere else.

Nevertheless, the town was thronged. Cars occupied every available inch of parking space, and the sidewalks were crowded with people. Las Vegas is a very good looking little desert city, with smart stores and some very good residences. The old portion of the town is well shaded. Here we got lunch and gassed up for the drive to the site of Hoover Dam, about 33 miles to the east. We anticipated some rough road, but much to our surprise we found a well maintained roadway over which we could make good time. Everywhere was evidence of new activity. Buildings were going up along the first few miles of the Boulder City, or Boulder Dam road. There were drink stands, filling stations, road houses, and every evidence of activity.

ACTIVITY AT BOULDER CITY

A railroad has been built as far as Boulder City, and there construction crews were working on highways. Boulder City is about 25 miles east of Las Vegas and about 7 or 8 miles from the Colorado River. All of the lines of communication converged on the site of the city, which is merely the site of a proposed Government construction town at the present time, but a city of several thousand inhabitants, entirely controlled by the Federal Government, is expected to be built here, which will be the center of activity to prevail during the six or seven years that will be required to construct the greatest engineering undertaking in the history of modern civilization.

When we reached Boulder City site still more activity was in evidence. The road from here led to the northeast directly toward the Colorado River just above the canyon. Power lines, railroads, highways, and every other kind of communication were being constructed. Several tent cities were located here and there. We could see the river ahead, in that portion of the territory that is to be the bed of the proposed lake. Alongside of the road at one point is a sign which marks the shore of the lake that is to be created. It is far up the hillside about 600 feet above the bottom of the valley below. Continuing our descent, we were at last on the shores of a large river, which resembles the Rio Grande when at high water stage. It was some five or six hundred feet wide, and flowing swiftly, apparently 15 or 20 feet deep. Two boat companies are competing here to carry passengers to the site of Hoover Dam. One had its office and pier on the level flood plain while another was about a mile down the river at the very mouth of the canyon. A road had been cut out of the solid rock wall leading to the construction going on below, and to the lower boat company's pier, so we chose to go down to the lower one.

Photo by Hugh A. Brown

Bird's-eye view of Boulder City from Water Tank Hill, showing offices, mess house, and dormitories erected by the Six Companies (Inc.). In the foreground are two of the permanent houses for Government employees

TRIP THROUGH THE CANYON

We bought our tickets for the trip at $1 each and prepared to make the trip. From here we could look into the very mouth of the black canyon which yawned below us. The name of this canyon, Black Canyon, is very appropriate. The walls are exceedingly black and rise a distance of 1,000 feet above the water, and the canyon is so narrow that the swirling waters completely fill the gorge. I must confess that the scene was a bit forbidding. The current was so swift, and the canyon so mysterious and so dark, that the little launch below, tied to the pier, looked woefully inadequate to cope with the swift waters.

At 3 o'clock the boat was to leave, and there were six or eight passengers besides ourselves, ready to go. The boat took off from the shore and headed down the stream. A bend in the canyon a half mile below made it appear that there was no exit. As we approached the bend, however, the canyon opened up and we could look down the dark opening to the site of the dam some 2 or 3 miles below us. We moved swiftly along until we were swallowed up by the high towering black walls and the swift water. Suddenly the boatman gave a sharp twist to his rudder and began turning around in

midstream. A cable was stretched across the canyon, and men on a ledge in the wall signaled us to turn back. The engine now roared and churned the waters as we headed upstream. It seemed to be moving through the water at high velocity, but when I looked at the walls of the canyon, we were standing still.

A large puff of smoke shot out from the canyon wall a half mile below. This was followed by a boom that echoed and reverberated up and down the canyon. As the smoke drifted away, there was a great splash out into the middle of the river as several huge rocks, thrown out by the blast, fell into the waters. This was followed by still another puff and another boom and other rocks were hurled into the air to fall with a splash.

Now we again turned in the river and shot downstream. The black walls of the canyon were being tunneled and chiseled into holes, and landing platforms and roadways cut into the solid rock. Men were working here and there. Ladders extended to dizzy heights up the precipitous cliffs on either side. Cables extended across the river and strange marks were chalked or painted on the canyon walls. Preparations are going on for beginning construction of a dam that will rise 730 feet above foundation bed rock, about twice the height of any dam ever before constructed. This dam will stop the murky tide that now swirls through the canyon and hold the waters in reserve, and an entire year's flow will be impounded in the lake above. This lake will hold sufficient water to furnish every acre of irrigated land in the valley with 3 acre-feet per year for the next 20 years. Nearly a million horsepower of electrical energy will be generated at the huge dam. In addition to the construction of this enormous dam and generating plant, the cities of southern California expect to vote $200,000,000 to carry a huge syphon over mountain and plain from the Colorado to Los Angeles to provide water for domestic and municipal uses.

About an hour was spent in the canyon before we landed back where we started. It is a tremendous undertaking which can only be appreciated by an actual visit to the site of the dam.

For many years I was actively interested in the events that led to the launching of this huge project. In some slight measure I participated in the promotion of the enterprise, and I found the trip to the dam site a fascinating and moving experience.

CONDITIONS IN LAS VEGAS

We stayed in Las Vegas that night, and after supper we went down town to look the town over. Everything was wide open and people were thronging the streets. There were no saloons in evidence, and we saw but one case of drunkenness, but there were three gambling joints running wide open. I visited them all, for gambling is now legalized in Nevada, and the only restriction is that no one under 21 years is permitted in the "clubs." There was a slightly different looking crowd in each club. The rooms were crowded and men and women were lined up around the various games staking their money. Numerous tables were crowded with players and things were running full blast.

There was but one other place where we saw such crowds, and upon investigation I found that was a State employment agency. Crowds were around this place so thick that it was difficult to get by on the sidewalk.

THE RETURN TO LOS ANGELES

The next morning we were up at 5 o'clock and on the road as soon as we could get some breakfast. We still had the Mojave Desert to cross on the way to Los Angeles, and, while it was paved all the way, we had heard so many stories of heat and discomfort we were anxious to get over as much of it as possible before the sun got too hot. But it was cool in the early morning. The road was smooth and for the most part straight, with few curves. Mile after mile of desert rolled by. It was much the same type of desert we had come over but somewhat more varied. Long stretches of road extending over a rolling plain, the plain being punched here and there by towering masses of rock which fringed the horizon on every side, formed the landscape, rather than an endless expanse of sand. It was an interesting desert. We passed through "groves" of Joshua "trees." These are not true trees, but yuccas which have grown into trees, having a regular bark which resembles the bark of a tree. Some of them had trunks several feet in circumference and grew to a height of 40 or more feet, with numerous branches. These were strange forests that gave the impression that we were in topsy-turvy land, a dreamland where nothing familiar was to be seen but only strange things, the product of some crazy fancy.

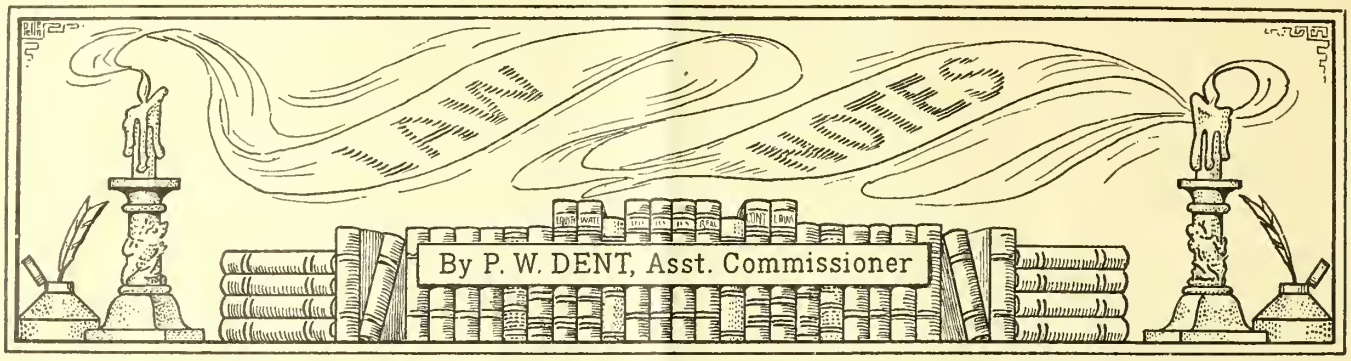
But the anticipated heat of the desert never materialized. On the contrary, there was an uncomfortable chilly wind from the north. We needed our coats, and I had on my summer suit brought from the valley. California is building, and has actually built nearly across the Mojave a fine, fast road. The old paved highway that followed largely the curves and topography of the terrain, is being replaced by a broad highway that leads directly to its objective. For the most part we traveled at 50 miles per hour through the great spaces that lie between

(Continued on p. 193)

Photo by Hugh A. Brown

OFFICIALS IN CHARGE OF HOOVER DAM CONSTRUCTION

Left to right: W. A. Bechtel, first vice president Six Companies (Inc.); W. R. Young, construction engineer Boulder Canyon project; Dr. Elwood Mead, Commissioner of Reclamation; F. T. Crowe, general manager Six Companies (Inc.); R. F. Walter, chief engineer Bureau of Reclamation.



Execution on Judgments in Favor of the United States

ALTHOUGH statutes of limitation may not run against a judgment in favor of the United States, the use of process in aid of execution of such judgments, when such process is adopted from the local law in pursuance of the conformity acts and the rules of the Federal court, may be subject to the conditions imposed by the local laws.

A Minidoka project case recently decided by the Supreme Court of the United States applies the foregoing rule. Section 6910 of the Idaho Compiled Statutes, 1919, permits the issuance of execution only within five years from the date of rendition of judgment, and section 916, United States Revised Statutes, in connection with standing rule 73 of the Idaho Federal District Court, adopts such Idaho statute as the rule of practice of that court. A judgment in favor of the United States was obtained in the court in 1921 against Schodde, Custer et al. for rental upon a grazing lease. More than five years after the rendition of the judgment, execution issued and a levy was made upon property of Custer.

An injunction was sought by the judgment debtor against the levying officer to restrain him from applying the seized property in satisfaction of the judgment. The injunction was denied by the United States district court, and the ruling affirmed by the circuit court of appeals in Custer *v.* McCutcheon (41 Fed. Second, 354). On application to the Supreme Court of the United States a writ of certiorari was granted (282 U. S. 826), and eventually the judgment of the lower court was reversed (75 L. Ed. —, 51 Sup. Ct. Rep. 530).

In an opinion written by Mr. Justice Roberts, it was said:

"The question presented is whether the Idaho statute (limiting the time in which writ of execution may issue), which has been adopted as governing execution process in the United States district court for that State, is applicable to an execution issued on behalf of the United States as a judgment plaintiff;"

following which it is held:

"It is clear, therefore, that Revised Statutes section 916 and rules of court adopted pursuant thereto confine the United States to such executions as may be issued by individuals under the State statutes, and impose upon it the same restrictions and exemptions as are applicable to other suitors, and the question here is whether an exception should be made to this general rule as respects the time fixed by the State statute within which execution must issue. We see no valid reason for making such an exception. The time limited for issuing executions is, strictly speaking, not a statute of limitations. On the contrary, the privilege of issuing an execution is merely to be exercised within a specified time, as are other procedural steps in the course of a litigation after it is instituted. The plaintiff is not precluded from bringing an action upon the judgment, but merely from having an execution in the form provided by State law."

When a money judgment of the United States is aged beyond the time when a writ of execution may issue as provided by local laws, the decision would seem not to impair the remedy by writ of attachment timed with the commencement of suit upon the judgement. The requirement of a bond for attachment invariably provided by local statutes, does not apply to the United States as plaintiff (United States *v.* Bryant, 111 U. S. 499; 28 L. Ed. 496).

B. E. STOUTEMYER,
District Counsel.

Conveyance of land without reservation conveys water right

In the Montana case of Yellowstone Valley Company *v.* Associated Mortgage Investors, 290 Pac. 255, the plaintiff owned two tracts of land, also two certificates for shares of the capital stock of a ditch company. To secure loans the plaintiff executed in favor of the defendant three mortgages upon its land. All of the mortgages contained a provision relative to the water rights and the tenements, hereditaments, and appurtenances belonging to the land, or in anywise appertaining. At the time of the execution and delivery of the mortgages the two certificates above mentioned were duly assigned and delivered to the defendant, and thereafter defendant had the stock transferred to it and new certificates issued therefor. In applying for the loans, plaintiff represented that the lands were irrigable, and the mortgages were made upon the basis of irrigated land values. Plaintiff being in default, defendant instituted a suit to foreclose the second and third mortgages. Copies of the mortgages were attached to the complaint. No other reference was made to the water rights or water stock. In due time the decree of foreclosure was entered and the lands were sold to the defendant at sheriff's sale. The sheriff's certificate of sale was issued correctly describing the lands, but failing to mention the appurtenances. Neither was there any mention of water rights or water stock. Plaintiff commenced an action to recover possession of the shares of stock. Plaintiff had judgment in the lower court to the effect that the plaintiff was the owner of the stock and that the defendant is not entitled to possession thereof in its individual capacity, and is entitled to hold the same only as trustee for the owners of the first mortgage. The defendant appealed. The decision of the lower court was reversed by the Supreme Court of Montana, the court saying:

"Plaintiff's theory is that the shares of stock in the ditch company are personal property, are not and can not be appurtenant to the land; that the stock was hypothecated to the defendant by way of pledge, and, the pledge not being foreclosed when the defendant bid in the lands for the full amount of the judgment, the

stock was released from its pledge, and, the debt being paid, the defendant has no interest therein.

"The determinative question is: Under the facts and circumstances shown, did the mortgage include the water rights represented by the shares of stock? * * *

"As is shown in the agreed statement of facts, the land in question was irrigated, and without irrigation was of little value. It appears conclusively that the water obtained from the canal of the Big Ditch Co. was essential to the use of the land in question, and had been used thereon for 30 years or more. Upon the facts shown there can be no question that the water rights represented by the shares of stock in the Big Ditch Co. were appurtenant to the lands. The authorities sustain this position. The fact that the certificates of stock—evidences of ownership of an interest in corporate property—are personal property, does not militate against this statement. Personal property can become an appurtenance to land without attachment or annexation. Section 6667, Revised Codes, 1921, provides that real or immovable property consists of: (1) Land; (2) that which is affixed to land; (3) that which is incidental or appurtenant to land. For instance, we find that mining tools are appurtenant to mines. Section 6670, Revised Codes, 1921. * * *

"We do not overlook the point that whether a water right evidenced by shares of stock is appurtenant to the land upon which the water is used is a question of fact. But, upon the conceded facts, that question does not trouble us; clearly, the water is appurtenant to the land. Such being the case, the governing rule is that everything essential to the beneficial use and enjoyment of the property conveyed is, in the absence of language indicating a different intention on the part of the grantor, to be considered as passing by the conveyance."

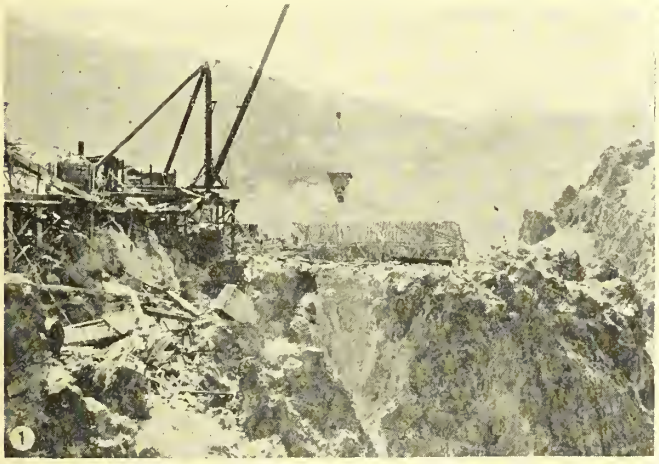
Liability For Flooding From Farm Ditch

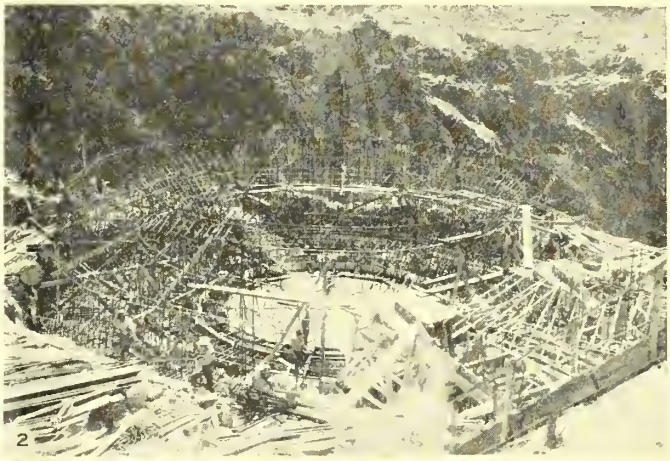
In Chavez *v.* Lopez, 290 Pac. 741, decided July 5, 1930, the Supreme Court of New Mexico arrived at what appears to be a correct conclusion upon the question of damages to the plaintiff's crop through the escape of irrigation water.

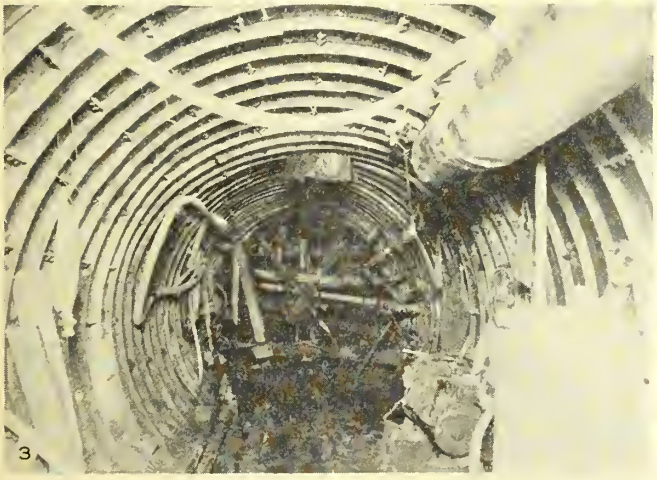
The defendant's father, in this case, had a garden watered by a culvert connected with an adjoining irrigation ditch. The defendant worked in the garden during the absence of his father, but had never opened or closed the culvert. One night when the water was turned into the ditch, which had previously been dry, the water ran through the culvert over the garden and on to the plaintiff's alfalfa field damaging the hay. The court in reversing the trial court and remanding the case with directions to enter judgment for the defendant said:

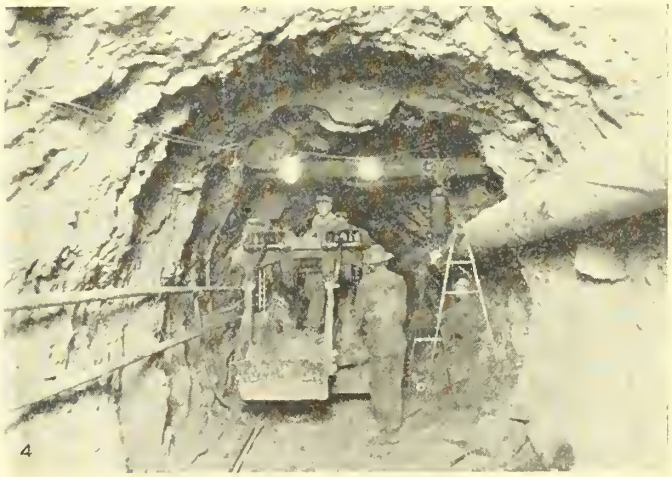
"This action is one for tort; to recover, the plaintiff must show that the defendant owed him some duty which he failed or neglected to perform. The injury was caused by some one leaving the culvert open. The son did not install, own, manage, or operate the culvert. He knew nothing of the damage until it was done. As a neighbor, he owed the plaintiff no legal duty with regard to his father's culvert."

H. J. S. Devries,
District Counsel.









PROGRESS PICTURES, OWYHEE DAM, OWYHEE PROJECT, OREGON-IDAHO

1, Ring gate promontory and structure from near panel of dam; 2, All steel for ring gate structure in place; 3, Tunnel No. 5, steel liner plates and bulkhead for grouting under 500 pounds per square inch pressure; 4, Conway mucker and car switcher in Tunnel No. 5.

Silt Costs Imperial Valley $1,400,000 Yearly

The reservoir formed by the Hoover Dam will not only store water for irrigation and domestic supply but will also store silt and thus prevent its deposition in the delta region, where it is an ever-increasing menace to the farm lands of the Imperial Valley. In the design of the reservoir, provision has been made for a silt pocket to hold from 5,000,000 to 8,000,000 acre-feet, out of a maximum storage capacity of 30,500,000 acre-feet It is estimated by engineers of this bureau that 3,000,000 acre-feet of silt will be stored at the end of a 50-year period. This silt must necessarily be stored, as no feasible plan has ever been found for removing silt from a storage reservoir.

With an average annual flow at Yuma, Ariz., of 17,000,000 acre-feet and an average silt content of 0.63 per cent, the annual load of silt brought into the delta region averages 105,000 acre-feet, or 170,000,000 cubic yards, under present conditions. This amount of silt is equal in volume to the total excavation made by the United States in constructing the Panama Canal.

LARGEST IRRIGATION DISTRICT

The Imperial irrigation district, with its 605,000 acres, is the largest irrigation district in this country, and is also the lowest in elevation, the valley lands being below sea level. Around its eastern and southern borders flows the Colorado River over 100 feet above sea level. The valley is protected by levees, but these have to be raised each year in the delta section to keep pace with the slowly ascending elevation of the outside ground, with its accumulating deposits of silt.

LEVEES UNSAFE

There is an ever-present danger of a break in the levees and the river rushing downhill, to the valley floor, with a repetition of the 1905 disaster. It is for this reason that the farmers of the Imperial Valley look forward with eager anticipation to the completion of Hoover Dam, when their flood and drought problems will be solved and the silt problem will be minimized.

M. J. Dowd, chief engineer and general superintendent of the Imperial irrigation district, recently made the following interesting statement regarding silt conditions in the Imperial Valley:

"On the lower Colorado River silt is the major problem. It is the silt which creates the flood problem, and it is the silt which creates not only a very serious problem in the irrigation of the land but also results in excessive costs in operation and maintenance.

THE FLOOD PROBLEM

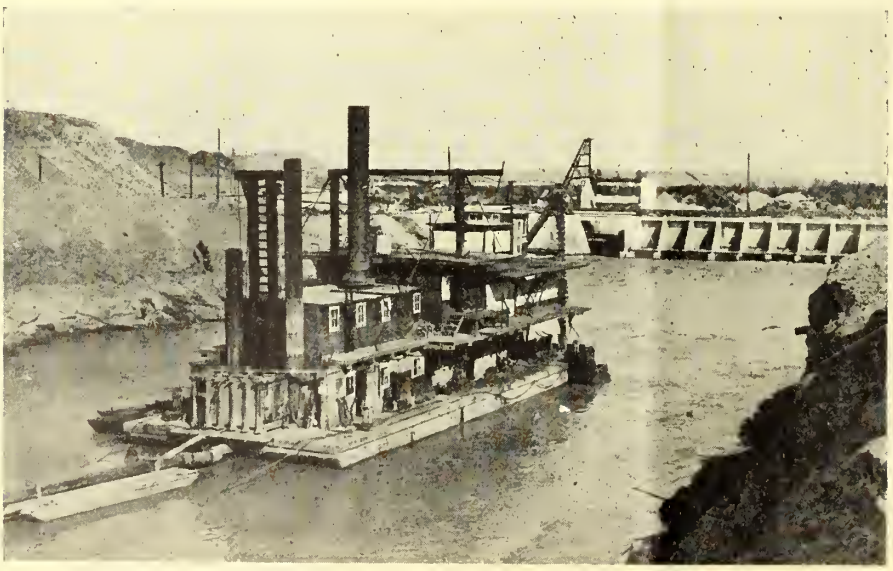
"Discussing, first, the flood problem, were it not for the silt depositing on the delta of the Colorado River, and thereby constantly raising the water surface against our protective levees, it would not be a difficult matter to channelize the river to the Gulf and maintain it well below the ground surface. In addition to raising the water surface, the silt also is a large factor in the continuous changing of the course of the river and thereby causing attacks on our protective levee system. Of the approximate $5,000,000 which has been spent by the Imperial irrigation district on levee protection, it is estimated that at least $4,000,000 can be attributed to silt alone.

SILT CONTROL DIFFICULT

"The silt is also the major cause of our present diversion difficulties. Our head gate is located immediately north of the international boundary line in the United States, and was designed as a skimming weir, having 74 openings, each 6 feet 6 inches in width, the diversions being controlled by use of flashboards inserted in the openings. Tests have shown that this gate has little effect upon the silt content of the water entering our canal, and large sums of money are spent annually in handling the silt through the canal system and onto the land. Immediately below the head gate we have two large suction dredges with which we remove from the head end of the canal on an average of 1,500,000 cubic yards of silt each year at a cost of about $75,000.

"On the canal system we operate a large fleet of drag lines and various types of small bucket-line dredges, cleaning on an average of over 3,500 miles of canal each year and removing approximately 3,000,000 cubic yards of silt.

"However, the total silt which we remove by mechanical means is but a fraction of that which enters through our head gate, the larger portion of the remainder being passed onto the land and some sluiced into wasteways which carry



Suction dredge removing silt deposits below headgates, Imperial Main Canal

it to Salton Sea. As land is farmed to within a short distance of Salton Sea, we have a serious problem in preventing the deposition of silt in the mouths of wasteways (New and Alamo Rivers) from causing overflow and damaging crops. For this one item we have spent $120,000 in payment of damage claims and as much as $40,000 in one year in controlling these outlet channels.

"With the deposition of such a large volume of silt upon the land it is necessary every few years to regrade the farms; and even so, the elevation of the land is increasing, requiring a raising of the lateral and main canal system throughout the entire project. Constant dredging of the canals creates a problem in disposing of the material excavated, and large sums of money are being spent each year in grading on the canals and laterals, with a gradual increase in cost as the banks become wider and higher.

"The silt is also a serious factor in operating the system, causing fluctuations and making regulation difficult. As one item in this connection, it is necessary to current meter all of the larger canals and laterals at least once and sometimes twice daily, in order to determine the amount of water flowing, for the reason that because of the silt the bottoms of the canals are constantly changing, making it impossible to rely upon gages as an indication of discharge.

INDIVIDUAL FARMER UNDER HEAVY EXPENSE

"The expense to the individual farmer in maintaining his own head ditches and in periodically regrading his land is very high. As a result of considerable investigation it has been determined that this cost amounts to a minimum of $2 per acre per year, which, applied to the 450,000 acres under cultivation in Imperial Valley, gives a total of $900,000 for this one item alone. There is also the interference with the growing of crops, particularly furrow-irrigated crops, and flood irrigating during the hot months of July, August, and September. Just what this cost amounts to can not be stated, as no estimate has ever been made that I know of, but it is certain to be large.

"Again referring to our diversion difficulties, because of the vast amount of silt in the water we are not permitted to put in a permanent diversion dam in the river but are forced to install a temporary dam during the low flow, which has to be removed as the floods arrive. Over a period of years the cost of the diversion dam averages in the neighborhood of $30,000 annually and, of course, is not to be compared with a permanent diversion dam as regards desirability.

"Summing up all these factors, it may be stated that the excessive amount of silt is causing an expenditure of $500,000 annually, and in addition results in a cost to the individual farmer of $900,000 per year, or a total cost of $1,400,000 annually. Under the conditions as exist on the Colorado River, I am of the opinion that the only permanent solution to the silt problem is the storage of such silt on the river, together with desilting works at the headworks as is contemplated for the All-American Canal."

Placing Concrete in the Owyhee Dam at the Rate of 50,000 Cubic Yards Per Month

By Clifford A. Betts, Office Engineer, Owyhee Project, Owyhee, Oreg.

THE Owyhee Dam will contain over 530,000 cubic yards of concrete weighing in excess of 1,000,000 tons when completed to its full height of 405 feet at maximum section and 530 feet above lowest foundations. The placing of this large quantity of concrete is over 60 per cent finished and constitutes one of the most interesting phases of the work being carried on by the Bureau of Reclamation in eastern Oregon to provide an irrigation water supply for 123,000 acres of the Owyhee project.

Although the concreting involves fewer difficulties than did the preparation of the foundations with fault zone extending 175 feet below the stream bed, its importance to the permanence of the structure is evidenced by the fact that the largest single item, or 49 per cent of the $3,500,000 dam contract with the General Construction Co., is for placing concrete at $3.50 per cubic yard. After adding to this the cost of cement furnished by the United States and the cost of the Owyhee Railroad, built by the Government from the Oregon Short Line Railroad at Dunaway to the Owyhee Dam for the contractor to operate, the cost of concrete per cubic yard remains at the very low total of $7.

Large deposits of superior Boise River graded aggregates are available at Dunaway gravel pits, 24 miles by railroad from the dam. Three trains daily, hauling 700 cubic yards each, deliver pit-run sand and gravel to the screening plant at the dam site for separation into sand, three sizes of gravel, and cobbles, which can be recombined into the most suitable proportions at the mixing plant, thus insuring uniformity in the mix.

DESCRIPTION OF PLANT

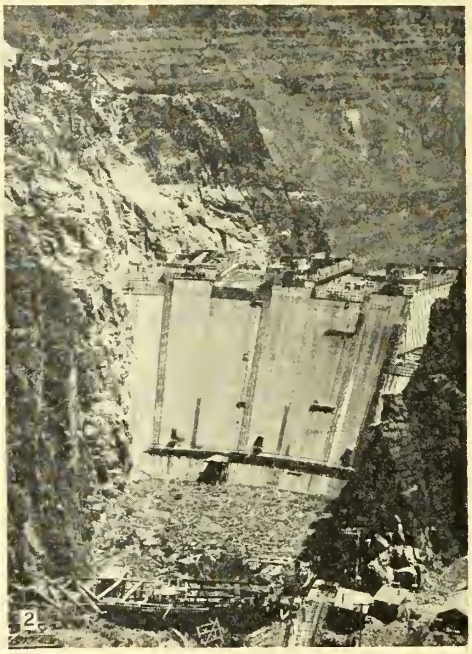
An endless belt conveyor fed by gates beneath the stock piles carries one size at a time to bins above the mixer. Air-operated gates in the bottom of these bins supply the mixer hoppers, which are mounted on platform scales so that the cumulative weight of the aggregates can be read on the operator's dial as the required sizes are let into the hoppers. Cement is added separately from a batcher fed by worm conveyor from the silo, cement being received in bulk. The mixing plant has a capacity of 1,100 cubic yards of concrete per 8-hour shift and has been operated to this limit under favorable placing conditions. To accomplish this meant that the two 4-yard mixers had to be filled, mixed for one and a half minutes, and dumped into the concrete shuttle train twin 4-yard cars every three and one half minutes or oftener; the trains had to travel one-third of a mile, dump into the 8-yard cableway bucket and return in the same length of time; and similarly the bucket had to deposit the 16 tons of concrete and return to the loading dock. So accurately were these operations synchronized that pouring limitations (4-foot lift in 72 hours), rather than equipment capacity, have controlled the rate of placing. The 25-ton cableway with 1,300-foot span, traveling head tower to cover all parts of the dam, and remote control, permitting the operator to remain near the point of delivery, have proven well adapted to placing concrete rapidly without segregation. The success of this method is reflected in the specifications requiring bottom dump bucket placing in the Hoover Dam.

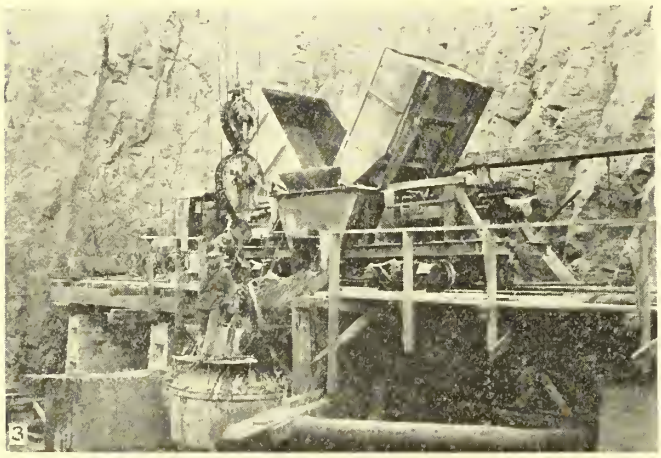
By the use of one barrel of cement to the cubic yard and adherence to a water cement ratio of around 1, concrete having a compressive strength of 3,500 pounds per square inch in 28 days has been produced uniformly. The proportions of materials (1 : 2.7 : 6.45 by weight) was determined by laboratory studies of the behavior of the Dunaway aggregates, and while strength is in excess of the 1,500 pounds per square inch required in the specifications (dam designed for maximum unit stress of 600 pounds per square inch), considerations of impermeability and permanence under the high heads that will prevail demanded the mix that was adopted.

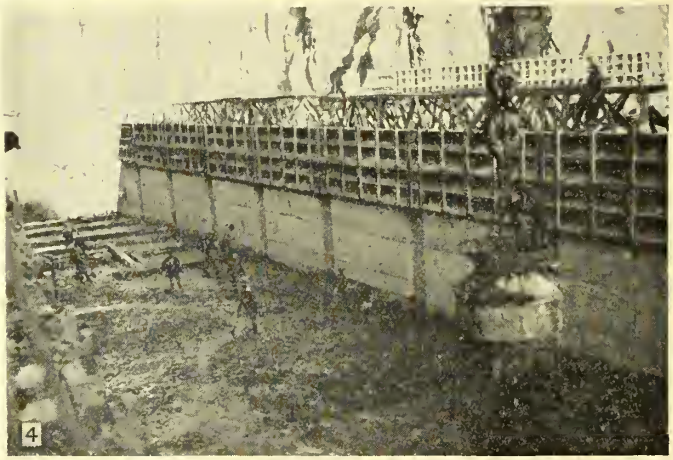
Moist curing, so essential to good concrete, is accomplished by spraying the

OWYHEE DAM

1. MIXING AND SCREENING PLANT AT DAM
2. DAM UNDER CONSTRUCTION. NOTE GALLERY FORMS ON TOP OF DAM
3. CONCRETE BEING DUMPED INTO 8-CUBIC YARD BUCKET
4. CONCRETE BUCKET DUMPING IN PANEL NO. 6







exposed surfaces of the concrete. Heat is generated by chemical action within the mass, notwithstanding the fact that the total depth or pour is limited to 4 feet in 72 hours and 28 feet in a month. Maximum temperature rise of 63° F. has been recorded. Cooling of the heated mass will require a long period.

Placing and form work are complicated by the provision for over 3,400 feet of galleries and shafts, by the installation of 2,000,000 pounds of valves and appurtenances, by the placing of three-fourths of a million pounds of steel reinforcement, and by the placing of over 20 miles of piping for grouting, drainage, etc., as well as 3 miles of electrical conduit.

Construction and contraction joints being the vulnerable points, special care is being taken at construction joints to make good contacts by removing all laitance, washing and applying a grout bed for fresh concrete, while in the contraction joints grouting under 100 pounds per square inch pressure after the concrete has cooled will seal joints and result in a monolithic mass capable of withstanding the effects of water, weather, and time.

Notes for Contractors

Baker project.—Twelve bids were received for the construction of Thief Valley Dam on the Baker project, bids for which were opened on July 27, 1931. Decision as to the award will be announced later.

Boulder Canyon project.—Contract for street, alley, parking area, and sidewalk grading; street paving; street and parking area surfacing; curbs and gutters; sidewalks; sanitary sewers; and water distribution system for Boulder City, Nev., has been let to the New Mexico Construction Co. of Albuquerque, N. Mex., at a total price of $273,972.

Contract for the construction of the second group of 12 three and four room residences at Boulder City, Nev., has been let to Louis J. Bowers of Boulder City, Nev., at a total price of $18,916.20, all materials to be furnished by the Government.

Plans and specifications for the construction of the water purification and sewage disposal plants for Boulder City, Nev., have been issued. All materials and mechanical equipment will be furnished by the Government. The equipment has already been purchased. The contract will cover the construction of reinforced concrete tanks, chambers, and compartments for the two plants; the installation of the equipment and the construction of the required buildings.

Plans are being prepared for additional residences to be constructed at Boulder City, Nev., and bids for the construction of the third group of residences, which will include five and six room houses, will be requested as soon as the plans are completed. Plans are also being made for a garage for municipal purposes, which will

also house the fire equipment, and for a school building and a swimming pool.

Grand Valley project.—Plans and specifications are being prepared for the hydraulic and electrical machinery for the Grand Valley power plant.

Minidoka project.—Eleven bids were received for clearing a part of the Jackson Lake reservoir site, bids for which were opened on July 31, 1931. The low bidders were the Fullen Construction Co., of Gering, Nebr., for schedule No. 1, with a bid of $58,800; Jonovich & Co., of Cle Elum, Wash., for schedule No. 2, with a bid of $32,000; and A. Mitchell, of Sacramento, Calif., for schedule No. 3, whose bid was $57,300.

Minidoka project, Gooding division.—Bids for earthwork and structures on the Milner-Gooding Canal, between station 3317+21 and station 3737+10, and the earthwork enlargement of the North Gooding Canal between station 27 and station 257 will be opened at Burley, Idaho, on September 16, 1931. A statement of the estimated quantities involved was published in the last issue of the NEW RECLAMATION ERA.

Owyhee project.—Plans and specifications are being prepared for the construction of a portion of the Mitchell-Butte Canal on the Owyhee project. The work covered by the specifications will include the earthwork excavation of about 3 miles of earth-section canal, excavation for 1,025 feet of concrete-lined canal section and about 3,200 feet of flume section, and the construction of three tunnels 530, 1,372, and 439 feet in length. The amount of excavation involved will be about 525,000 cubic yards.

Yakima project, Cle Elum Dam.—Eighteen bids were received for the construction of the Cle Elum Dam on the Yakima project, bids for which were opened on July 10, 1931, and eight additional bids were submitted covering only the clearing of the reservoir site. The contract for the construction of the dam was awarded to Winston Bros. Co., of Minneapolis, Minn., whose bid was $1,311,533.50. It was decided to readvertise for the clearing of the reservoir.

Yakima project, Kennewick division.—Bids for the hydraulic and electrical apparatus for the Prosser power plant and the Kennewick Highlands pumping plant will be opened at Denver on September 11, 1931. The requirements are for one 4,200-horsepower vertical hydraulic turbine, with governor and governor pump; one 3,000 kilovolt-ampere, alternating-current generator, complete, with direct-connected exciter and thrust bearing; one 3,000 kilovolt-ampere, 3-phase, 2,300 to 39,900/69,000 Y-volt transformer; three 500 kilovolt-ampere, single-phase, 66,000 to 2,400/4160 Y-volt transformers; three or six 69,000-volt disconnecting switches; one or two 69,000-volt lightning arresters; two 69,000-volt air-break switches; one pumping-plant switchboard; one power-plant switchboard and auxiliary apparatus; six 69,000-volt expulsion fuzes; one horizontal centrifugal pump, having a capacity of 18 second-feet when operating under a total effective head of 152 feet, arranged for direct connection to two 250-horsepower motors (these motors are not required to be furnished); and two centrifugal pumping units, complete with pumps, motors, and controls, each having a capacity of 12 second-feet when operating under a total effective head of 200 feet. All apparatus will be installed by the Government. Plans and specifications are being prepared for the construction of the power plant and power canal.

Yakima project, Kittitas division.—On August 21 bids (specifications No. 525) were opened at Ellensburg, Wash., for construction of earthwork and structures on the Wippel pump, gravity, and turbine laterals of the North Branch Canal system. The work is divided into 11 schedules. This will complete all canal work on the Kittitas division.

Bids (specifications No. 524) were opened at Denver, Colo., on August 17 for furnishing two direct pumping units for the Wippel pumping plant, each consisting of a 25-second-foot horizontal pump driven by and directly connected to a hydraulic turbine. Plans and specifications are being prepared for the construction of the pumping plant and the installation of the pumping equipment.

Tunnel Record, Owyhee Project

A maximum of 63 feet of tunnel in one day is the record to date for tunnel excavation, which was made in May of this year on the Owyhee project, Oregon, in excavating Tunnel No. 5, by the J. F. Shea Co., Portland (Oreg.), contractors.

A comparison with the New Cascade Tunnel on the Great Northern Railway near Seattle, Wash., driven by A. Guthrie & Co. in 1926, on which the best previous record was made, is of interest.

It will be noted that the Owyhee Tunnel is 2 to 3 feet larger in size.

The record to the end of June, 1931, in the excavation of the Owyhee Tunnel is as follows:

Monthly progress, Owyhee Tunnel No. 5

Month	Monthly progress	Total to end of month	Maximum in 1 day	Number of shifts per day
	Feet	*Feet*	*Feet*	
July, 1930 [1]	319	319	26	2
August	741	1,060	32	2
September	871	1,931	43	2
October	958	2,889	50	2
November	923	3,812	41	2
December	873	4,685	45	2
January, 1931	920	5,605	48	2
February	768	6,373	38	2
March	844	7,217	42	2
April	1,120	8,337	44	2
May	1,157	9,494	63	(2) (3)
June	926	10,420	48	3

[1] Conway shovels began excavation July 10–12.
[2] For 15 days.
[3] For 16 days.

Comparative tunnel records

Tunnel	Project	Year	Size (feet)	Best consecutive advance, in feet				8-hour shifts per day
				1 day	2 days	3 days	31 days	
Owyhee No. 5	Owyhee	1931	11 x 11	63	119	169	1,315	2 and 3
New Cascade	Great Northern Railway	1926	8 x 9	52	90	140	1,157	3

Activities at Hoover Dam

(Continued from p. 187)

the low passes. We arrived at Barstow, 160 miles from Las Vegas before we realized it. At Yermo, a little town about 10 miles before we reached Barstow, we were stopped by the inspectors of the California department of agriculture, and searched for contraband fruit. We had a half dozen Arizona oranges in our possession and these were promptly confiscated. We also here met the officials of the highway department and were issued a six months permit to travel in California and a certificate was stuck on our windshield. No charge was made.

Barstow is a city of some little importance located in the midst of the desert. It is a typical hustling California town, and everything was spick and span. It is a railroad division town and railroad shops with a little irrigated section around it, coupled with the tourist travel, seem to be the resource of the little city. An hour later we reached Cajon Pass and began the drop down into the oasis of southern California. The long descent is an easy one and the road is broad and smooth, cutting long curves through the mountain side.

Once at the bottom, orange groves replaced the desert. San Bernardino, Redlands, Riverside, and a score of other smaller but notable California towns occupied the valley. We had reached the famed orchards of southern California.

Office of the Chief Engineer, Custom House, Denver, Colo.

By L. R. Smith, Chief Clerk

PRIOR to May 11, 1931, the office of the chief engineer in Denver was located in the Wilda Building at 1441 Welton Street, and in the Temple Court, an adjoining building, in which temporary space was secured on account of rapid expansion of activities in connection with the Boulder Canyon project. The quarters were not entirely satisfactory, especially because of the fire hazard, and were not particularly conducive to efficiency.

The customhouse, a 5-story, modern, fireproof building, in which the Denver office is now located, was completed May 8, 1931, and the transfer of the office was started at 4.30 p. m., May 9, 1931, and completed, with all furniture and equipment in place, by 3 p. m., Sunday, May 10, 1931. The move was promptly and efficiently handled and little delay in the work of the office was occasioned thereby.

The entire fourth floor of the new building is occupied by the bureau, together with a considerable portion of the basement, in which a modern blue-print and photostat plant, a small machine shop, a concrete laboratory, and a stock and equipment storage room combined with space for inactive files and records, are located.

FOURTH FLOOR

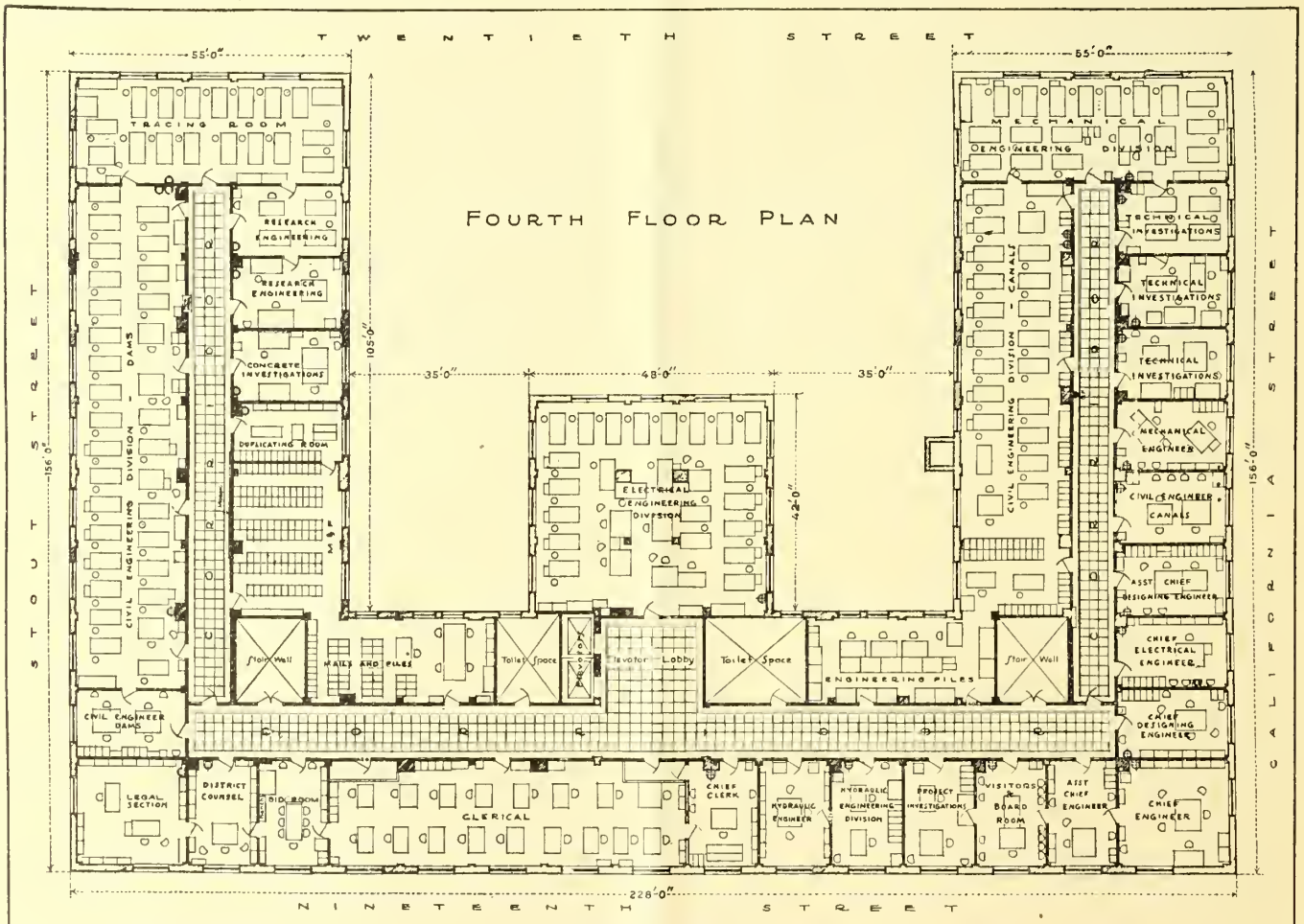
The fourth floor contains 14 rooms used as individual offices. One room is maintained for visitors and board meetings, 1 for the opening of bids, 6 for general office quarters, 1 for duplicating work, and 7 large rooms segregated in use for mechanical, canal, and dam designing and engineering work, together with 1 each for tracing, general files, engineering files, and general clerical work. The net floor area of these rooms is 17,800 square feet, and an average of 170 employees occupy this space, together with files and immediate equipment. The quarters are well arranged, well lighted and ventilated, and modern in every respect. A layout showing the use of each room and the approximate location of furniture and equipment, is attached.

BASEMENT

Basement space occupied by the bureau totals 4,510 square feet. One room is used as an instrument room, in which engineering equipment and various items of testing equipment are stored pending their requirement in the field.

One room in the basement having a floor area of approximately 1,000 square feet, is used for the storage of inactive files and of stationery and other stock. This room is equipped with steel transfer cases and steel stock bins and shelves.

A blue-print and photostat room occupies a net basement floor area of approximately 600 square feet. A continuous blue-print machine, complete with accessories, an 18 by 22 inch photostat machine, and a Holland developing machine,



U. S. CUSTOM HOUSE
HEADQUARTERS OF DENVER OFFICE

are the principal items of equipment. All necessary minor equipment is provided and the required output necessitates the employment of two operators and the full capacity of the equipment during the regular hours of work. The plant has been operated to date at a cost of approximately 50 per cent of commercial prices.

A machine shop occupies 470 square feet of floor area. A 21-inch upright, motor-driven, back-geared drill, a 16-inch geared motor-driven shaper, and a 16-inch swing, 8-foot bed motor-driven engine lathe are the principal items of equipment.

CONCRETE LABORATORY IN OPERATION

Approximately 2,300 square feet of floor space is used in cooperation with the Bureau of Standards, for a concrete laboratory. Complete equipment is available, including a 4,000,000-pound capacity, 2-column hydraulic compression testing machine, on which test specimens up to 36 by 72 inches will be broken.

PERPETUAL TELEPHONE SERVICE

Telephone service is provided for all Government activities in Denver by an automatic outgoing and intercommunicating service, together with manual operation for the receipt and distribution of incoming calls. The board is connected with 24 incoming and 20 outgoing trunk lines. Four operators are employed, three of whom are on duty from 7.30 in the morning until 5.30 in the evening and 24-hour service is provided. The only duty required of the operators is to answer and distribute incoming calls. The bureau is provided with 24 main line and 5 extension telephones. Full operating service, together with full automatic intercommunicating service provides a maximum of communication efficiency at a cost less than that previously incurred.

ON the Kittitas division of the Yakima project grain cutting and hay baling were the principal activities during July. Reports from the various divisions are that the crops are fair to excellent. In the district from Wilson Creek to Caribou Creek, which was partly irrigated from creeks and which was so dry last year that practically no crops matured and water had to be hauled for domestic use and stock, there was a decided improvement. Crops were also good in the Reeser Creek district.

THE history of watermelons dates far back to ancient Egyptian times, but they were brought to this country from Africa.

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A CHICKEN hatchery having a capacity of 6,000 chicks on the Wakefield Farm, Orland project, was recently completed, and will furnish fryers for the San Francisco hotel trade.

Yuma Project Benefits by Colorado River Development

By C. B. Clegg, Acting Office Engineer, Yuma Project

THE construction of Hoover Dam and the development of the Colorado River is receiving wide publicity and awakening an interest in the early history of Arizona and the adjacent territory. The present-day Yuma, with its modern buildings, agricultural and mineral back-country, its unique location on a transcontinental railroad, highway, and proposed transcontinental airway, is one of the principal crossings on the Colorado River and is located within a few minutes' drive of ports of entry for the States of Sonora and Lower California, Mexico. In addition it has the most interesting historical background of any city in the Southwest as evidenced by glancing through the early histories of Arizona dating back to the earliest known explorations of this section of the United States by Pedro Nadal and Juan de la Asuncion.

EARLY EXPLORATIONS IN THE SOUTHWEST

These two Jesuit monks, coming from the interior of Mexico in January, 1538, reached the junction of the Gila and Colorado Rivers, where stands the present city of Yuma and were the first known Europeans to reach the lower Colorado and Gila Rivers.

In September, 1540, Hernando de Alarcon, the first known navigator of the Colorado River, reached Yuma by sailing, or rather being towed by Indians, up the river from its mouth in the Gulf of California.

The next known exploration of this territory was made during the early part of 1605, when Juan de Onote and Chaplain Pedro Escobar reached the Colorado above Yuma and followed this river, which they named Rio Grande de Buena Esparanza or "Great River of Good Hope" to its mouth.

Friar Kino, who is widely associated with the early exploration of southern Arizona, reached Yuma in May, 1700, and gave the name of San Dionisio to a ranchería located near the site of the present city of Yuma at the junction of the Colorado and Gila Rivers.

The next known exploration was by the Franciscan monk Padre Garces, who has been called by early historians "Patron Saint of Arizona" because of his activities in that State. Garces visited Yuma in February, 1774, making a second trip here from Tucson, Ariz., on November 30, 1775, at which time he conferred with Palma, chief of the Yuma Indians, and established a presidio-pueblo mission, called Puerta de la Purisima Concepcion, at the identical site of the Fort Yuma military post established in March, 1851, and the present modern Fort Yuma Indian Agency, which was established subsequent to the abandoning of the military post there in 1884.

In March, 1780, Garces established a second presidio-pueblo mission called San Pedro y San Pablo de Bicuner on the Colorado River about 8 miles below Yuma at a point now known as Pilot Knob, where are now located the diversion works for the Imperial irrigation district, comprising some 500,000 irrigated acres in Imperial Valley, Calif.

On Tuesday, July 17, 1781, while conducting mass at Concepcion Mission, Garces was clubbed to death by the Yumas, who destroyed both missions and killed the priests, as well as a group of Spanish explorers camped across the river from Concepcion. The explorers themselves incited the massacre by pasturing their stock, consisting of 1,000 head, on the entire bean crop of the Indians.

In 1929 a large statue of Padre Garces was erected in the churchyard of the Catholic Indian mission located on the grounds of the Fort Yuma Indian Agency, which is the site of the original mission erected by Garces in 1775. The present mission is conducted by Franciscan priests, the same order to which Padre Garces belonged.

Other attempts to explore and settle this region were unsuccessful because of the hostile attitude of the Yumas until 1826, when the Pattie expedition came down the Gila to its junction with the Colorado.

The Mormon Battalion from Council Bluffs, Iowa, passed through Yuma on January 9, 1846, enroute to the Pacific

Yuma, Ariz., looking toward southwest from Indian Hill, as it appeared in 1876

PRESENT DAY

DEVELOPMENT

YUMA

IRRIGATION

PROJECT

ARIZONA

1, Yuma's modern airport; 2, Grapefruit harvest on Yuma Mesa; 3, Grapefruit on 4-year-old syndicate grove, Yuma Mesa; 4, Grapefruit orchard on Yuma Auxiliary project; 5, Partly picked cotton field; 6, 74 bales of cotton loaded on truck for delivery at Los Angeles Harbor; 7, Fourth Avenue Grammar School; 8, a modern stucco farm home

A 1930 AERIAL VIEW OF YUMA

1. Bureau of Reclamation headquarters office and grounds; 2, Colorado River flowing into Mexico; 3, Colorado River siphon intake; 4, Colorado River siphon outlet; 5, Yuma project Main Canal; 6, Yuma Indian Agency, under Government operation and control; 7, Colorado River and overflow area; 8, Remains of the old Federal and State prison; 9, Southern Pacific Railroad depot; 10, Southern Pacific roundhouse; 11, City of Yuma, Main Street; 12, City and County building and grounds; 13, 14, and 15, Grammar School; 16, High-school buildings and campus; 17, Municipal swimming pool; 18, Yuma Mesa citrus groves. Area shown north of river in California; area south of river in Arizona.

coast. This was followed by an expedition commanded by General Kearney, which reached Yuma on November 24, 1846, at which time they noted the ruins of an old Spanish pueblo mission at the junction of the Gila and Colorado erected by Friar Kino at the beginning of the seventeenth century.

Several expeditions followed during the succeeding years, the most notable of which was that of a party from New Orleans headed by Dr. O. M. Wozencraft in 1846. This party established the southern route by way of Apache Pass, Sonoita, and Tinajas Altas to the junction of the Gila and Colorado at Yuma, which trail is now known as the Camino de Diablo or "Road of the Devil." This same route was used by fully 60,000 people during the years preceding the Civil War and was said to be literally lined with skeletons as the result of scarcity of water and the de predations of the Apaches.

Doctor Wozencraft established a ferry across the Colorado at Yuma which was operated more or less continuously under various ownerships until the completion of the present highway bridge, which was erected jointly by the Government and the States of California and Arizona during 1915.

Probably the earliest mercantile establishment within the present boundaries of Arizona was that of George F. Hooper which was located at Arizona City, now Yuma, in 1851. This firm flourished and established branches at various points in the Territory and continued business under the firm name until 1875.

Fort Yuma was established and garrisoned with troops in March, 1851, on the site of the old Spanish mission Concepcion, erected by Padre Garces in 1775. The rough rock foundations of the old mission and several copper pots were unearthed when constructing the fort, which was maintained until the coming of the Southern Pacific Railroad to Yuma in 1878.

YUMA INDIANS FEAR FIRST STEAMER

With the coming of the first soldiers the ferry business, which had suffered from the warlike measures of the Yumas, was resumed and new ferries established. The first steamer that ever floated on the waters of the Colorado reached Yuma from the Gulf of California in 1851. The *Yuma*, as she was called, was of the stern-wheel variety and caused untold consternation among the Indians who, it is said, ran for their lives crying that "the devil was coming, blowing fire and smoke out of his nose, and kicking the water back with his feet." This boat was followed by others which engaged in navigation up and down the Colorado from Yuma to Needles, Calif., until the completion in 1907 by the Bureau of Reclamation of Laguna Dam some 14 miles up river from Yuma.

YUMA'S ORIGIN

As a result of the Gadsden Purchase in 1853 Yuma, which had been in Mexican territory, became a part of the United States.

The origin of Arizona City, now Yuma, in 1854 is interesting. C. D. Poston, an early pioneer, with several mining engineers en route from Arizona to California laid out the town site and traded a corner lot for $25 ferriage fees across the Colorado River. The town site was incorporated in California under the name of Colorado City. This town was destroyed in the flood of 1862, after which the name of Arizona City was used instead. Colorado City, now Yuma, was the only American occupation within what is now the State of Arizona in 1854, as the United States did not take formal military possession of the Gadsden Purchase until 1856.

The first stage service from San Diego, Calif., via Yuma and Tucson to San Antonio, Tex., was established during November, 1857. This was followed by the famous Butterfield stages which operated through Yuma from September, 1858, until the outbreak of the Civil War.

COLORADO RIVER EXPLORED, 1857–58

An official exploration of the Colorado was made in the winter of 1857–58 by Lieut. J. C. Ives, of the Topographical Corps, in a grotesque steamer named *Explorer*. The boat was sold by Ives

and later broke loose from its moorings at Yuma. The iron hull of this vessel was found and identified by a party of engineers during 1929. The hull was found on the river delta some 40 miles below Yuma and about 3 or 4 miles from the present channel of the river.

A quartermaster's depot to furnish supplies to several forts in southern and central Arizona was established at Yuma in 1864. The depot was destroyed by fire in 1867 and rebuilt on the present site of the headquarters of the Bureau of Reclamation at Yuma, whose office and shops occupy a portion of the old buildings.

Arizona City, now Yuma, prior to 1866 was the main point of the southwest and center of trade for most of the then Territory of Arizona, which at that time had a population computed at from 3,000 to 4,000, a majority of which were Mexicans or their descendants. The territory which was some four or five times as large as the State of New York, did not contain an established bank, free school, or regular Protestant church. The population of Arizona City at this time was about 500.

MAIL ROUTES AND RAILROADS ESTABLISHED

The first mail routes through southern Arizona via Yuma operated during 1869. Daily mail service was established during 1875 with 6-horse Concord coaches connecting with the Southern Pacific Railroad, which was building from Colton, Calif., southeastward to Yuma. Railroad service was established into Yuma from west in November, 1878, and construction eastward reached Tucson, Ariz., in 1880.

The county seat of Yuma County was removed from La Paz, a mining camp, to Arizona City (now Yuma), in 1870. On March 11, 1871, Arizona City was incorporated by an act of the Territorial legislature, and on February 3, 1873, its name was changed to Yuma. At about this time the American population, in which were included all who were not Mexican, embraced just five persons, all of whom in 1914 were still living in the locality.

Arizona's Territorial prison was erected at Yuma during 1876. This prison had wide publicity and was the scene of much excitement. The prison was removed to Florence, Ariz., in 1907. The old buildings served as a local high school for several years. The remains of the old prison, located on a bluff overlooking the Colorado at the Arizona end of the highway and railroad bridges, have recently been leased to the Veterans of Foreign Wars, who plan to preserve the old buildings and use a portion of them for clubrooms.

With the coming of the Bureau of Reclamation in 1902 and the resultant development of some 60,000 acres of valley lands in California and Arizona adjacent to Yuma, as well as an extensive citrus development made possible by the bureau on the Yuma Mesa, the town has prospered. The present town has a population of some 5,000, with a modern school system, miles of paved highways threading the valley lands, active social and civic organizations, and prospects of becoming the center in the southwest of the citrus and pecan industries.

Klamath Conquers the Grasshopper

By C. A. Henderson, County Agricultural Agent

Grasshopper poisoning was discontinued on the Klamath irrigation project July 1 and started again on July 11. In one area where egg-bed poisoning was impossible because of the inaccessible nature of the country, grasshoppers developed to maturity and invaded the higher lands. Poisoning crews were established July 11, and this infestation was under control within five days. However, during the period July 4 to 11, 5,000 acres of pasture land on one ranch were seriously damaged. This infestation was about 13 miles long, but exceptionally good results were secured on the adult hoppers. A check up on results on July 18 indicated that 80 per cent of the infestation had been killed at that time, the kill averaging from 20 to 30 adult hoppers per square foot over 26 square miles. The owner of the ranch reported that the balance of his hay and pasture land was completely out of danger and that he had never seen such immediate results in grasshopper control.

Limited poisoning was continued throughout the month, notwithstanding shortage of funds for the work. At the present time all egg beds are being mapped, preparatory to next year's campaign. Indications are that next year's project will be much smaller and easier to handle than was the case this year.

STATE AND FEDERAL AID REQUESTED

During the month the seriousness of the situation was placed before the State emergency appropriations committee and the superintendent of the Klamath Indian Reservation in the hope of securing additional financial assistance for carrying the project to completion. The chairman of the State committee spent one day in examining the situation, in company with Mr. Mahaffey, of Bend, William Kittridge, of the Upper Klamath Marsh, and the county agent. He found the situation quite serious at that time and stated that he was fully convinced that State assistance was imperative.

Now that the season's work is practically completed, other than limited poisoning on egg beds, plotting of egg beds for next season, and storage of material and equipment, a brief summary of the general situation might be in order.

Owing to the dry years, infestation has been extremely serious and more far-reaching than had been expected. The poisoning program was carried out on schedule from May 1 to about August 10, with outstanding results. In the main, crop loss has been kept to a minimum, and all cattle and sheep remained in the affected areas. Approximately two and a half million pounds of poisoned bran mash were prepared and distributed over an area involving roughly a district 75 miles east and west and about 30 miles north and south. Although this entire district is not infested, nevertheless every mountain, meadow, valley, and all grass land was heavily infested. The poison line maintained through and around these areas was over 700 miles in length.

Dependable stockmen of this district state that it would have been impossible to carry any cattle in this district after July 1 had not poisoning been undertaken. All stockmen are particularly well satisfied with results of the poisoning campaign and have cooperated throughout the season in every possible way in making this work successful.

DEATH OF JUDGE GARDNER

Judge George B. Gardner, whose service in the Department of the Interior covered a continuous period of nearly 40 years, was born in Salyersville, Ky., in 1861, and died at Sharon, Conn., on August 13, 1931.

In 1893 Mr. Gardner was given an appointment by Secretary Hoke Smith in the office of the Solicitor, where he became first assistant attorney and prepared many legal opinions upon questions arising in the Bureau of Reclamation. When the Board of Appeals was created in 1914 he became its chairman, which position he occupied until his death.

Judge Gardner was a member of the American and Federal Bar Associations.

THE Western Gas Co. has completed its natural gas line from El Paso, Rio Grande project, to Douglas and Bisbee, Ariz., and plans on building a branch line to Las Cruces, N. Mex.

The Veterans' Memorial Building at Orland, Calif.

By E. R. Asdell, general foreman, Orland project

THE Veterans' Memorial Building of Orland, Calif., was erected by Glenn County under a provision of the California law, permitting the county supervisors to levy annually a direct tax of not to exceed 3 mills per dollar, to construct, furnish, and maintain buildings for the use of organizations of ex-service men. The structure was built at the request and under the auspices of the Tommy A. Thompson Post of the American Legion at Orland.

Plans were drawn, a site purchased, and a contract awarded in 1929. Construction of the building was started early in 1930, but as the funds available at that time were limited, work during the summer months was confined to the excavation of the basement and construction of the foundation. Work was resumed late in 1930 and the building completed in March, 1931. The total cost of the building, including $2,000 for the site and $7,000 for furnishings, represents an expenditure by the county of approximately $62,000.

The building, which is 210 feet long, 105 feet wide, and 30 feet high, is of waterproofed reinforced concrete construction with a 4-ply, 60-pound felt and tar gravel-covered roof, carried on steel trusses. The outside was given a dash coat of California stucco with no attempt to smooth the walls. This method of outside finish, which is new to this vicinity, has not only met with general satisfaction and approval but also resulted in a saving of $830 over a plaster job. The interior of the building is plastered throughout, with furring on all exterior walls, and finished with California stucco.

STYLE OF ARCHITECTURE

The architecture is a modified Spanish design with a 60-foot tower over the southeast entrance and a 25-foot tower, surmounted by a 16-foot flag pole over the southwest entrance. Four concrete columns between the towers with small fluted tile columns at the windows, wrought-iron grille decorations at the entrance, and a tile emblem over the central windows complete the front of the building.

PLAN OF INTERIOR

The feature of the floor plan is a 65 by 85 foot auditorium, 24 feet high, located in the central part of the building with two double entrances through a lobby and foyer in the east end, together with a 27 by 50 foot stage and dressing rooms in the west end. Three large windows, which open to the south, and three double doors, opening to a 20 by 80 foot concrete terrace on the north, provide ample ventilation and exits. The acoustic properties were very satisfactorily taken care of by ceiling with celotex, held in place by 1 by 2 inch pine battens. The hardwood floor was made flat, and removable seating was provided so that the auditorium could be used for dancing, when desired.

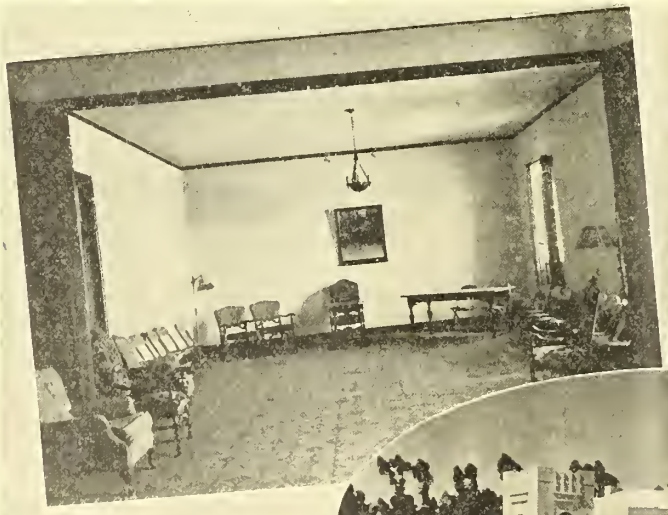
The west wing of the building contains an entrance lobby, lounge room, lodge room, lunch room, kitchenette, men's dressing room, and cloak rooms, together with a room in the tower above the entrance lobby. In the east wing are the main entrance lobby and foyer, a reception room, checking booth, ladies' dressing room, and room in the tower above the entrance lobby, in which provision has been made for the installation of a moving picture projecting machine. The basement contains a large dining room, a kitchen (connected to the kitchenette above by a dumb-waiter), and furnace room, as well as a room for the use of the local deputy county horticultural commissioner.

Steam heat is provided in all of the rooms by an oil burning furnace with the fuel supply stored in an underground tank located outside the building. Provision was made for the installation of auxiliary electric heaters in all the smaller rooms.

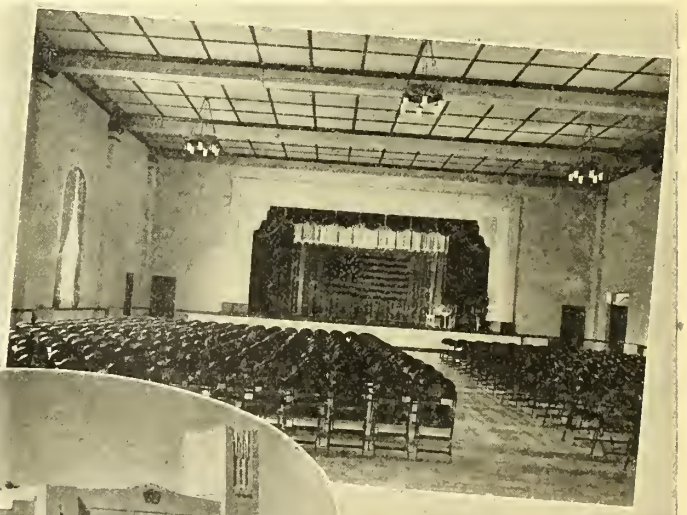
The building occupies a full block of land directly in front of a city park, on which there is a fine growth of eucalyptus trees which form a beautiful background for it. The grounds will ultimately be landscaped in accordance with a plan prepared by the California State gardener.

DEDICATION CEREMONIES

The building was appropriately dedicated on May 2, 1931, with an elaborate program, beginning in the afternoon and



RECEPTION ROOM



AUDITORIUM

VETERAN'S MEMORIAL BUILDING

ORLANDO, CALIFORNIA

Tractor and grader equipment for cleaning canal banks

terminating with a dance at night. The dedication ceremonies proved an outstanding event of the year in the activities of Orland project community organizations. The afternoon program, attended by an audience which taxed the seating capacity of the auditorium, consisted of musical numbers by the Orland High School Band, addresses by representatives of the Glenn County Board of Supervisors, the City Council of Orland, various organizations of war veterans, the California American Legion, and the United States Army. The evening was featured by a drum and bugle contest, in which corps from three American Legion posts participated, together with a public initation by a degree team from a Navy Legion post of San Francisco, while a public dance brought the dedication exercises to a close.

Growing Seed Peas on the Kittitas Division

Of the 800 acres of seed peas which are being grown this year in the Kittitas Valley, a good portion of the acreage is on lands under the Kittitas unit of the Yakima irrigation project. This unit is delivering water to about 12,000 acres this season as the second year of water delivery and approximately 20,000 acres more will be added before the end of the season.

Farmers contract the production of the seed peas at a fixed price of 2¾ cents and 3 cents per pound. Yields of 35 to 50 bushels per acre are common, and in addition to the income from the seed the grower has a valuable product in the form of straw. The pea straw is fed to livestock during the winter months and has a feeding value equal to about two-thirds of the value of alfalfa hay.

Community-wide organizations are cooperating on the seed-pea project in an effort to enlarge upon the field of production. The growing of peas gives the farmer a profitable crop at a known price. Ellensburg, Wash., is the largest trading center within the Kittitas unit and is a city of 4,621 population.

The farmers, the men who make their homes upon the lands which they till, are the best citizens in the Nation. It is a well known fact that the farm population of this Nation can be depended upon for safe and sane and loyal citizenship.—*George R. Wheeler.*

Modern Canal Cleaning Methods

A demonstration to show the practicability of caterpillar tractors and equipment for canal maintenance operations was held recently in one of the main canals of the Gem irrigation district near Homedale, Idaho. The grading of the top bank and bottom of the canal is done with a standard grader, while mossing is accomplished by the use of heavy chains and one "30" on each bank.

The two accompanying photographs show two caterpillar 30's pulling a "60" leaning wheel grader with two 3-foot extensions on the moldboard. One tractor is in the canal, and one on the bank with blade to rear, cutting berm and elevating it to canal bank where the grader can throw it on, over, and out. The berm is generally covered with willows, grass, and weeds, which impede the flow of water and allow soil in the water to settle and form bumps. Ordinarily this work has been done by a dragline or by a large wooden V with grader cutting edges attached.

Several of the Bureau of Reclamation projects are now equipped with caterpillar tractors for use in canal-cleaning operations. The tractor and grader equipment are well adapted to cleaning berms in canals when the water is out but Ruth dredgers are ordinarily used when water is running.

Secondary Projects

A report on Twin Springs Reservoir, Boise project storage, is being made in the Denver office. Investigation of the Rathdrum Prairie project, Washington, is in progress. An examination of the Burbank project, Washington, was made in June by H. W. Bashore. Under a cooperative contract with the State of Wyoming, the bureau is making investigations, with J. R. Iakisch in charge, of the Polecat Bench, Chapman Bench, and Heart Mountain divisions of the Shoshone project. Soil classification and mapping have been completed and water supply studies are in progress.

On the Columbia Basin project, a geological examination of inland reservoir sites is planned. Field work under way on the North Platte power investigations comprises topographic mapping of Seminoe Canyon and the area between Seminoe Canyon and Pathfinder Reservoir, drilling at two Seminoe Canyon dam sites, and mapping the power section of the river below the Northgate dam site. Under investigations authorized by section 15 of the Boulder Canyon project act, a survey party has been sent into the Green River Basin in Wyoming to investigate a project with diversion from the Green River near Kendall to supply lands lying to the west of the river and south to Middle Piney Creek. On the Salt Lake Basin project in Utah, the economic report on the Moon Lake division was released by the Water Storage Commission on June 24. In the Musselshell Valley, Mont., local interests are seeking a cooperative contract to provide for further studies of irrigation possibilities to supplement surveys made by the United States Army Engineer Corps.

THE canal system on the Kittitas division of the Yakima project is operating very satisfactorily, no serious trouble having been experienced.

What The Reclamation Women Do In Las Vegas

By One of Them [1]

A CIVIL engineer is primarily a worker and a builder; a man whose liveliest interest lies in the overcoming of obstacles and mastering of difficulties; one whose dreams center upon bridges and dams and whose conception of a pastime is the deflecting of a river from its bed; one to whom the thunder of blasting is as music in his ears and whose home is wherever he can spread his blanket. If one should desire to wax poetical on the subject one might liken him to a knight-errant, though in this material twentieth century it is not considered advisable to go about a-rescueing damsels in distress so this modern knight goes about bringing order out of chaos, turning life-giving waters on arid lands, opening new fields for homeseekers and settlers and by the might of his shining vision bringing beauty out of desolation.

But an engineer's wife is not like that, ah, no! No knight-errantess is she—far from it; more likely she is a domestic and home-loving body whose affections cling about the family hearth-stone; who enjoys social contacts, clubs, and parties; who in the spring is wont to be found studying seed catalogues and whose greatest pleasure lies in exchanging bulbs and plants with her horticultural neighbors.

This woman is no gypsy of the road but, having cast her lot with such a one, her mission in life consists of following him to the far corners of the earth and if she is fortunate she in time grows hardened to leaving one beloved home after another and finds a vicarious excitement in conjecturing what the next move will bring. She spends one-half of her life in packing her lares and penates and the other half in assembling and mending what is left of them. She plants quick-growing vines, such as gourd or cucumber, over the doors of each new home whether it be a cute little bungalow or a rude tar-paper shack and by putting dainty curtains at the windows and strewing rugs on the floor manages to impart an appearance of rest and permanence.

Many of the reclamation families have moved at least once a year, so it was with almost unmixed joy that most of them hailed the opportunity of coming to the Hoover Dam. At least here was a prospect of remaining in the same place for five or six years and that unfolded a wonderful vista to these unwilling gypsies of fate. A home at last, a place where they could plant real vines and bulbs and flowering shrubs, could have shade trees and lawns, could relax and begin to *live*.

It is true that the powers-that-be had tactfully advised their husbands to leave their families behind them till such time as the little reclamation city on the hill near the dam should be ready for their occupancy, a year maybe, as Las Vegas was a difficult place to live, on account of the high cost of living and other things—excellent advice, but whoever thought advice good when so patently opposed to their wishes. So most of the wives came with their husbands and even anticipated with satisfaction the small-town activities, the calls from ladies of the various churches and clubs, the invitations to join in things; altogether the usual small-town procedure. But Las Vegas though small and young—as towns go—is quite precocious and absolutely cosmopolitan.

THE LOT OF THE ENGINEER'S WIFE

Nevertheless, the wives of the engineers lived lonely lives in small and expensive houses and apartments. Their husbands in most cases were engaged in work at the dam site, a distance of 30 or 35 miles and only came to Las Vegas over Sunday; for the rest of the week these formerly busy women had very little to do and were sunk in a sea of boredom. Those with families were fairly well occupied but many of them were completely alone and even the gorgeous sunshine of this desert country lost its charm. It is to their honor though that not one of them ever wished that she had not come and the hope of seeing their knight-errant at the end of the week repaid them for the loneliness they endured. Very few of the women had ever known each other before and only a few calls were exchanged.

Then into this pool of stagnation a bright meteor fell sending the ripples from shore to shore; in other words the wives

Courthouse, Las Vegas, Nev.

[1] Mrs. D. L. Carmody, wife of Engineer Carmody, assigned to the Boulder Canyon project.

of the two foremost engineers here gave a party or two and invited all of the reclamation women. It was surely an inspiration to which they all responded with enthusiasm. Most of them had been at some time on the same project and had many acquaintances in common. They were a merry crowd, and soon you might hear scraps of conversation on every side, such as, "Oh, were you there? I also was at Rimrock"; and "So you came here from Yakima"; and "Did you know the ———s at Gibson Dam?"; and "Why, you are the one that the ———s of Riverton used to tell me about"; and "When were you at Arrowrock? I was there"; and "Oh, yes, I think Denver is charming. Did you ever meet the ———s?"

So the talk waxed and became more and more intimate and in a short time the women, who had felt like friendless strangers, were among friends and the beginning of ties were knit that will hold as long as life shall last. Those parties were the starting point of a spirit of comradeship and esprit de corps that has led to many delightful meetings and all of us have felt that our coming to Las Vegas was not in vain. We no longer are like ships at night that pass in a sea of loneliness but are now a strong convoy and journey happily on our way looking forward with eagerness and enthusiasm to the day when we shall come to anchor in the little harbor of Boulder City.

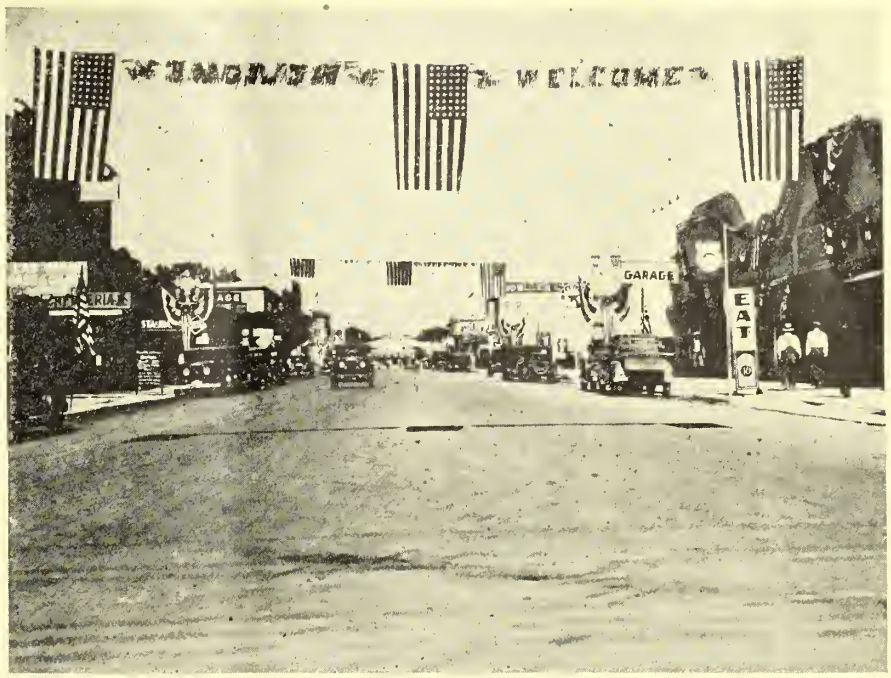
Six Companies (Inc.) Plans Clubhouse for Workers

The Six Companies (Inc.) is interested in the social welfare of its workers, as evidenced by the erection of a large clubhouse where sports and recreation of a wholesome variety may be enjoyed. Frank Moran, former heavyweight, has been selected to take charge of the work. Mr. Moran is now engaged in acquainting himself with the men and their tastes for sports.

The clubhouse is an L-shaped building, 96 feet long on each side of the L, 60 feet long on the inside of the L, and 36 feet wide on each end of the L. The 14-foot ceiling, 33 windows and transoms, and 7 doors insure plenty of fresh air and light; and a dance floor below, together with 12 pool and billiard tables, insures amusement in the midst of the busy camp life.

The new and commodious commissary, now in operation in the west end of the clubhouse, is equipped to dispense pop, overalls, and newspapers.

Mr. Moran's idea is to develop local, rather than imported, talent. He says: "We want sport for sport's sake, not for the sake of commercialization. We probably will be scheduling games with Las Vegas athletes in various sports, and we expect to give them some pretty stiff competition. There are some mighty good athletes on this job, and they're keeping themselves in good trim."



MAIN STREET, LAS VEGAS, NEV.

Photograph taken during celebration of commencement of work on Union Pacific branch line as first unit of project.

INSPIRED ACHIEVEMENT

When God had made the earth and sky,
And sea, and every living thing,
And saw 'twas good, then the Most High
Made man to be the earthly king.

Gave him dominion over all,
That every creature would fulfill
Its place, and at his beck and call
To go or come as man should will.

And then to make His work replete
The Great Creator placed a crown
Upon the woman, at whose feet
Empires have laid their trophies down.

From that remote and obscure past
Man has moved forward, upward till
The world is mastered, yea! at last,
Through knowledge, genius, brawn, and skill.

Man fells the forest with a stroke,
He makes the earth bend to his sway,
And every barrier he has broke
That challenged him along his way.

He builds gigantic structures high,
He spans the waters wide and deep,
And conquers space of earth and sky
To aid him in his onward sweep.

The great achievements man hath wrought
Could ne'er have been his boast and pride,
Unless emboldened as he fought
By woman ever at his side.

It matters not how great the work,
If when you feel there's some one near
To watch and pray, and never shirk,
Although your task may be severe.

Whatever man will do or dare,
A woman faces with her soul,
Inspires him with her spirit rare
To press on upward to the goal.

—Amos W. Hawk,
Chief, Supply Division, Dept. of Interior.

Frost Investigations

On the Kittitas division of the Yakima project, Washington, the United States Weather Bureau has begun investigations which will be extended over a 5-year period to determine the areas that are not suited for fruit production because of the possibility of damaging frosts. On most irrigation projects such information has been obtained at the expense of individuals who have spent thousands of dollars planting fruit orchards only to have the venture turn out a total loss because of lack of knowledge of climatic conditions.

With the cooperation of local interests 26 stations have been established at points well distributed over the project. At each station a standard instrument shelter has been erected with a minimum thermometer and a weekly thermograph. A key temperature station has been established about 2 miles southeast of Ellensburg, where daily observations were taken at 4.40 p. m. One important function of this station will be to issue frost warnings whenever there is expected a drop in temperature that will cause damage to orchards. The first season's operations were started on March 24 and continued until May 20.

Work of this character is highly constructive and will be of great value to the Kittitas division, as it will eliminate the usual experimental methods by actual planting which too often result in the loss of large sums of money to the individual. The field work is under the direction of Mr. Fred A. Baughman, observer, United States Weather Bureau.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, returned to the Washington office on August 5, having accompanied the Subcommittee of the House Appropriations Committee for the Interior Department on their recent trip of inspection over a number of the Federal irrigation projects and national parks.

E. K. Burlew, administrative assistant to the Secretary and budget officer of the department, and Hugh A. Brown, director of reclamation economics, held a conference in Chicago on August 10, with representatives of the railroads traversing the irrigation projects in the Western States and others to discuss plans for the reclamation exhibit at the Century of Progress World's Fair in Chicago in 1933.

Miss Mae A. Schnurr, assistant to the commissioner, will give an address at Tifton, Ga., on September 11, on rural community problems at a meeting held under the joint auspices of the Georgia State Chamber of Commerce, the Tifton County Board of Trade, and the Georgia Coastal Plain Experiment Stations. Miss Schnurr will travel from Washington to Atlanta, Ga. by airplane.

W. C. Beatty, engineer in the Denver office, spent the month of July at Boulder City and Las Vegas, Nev., assisting with the installation of the water-supply equipment.

R. F. Walter, chief engineer, and the Montana manager of the Utah-Idaho Sugar Co. held a recent conference with the superintendent of the Milk River project on the St. Mary storage unit relative to repairs of the Spider Coulee flume. The sugar company is anxious that the flume repair which is to be accomplished this fall be carried on in such a way as to allow the continuous operation of the St. Mary canal at partial capacity for water supply to the Chinook plant during its fall campaign.

E. B. Debler, hydrographic engineer of the Denver office, attended the conference at Los Angeles on August 13 to consider the division of the California apportionment of Colorado River water among the several interests in that State.

R. F. Walter, chief engineer, paid a recent visit to the Boulder Canyon, Yuma, Rio Grande, and Carlsbad projects.

William F. Kubach, chief accountant, left Washington on August 14 for the Bitter Root project, for the purpose of auditing the district's indebtedness prior to settlement. Mr. Kubach's trip also includes a visit to the Milk River project with regard to the contracts of the irrigation districts of the Chinook division.

S. O. Harper, assistant chief engineer at Denver, held a recent conference at Las Vegas with representatives of the Six Companies (Inc.), and Louis C. Cramton, special attorney to the Secretary of the Interior, concerning the operation of business enterprises in Boulder City. Mr. Harper also made a general inspection of the work in progress.

Among the recent visitors to the Minidoka project were H. L. Senger, chief engineer, and M. L. Hibbard, general manager of the Idaho Power Co., and E. S. Randolph, engineer for the Panama Canal Zone.

John K. Rohrer, associate engineer on the Minidoka project, has been transferred to the Baker project, Oregon.

Charles J. Bartholet, State supervisor of hydraulics, Erle J. Barnes, State director of conservation and development, and John C. Hurspool, assistant State attorney general, paid recent visits to the Yakima project.

J. L. Savage, chief designing engineer, and L. N. McClellan, chief electrical engineer, spent a couple of days in Guernsey, Wyo., looking over the tests of concrete blocks subjected to action of water under high velocity. They also examined the small experimental needle valve and made a general inspection of the Guernsey Dam and power plant.

Ben G. Sucher, cost keeper on the Klamath project, was transferred to the Boulder Canyon project, effective July 22. J. M. DeRosiers, timekeeper on the Yuma project, succeeded Mr. Sucher at Klamath Falls.

Earl R. Fogarty, formerly employed on the economic work of the Bureau of Reclamation, and who during the past year and a half has been taking a special course in land classification and soil analysis at the Oregon State College, was reappointed recently as associate reclamation economist to carry on the work of classifying the land and making a soil survey of the proposed Rathdrum Prairie project in Idaho.

F. F. Smith, construction engineer, has returned to duty on the Salt Lake Basin project after an eight months' absence on work for the Mexican Government.

Khaja Azeemuddin, who has been deputized by the Nizam's Government, India, to visit the various hydraulic works and to study the methods of construction and organization employed in this country, called at the Washington office, and was given letters of introduction from the Commissioner to the offices of the several projects to be included in his survey.

C. L. Forsling, director of the intermountain experiment station, United States Forest Service, Ogden, Utah, and Jay Higgins, of the Denver office of the Forest Service, visited the Grand Valley project and investigated the areas lying above the main canal in a study of the unusual erosion conditions caused by overgrazing of this area.

A. N. Khosla, executive engineer, Punjab irrigation district, India, has been inspecting the experimental works in connection with the spillway model for the Hoover Dam at milepost 2 of the South Canal, drainage ditches, and the experimental concrete blocks at Boot siphon, Uncompahgre project.

A. S. Wyman, of the Corps of Engineers, War Department, who has been engaged for the past few months in making investigations of the silt content of the waters of the Yellowstone and Missouri Rivers in the vicinity of the Lower Yellowstone project, called at the project office to obtain data on soundings in the river above the Yellowstone Dam before the dam was constructed. He proposes to take additional soundings to determine the accumulation of silt.

U. S. GOVERNMENT PRINTING OFFICE: 1931

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant
P. W. Dent, Assistant Commissioner
C. N. McCulloch, Chief Clerk
Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, 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, 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	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, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	do	do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	Charles F. Weinkauf. C. H. Lillingston	J. R. Alexander. R. J. Coffey	Las Vegas, Nev. Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Las Vegas, Nev.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr		F. P. Greene	B.E.Stoutemeyer	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	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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.
Umatilla, McKay Dam	Pendelton, Oreg	C. L. Tice	Reserv. Supt		Denver office	B.E.Stoutemeyer	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. P. Greene	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 [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima [7]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B.E.Stoutemeyer	Portland, Oreg.
Yakima Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr		do	do	Do.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	do	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent		Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	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] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] 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.
Boise [1]	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	Fort Shaw, Mont.	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield, 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	R. S. Hopkins	Manager	R. S. Hopkins	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	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

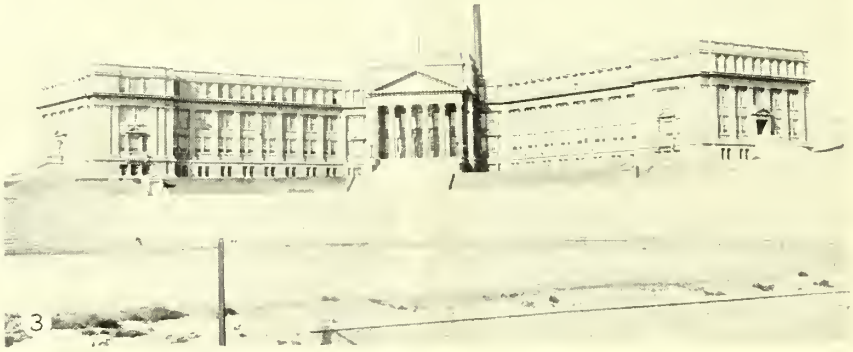
[1] Boise, Kuna, Nampa, Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

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.
North Platte River power	do	Denver office	None.
Rathdrum Prairie, Idaho	Spokane, Wash	H. W. Bashore	None.

SALLIE A. B. COE, *Editor.*

PUBLIC SCHOOLS ON U.S. PROJECTS



1 AND 2. WILLWOOD SCHOOL CHILDREN, SHOSHONE PROJECT, ARE CONVEYED IN BUSSES TO POWELL SCHOOL. 3, EL PASO HIGH SCHOOL, RIO GRANDE PROJECT. 4 JUNIOR HIGH SCHOOL, ELLENSBURG, KITTITAS DIVISION, YAKIMA PROJECT. 5, STATE NORMAL SCHOOL, ALBION, IDAHO, MINIDOKA PROJECT, 6, NEWELL HIGH SCHOOL, BELLE FOURCHE PROJECT. 7, NEW VALE SCHOOL, BELLE FOURCHE PROJECT

NEW RECLAMATION ERA

VOL. 22, NO. 10 OCTOBER, 1931

GANNETT GLACIER
RESERVOIR OF RIVERTON PROJECT, WYOMING (SEE PAGE 227)

PLANTING SEEDS OF CIVILIZATION

FEDERAL RECLAMATION projects are the seeds of civilization planted in 40 per cent of our landed area now largely unoccupied and idle. From these seeds planted by the Government will grow units in our American civilization. These units in turn will grow and spread until this vast region is developed to its full potential capacity, to the ultimate betterment and the increased happiness of the rest of the Nation.

We can compare this pioneering venture of converting desert wastes into productive fields with any other pioneering enterprises which have been undertaken by private initiative or business corporations along new or untrodden paths in the program for the development of the West, with results decidedly encouraging and reassuring. The combined losses in irrigation are picayune as compared to those in gold and silver mines. When it comes to telling the whole story and picturing all the countless contributions which irrigation and land reclamation have made to the sum total of human comforts and conveniences, statisticians may produce arguments which appeal to sceptics and the uninformed, but still they will fall far short of convincing those who have followed and who understand and sympathize with the difficulties, the achievements, the scientific contributions, and the added wealth and opportunities which have followed in the wake of and grown out of this movement.

—JAMES A. KING,
Mason City, Iowa.

NEW 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. 22, No. 10 OCTOBER, 1931

Interesting High Lights on the Federal Reclamation Projects

ALTHOUGH the weather has been warm and dry on the Federal irrigation projects, conditions in general have been very favorable for crops, which have made an excellent growth with the application of sufficient water.

AT THE close of August the contract for the Owyhee Dam, Owyhee project, was 80 per cent completed.

SHIPMENTS of Jonathan apples from the more advanced sections of the Yakima project are being made at about $1.35 per box for No. 1's.

THE range on the Milk River project has been greatly improved by recent heavy rains. Livestock on the project is in excellent condition and it is expected that feed for the winter will be ample. It is probable that winter feeding on the project lands will exceed that of normal years.

DURING the month of August 46 prospective settlers were shown over the land recently opened to entry on the Riverton project, 9 applications for farm units were received, 4 applicants were accepted and paid the advance water rental charge for 1932, and 1 man filed homestead entry.

FAVORED with warm weather and plentry of water sugar beets on the Lower Yellowstone project have made an excellent growth. There are about 10,000 acres of beets on the project, and the sugar company has raised its estimate of an average yield from 10 to 10½ tons per acre.

ABOUT August 1 Mr. Thorpe shipped into the Sun River project from the Billings territory 200 colonies of bees. At the end of the month the bees had gathered over 4 tons of honey of the best quality.

WILLIAM WEISER, president of the Grand Valley Bank, Grand Junction, Colo., is contemplating an interesting experiment in the placing of 25 to 100 head of good young sheep on each of 20 to 40 farms. He plans to finance the undertaking at 8 per cent with a small down payment under a contract with the individual which will provide that all wool and increase will be marketed through him in large quantities, and thus insure a higher price than could be obtained by the individual farmer for the smaller lots. A livestock man with the bank will supervise these operations and advise the farmers in all matters pertaining to livestock. Mr. Weiser considers this fall an opportune time to put this scheme into operation owing to the present low prices of sheep.

FOUR miles of the 6.5 miles of new 20-foot bitulithic Federal aid highway through the reservation division of the Yuma project has been completed. The entire highway from Phoenix, Ariz. to either Los Angeles or San Diego, Calif., via Yuma, is now hard surfaced with the exception of 9 miles of road immediately west of the reservation division road, which is oiled macadam in good condition.

THE night indoor baseball games, played under lights at the high school athletic field on the Yuma project, between league teams composed of employees of the various organizations in the community have been increasing in popularity with attendences of 1,500 and 2,000 nightly. The games are played 4 nights each week.

INTEREST in settlement on the Vale project continued during the month of August, when 37 inquiries were received by mail by the Vale-Owyhee Government Projects Land Settlement Association, and 21 interested persons called at the office relative to lands on the project. One sale of 40 acres was made.

THE Montrose community on the Uncompahgre project held a jubilee and other festivities on September 4 in celebration of the fiftieth anniversary of the removal of the Indians from the Uncompahgre Valley and the advent of the white man in the community.

THREE farms on the Milk River project were sold to dry land farmers during the month of August. Several other contracts for sale are being negotiated and the applications for farms by dry farmers far exceed the units actually available for sale. The problem of settlement upon the Malta division is now not one of finding new settlers, but rather of finding suitable farms. Many of the applicants for project farms are first-class dry land farmers who should make very desirable settlers. Opportunities for settlers are now available on the Willwood division of the Shoshone project, Wyoming, and the Greenfields division of the Sun River project, Montana.

INQUIRIES continue to come in from prospective settlers on the Sun River project. Of the 87 farm units recently opened to entry, 56 have been definitely allotted to ex-service men. Considerable interest is also being manifest by other than ex-soldiers, and it is anticipated that within a short time all of these farms will be taken up by qualified settlers.

THE Rio Grande project reports the general condition of crops as good and very little evidence of cotton pests. Fruit crops are doing well and have escaped all storm damage.

OWING to the heavy hay crop on the Klamath project, outside stockmen are shipping a large number of cattle to the project to be fed. Dairymen are continuing to weed out their poor stock and are purchasing stock of better quality.

Development of Supplemental Storage Water Supplies by the Federal Government[1]

By B. E. Stoutemyer, District Counsel, Bureau of Reclamation

THE rainfall records which have been kept at Seattle for the last 50 years and which are typical of the conditions which prevailed on the Pacific slope generally, show that the average rainfall of the last 10 years has been little more than 50 per cent of the average rainfall of the 10 years between 30 and 40 years ago.

A decrease in rainfall, such as has been experienced on the Pacific slope in recent years, is always reflected in an ever greater per cent of decrease in stream flow. That is to say, the smaller the rainfall, the larger the percentage consumed in evaporation and the smaller the percentage that runs off in stream flow, so that when we have a 50 per cent decrease in rainfall we may usually expect a decrease of 60 per cent or more in stream flow.

Through the development of the science of reading the rainfall records of past centuries, as registered in the rings of the trees, it has now become possible to tell with an approximate degree of accuracy, the rainfall of each year for more than a thousand years before Columbus discovered America.

It is reassuring to know that when cycles of low-water years, such as we are now experiencing, have occurred in the past, they have always been followed in time by a return to years of normal or better than normal rainfall, but it is also very disturbing to learn from the record of the trees that periods of a number of years of drouth, far more severe than anything known by the present generation, have occurred in the past and may occur again. One theory as to what destroyed the cliff dwellers is that they were destroyed or driven out by such a period of drouth continuing over a number of years.

At the present time there are a number of places on the Pacific slope, particularly in the State of California, where the ground water has been pumped down to a lower and lower elevation each year until the pumping lift has now become prohibitive and whole communities are finding it necessary to move out and abandon highly-developed orchards and farms and to a large extent also the towns dependent on these farm and orchard areas.

Under the conditions of decreased stream flow which have prevailed during recent years, it is not surprising that the Reclamation Bureau has been bombarded with requests from all over the Western States for the construction of additional reservoirs and other irrigation works to provide a supplemental water supply to save projects which are already settled and in many cases highly developed but which, on account of shortage of water, are threatened with overwhelming losses and in some cases are in danger of reverting to the desert.

The reclamation fund now available for construction purposes amounts to less than $5,000,000 per year, and as the arid and semiarid sections in which additional reservoirs are needed embrace about one-third of the entire United States, it has been found possible to undertake only a few of the many reservoirs which are needed for this purpose.

Nearly all of the projects now under construction by the Reclamation Bureau have been undertaken in whole or in part for the benefit of communities which are already settled and in many cases highly improved but which in order to survive and prosper must have a larger or more economical water supply, and the present policy is to devote the reclamation fund more and more to projects of this kind.

AMERICAN FALLS RESERVOIR

Among the projects recently constructed for this purpose one of the most important is the American Falls Reservoir which now furnishes stored water directly and indirectly for over a million acres of irrigated land in the Snake River Valley in Idaho.

The American Falls Reservoir is the second largest reservoir in the United States in capacity and the largest in water supply.

It has a capacity of 1,700,000 acre-feet and cost $4.44 per acre-foot. It was constructed by the United States in cooperation with a number of irrigation districts and irrigation companies of the Snake River Valley, about half the cost being paid in advance by the companies and districts and the other half by the United States.

By means of the exchange of stored water in American Falls Reservoir for stored water in the Jackson Lake Reservoir, the benefits of the American Falls Reservoir are made available to the upper valley (above American Falls) as well as the lower valley which is served directly from the American Falls Reservoir.

A large irrigation district embracing about 500,000 acres of irrigated land and known as the American Falls Reservoir district was organized to finance the major portion of that part of the reservoir to be paid for by the private projects, and a dozen smaller districts and irrigation companies also cooperated and advanced their respective proportions of the cost of the reservoir. Altogether, between three and four million dollars was paid in advance by the irrigation districts and companies toward the cost of the reservoir, and the Government furnished approximately the same amount. Each party acquired a right to the use of a proportionate part of the reservoir capacity in proportion to the amount paid. Most of the companies and districts that cooperated in the construction of the American Falls Reservoir did so for the purpose of insuring their water supply in occasional years of unusual low water. They considered that they already had a sufficient water supply about four years out of five, but the records showed that judging from the stream measurements which had been kept for about 30 years, an extreme low-water year should be expected about one year in five.

At the time we were organizing the American Falls Reservoir district for the purpose of securing the construction of the American Falls Reservoir, the principal argument for the reservoir was that experience had shown that without the proposed reservoir, severe water shortage must be expected about one year in five, and that whenever such a water shortage occurred the crop losses in one year amounted to as much as the entire cost of the reservoir. It was on this basis that the reservoir construction was undertaken, but since the reservoir was completed, instead of the expected one low-water year in five, we have had three low-water years out of five (this year being the lowest of all) and the American Falls Reservoir has proved the salvation of the entire Snake River Valley.

The Government secured approximately a one-half share in this reservoir and is using 400,000 acre-feet of its share to supplement the water supply of the Gooding project, as it is now called, formerly known as the Idaho Irrigation Co.'s Wood River project. The Gooding project was a Carey Act project of about

[1] Address delivered before the twenty-first annual session of the Oregon Reclamation Congress held at Medford, Oreg., September 8-9, 1931.

80,000 acres which had been settled for a number of years but was so short of water that it could not survive without an additional water supply. In this way the Gooding project, now under constructon by the Government, grew out of the American Falls Reservoir and is being constructed for the purpose of saving an existing project on which several thousand settlers had established their homes. This project prior to 1931 was dependent on the Wood River and a reservoir on that stream known as the Magic Reservoir for its entire water supply; but the water supply available from Wood River proved to be only about half the amount required.

The Reclamation Bureau made surveys and investigations to determine what could be done to relieve the water shortage on this project, and it was found that a canal diverting from Snake River above the Milner Dam could be so constructed that it would cover just about one-half of the 80,000 acres heretofore dependent upon the Wood River for its water supply, and that by furnishing the lower half of the project with water from the American Falls Reservoir, all the water available from Wood River could be used on the upper half of the project, thus furnishing a full supply for the entire project. The Milner-Gooding canal, which is now being constructed by the Reclamation Bureau, has been undertaken for this purpose and is now approaching completion. Water from the American Falls reservoir was furnished on part of the project this summer and it is expected that the canal will be finished before the beginning of the next irrigation season. This is the project that is commonly known as the Gooding project and is officially designated as the Gooding division of the Minidoka project.

CLE ELUM RESERVOIR

During the past month the contract was awarded for the construction of the Cle Elum Reservoir which is to be the principal reservoir for the wonderfully rich and productive Yakima Valley in the State of Washington.

Without going into details concerning the Cle Elum Reservoir, it is sufficient to say that what the American Falls Reservoir is to the Snake River Valley of southern Idaho, the Cle Elum Reservoir will be for the Yakima Valley. It insures an abundant water supply for the entire Yakima Valley.

The estimated cost of this reservoir was about three and one-half million dollars, but the low bid which was submitted by one of the best contracting companies in the country (Winston Bros., of Minneapolis) is several hundred thousand dollars below the estimate, so it is now thought that if similar economies can be secured on material and supplies and other features of the work, the cost may be only about $3,000,000 instead of the estimated $3,500,000.

In addition to argument based upon the urgent need for more water, one of the strong arguments for doing as much of this kind of work as possible at the present time is that very favorable bids can now be secured from the best of contracting firms. Another is that it furnishes a large amount of much-needed employment. Almost every dollar spent on such a job goes to pay for labor directly or indirectly. A part of the expense is for cement and lumber and machinery and other supplies, but such supplies also represent labor in near-by or distant communities.

KENNEWICK PROJECT

Another project for which the first contracts were let during the summer of 1931 is the Highlands unit of the Kennewick project. This is a privately constructed project occupied by about 300 families on small orchard tracts located at the lower end of the Yakima Valley. Most of these families have spent 10 or 12 years' time and as much as $500 per acre in developing small orchard tracts in the vicinity of the town of Kennewick, but on account of water shortage and high pumping costs it is now found that the entire enterprise will have to be abandoned unless more water can be furnished at less cost. The project as now being constructed by the Government includes the reconstruction and enlargement of irrigation works to provide about double the present water supply. It also includes the construction of a power plant which, in addition to furnishing electric energy to the Kennewick district at about one-half of the cost per kilowatt-hour heretofore paid, will also furnish cheap power to several other small irrigation districts which could not survive without some reduction in power costs.

OWYHEE PROJECT

One of the principal reasons for undertaking the Owyhee project, which is now under construction in Eastern Oregon, is to furnish a gravity water supply to a number of districts which have heretofore secured water by pumping from Snake River but find the pumping costs, which in many cases amount to 10 or 12 dollars per acre per year, too high to be continued and that these well-developed farms will have to be abandoned unless a cheaper water supply can be furnished. For these districts the Owyhee project will furnish a gravity water supply at a reduced cost so that these homes will not have to be abandoned and the lands will not revert to the desert. This project also provides water for new lands.

VALE PROJECT

The Warm Springs Irrigation district, partly on account of excessive bond issues and partly on account of the fact that most of the land of the district became seeped and incapable of producing crops without drainage, found itself hopelessly mired in debt as well as in seepage water. The district, however, had a reservoir of larger capacity than was required for the needs of this district. The sale of a half interest in the Warm Springs Reservoir to the Government to be paid for in part in cash and in part in the construction of a drainage system in the Warm Springs district has resulted in the drainage of most of the seeped land in the district and has also provided the district with sufficient funds to enable it to make a settlement with the bondholders and get into a solvent condition. The water from that part of the reservoir purchased by the Government will be used to irrigate lands in the Vale, Oreg., irrigation district which is considered the Vale project proper, but the principal motive for the adoption of the Vale project was to save the Warm Springs district.

SMALL BAKER PROJECT

During the past month bids have been opened for a small reservoir near the city of Baker, Oreg., at a site known as the Thief Valley reservoir site. This reservoir will furnish a supplemental water supply for lands in the lower Powder River Valley which have long been settled and partially irrigated with flood water. Water shortages in this valley have been growing increasingly acute during recent years and an additional water supply is now considered necessary to save the development already established.

SALT LAKE BASIN PROJECT IN UTAH

Modern irrigation as known in the arid region of the United States by white English-speaking people was begun by the Mormon pioneers in Utah in 1847.

The president of that people, Willford Woodruff, in his speech before the first irrigation congress, which met in Salt Lake City in September 1891, said:

"Forty-four years ago the 24th of last July, I entered this valley with 143 emigrants, or in other words, pioneers. We were led by President Young. This country that we arrived upon was called the Great American Desert, and certainly, as far as we could see, it did not deviate from that in the least. We found a barren desert here. There was no mark of the Anglo-Saxon race, no mark of the white man—everything was barren, dry, and desert. We pitched our camp a little to the southeast from here, about 11 o'clock in the day. We had a desire to try the soil, to know what it could pro-

duce. Of course, all this company—nearly the whole of us—were born and raised in the New England States—Vermont, Maine, Massachusetts, and Connecticut—and had no experience in irrigation. We pitched our camp, put some teams onto our plows, and undertook to plow the earth, but we found that neither wood nor iron was strong enough to make furrows in this soil. It was like adamant; of course, we had to turn water on it. We would have done anything. We went and turned out City Creek; we turned it over to our ground. When we came to put our teams upon it, of course, they sank down in the mud. We had to wait until this land dried enough to hold our teams up. We put in our crops and stayed here. In the meantime President Young laid out this city, as you see it to-day, in the midst of sagebrush, without a house within hundreds of miles of us. Now, what I wish to say is this: You gentlemen come here to-day, you see the city, you go through the country. Here are thousands of miles, I might say, through these mountains filled with cities, towns, villages, gardens, and orchards, and the produce of the earth that sustains the people. Without this water, this irrigation for which you have met there to-day, this country would be as barren as it was in 1847, as we found it. Whoever occupies these lands has got to have the water to perform the work. We have had to learn by experience, and all that we have obtained in these mountains has been by irrigation."

Much of the land in the Salt Lake Basin, where the first irrigation on the North American Continent by white English-speaking peoples began, has never had a complete water supply. The Salt Lake Basin project is being constructed for the purpose of providing a more complete water supply for lands irrigated by the Mormon pioneers and their descendants in the Salt Lake Basin, where irrigation by white English-speaking people began on this continent. It includes the construction of reservoirs on streams flowing into the Salt Lake Basin, the principal one being the Echo Reservoir; also some canals to convey the stored water to pointswhere it can reach the lands which need the supplemental supply

HOOVER RESERVOIR

We now come to the largest of all reclamation projects, the Hoover Reservoir now under construction in the Black Canyon of the Colorado River in the section where the Colorado forms the boundary between the States of Arizona and Nevada. With a capacity of 30,000,000 acre-feet, this reservoir will be larger than the combined capacity of all the other reservoirs constructed by the Reclamation Bureau since its beginning in 1902. It will accomplish many beneficial purposes—flood control, irrigation, municipal water supply, and power. Not the least of these is the furnishing of a much-needed additional water supply for a dozen fast-growing municipalities in southern California, including the city of Los Angeles.

The Colorado River carries 200,000 second-feet of water at its flood and only 1,200 second-feet at its low stage. Needless to say when the Colorado is at its low stage there is a serious water shortage in the Imperial Valley and when the floods come the Imperial Valley is threatened by a disaster greater than drought, for the Colorado River flows along the top of a silt dike which the river itself has built up and the Imperial Valley lies far below the level of the sea. Consequently in case of a flood in the Imperial Valley the water can never be removed except by evaporation. The greatest difficulty was experienced in turning the river back into its old channel after the last break, and if it had continued much longer could not have

Six Companies' north dining room, 575-men capacity, Boulder City, Boulder Canyon project

been turned out at all. This danger can be readily understood when you consider the steep grade from the river banks to the Salton Sea at the bottom of the valley, the silt formation of unknown depth which forms this slope, the tremendous velocity with which the river at flood flows down this incline, and the rapidity with which such a current cuts down and back in such a silt formation.

The engineers who have been studying the problem of the Imperial Valley have reached the conclusion that the Imperial Valley with its 700,000 acres of irrigated land and its numerous towns and valleys will surely be destroyed beyond all possibility of recovery unless the river is controlled by a reservoir, such as is now being constructed at the Hoover Dam. So the race is on to determine whether the Hoover Dam will reach completion before the next great flood occurs in the Colorado River; and the Imperial Valley, with all its hundreds of thousands of acres of improved farms—the homes of its thousands of settlers—and its numerous towns, its railroads, its highways, and all the improvements that go with such a settlement, is the stake. However ardent the wish may be in other parts of the West for more rain and more stream flow the people of the Imperial Valley are praying for no more floods for the next 7 years, after which it is expected that the Hoover Reservoir will be completed with sufficient capacity to store the entire flow of the Colorado River for 2 years and let it down in moderate and controlled quantities as needed for irrigation, municipal water supply, and power.

While flood control was the most urgent reason for the early construction of the Boulder Canyon project, its use, as a source of supplemental water supply for the cities of southern California, is no less important.

Irrigation experts say that nowhere in the world is irrigation water being used so economically and efficiently as in southern California, but even so the annual use exceeds the inflow and the ground water is being pumped lower and lower each year. Without more water the city of Los Angeles and other important cities in southern California must stop growing. For years past the city of Los Angeles has been engaged in an incessant search for more water. All the farms in the Owens Valley have been purchased and the entire water supply of that valley is being brought into the city through the Los Angeles Aqueduct, which was considered an engineering wonder at the time it was constructed. The only source from which a sufficient additional supply can be secured is the Colorado River. This requires a reservoir to control the river and an immense amount of cheap power to pump a million acre-feet of water per year (1,500 second-feet continuous flow) to an elevation of 1,500 feet to get it over the divide which separates southern California from the Colorado River. About one-third of all the power that can be produced at the Hoover Dam is needed by the city of Los Angeles and associated municipalities to pump its municipal water supply.

The supplemental water supply from the Hoover Reservoir and an abundance of cheap power from the same source make possible the continued growth of the cities of southern California which is of almost as much importance to the farmers and lumbermen of the Northwest as it is to the people of California. About a year ago I asked the manager of the Caldwell Cooperative Creamery (which handles a large part of the butterfat produced in the Boise Valley): "Where do you sell your butter?" His answer was, "We sell 90 per cent of our butter in the city of Los Angeles." The importance of the California market to the northwestern dairymen can hardly be overestimated. The same is true in a somewhat less degree of almost everything that we produce in the Northwest. So the construction of the Boulder Canyon project not only protects the Imperial Valley and enables the cities of southern California to continue their growth, but also helps and protects all parts of the country which market their products in southern California and especially the farmers and lumbermen of the Northwest.

POWER RECEIPTS PAY THE ENTIRE COST

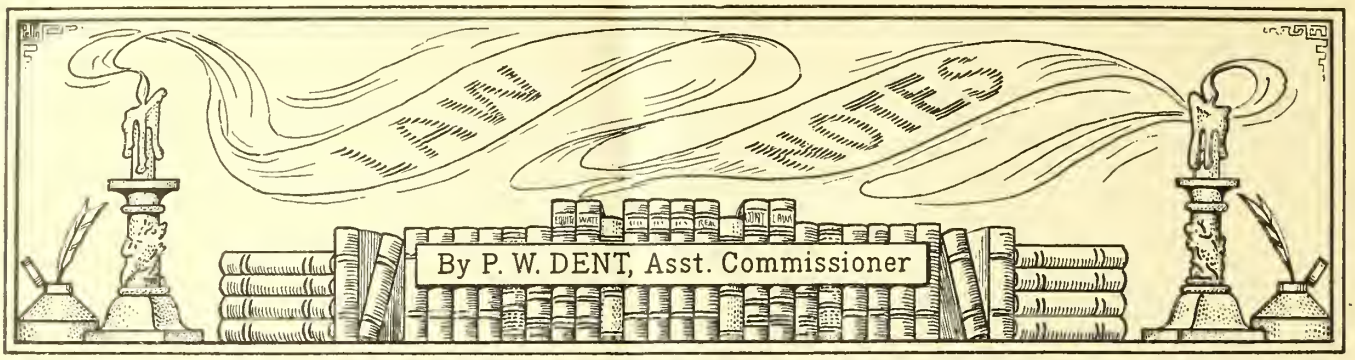
One of the most interesting features of the Boulder Canyon project, or Hoover Dam as it is now called, is the method provided for paying the cost.

At the present time the whole world is diligently searching for some method to relieve unemployment and, at the same time, to avoid increasing the burdens of the taxpayers. This difficult problem has been most successfully solved under the financial plan provided in the Boulder Canyon act. Under the provisions of the act it was required that contracts with responsible parties must first be secured for the sale of a sufficient amount of electric energy to pay the entire cost of the project with 4 per cent interest before the work could proceed. This requirement has been met, the city of Los Angeles and the Southern California Edison Co. being the principal subscribers for the firm power. A percentage of the power receipts is allotted to the States of Nevada and Arizona in lieu of taxes, and after the entire cost has been paid with interest, which it is estimated will require less than 40 years, the power receipts will still continue and will then be available for additional water supply improvements in the Colorado River drainage basin.

In the East and Middle West, and especially along the Mississippi River and its tributaries, flood control and navigation have been provided at great cost to the taxpayers of the Nation, but the Colorado River pays for its own control. A large amount of employment is being provided at a time when employment is most urgently needed and without placing any burden on the taxpayers of the Nation. When public works to provide employment place additional burdens on the taxpayers, there is always a question whether they do more good or harm, but a public improvement which pays its own way is a happy and unusual experience. It took nine years to get the Boulder Canyon bill through Congress, and the fact that the contract was let just at the time when employment was most urgently needed was merely a happy coincident in no way due to advance planning on our part. Nevertheless the Boulder Canyon act furnishes the most successful answer yet found to the world's most difficult problem of unemployment.

How far the Boulder Canyon plan can be employed in the Northwest is problematical.

There are a number of places in the Northwest where large amounts of electrical energy can be developed at a cost even lower than that at the Hoover Dam, and in some cases in connection with works which would be useful for navigation and irrigation, as well as power, but the most serious question in connection with such projects in the Northwest is the question whether a market can be found for the power even at a price of less than 2 mills per kilowatt-hour at the plant. The problem of finding a sufficient market may require some patience, but in view of the fact that the amount of electrical energy used in this country has doubled on the average every 10 years, the problem is not a hopeless one. In the last analysis it may resolve itself into the question whether the cities of the Northwest will want to supply the future increase in their power requirements from works which will serve the purposes of navigation and irrigation as well as power development rather than from works which are useful for power development only. Some of the larger enterprises might require the cooperation of all the larger cities in the Northwest. It is the established policy of the Government to avoid going into the retail power business and to dispose of the power developed in connection with its irrigation and reservoir projects at wholesale prices to cities and companies which own and operate the distribution systems. In this way the duplication of existing distribution systems is avoided.



New Mexico Legislation in 1931

THAT New Mexico is becoming increasingly alert to the importance of the water resources of that State is apparent from the fact that about one-fifth of a total of 162 chapters of laws enacted by the 1931 legislature concerned, directly or indirectly, irrigation and water matters. Twenty-four special acts authorized the expenditure of approximately $150,000 for various undertakings, including improvements to banks of the Rio Grande, administration of the Rio Grande interstate compact, drainage operations on the Pecos River in the vicinity of Fort Sumner, N. Mex., the plugging of artesian wells, stream gaging, flood protection work, investigation of underground and surface stream water supply, investigation of dam sites and reservoir sites, and construction and improvement of certain small irrigation works. In most instances the legislation pertaining to investigation authorizes the cooperation of the State with one or more Federal agencies, and embraces numerous and widely scattered localities throughout the State.

Other enactments of more general application, with chapter and page citations of Laws of New Mexico, 1931, may be summarized as follows:

Underground waters subject to appropriation (ch. 131, p. 229).—The law of prior appropriation has always been recognized in New Mexico with respect to water flowing on the surface of the ground. By this act the waters of underground streams, channels, artesian basins, reservoirs, or lakes having reasonably ascertainable boundaries are declared to be public waters and to belong to the public and to be subject to appropriation for beneficial use. Beneficial use is the basis, the measure, and the limit to the right to the use of such waters. Application is made to the State engineer and after published notice, a hearing may be had and a permit granted for the appropriation of such waters. Four years' nonuse of such waters forfeits the right and the water so unused reverts to the public and becomes subject to further appropriation.

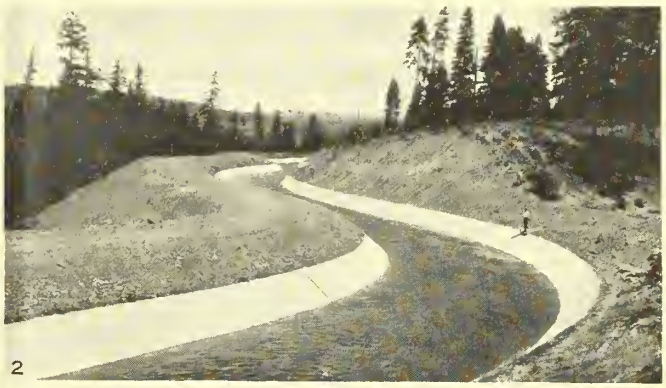
Irrigation district taxes (ch. 91, p. 148).—A new situation with respect to irrigation district taxes is created. It provides that one-half of taxes shall become payable December 1 and the second half shall become payable June 1 following; the first half to become delinquent January 1 and the second half to become delinquent July 1 following, delinquencies to bear interest at 1 per cent per month until paid. (By secs. 141–414, New Mexico Statutes Annotated, 1929, these taxes became due and delinquent on the same dates as State and county taxes; namely, one-half December 1 and one-half May 1). Section 3 requires the assessor-collector, within six months after July 1 of each year, to publish once a week for four consecutive weeks a delinquent tax list and notice that he will sell delinquent lands at public auction. At the sale on the designated day the assessor-collector in person or by deputy shall strike off to the best bidder for cash sufficient of the delinquent land to produce the amount due. The district may bid in the land for the amount of taxes. The landowner has three years from date of sale in which to redeem and may retain possession until he redeems the land or until the redemption time has expired. Upon redemption he must pay the amount bid at the tax sale plus interest at 1½ per cent per month from date of sale. On expiration of the period of redemption the assessor-collector shall issue a tax deed which shall vest in the grantee a perfect and complete title in fee simple free and clear of all liens and encumbrances, except taxes, levies, and assessments of the district levied thereon prior or subsequent to the year for which the same was sold, and county, State, and municipal taxes, and estops all parties from raising any objection except that the taxes, levies, and assessments have been paid or that the real estate was not liable to such tax levies and assessments. It is also provided that if the land is bought in by the district a duplicate certificate of sale shall be sold by the assessor-collector to any person who shall pay the face value thereof with accrued interest and if the same can not be sold at a private sale within one year from date of such certificate, it shall be sold at public auction to the highest bidder for cash.

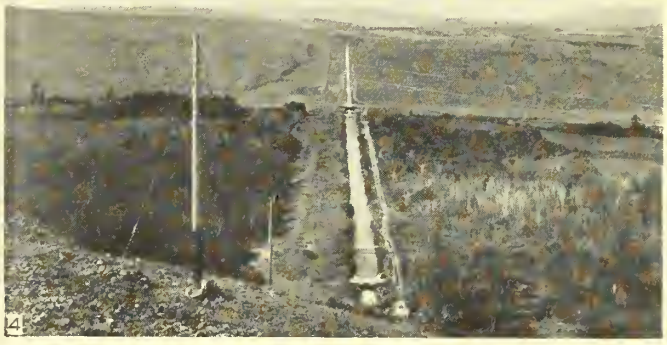
Civil service systems (ch. 78, p. 135).—This act authorizes irrigation districts cooperating with the United States to establish a civil service system with a board consisting of two permanent employees of the district and one member of the board of directors empowered to enact rules and regulations relating to the hiring of employees of the district. It provides for the creation of a fund to pension old or incapacitated employees and to make a reasonable reservation out of wages and salaries to support such fund and provide out of its general fund, or any other fund created for such purpose, the premiums for group insurance or employers' liability insurance.

Local improvement districts (ch. 80, p. 137).—This act amends chapter 39, Laws of New Mexico, 1921. It authorizes irrigation districts cooperating with the United States to create within such a distrist local improvement districts for special construction, reconstruction, betterment, or improvement in an irrigation system, including drainage and protection from arroyo floods or encroachment of arroyo fans, river rectification and control, river bank protection, construction of levees and jetties of special benefit to certain agricultural lands tributary thereto. It provides procedure for creation of such local improvement district and taxation of lands benefited, which in general is the same as that for the district proper, except that no election is required. The provision is not applicable to lands within or contiguous to the corporation limits of a municipality nor to lands benefited by protective works planned or built by a municipality.

Artesian conservancy districts (ch. 97, p. 157).—There were heretofore on the statute books of New Mexico four complete, distinct, and separate acts relating to the organization and operation of irrigation or conservancy districts. A fifth act has now been added providing for the creation of artesian conservancy districts for the purpose of conserving waters in artesian basins the boundaries of which have been scientifically determined. The act cited also declares all artesian wells wasting waters from any artesian basin to be nuisances and provides for plugging such wells. Such a district may include all lands overlying any such basin and any land outside the boundaries thereof on which waters from such basin are being used either for private, public, commercial, domestic or irrigation, purposes, or otherwise. Two or more basins or reservoirs may be embraced in the same conservancy district under certain conditions. The procedure for the formation of such a district is quite similar to that prescribed for the formation of conservancy districts. It is interesting to note that, unlike irrigation districts, no election is required for creation of artesian conservancy districts. Such a district is initiated by a petition filed in the district court by owners of more than one-third of the real property in such proposed district in either acreage or value. Any city interested in some degree in improvements may upon proper action of its governing body alone sign a petition. Objections may be filed, a hearing is held, and the court may declare the district organized, the decree not being final as to boundaries, whereupon the district becomes a political subdivision of the State with powers similar to those usually granted to irrigation districts by the various acts. Such districts ultimately have five directors. A director's term of office is six years. After formation, the district may proceed in cooperation with the State engineer and the United States Geological Survey to outline a plan for and make estimates of the cost of needed improvements, which may include plugging of all artesian wells in the district found by tests to be materially leaking or wasting water. An ad valorem tax not exceeding five mills may be levied. The district may borrow money in anticipation of the proceeds from collection of taxes to be derived from any uniform annual levy.

Guarantee fund—conservancy districts (ch. 50, p. 91).—With respect to conservancy districts of 50,000 acres or more this act provides that there shall be



KITTITAS DIVISION, YAKIMA PROJECT, WASHINGTON

1, Easton Dam; 2 and 3, about 615 second-feet of water flowing in main canal; 4, Taneum Creek siphon and wasteway; 5, alfalfa on ranch near Cle Elum; 6, potato field under North Branch Canal.

created a guarantee fund for the purpose of guaranteeing the prompt payment of principal and interest on all conservancy bonds, the fund to be raised by a tax of two mills per dollar of assessed valuation. When the amount of the guarantee fund exceeds 15 per cent of the total bonded indebtedness, no further levy may be made until the fund is depleted below that amount. The fund may not be used to pay bonds sold after the passage of the act upon options existing prior thereto. Section 9 of the act provides that landowners who have not paid assessments levied in 1929 and 1930 may, on or before July 1, 1931, give the county treasurer a note payable to the district to become due on or before 10 years after date and bearing interest at 6 per cent, which shall be received in lieu of payment of such assessment, and enforcement of collection shall be suspended until the note becomes due. Section 10 authorizes the board to sell debentures not exceeding 90 per cent of the aggregate principal amount of such notes and pledge the proceeds of the notes to pay such debentures and for the creation of a debenture fund.

Electrical pumping districts (ch. 133, p. 232).—This act amends the laws of 1929, chapter 76, so as to enable electrical pumping districts to acquire water wells, electrical motors and engines.

Title instruments—reduced recording costs to irrigation districts (ch. 137, p. 243).—The State and municipalities and other subdivisions, including irrigation districts, are by this act authorized to have title instruments in which such municipality or district is the grantee recorded by the county clerks of the respective counties at a cost not to exceed 25 cents per instrument. In acquisition of rights-of-way by districts this should effect a substantial saving, as the usual recording fee is $1.50. The act fails, however, to extend the reduced recording cost to cases where the United States is the grantee in the acquisition of real estate for the use of an irrigation district.

Receivers for municipal irrigation districts (ch. 55, p. 106).—There appears to be a growing tendency of the legislatures of the irrigation States to enact various provisions in general terms at the instance of some particular irrigation district and to meet real or fancied needs in the particular case. The result has been a marked difference in provisions on the same subject in acts of different States. Not infrequently such special provisions, enacted in general terms, are detrimental to irrigation districts other than the one at the instance of which the amendments were enacted. The chapter just cited provides that whenever any municipal irrigation district shall become insolvent and unable to pay its debts, the district court may at the suit of the board of directors, appoint a receiver for the district to operate the same under the court's direction, such receiver being given the same powers as those exercised by the board and such additional powers as a court of equity may or can grant. Inquiry discloses that this act was passed in connection with an irrigation district in the northern part of the State. The act recites its application to "municipal irrigation districts" and its application is not entirely clear, as no other New Mexico statute relating to the several classes of districts uses the term "municipal irrigation district." Heretofore only four other States had receivership provisions in their irrigation district laws; namely, Idaho, Texas (relating only to water improvement districts created by consolidation of two or more such districts), Utah, and Washington. The various acts are greatly dissimilar.

H. J. S. Devries,
District Counsel.

Right to Enjoin a Hearing by the Department of Public Works Denied by Supreme Court of Nebraska

THE case of Dawson County Irrigation Co. *v.* McMullen (231 N. W. 840) is an action to enjoin the State officials comprising the department of public works from conducting a hearing pursuant to the provisions of section 8428, Compiled Statutes of Nebraska 1922. The lower court sustained a general demurrer to plaintiff's amended petition, and upon the failure of the plaintiff to plead further, judgment of dismissal was entered. The decision of the lower court was affirmed by the supreme court. The statute involved empowers the department of public works to cancel water appropriation after hearing where water is not put to beneficial use. Some excerpts from the decision of the supreme court follow:

"The section of the statute quoted is attacked on several grounds. It is charged, in effect, that the statute is unconstitutional because it purports to give to the department of public works judicial powers, in violation of section 1, article 5, of the constitution, which vests judicial powers in the tribunals therein named. * * *

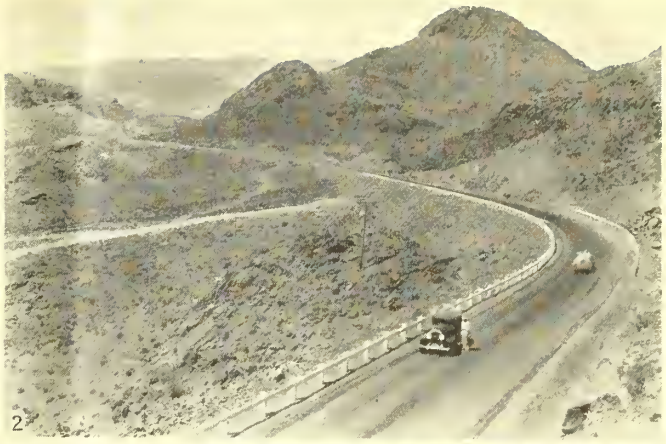
"By a long line of decisions this court is firmly committed to the proposition that, under said section 8428, the State board of irrigation and its successor, the department of public works, is an administrative body, possessing quasi judicial powers, and that the section is not in violation of section 1, article 5, of the constitution. * * *

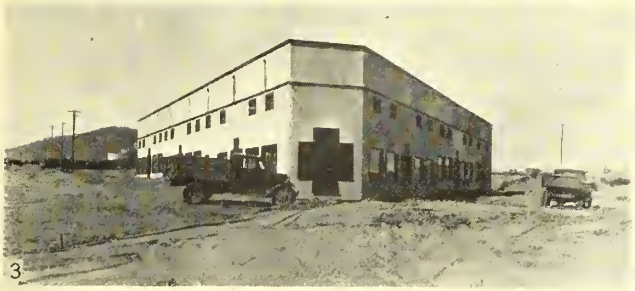
"Plaintiff further contends that, if the statute in question authorizes any action by the department of public works, it is to cancel or annul the entire appropriation; that the department is not vested with power to cancel or annul the appropriation in part, and that it is about to proceed to, and will, unless enjoined, enter an order beyond the power conferred by said section. This contention is wholly without merit. It can not be determined in advance what order or ruling may be made by the department in the exercise of its quasi judicial functions, but, if any erroneous order is made, redress may be had by an appeal to the courts. Under the circumstances, plaintiff was not entitled to injunctive relief. The department was authorized to conduct a hearing. It will not be presumed in advance of such hearing that it will attempt to go beyond the powers conferred. Should it do so, redress may be had by an appeal from its decision.

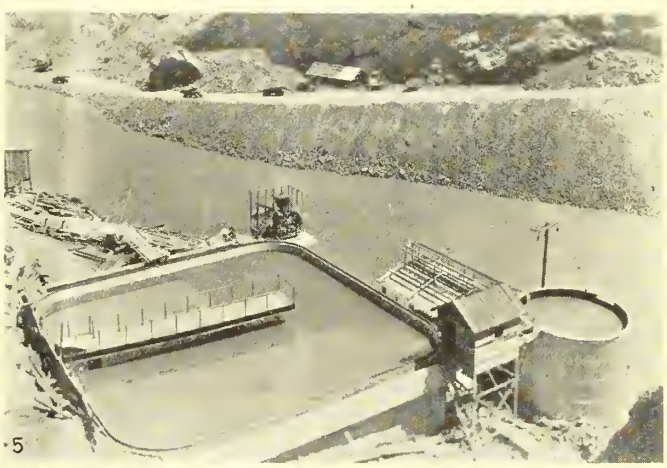
"Plaintiff urges and insists that a construction of section 8428, Compiled Statutes 1922, is imperative, to determine whether or not the department of public works is vested with the power to cancel and annul the water appropriation in part, or whether it is limited to the right to cancel and annul the appropriation in toto for nonuse or because of abandonment. That question is not properly before us at this time.

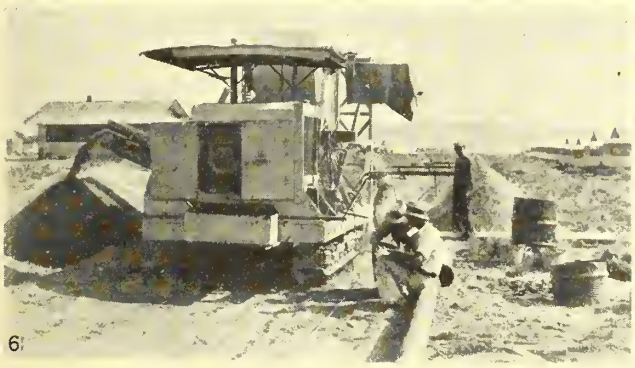
"The only proposition presented here is whether or not plaintiff is entitled to enjoin a hearing by the department of public works. Had plaintiff submitted to a hearing before the department, a ruling made by it, and an appeal taken therefrom and brought to this court in that manner, the proper construction of the statute might have been involved, and, if so, would have been passed upon. The construction of the statute in that respect is not involved in this appeal. To undertake to pass upon it would amount to dictum, and would not be binding in a subsequent case where the question was properly involved."

Wm. J. Burke,
District Counsel.









PROGRESS PICTURES ON BOULDER CANYON PROJECT

1. United States construction railroad looking northeast from Station 112; 2, highway near Tunnel Ridge, looking west; 3, Six Companies' commissary; 4, administration building foundation under erection, view from east, water tank in background; 5, presedimentation tank, from road above looking upstream; 6, trencher for water mains, New Mexico Construction Co.'s machine; 7, Six Company's kitchen, Boulder City, 8, wheel trailer equipped with pneumatic tires, at work on Boulder City-Hoover Dam Highway. Photo by Caterpillar Traction Co.).

Construction of the Echo Dam on the Salt Lake Basin Project, Utah

By Kenneth B. Keener, Senior Engineer, Denver Office, Bureau of Reclamation

WITH the completion of the Echo Dam on the Salt Lake Basin project, Utah, the United States Bureau of Reclamation has added another dam to its long list of these major structures. This dam, an earth-fill type, protected upstream with a riprap facing and downstream with a gravel, cobble, and rock fill, is located on the Weber River, near Echo, Utah, about 30 miles northeast of Salt Lake City.

HYDRAULIC FEATURES

The reservoir formed by this dam is about 5 miles long, and has a maximum water surface area of 1,475 acres and a storage capacityof 74,000 acre-feet. With full reservoir, at elevation 5,560, the freeboard to the crest of the dam or top of roadway is 10 feet, and 13 feet to the top of the parapet wall. With maximum reservoir water surface, a total discharge, of 17,000 second-feet may pass this dam, 15,000 through the spillway, and 2,000 through the outlet works, the total being about three times the maximum flood of record in the river at this point. The drainage area above the dam is 738 square miles, and the average annual run-off for the years of record amounts to 322,400 acre-feet.

The Weber River Water Users' Association has contracted to repay to the Government the total cost of the dam and related works, which according to present roughly estimated figures will amount to about $2,230,000. Several canal companies have in turn contracted to purchase permanent water-storage rights at about $41 per acre-foot. In order that two private power plants below the dam may be operated, it will be necessary to maintain a normal river flow of 365 second-feet. During the months of May to September, inclusive, the combined power and irrigation demands reach a maximum of 760 second-feet.

The Weber-Provo diversion canal, another feature of the Salt Lake Basin project, has recently been completed by the bureau. This canal, 9 miles in length and having a capacity of 210 second-feet, has its heading on the Weber River 25 miles above the Echo Dam, and diverts water from this river to the Provo River. When another proposed dam is constructed on the Provo River it is planned to enlarge this diversion canal to carry a maximum discharge of 1,000 second-feet.

FOUNDATION AND MATERIAL TESTS

The base of Echo Dam rests on an impervious natural stratum of clay, sand, and gravel, under which is a layer of relatively pervious sand and gravel, resting on bedrock known as Wasatch conglomerate. This rock is about 26 feet below the bed of the river. The foundation for the dam and the material in proposed adjacent borrow pits was investigated by test holes prior to design and construction. Mechanical analysis of soil samples taken at the dam site and from the borrow pits showed that gravel larger than 1 inch ranged from 3 to 13 per cent, and that the average grading for the remainder of the samples was 4.55 per cent fine gravel, 5.83 coarse sand, 6.58 medium sand, 20.92 fine sand, 27.57 very fine sand, 18.79 silt, and 15.99 per cent clay.

To test percolation properties of these materials, which were used in the earth-fill portion of the dam, a sample was packed 3 feet deep in a 4-foot length of 8-inch corrugated metal pipe which was coated inside with tar and sand to prevent direct flow along the surface of the pipe. An average result of such tests showed that when the pipe was filled with water to the top it appeared at the bottom in 16 hours; that 1¾ quarts passed in the next 24 hours and then 3½ quarts daily for 4 days, the 1-foot depth of water being maintained at the top. The average computed velocity was 0.11 feet in 24 hours. Other tests for shrinkage made by drying elongated formed samples in an oven showed 2 per cent linear and 7 per cent volumetric shrinkage, the moisture equivalent being about 15 per cent. It was found during construction that maximum compactness of materials was obtained with 10 per cent moisture and the endeavor was to maintain this proportion in sprinkling operations, as described later.

DESIGN OF DAM

The crest of the Echo Dam is 25 feet wide and 1,804 feet in length from the side of the spillway channel on the west to the center line of the Lincoln Highway on the east. At the maximum section of the dam the crest is 125 feet above the river bed, or about 151 feet above bedrock. Typical sections of the dam illustrating its design in some detail are shown on the accompanying drawing. Various quantities of material required in its construction included about 67,000 cubic yards of stripping for embankments, 1,350,000 cubic yards of earth fill, 240,000 cubic yards of gravel, cobble, and rock fill, 47,000 cubic yards of riprap on the upstream face and 8,800 cubic yards of concrete. The reinforced-concrete core wall, varying from 18 inches in thickness at the bottom to 12 inches at the top and 12 feet in height, was bonded into bedrock by a footing 3 feet wide and having a minimum depth of 1½ feet. This core wall, and the cut-off trench in which it was constructed, was located where the pervious stratum of sand and gravel was thick. The trench was back filled with material, largely clay, and this was sprinkled and rolled in 8-inch layers in the same manner as the earth-fill portion of the dam. Where the pervious stratum was thin and the thickness of the overlying impervious stratum of clay, sand, and gravel was about 30 feet or less, the cut-off consisted of a 30-inch width trench excavated through both strata and about 18 inches into bedrock, which was then filled with concrete to about 5 feet above the pervious stratum and the balance of the trench filled with puddled clay. Where the impervious stratum on the thin bed of gravel was greater than 30 feet the cut-off consisted of a tunnel or stoped excavation, 4 feet in width, which was completely filled with concrete.

The base width at maximum section is 830 feet, but the percolation distance is increased about 300 feet by a dry earth blanket at the upstream toe. The upstream slope of the dam, for a vertical distance of 90 feet below the crest, is

protected from wave action by a 4-foot layer of conglomerate rock riprap. The concrete parapet wall extending along the upstream edge of the crest and the concrete roadway curb along the opposite edge were not constructed until initial settlement of the embankment had occurred. Drainage is provided in the downstream toe of the dam by 8 and 12 inch tile laid in trenches and back filled with gravel and cobbles.

CONSTRUCTION METHODS

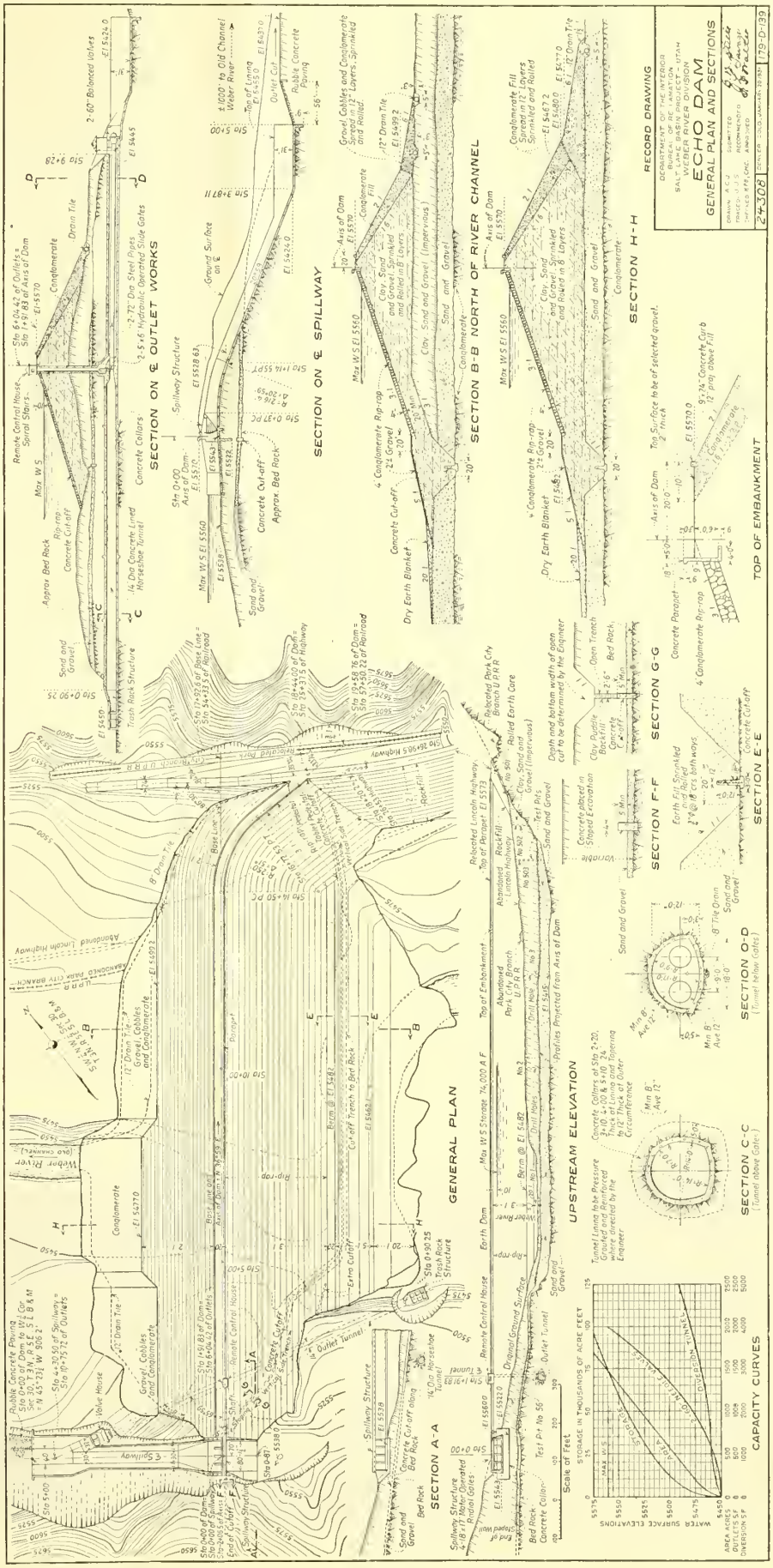
The material placed in the earth-fill portion of the dam was sprinkled and rolled in 8-inch layers, the type of rollers used being those with projecting feet. Water in excess of the 10 per cent required to secure maximum compactness also made the material too wet for economical handling. Hydraulic placing had been contemplated at one time, but this plan was discarded when mechanical analysis showed that there was insufficient coarse material to maintain the outer slopes against the pressure of a wet core. The material at the borrow pits was excavated and loaded by electric, gasoline, and Diesel oil-operated shovels, and hauled to the embankment by 5-yard motor trucks, 7-yard crawler-type motor trucks, and by 16-yard dump wagons, the latter pulled by 60-horsepower crawler tractors. Prior to dumping each load the site was sprinkled and after dumping the pile was also sprinkled and then leveled by a tractor bulldozer. Further leveling was accomplished by a grader with a 12-foot blade. However, leveling with the bulldozer was not required when the 16-yard dump wagons were used, as these distributed the material in dumping.

The conglomerate rock fill in the river channel was sprinkled and rolled in 12-inch layers, the operations being practically the same as described for the earth fill. Stones larger than 12 inches were picked out and piled along the downstream toe.

Sand from the river bed was suitable for concrete though it required washing. The gravel also was of good quality and after removal of a rather large percentage of one-fourth to five-eighths inch pea gravel was fairly well graded.

SPILLWAY AND STILLING POOL

The spillway, located at the left end of the embankment and at right angles with the axis, is of the straight-channel type and discharges into a stilling basin at its lower end and then by an unlined open cut into the river. The spillway crest is separated by concrete piers into four bays, the flow through each being regulated by a counterbalanced radial gate, 17 feet high by 18 feet wide. The gates are automatically controlled by electric-motor-



operated hoists, the motors being governed by floats in wells located within two of the piers. Gasoline engine operation is also provided in case of emergency.

The total length of the concrete spillway from the inlet end to the downstream edge of the pool is 587 feet, the drop being largely on a 21° slope, the channel for this gradient having a 30-foot base width and 1:1 side slopes. The stilling pool has a base width of 40 feet, 1:1 side slopes and a depth of 31 feet, its bottom being 17 feet below the elevation of the river channel. The unlined channel leading from the pool has a base width of 30 feet and 1½:1 side slopes.

OUTLET TUNNEL AND GATES

The outlet works for the release of irrigation and power water is by means of a concrete-lined tunnel 838 feet in length driven through the conglomerate rock under the left abutment of the dam. A concrete trash-rack structure at the intake end protects the outlet works from débris. The upstream reach of the tunnel, to the emergency gates, located below the crest of the dam, is a horseshoe section 14 feet in diameter. Below the emergency gates the tunnel is segmental in section, 12 feet in height and 18 feet in width and the discharge in this reach is through two 72-inch riveted steel pipes. The flow through these pipes is controlled by 60-inch internal differential needle valves at the downstream ends which discharge into the stilling pool basin. The emergency gates above referred to are hydraulically operated 5 by 6-foot semisteel slide gates.

In placing the 12-inch tunnel lining, the concrete was dropped through a 6-inch pipe in the gate shaft to a hopper in the emergency gate chamber, from which it was charged in a concrete gun of 3-yard capacity and then shot through a 6-inch pipe to the crown of the portable sheet-steel-lined forms which were supported on a jumbo car. The invert to the tunnel lining was placed after completing the sides and crown. The pressure tunnel or that portion upstream from the emergency gates was grouted at a pressure of 40 pounds per square inch, this being approximately equal to pressure on the tunnel with full reservoir. The grout was forced in through 2-inch holes drilled 8 feet deep through the concrete and into the surrounding rock.

AUXILIARY WORKS

Owing to the Lincoln Highway and the Park City branch of the Union Pacific Railroad being about 70 feet below the crest of the dam, it was necessary to relocate and reconstruct portions of these. The reconstructed railroad now rises on a 2 per cent grade from Echo and passes the right abutment of the dam in a cut about 25 feet below the crest of the dam and skirts the easterly shore of the reservoir at crest level. To prevent seepage from the reservoir into the railroad cut a puddled core was constructed in the highway fill which was located approximately parallel to the railroad and between the left end of the dam and the cut. About 5 miles of the Lincoln Highway were reconstructed.

ENGINEERS AND CONTRACTORS

The contract for the dam was awarded in November, 1927, to A. Guthrie & Co. (Inc.), of Portland, Oreg., at a price of $1,125,098, the Government furnishing cement, reinforcement bars, gates, and other equipment and materials which are a part of the completed structure. Contract for reconstruction of the highway and railroad was let to the Utah Construction Co., of Ogden, Utah, at a price of $386,970, this work being completed about April, 1929. F. F. Smith was construction engineer for the Bureau of Reclamation.

Boulder City Building Activities

The administration building, which will contain the offices of the Bureau of Reclamation on the Boulder Canyon project, is to be built in the extreme north section of Boulder City, Nev. Bids for construction of this building, together with a dormitory and municipal building were opened at Las Vegas, Nev., on August 10. Contract has been awarded to B. O. Siegfus, of Salt Lake City, Utah, for $46,253. The Government purchases material and equipment.

It is expected that the project organization can move into the new offices about January 1, 1932. The administration building will accommodate about 100 employees. Outside walls will be of brick hollow wall construction, covered on the outside with stucco, this type of construction being used for all three buildings. It will be a 2-story building, 54 by 137½ feet in size, with full basement. The building will have a cooling or air-conditioning system, and contain a heating plant which will also serve the dormitory.

On the first floor will be located offices of the construction engineer, office engineer, field engineer, chief clerk, and rooms for drafting, stenographic, and clerical forces. The second floor will have quarters for the district counsel, visiting engineers, consultation and drafting rooms. There will be a garage in the basement to accommodate six automobiles, and also instrument and storage rooms, together with the heating and air-conditioning plants.

The dormitory, located a short distance east of the administration building, will be a 1-story U-shaped Spanish type building, with an average width of 35 feet and a length of 225 feet. It will contain 20 rooms, with accommodations for 40

(Continued on p. 227)

Echo Dam, Salt Lake Basin project, Utah

Notes for Contractors

Baker project.—The contract for the construction of Thief Valley Dam has been awarded to the W. H. Puckett Co., of Boise, Idaho, at a total price of $71,850.

Contract for furnishing the outlet gates and frames for the dam has been awarded to the Ottumwa Iron Works, of Ottumwa, Iowa, for $875; contract for the gate hoists, reduction transmission, stems, indicators, and packing boxes has been awarded to the Aldrich Pump Co., of Allentown, Pa., for $2,700 and contract for the trash racks and other miscellaneous metal work has been awarded to the American Locomotive Co., of Dunkirk, N. Y., for $952.

Boulder Canyon project.—Bids under specifications No. 535-D for drilling for concrete cores at Gibson Dam, to determine the efficiency of the grouting system designed by the bureau and contemplated for use for Hoover Dam, were opened on August 17, 1931, and contract was awarded to the Diamond Drill Contracting Co., of Spokane, Wash., at a total bid price of $5,938.75.

Contract for the construction of the administration, municipal ,and dormitory buildings at Boulder City has been awarded to the low bidder, B. O. Siegfus, of Salt Lake City, Utah, whose bid was $46,253. All materials will be furnished by the Government and the foundations of the administration and dormitory buildings were constructed under a separate contract.

Bids were opened on August 7, 1931, for furnishing and installing an air-conditioning and heating system in the administration building. The lowest bid received was $16,335 and all bids were rejected.

Bids for the construction of a complete water purification and a sewage disposal plant for Boulder City were opened on October 5, 1931.

Specifications No. 540-D have been issued covering the construction of three 6-room and one 17-room residence at Boulder City, Nev., and plans are being prepared for nine 5-room residences and another group of 3 and 4 room residences. Specifications have also been issued for electric refrigerators, electric ranges, and electric water heaters to be installed in Government residences.

A Howe fire truck and a 21-passenger motor bus have been purchased and plans and specifications are being prepared for the construction of a large garage to house this equipment and also all Government-owned automobiles and trucks and a repair shop.

Grand Valley project.—Specifications have been issued for the purchase of hydraulic and electrical apparatus for the Grand Valley power plant and bids will be opened at the office of the chief engineer, in Denver, Colo., on October 20, 1931.

Minidoka project.—Contract for schedule No. 1 for clearing Jackson Lake Reservoir in Wyoming has been awarded to the Fullen Construction Co., of Gering, Nebr., for $58,800 and contract for schedule No. 2 has been awarded to Jonovich & Co., of Cle Elum, Wash., for $32,000. All bids for schedule No. 3 were rejected on account of lack of funds.

Owyhee project.—Specifications have been completed for the construction of a portion of the north canal on the Mitchell Butte division, including the excavation of about 3 miles of earth section canal, excavation for 1,025 feet of concrete-lined canal section, and about 3,200 feet of flume section, and the construction of three tunnels 530 feet, 1,372 feet, and 439 feet in length. The principal items and estimated quantities involved are as follows: 537,000 cubic yards of all classes of canal excavation; 16,450 cubic yards of all classes of structure excavation; 20,000 cubic yards of all classes of tunnel excavation; 3,000 station cubic yards of overhaul; 2,000 cubic yards of back fill; 700 cubic yards of puddling or tamping back fill; 1,500 cubic yards of concrete in structures; 5,000 cubic yards of concrete in tunnels; laying 300 linear feet of 6-inch pipe with uncemented joints; placing 155,000 pounds of reinforcement bars; installing 28,000 pounds of gates and metal work; erecting 40,000 feet, board measure, of permanent timbering in tunnels.

Salt Lake Basin project.—Contract for the construction of the parapet wall and curb and surfacing the crest of the embankment on the Echo Dam has been awarded to Cox and Christianson of Salt Lake City, Utah, at a total price of $19,345.08.

Yakima project—Cle Elum Dam.—Contract for the construction of the Cle Elum Dam has been awarded to Winston Bros. Co., of Minneapolis, Minn., at a total price of $1,311,533.50. All bids for clearing the Cle Elum reservoir were rejected and the work readvertised, bids being opened on September 18, 1931.

Yakima project—Kennewick division.—Plans and specifications have been prepared for the construction of the Prosser power canal, the Prosser power plant and the installation of the hydraulic and electrical apparatus in the power plant.

Yakima project—Kittitas division.—Bids were opened on August 21, 1931, for the earthwork and structures on the North Branch canal lateral system, Wippel pump, Gravity and Turbine laterals, specifications No. 525. Nineteen bids were received and the contract for all schedules was awarded to the low bidder, J. A. Terteling & Sons, of Spokane, Wash., the amount of the bid being $133,397.25.

Bids were opened on August 17, 1931 for direct pumping units for the Wippel pumping plant. Seven bids were received and contract was awarded to the low bidder, Newport News Shipbuilding & Dry Dock Co., whose bid was $14,700.

Plans and specifications are being prepared for the construction of the Wippel pumping plant and the installation of the hydraulic and electrical apparatus.

Vale project.—Bids were opened on September 24, 1931, for concrete lining the Vale main canal between station 1082 to station 1093, the lined section to have a bottom width of 14 feet, a depth of 8 feet, and side slopes of 1½ to 1. The work involves the excavation of 4,400 cubic yards of material, 546 cubic yards of concrete lining, and placing 47,000 pounds of reinforcement steel.

Construction Results

The summary of construction results to June 30, 1931, shows that the Bureau of Reclamation has constructed to date 13,594 miles of canals and 3,873 miles of drains and waste-water ditches. One hundred and thirty-two tunnels have been driven, which have a total length of 210,417 feet, or about 40 miles. The bureau has constructed and acquired by purchase 127 storage and diversion dams having a total volume of 22,688,296 cubic yards, or about six times the volume of the 727-foot Hoover Dam.

The bureau has built 255 miles of dikes and levees, 165,427 canal structures, 12,194 bridges, 15,787 culverts, 5,540 flumes, and laid 4,436,952 feet, or 840 miles of pipe. In the construction of irrigation projects, it has been necessary to construct 1,461 miles of roads, 117 miles of railroad, 4,011 miles of telephone lines, and 3,226 miles of transmission lines.

Total excavation to date of all classes is 292,105,859 cubic yards. This would make a pile of earth and rock 1 mile long, 1 mile wide, and 283 feet high. The amount of riprap laid is 2,570,254 cubic yards, and paving, 1,974,756 square yards. In the building of various structures the bureau has placed 4,776,359 cubic yards of concrete in which 5,350,393 barrels of cement were used. These figures as to concrete and cement closely approximate the quantities which will be required in constructing the Hoover Dam, power plant, and appurtenant works.

The Willwood Division of the Shoshone Project, Wyoming

By George O. Sanford, Assistant Director of Reclamation Economics

EARLY in May, 1899, Col. W. F. Cody (Buffalo Bill) and his partner, Nate Salisbury, acquired from the State of Wyoming a right to appropriate waters of the Shoshone River for the irrigation of about 60,000 acres of bench land extending for a distance of about 30 miles or more northeast of the city of Cody. It is of interest to note that the present Commissioner of the Bureau of Reclamation, as State engineer of Wyoming, approved the application in the following terms:

"This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

"Construction of proposed work shall begin within one year from date of approval.

"The time for completing the work shall terminate on December 31, 1905.

"The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1910.

"The amount of the appropriation shall be limited to 1 cubic foot per second of time for each 70 acres of land reclaimed on or before December 31, 1910, and the additional volume used for ——— purposes on or before said date.

"Witness my hand this 22d day of May, 1899.

ELWOOD MEAD,
State Engineer."

GOVERNMENT TAKES OVER PROJECT

This marked the beginning of the Shoshone project. A preliminary report and estimate of cost showed that the project was too costly to be financed with private capital, and in January, 1903, the Governor of Wyoming offered to relinquish the lands that had been segregated for irrigation purposes under the Carey Act, provided the United States would proceed with the construction of the project. Preliminary investigations were authorized by the Chief Engineer, April 20, 1903, and in February, 1904, the Secretary of the Interior set aside $2,500,000 for the construction of the project.

The "Cody-Salisbury tract" was located on the north side of the river, but it was also planned to irrigate a strip of land on the south side which had also been segregated under the provisions of the Carey Act. In letter of February 24, 1903, the governor, in showing his willingness to turn over to the United States all of the Carey Act lands states:

"Under the original appropriation it was planned to water a small strip of land under that segregation which lies on the south side of the Shoshone River by means of a flume crossing the river at a height of about 250 feet, which is entirely impracticable. We have an arrangement with some other parties who will take a ditch out themselves and who will irrigate this small strip of country on the south side."

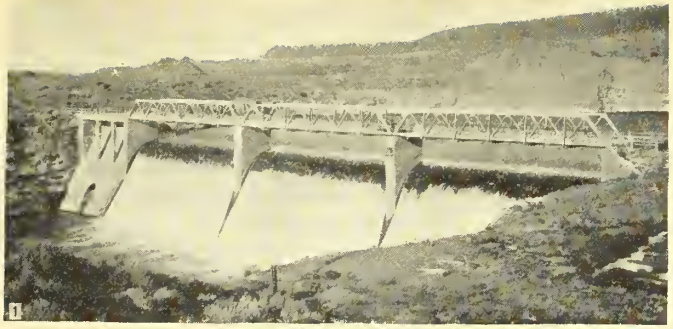
The "other parties" in question were the Mormon settlers that came into the valley about the time the project was initiated and did give serious consideration to the development of the south-side strip of land, but owing to the probability of legal complications they abandoned this area and located farther down the Shoshone River where the towns of Byron, Cowley, and Lovell were established. It was while the area was being considered by the Mormons that it was called the Willwood project, the name being given by Byron Sessions, one of the pioneer settlers of Wyoming, and coming from the name Willford Woodruff, one of the early leaders of the Mormon Church. It was Mr. Sessions's opinion that by using the first syllable of each word a better name was secured than using either name as it stood.

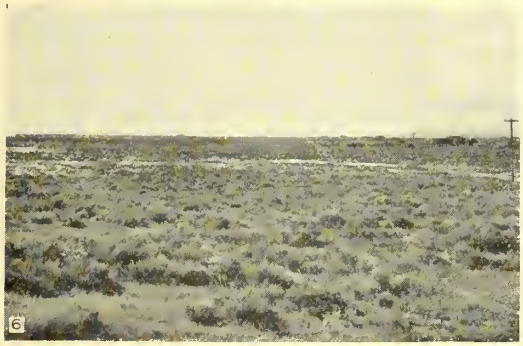
DAM AND CANAL COMPLETED

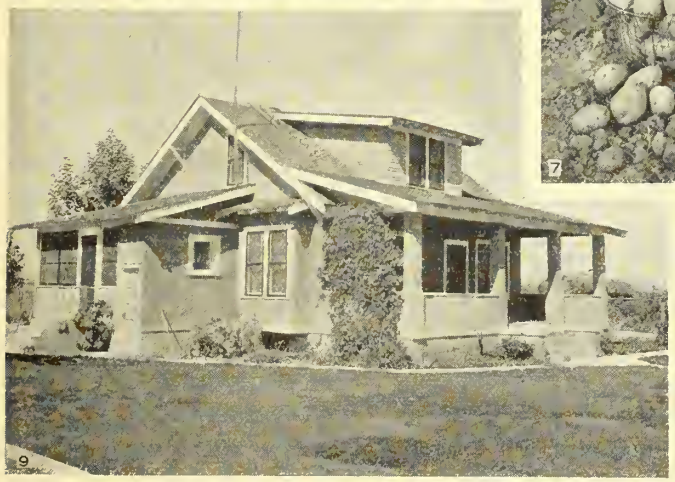
The lands embraced in the Willwood division were withdrawn under the provisions of the reclamation act in 1904 and at that time it became officially a portion of the Shoshone project. Preliminary investigations indicated that it might be possible to irrigate an area of about 25,000 acres although this estimate was very uncertain as canals had not been located nor had any soil investigations been made. Preliminary surveys were started in 1910 and continued in 1911. The chief problem connected with the Willwood division was the location of the first 4 miles of main canal and particularly whether to divert from the river with a low weir and an expensive canal along the sandstone bluffs paralleling the south side of the river or a relatively high dam that would make it possible to bring the canal quickly to ground surface at the westerly end of the irrigable area. Surveys and estimates carried on through 1918–19 resulted in a report recommending the construction of a diversion dam of about 45 feet high, located about 6 miles below the Corbett diversion dam. Construction work was started in 1922 and the dam and canal system completed so that the first lands were opened to entry June 1, 1927.

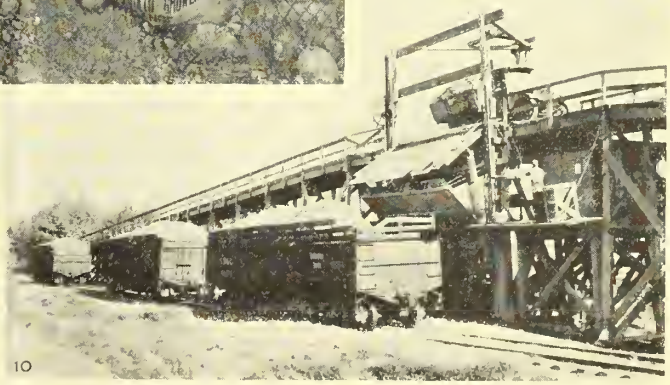
CLIMATE AND SOIL ADAPTED TO STAPLE CROPS

Most of the irrigable area of the Willwood division is located on nearly level terraces typical of the Big Horn Basin. The soil is either a sandy or a clay loam, usually covered with a growth of salt sage which is easily removed and the ground prepared for the production of crops with very little expense. The relatively shallow soils underlain with shale or gravel, which are located principally in the easterly portion of the division, have been eliminated and the net irrigable area has been reduced to about 12,000 acres. Climatic conditions and length of growing season are very favorable to the production of all staple crops. In all cases the principal farming operations should center around the









SCENES ON SHOSHONE FEDERAL IRRIGATION PROJECT

1, Willwood diversion dam; 2, outlet tunnel to Willwood Canal; 3, new home of a Willwood settler; 4, threshing Great Northern beans on a Willwood farm; 5, Holstein cattle on the Garland division; 6, desert land, Willwood division; 7, Bliss Triumph potatoes, Willwood division; 8, Shoshone Dam and power plant; 9, a modern farm home on the Garland division; 10, beet dump, Garland division.

production of hay and grain to be fed to livestock on the farm. Sugar beets, potatoes, and beans are the principal cash crops. The annual rainfall averages less than 6 inches and nothing can be grown without irrigation. Shoshone Reservoir, with a capacity of 456,000 acre-feet of water insures an ample supply of water. No town has been established on the division and all business is transacted at Powell, the principal town on the Garland division of the project, which is located on the north side of the river about 4 miles from the center of the Willwood division. Nearly all the lands of this division are in the Powell district where there are good consolidated schools and bus transportation.

CONSTRUCTION CHARGES PAYABLE IN 40 YEARS

The canal system has been constructed by the United States so that water is delivered to each farm unit. The lands have been classified and construction charges have been fixed against the different classes in accordance with their productivity and range from $69 to $125 per acre, payable in 40 years, without interest. These charges have been determined from actual extenditures and estimates to fully complete the canal system and provide a considerable fund for continuing drainage work. If it should develop, as the division nears completion, that the actual cost, including drainage, is less than the original estimate, the per acre construction charge for all lands on the division will be reduced to make the charges equal to the cost. Construction charges are not collected at present but when the settlement of the division has advanced sufficiently to warrant the formation of an irrigation district, a joint liability contract will be required calling for the payment of construction charges over a period of 40 years. At present water is being delivered on a rental basis at $1.25 per acre for each irrigable area, payable in advance.

FARMS NOW AVAILABLE HOW TO APPLY

Since the original opening in 1927 there have been three subsequent openings covering in all 140 farm units. Settlement has been proceeding at a reasonable rate and there are still a considerable number of excellent farms now available, and as the required 90-day period of preference right for ex-service men has passed the lands are open to all classes of citizens who can qualify as to capital, industry, experience, and character. The successful farms that have been developed on the Garland division of the Shoshone project and the good start that has been made on the Willwood are sufficient evidence to warrant anyone desiring to locate on a farm in the great Northwest to give serious consideration to the Willwood division. Full information relating to vacant farms and all other related matters can be obtained by writing to Mr. L. H. Mitchell, project superintendent, Powell, Wyo., or Mr. Val Kuska, colonization agent, Burlington Route, Omaha, Nebr. Descriptive literature and farm application blank may also be obtained by addressing the Commissioner, Bureau of Reclamation, Washington, D. C.

THIS year El Paso Electric Co. plans to improve its plant in El Paso and its service lines in the El Paso and Mesilla Valleys. Improvements made during the past two years have cost almost $7,000,000. This includes the power plant built up the valley. The proposed improvements are estimated at $260,000.—*The Earth.*

Alfalfa hay in shock near Nyssa, Oreg., Owyhee project

Owyhee Project Land Pleases Purchasers

The following statements from purchasers of irrigable land on the Owyhee project, Oregon-Idaho, are from a recent circular letter to the members of the Ontario Commercial Club, from its president, V. B. Staples:

"Dr. M. C. Barlow, Salt Lake City, Utah, who has purchased 200 acres under the Owyhee project, in reply to a prospective purchaser of land, wrote as follows:

"The soil in the Oregon country is very much like the soil of the upper Snake River Valley. The country has too little rainfall during the growing season to make dry farming profitable. I have made three trips to Ontario, and from what I have observed the crops and possibilities are equal to those stated in the folder sent out by the Ontario Commercial Club. It of course would take the better soils and better methods of tillage to equal the figures printed. My candid opinion is that the choice soils under the proposed irrigation project, and also those well-drained soils on the flat, have possibilities that have not yet been reached even in the Twin Falls tract; they will exceel Twin Falls in the production of hay, corn, early potatoes, onions, beans perhaps, dairying, apples and small fruits, but will never equal them in sugar beets, grain, and late potatoes. Every indication points to the Owyhee district becoming one of the outstanding projects of the Northwest. After having farmed several years in the upper Snake River Valley, several in the middle Snake River Valley, and several in Utah, I am convinced that the better lands of the Owyhee project have many advantages not possessed by any of these regions. Add to this the excellent weather conditions and you have a country the equal of which it is almost, if not entirely, impossible to find.'"

The following is a letter from Albert L. Pfeiler, Oxnard, Calif., one of the large Lima bean growers there, who has purchased 160 acres under the Owyhee project.

"Two years ago the California Lima Bean Growers Association called upon several hundred growers for actual production costs. The average of these reports revealed a production cost of $142.80 per acre. Fifty per cent of this amount, the figures indicated, was for taxes and interest on $1,000, per acre land. Having purchased land under your Owyhee project for the purpose of growing baby Lima beans, I also see other advantages beside the great difference in land values, viz: Mellow soil which lends itself to preparation with little effort. This

I consider a great point; also irrigation costs and taxes are much less. I have every reason to believe beans can be raised on your lands for not to exceed $50 per acre. Alfalfa production costs in California are $13 per ton with an average selling price of $16 per ton. I figure it will cost me $7 per ton against an average market price of $10 in your valley. This is a better deal as I will be able to produce an equal tonnage with only 3 cuttings while 6 cuttings, rakings, and irrigations are required in this State. Your system of pasturing and winter feeding has also a great fertilizing value to the land and together with your long-lived stands averaging about 8 years you have the alfalfa paradise."

Paul V. Maris, director of the extension service, of the Oregon Agricultural College, in a recent address at Corvallis, said:

"Our experiment station found that it costs the Williamette dairymen 12 cents per pound more to produce butterfat than it costs the dairymen of central and eastern Oregon. No region can successfully compete under such a handicap and it will take irrigation of our grass pastures and alfalfa hay to correct the situation."

Commenting on these statements Mr. Staples asserts that "with the advantages as above outlined this district has a future which is a capital asset to every business and professional man."

There are no public lands now available for entry on the Owyhee project, which comprises an area of 122,000 acres, 85,000 of which are in private ownership. It is expected that water will be available for the irrigation of the first unit of public land in 1934 and that additional areas of public land will come under irrigation annually thereafter. Progress of construction on the Owyhee Dam and tunnels is satisfactory and the work is going ahead according to schedule.

The Bureau of Reclamation does not recommend that settlers purchase privately owned land and attempt to farm it before water is available. Where this was done on older projects settlers were unable to make satisfactory returns by dry-farming methods while awaiting water for irrigation. Settlers may purchase the privately owned land in order to secure a particular location, but in doing this it should be definitely understood that water will not be available for irrigation for several years. They should be financially able to pay taxes and carry these lands without any returns from crops, because in this region the precipitation averages 11 inches per year, which is not sufficient to grow profitable crops without irrigation. Inquiries concerning opportunities to purchase land in private ownership should be addressed to the Vale-Owyhee Government Projects Land Settlement Association, Vale, Oreg.

Arizona's Prehistoric Canals in the Salt River Valley

Some of the most interesting reminders of the prehistoric race which tilled the desert soil of Arizona are found in what is now the famous Salt River Valley. These relics of an ancient civilization which have been described in an article for the United States Daily by Dr. Neil M. Judd, curator, division of archæology, of the National Museum, Washington, D. C., are the traces which still remain of some 300 miles of irrigation canals.

Doctor Judd states that these prehistoric canals were so accurately and efficiently constructed that portions of them, taken over by white settlers about 1870, are actually in use at the present time. Nowhere else in the New World has evidence been found of prehistoric irrigation systems comparable to those of central Arizona. Doctor Judd believes that they may even have surpassed, both in size and in the number of acres served, those famous systems of the Tigris and Euphrates Valleys, and every mile was literally dug by hand.

The prehistoric canal builders, with barefooted helpers instead of caterpillar tractors, with stone hoes instead of steam shovels, constructed canals comparable in size to those of to-day. Doctor Judd photographed one canal north of Mesa that stands to-day 66 feet wide and 8 feet deep. It led from the Salt River far across the valley, and as the river cut its channel below the canal bottom, the useless canal was replaced by another, connecting with a new intake farther upstream.

Modern irrigation canals and the industry they symbolize have done most to erase from central Arizona former vestiges of that native civilization which once prospered there. The sad ruins of aboriginal homes have been leveled with their neighboring fields. The canals which once watered those fields have been filled or scraped away. Where Indian farmers 800 or 1,000 years ago cultivated gardens of beans, maize, and squashes, vast acres of cotton, lettuce, and melons are now harvested. Attractive dwellings and sumptuous winter resorts with green lawns and flower-bordered walks have replaced the mud-walled habitations of the ancient folk.

Such is the Salt River project to-day. Despite the vast gulf which separates this thriving, developed, irrigated area from the ancient civilization, there can not help but be a kindred feeling between the prosperous irrigation farmer of to-day and the prehistoric folk who irrigated the same fields a thousand years ago.

SALT RIVER PROJECT, ARIZONA

Prehistoric canal, Mesa, Ariz., near heading of the Utah Canal

Simms High School on Sun River Project, Montana

By W. O. Zirnstein, Smith-Hughes Instructor

SMITH-HUGHES work or instruction in vocational agriculture started in Simms in the fall of 1923 with Carl Lindstrom as instructor. Since that time there have been occasional changes but for most part the teachers have held relatively long tenures of position.

Simms itself originated in 1907 when the reclamation work on the Sun River project began and although now a small town of 487 inhabitants, it is situated in one of the better agricultural centers of the valley which makes it an ideal location for a Smith-Hughes department. In fact students from Vaughn, 18 miles to the east, and from the Fairfield bench to the north are taking advantage of the organized bus system, the facilities of the new high-school building and the agricultural instruction.

From 33 to 38 were enrolled during the past school year which is 77 per cent of the boys enrolled in high school and 38 per cent of the total high-school enrollment. Courses for freshmen and sophomores included crops and soils and farm mechanics, while the juniors and seniors carried on individual and group work relative to the major problems on their home farms and in the community at large. The younger group will study animal husbandry and farm mechanics this coming school year and dairying and poultry will each be given one semester for the upper class men.

SCHOOL IMPROVEMENTS BY STUDENT BODY

A majority of the boys are members of the Simms chapter of the Future Farmers of America, a national organization of farm boys with local and State chapters in every State giving instructions in vocational agriculture. Through their class and extracurricular activities much good has been accomplished. Last fall the shop class remodeled one-half of the basement of the old high-school building into a very efficient laboratory. The work involved considerable planning, woodwork, concrete construction, plumbing and small building construction. The present office, agricultural classroom, and farm shop are all on the same floor, making an efficient and relatively easily supervised lay-out.

A tennis court was leveled and made ready to use by the future farmers and its hearty acceptance by the student body will likely cause another to be constructed this fall. Three "barnyard golf" courses have been set up to take care of some of the overflow from the tennis courts. Other playground equipment for the grade children, a baseball diamond, track facilities, and a basket ball floor provide a well-balanced recreational program.

> ***TITLES OF PHOTOGRAPHS ON OPPOSITE PAGE***
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> 1. Simms High School addition completed in August, 1930. The grounds have since been improved by the planting of a lawn.
> 2. S. S. Sutherland, associate professor of agricultural education, and J. B. Border, State supervisor of vocational agriculture in Montana. (Made the main speeches at the father and son banquet referred to in the article.)
> 3. Simms future farmers ready for a judging trip to nearby stock ranches.
> 4. Simms future farmers building a storm shelter for the runway into the farm shop.
> 5. Grant Cline, a freshman in agriculture, and his pure-bred Chester White sow and litter.

In the fall of 1930, a Future Farmers of America committee invited the neighboring Future Farmers of America of Choteau, Belt, and Cascade to participate in an interschool grain and stock judging contest. The Simms chapter took first prize, Choteau, second; Cascade, third; and Belt, fourth.

The next important event was the father and son banquet attended by 85 fathers, sons, and invited guests. S. S. Sutherland of the agricultural training department of Montana State College, and J. E. Border, State supervisor of vocational agriculture, made the main addresses. (See photographs.)

An agreement was made during the winter with the local agencies of national machinery companies to conduct from one to two day machinery schools in all institutions in northern Montana giving instruction in vocational agriculture. Local boys gleaned much information from the work, and it is hoped that further arrangements for expansion of these activities may be made in the future.

BEAUTIFICATION OF GROUNDS BY AGRICULTURAL STUDENTS

The advanced class in agriculture, composed of juniors and seniors, took as a class project the planning, preparing, and seeding of the four-fifths acre lawn lying in front of the new school building. When completed the school will be the outstanding beauty spot in town. A tree-filled park has already been started in the background and has made progress, thanks to the cooperation of the Bureau of Reclamation. Members of the class in farm mechanics rebuilt and repaired the surrounding fence so that stock will not molest the trees and lawn.

The Simms chapter was honored this spring by having two State farmers elected from its membership. Glendon Hanna was elected to the office of State reporter and Raleigh Barlow is to be nominated for the degree of American Farmer at the national meeting of the Future Farmers of America, which will be held at Kansas City in November of this year.

A vacation camp of three days in the mountains was established this summer and a project tour of the chapter's own projects will be undertaken. An attempt is being made to cooperate with near-by schools in carrying out these enterprises.

Other minor activities have been carried on during the past year and the boys feel that their time has been well spent in creative activity. With the prospects for a larger high school and departmental enrollment, larger goals will be set for the coming school year.

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SUN RIVER

PROJECT

MONTANA

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See titles on opposite page

The Importance and Fundamentals of Rural Community Organization[1]

By Miss Mae A. Schnurr, Assistant to the Commissioner

THE first three days of this week there was a conference at Chicago University attended by representatives of nearly every State in the Union. The purpose was to try to work out an economic policy for American agriculture. The significance of this is that the idea of every man for himself and each farmer giving no attention to the concerns of his neighbor, which dominated American rural life from the beginning of the Nation until the beginning of this century, had broken down. It does not begin to meet the situation created by the great combinations in other industries, and the removal of the workers from close contact with farmers into distant cities. This has made marketing a problem that did not at one time exist. It has made costs of transportation a great burden on the farmer, until what he receives from his products is only a small fraction of what the consumer pays. The farmer finds himself in the grip of forces whose power he understands but with which he finds himself, as an individual, wholly unable to cope.

Thinkers gathered at Chicago and here are trying to evolve a system of farming that will bring back to rural life the opportunities and attractions it is in danger of losing.

My thesis for the first thing is for the farmer to have for his first object the production of the greater part of the things that he and his family consume. That gets rid of the problems of markets and the cost of transportation. The second is that in the choice of money crops the farmer study, first, what his soil and climate will best produce and, second, where and how he can find a buyer for what he has to sell.

MANY THEORIES ADVANCED

Having the supply more nearly meet the demand is a problem to which every economic analyst is giving consideration. Many theories have been advanced to deal with this subject, and while we are theorizing, the situation becomes worse every day.

What is the answer? Some advocate an entirely different order of things is necessary, while others say certain relatively simple changes may save what we have and add what we lack to bring order out of chaos.

I believe organization is the answer. With it an orderly development will take place based on intelligent surveys of needs in advance of production.

ORGANIZATION PLUS LOYALTY

We have much to learn from the farmers of Scandinavian countries in the matter of organization and loyalty. There farmers go diligently about the business of farming. They elect the men capable of dealing with the subject of distribution of their products after they have raised them. They set up a high standard, hew to the line in maintaining it, and by the combination of organization and loyalty to organization have constant markets for their high-grade products.

[1] Address delivered before the annual meeting of the Georgia State Chamber of Commerce, at Tifton, Ga., September 11, 1931.

Photo by Geo. A. Beyer

Miss Schnurr boarding plane at Washington Airport for a 7-hour flight to Atlanta, Ga. The hostess of the plane, Miss Frost, appears on the lower step

AMERICAN FARMER INDIVIDUALIST

I have merely injected this reference to the farmers of Scandinavia to bring out the point that loyalty to organization is as vital as organization itself and it is found more or less lacking in the United States. The farmer has been an individualist so long that even the knowledge that he had had a hand in the selection of advisers in the election of officers of the farmer organizations does not prevent him from believing that his individual thought might with advantage be worked out individually in dealing with the distribution problem.

Good farming depends on the combination of willingness to work, education as to the best methods to obtain good results, and sufficient capital to get started. Willingness to work alone does not make a good farmer. We have learned this in Federal reclamation by sad experience.

In many sections agriculture is the backbone of the community. It is important that an individual interest be taken in each farm of that community so that each unit will be self-supporting. A community can be no stronger than its supporting industry.

FARM OWNERSHIP URGED

Tenant farming is not the answer. An owner on every farm is. Any effort to bring about the ideal of an owner on every farm is commendable and is bound to result in the upbuilding of any community. An owner is not going to grow crops year after year that will rob the fertility of his soil, without replacing it. An owner will not permit his place to become run down. His home, outbuildings, fences, and working equipment, will be kept in good order because these are his assets.

A tenant on a farm, like a tenant in a house, looks to immediate gain or saving for himself. He leaves to the owner the worry of income on his investment, or increment in the value of his property. However, tenancy is recognized as a very essential step to home ownership, that is, where tenancy is undertaken with ownership as a goal.

FEWER TENANTS

The low prices for products, and the compulsion of extreme parsimony, have had the effect of decreasing the number of farm tenants, the owners having to take over the operation of their farms with the exodus of the tenant to the cities when his labors were not rewarded by a ready sale for the products raised, or an income from the same that would afford a living.

In Federal reclamation, in the past few years, there has been an increase in the percentage of irrigated farms operated by owners and a very gratifying increase in applications for farm units as these are made available for settlement.

On an opening of 24 farm units in the fall of 1930 there were 160 qualified applicants, that is, men who had at least $2,000 in capital or its equivalent in farm equipment, and two years' farming experience, the minimum requirements under our regulations. Three were some applicants in this group with capital from $5,000 to $10,000.

This is the experience on just one opening. Others are similar and show a decided back-to-the-farm movement. This may be attributable to several causes. It is thought fewer opportunities in the cities and a struggle with lack of capital to furnish the necessities of life create a desire to get on the land and grow the things that are necessary for every-day consumption of the family. With the individual needs of families taken care of in this manner, combined with an intelligent survey of other requirements undertaken by a combination of effort of community, State, and national organizations, the acute question of supply and demand would be adjusted.

ASSISTANCE TO FARM OWNERSHIP NEEDED

Many disappointments might be avoided and more farms be placed on a paying basis if assistance to farm ownership could be extended by some organized group. Such a plan was proposed for the Southern States by bills introduced in Congress during the last few years. Nothing, however, came of them so far as the enactment of legislation or the appropriation of necessary funds were concerned but I have no doubt that eventually some plan must be put in operation.

So many farms have been taken out of cultivation in the South that only a program of forestation and rehabilitation of farms on a diversified farming basis can bring back satisfactory economic conditions. By that I mean, part of the land planted to young trees would help the maintenance of the watershed and create an asset for posterity. The creation of farms in organized rural communities would bring back the establishment of economic independence, go far toward the stabilization of farm prices and income, benefit the State and national governments by creating taxable values, and also create demands for the products of the cities.

The average person does not realize that the success of the farmer means so much to the success of many industries in the cities. As a matter of fact, the operations of the Federal reclamation policy alone have created, or are helping to maintain, 214 cities and towns on the projects throughout the arid and semiarid regions of the West, and provide a market for countless products manufactured in scores of cities in the industrial East and Middle West.

VOCATIONAL AGRICULTURAL TRAINING

That the South is rural-minded is evidenced by the interest taken in the establishment and maintenance of vocational agricultural schools. One doesn't seek knowledge in a profession not to one's liking. The early farmers of the South may not have had the opportunity for institutional training along agricultural lines, but the present-day youth of the South, recognizing the opportunity for improvement in methods, and its advantages in contrast to urban activities, is taking advantage of the opportunities of education as evidenced by continued increase in enrollment in the various agricultural schools.

There could be no more opportune time than the present for a back-to-the-farm movement in the South. It may be initiated by making small tracts of land available and on such terms that the farmer may pay as he goes. In addition to establishing a home, he will, with the proper guidance, grow the things he needs for every-day consumption. In this position he can afford to wait for better prices, organization, and other factors that mean stabilization of agriculture.

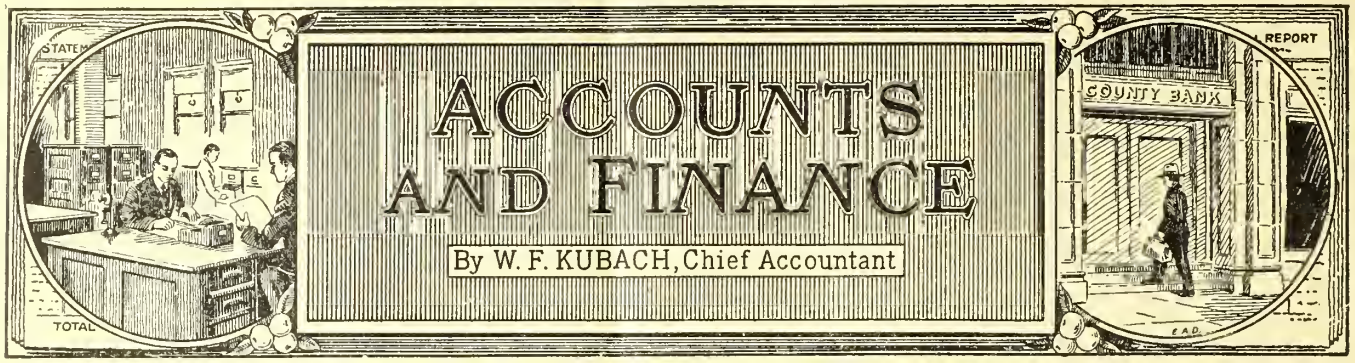
A source of credit for the farmer is necessary if he is to succeed, and this should be at a rate of interest agriculture can pay.

Organization of a community will bring with it a community bank which should be owned and operated by the people. Other community activities should follow as the necessity develops.

You don't have to go outside of these Southern States for your leadership and authority on rural community organization. I know a number of your men who are outstanding authorities on the subject. It has been my pleasure to work with them.

Solution of the problems under discussion here is not accomplished by devising a plan alone but by putting one into operation. Therefore, I hope this meeting will not adjourn without providing ways and means for carrying out some of the splendid suggestions proposed.

It is a privilege to work with people who are as earnest and inspiring in their efforts as the people of the South with whom I have come in contact. Their earnestness has been contagious, and we have developed an interest in all of the things you want to accomplish. My visit here is designed to show that interest and lend what encouragement I can to spur you on to your goal. If I have accomplished this, the trip is very worth while.



Construction Repayments in 1931 Greater Than in 1930

CONSTRUCTION collections during the fiscal year 1931 amounted to $4,337,611.14, an increase of $1,266,863.71 as compared with the fiscal year 1930.

Repayments of operation and maintenance charges amounted to $1,327,053.28, a decrease of $199,575.96 as compared with 1930. However, this reduction is due mainly to the general lowering of operation and maintenance costs, as the total delinquency as of June 30, 1931, is only $29,515.78 greater than it was for the same date in 1930. Total payments for the fiscal year amounted to $7,409,723.84 and disclose a substantial increase over the fiscal year 1930 of $1,396,051.57.

By reference to the accompanying table, it is gratifying to note that there are 4 projects in the 100 per cent class, 6 projects with an average of 99.5 per cent, 3 projects averaging 98.9 per cent, 6 projects in the class of 95 to 98 per cent, 2 in the class of 90 to 95 per cent, and only 3 projects below 90 per cent. The projects as a whole produce a splendid average of 97.3 per cent or a delinquency of only 2.7 per cent.

A dairy herd on the Boise project, Idaho

STATUS OF CONSTRUCTION ACCOUNT REPAYMENTS, JUNE 30 1931

State and project		Construction account June 30, 1931, repayable	Value of repayment contracts	Amounts of repayment contract due on June 30, 1931	Balance of repayment contract deferred (not due)	Amounts paid on amounts due	Amounts uncollected of amounts due	Per cent repaid of amounts due
Arizona	Salt River	$10,166,021.97	$10,166,021.97	$7,116,215.41	$3,049,806.56	$7,116,215.41		100.0
Arizona-California	Yuma	9,522,400.20	5,076,280.21	3,823,790.30	1,252,489.91	3,666,166.98	$157,623.32	95.9
California	Orland	2,360,182.35	2,474,446.35	765,670.19	1,708,776.16	738,270.73	27,399.46	96.4
Colorado	Grand Valley	4,063,863.81	4,074,584.11	160,219.93	3,914,364.18	127,777.49	32,442.44	79.8
Do	Uncompahgre	5,466,485.80	5,509,945.06	826,817.82	4,683,127.24	490,685.27	336,132.55	59.3
Idaho	Boise	17,130,069.86	14,698,000.12	3,785,423.60	10,912,576.52	3,780,051.42	5,372.18	99.9
Do	King Hill	1,490,389.98	1,490,389.98	42,550.00	1,447,839.98		42,550.00	
Do	Minidoka	13,831,815.03	11,617,814.78	7,156,286.83	4,461,527.95	7,098,248.91	58,037.92	99.2
Do	Minidoka-Gooding	3,724,518.48	5,279,580.36	279,580.36	5,000,000.00	279,580.36		100.0
Montana	Huntley	1,859,806.88	1,823,830.64	541,384.49	1,282,446.15	541,028.02	356.47	99.9
Do	Milk River	5,339,890.40	5,012,010.00	3,002.76	5,009,007.24	3,002.76		100.0
Do	Sun River	7,431,705.54	10,012,509.02	202,155.58	9,810,353.44	201,359.98	795.60	99.6
Montana-North Dakota	Lower Yellowstone	4,151,523.20	4,125,999.25	284,011.51	3,841,987.74	280,209.13	3,802.38	98.7
Nebraska-Wyoming	North Platte	20,962,667.01	22,214,537.26	3,031,365.03	19,183,172.23	2,965,095.66	66,269.37	97.8
Nevada	Newlands	3,484,999.52	3,260,278.05	1,051,838.03	2,208,440.02	1,049,061.73	2,776.30	99.7
New Mexico	Carlsbad	1,420,485.11	1,425,182.75	920,241.63	504,941.12	877,512.98	42,728.65	95.4
New Mexico-Texas	Rio Grande	12,946,755.90	13,639,075.00	2,952,801.00	10,686,274.00	2,913,724.15	39,076.85	98.7
Oregon	Baker	66,598.04						
Do	Umatilla	4,395,345.74	3,818,252.93	482,424.85	3,335,828.08	397,376.11	85,048.74	82.5
Do	Vale	3,292,227.20	4,500,000.00		4,500,000.00			
Oregon-California	Klamath	5,659,049.95	4,083,726.52	1,135,262.62	2,948,463.90	1,061,845.84	73,416.78	93.5
Oregon-Idaho	Owyhee	6,468,636.36	18,000,000.00		18,000,000.00			
South Dakota	Belle Fourche	4,663,751.02	5,404,739.77	644,628.27	4,760,111.50	644,628.27		100.0
Utah	Salt Lake Basin	2,748,434.01	3,000,000.00		3,000,000.00			
Do	Strawberry Valley	3,342,028.55	3,342,028.55	1,210,445.91	2,131,582.64	1,197,447.01	12,998.90	98.9
Washington	Okanogan	424,198.97	424,198.97	141,217.39	282,981.58	131,217.39	10,000.00	92.9
Do	Yakima	14,175,974.18	12,392,304.68	6,534,503.60	5,857,801.08	6,331,526.64	202,976.96	96.9
Do	Yakima-Kittitas	8,011,420.44	9,000,000.00		9,000,000.00			
Wyoming	Riverton	3,901,054.12	5,037,970.52		5,037,970.52			
Do	Shoshone	8,549,666.08	5,587,782.96	822,174.57	4,765,608.39	821,521.76	652.81	99.9
Total		191,051,965.70	196,491,489.81	43,914,011.68	152,577,478.13	42,713,554.00	1,200,457.68	97.3

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Activities in Boulder City

(Continued from p. 216)

bachelor employees. A 10-foot porch will extend the entire 125 feet of frontage of the building.

The municipal building will be a 1-story L-shaped building, with a basement under part of the main portion of the L. It will be located on lots 12, 13, 14, and 15, block 21, facing Arizona Street. The main portion of the building will be 40 by 107 feet in size and will be used for city administration purposes. The main floor, 42 by 81½ feet in size, will be used by the post office, and the basement for jail and heating plant purposes. On the main floor, besides the post office, there will be a court room and quarters for the United States marshal, city clerk, city engineer, and city manager.

Agricultural colleges in the Southwest have for several years stressed the importance of a farm program calling for several sources of income, with the result that the "single cropper" is rapidly disappearing. In the 1930 depression farmers who practiced diversification suffered less than those who depended upon one crop—wheat or cotton, for instance—and those who kept milk cows, hogs, and poultry as a rule made some money. Indications point to a more general diversification this year than ever before.—*The Earth.*

FRESNO County in the San Joaquin Valley, Calif., with 600,000 acres, has more irrigated land than any county in the United States. The county produces 60 per cent of America's raisins, 27 per cent of the grapes, 32 per cent of the figs, and 10 per cent of all the peaches.

Gannett Glacier, Reservoir Riverton Project, Wyoming

This year when streams in all parts of the arid region were lower than ever before because of the heat of this summer and the light snowfall of last winter, Wind River, from which the Riverton project draws its water, was a notable exception. The flow of this stream the latter part of the summer was above the average, and that was because of the fact that the late water supply of this river comes largely from the Gannett and Dinwoody Glaciers. The hotter the summer the more water comes from the melting snow. This year the stream flow from the Gannett Glacier late in August would swim a horse.

A reproduction of the photograph of Gannett Glacier appears on the front cover page.

Death of William H. Wattis

William H. Wattis, president of Six Companies (Inc.), which is building Hoover Dam, died of cancer in San Francisco on September 13, at the age of 72 years.

A close personal friend of Doctor Mead for the past 40 years, with whom he was intimately associated while the commissioner was State engineer of Wyoming, Mr. Wattis had served in an engineering and executive capacity in many important assignments, including the presidency of the Utah Construction Co. and the Utah-Idaho Sugar Co.

Funeral services were held at the Masonic Temple in Ogden, Utah, on September 18. E. O. Larson, in charge of the Salt Lake Basin investigations with headquarters at Salt Lake City, attended as the personal representative of Doctor Mead and the Bureau of Reclamation.

Colorado River Board to meet October 21

On October 21 the Colorado River Board will hold a meeting at Nyssa, Oreg., where they will spend two days looking over the various tests that are being made at Owyhee Dam. After leaving Nyssa the members of the board will go to Las Vegas and spend three days in an inspection of Hoover dam site and vicinity, thence to Montrose, Colo., where they will spend a day witnessing the model tests of Hoover Dam spillways, and from Montrose to Denver, where they will spend several days, including one day at Fort Collins, Colo., to witness the model tests at that point.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, attended the round-table discussion on an economic policy for agriculture in Chicago, September 7, 8, and 9. The personnel of the conference included 10 Government specialists, representatives of outstanding agricultural colleges and universities, editors of farm magazines, representatives of research sections of large plants manufacturing farm equipment, economists, and others.

On August 24, Doctor Mead was appointed by Gov. James Rolph, jr., of California, a member of an honorary advisory committee to assist the California Water Resources Commission, which is engaged in a study of economic phases and proposed legislation which may be necessary to effect a coordinated plan for the development of the water resources of the State.

R. F. Walter, chief engineer; Charles A. Dobbel, executive assistant to the Secretary of the Interior; F. J. Bailey, Assistant Director of the Bureau of the Budget; Representatives Frank Murphy, of Ohio, Robert Luce, of Massachusetts, Edward T. Taylor, of Colorado, Addison T. Smith, of Idaho, and Vincent Carter, of Wyoming; Senators John B. Kendrick and Robert D. Carey, of Wyoming; W. A. Duvall, clerk of the Appropriations Committee; Gov. A. M. Clark of Wyoming; John A. Whiting, State engineer of Wyoming; and C. M. Cox, State land commissioner of Wyoming, representing a portion of the subcommittee of the House Appropriations Committee, visited the Riverton project, and members of this delegation also visited the Cle Elum dam site on the Yakima project, the Owyhee Dam on the Owyhee project, and the Vale and Minidoka projects.

R. F. Walter, chief engineer, held a recent conference at Spokane, Wash., with H. W. Bashore on the Rathdrum and Burbank investigations, subsequently accompanying the subcommittee of the House Appropriations Committee over several of the reclamation projects, national parks, and Indian reservations.

Porter W. Dent, Assistant Commissioner, left Washington on September 25 for Boise, where a conference was held with Congressman Burton L. French, of Idaho, and representatives of the Emmett, Gem, and Lake irrigation districts relative to water rights and power charges on the Boise and Owyhee projects.

R. B. Williams, construction engineer of the Kittitas division of the Yakima project, has been appointed chief of the engineering division of the Washington office to succeed Charles A. Bissell, who resigned some months ago to accept a position with the Metropolitan Water District at Los Angeles. Mr. Williams expected to enter on his new duties on October 1, but his arrival will be delayed owing to a recent break in the Yakima River Tunnel.

E. B. Debler, hydrographic engineer of the Denver office, arrived in Washington on September 8, for a conference with the commissioner, the assistant commissioner, and representatives from Imperial Valley on the proposed All-American canal.

An unusual coincidence occurred on September 8 when the Washington office was visited by its three former executive heads, F. H. Newell, the first director, who held the office from March 9, 1907, to December 9, 1914, and is now a consulting engineer residing in Washington; A. P. Davis, his successor from December 10, 1914, to June 19, 1923, who was on his return to California after a two years' assignment as chief engineer for irrigation development for the Soviet Government with headquarters at Glavklopkom, Tashkent, Union of Socialist Soviet Republics; and D. W. Davis, former Governor of Idaho, who was chief of the bureau from June 20, 1923, to April 2, 1924, and now resides in the Capital City.

Among the recent visitors to the Milk River project were the Hon. J. E. Erickson, Governor of Montana; J. C. Taylor, State director of extension work; Hon. Arthur M. Hyde, Secretary of Agriculture; Prof. M. L. Wilson, department of agricultural economics, Montana State College; and Ralph Budd, president Great Northern Railway.

R. F. Walter, chief engineer, and L. N. McClellan, electrical engineer, arrived in the Washington office on September 21 to consider various administrative and budget matters, including the relief of unemployment through reclamation construction work.

Roy R. Gill, of the Columbia Basin League, arrived in Washington on September 21 for a conference with the Commissioner regarding the Columbia Basin Project.

Senator Wesley L. Jones called at the Yakima project office on two occasions for the purpose of discussing a settlement of the controversy between the State of Washington and the Bureau of Reclamation over the issuance of permits to appropriate public waters of the State for the various divisions of the project.

William F. Kubach, chief accountant, returned to the Washington office on September 14, having made an official visit to the Bitter Root and Milk River projects.

S. O. Harper, assistant chief engineer, recently made a general inspection trip, including the Minidoka, Vale, Baker, and Klamath projects.

J. L. Savage, chief designing engineer, spent several days on the Belle Fourche project during which he inspected the slide on the face of Belle Fourche Dam and considered plans for repairing the damage. Later he went to Ellensburg, Wash., to assist R. B. Williams in the matter of repairs to the Yakima pressure tunnel.

Fred Tolman, assistant commissioner of the Idaho State Department of Reclamation, made an inspection of the American Falls Dam on the Minidoka project in connection with final proof on storage permits.

L. N. McClellan, chief electrical engineer, spent some time in Boulder City supervising the final installation and placing in operation of machinery for pumping water to Boulder City. He then went to Los Angeles to confer with the Southern California Edison Co. and the city of Los Angeles relative to the Hoover power plant machinery.

On September 23 W. A. Bechtel, first vice president of the Six Companies (Inc.) was elected president to succeed Mr. Wattis.

H. W. Johnson, chief clerk of the Sun River project, has been transferred to the same position on the Riverton project.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
R. B. Williams, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, 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, 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	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.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr		F. P. Greene	do	Do.
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.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	Wm. J. Burke	Billings, Mont.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	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. Stontemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	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.
Salt Lake Basin (Echo)	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	Wm. J. Burke	Billings, Mont.
Yakima	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	J. R. Alexander	Las Vegas, Nev.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr		do	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kennewick	Yakima, Wash	John S. Moore				do	Do.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. Eng	Ronald E. Rudolph	C. J. Ralston	B. E. Stontemyer	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	H. W. Johnson	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [6]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	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] Storage, Main, and Tule Lake divisions.
[6] 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.
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. Tont	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.
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	Gosben 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	R. S. Hopkins	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	Sydney I. Hooker	do	Edw. T. Hill	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.
Ratbdrum Prairie, Idaho	Spokane, Wash	H. W. Bashore	None.

SALLIE A. B. COE, *Editor.*

IRRIGATING POTATOES, DUTCH FLATS, NORTH PLATTE PROJECT, NEBRASKA-WYOMING

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22, NO. 11 NOVEMBER, 1931

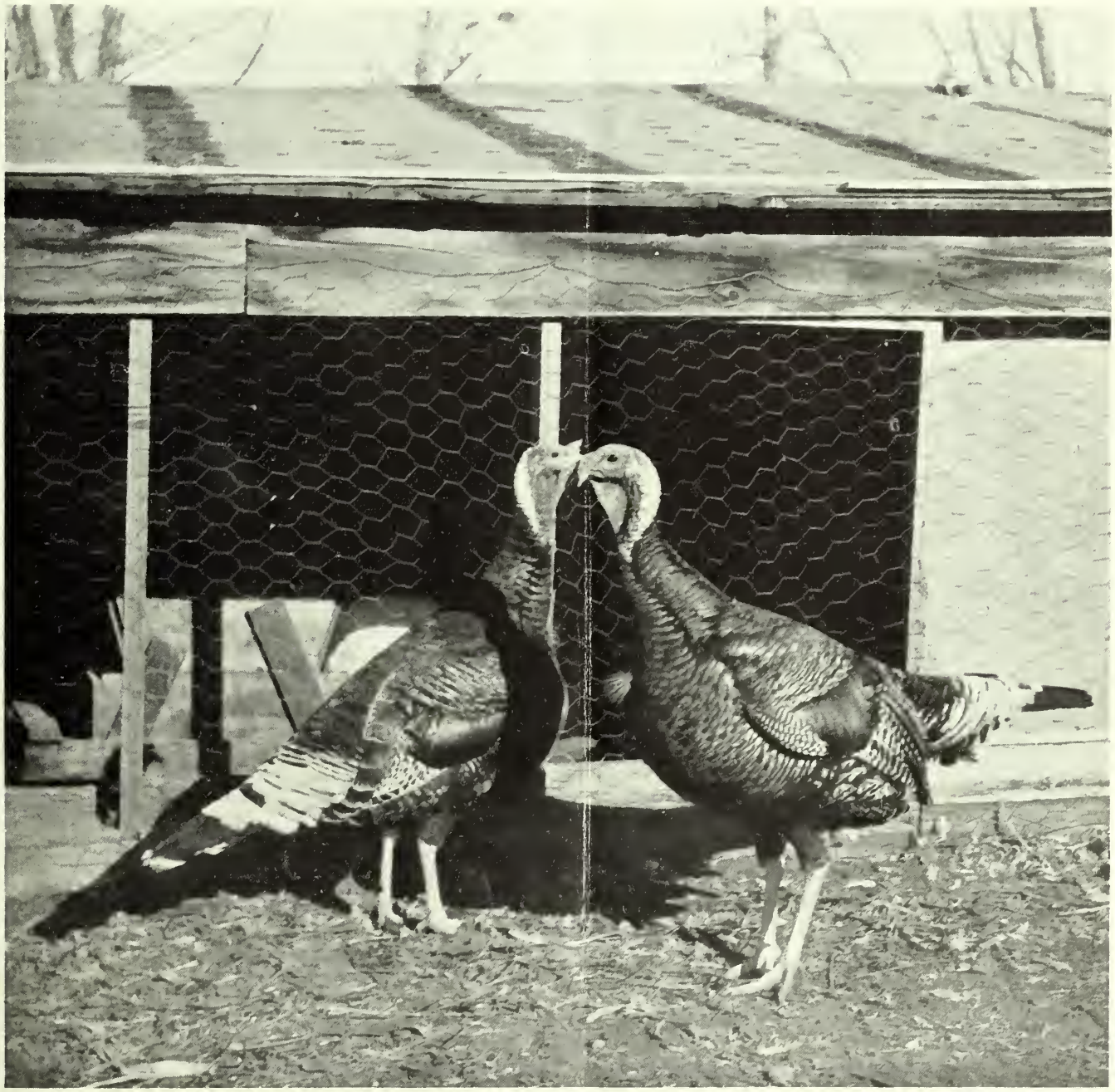


Photo by H. C. Stetson

PRIZE TURKEYS FOR THANKSGIVING FEAST

PRIZE TURKEY TOMS, WEIGHT 38 AND 46 POUNDS. RAISED ON FARM OF ROY SURBER, INTERSTATE DIVISION, NORTH PLATTE PROJECT, NEBRASKA-WYOMING

AMERICAN RED CROSS OBSERVES GOLDEN ANNIVERSARY

THE Fiftieth Anniversary Roll Call of the American Red Cross will open on Armistice Day, November 11, and will extend through Thanksgiving, November 26. Individual membership makes the society's program possible. Between the Roll Call dates every one will be invited to take out an annual membership.

Restoration of morale and of normal living habits in disaster-stricken areas is as important as the actual relief of human suffering. It is upon this theory that the American Red Cross works in calamities, such as floods, earthquakes, tornadoes, and drought. Its relief programs include more than relieving the plight of sufferers on a temporary basis.

Working to prevent a repetition of suffering, the Red Cross plans its tasks along lines of permanency. In floods, fires, storms, and like disasters which render many victims homeless, the relief agency helps in whatever rebuilding program is necessary, nurses the injured, fights possible outbreaks of disease, distributes garden seed if necessary, and proceeds in accordance with policies designed to restore the victims to their feet. Thus are speeded up the recoveries of stricken communities.

When your contribution is solicited respond promptly and heartily. Help this great national organization in its efforts to alleviate suffering humanity and reestablish normal conditions in calamity-stricken areas.

JOIN THE AMERICAN RED CROSS

NEW 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. 22, No. 11 NOVEMBER, 1931

Interesting High Lights on the Federal Reclamation Projects

BECAUSE of cooler weather and better living accommodations, working conditions on the Boulder Canyon project have definitely improved, and as a result there is less unrest and discontent among the men and a more efficient cooperation between employers and employees with a reduction in labor turnover.

PLANS for the new $190,000 Federal building at Yuma, Ariz., Yuma project, are nearing completion. The construction of this building is expected to start during the coming winter. Provision has been made for Reclamation offices in this building. The All-American Canal staff will probably also be located there.

WORK is nearly complete on the 6.5 miles of new 20-foot bitulithic Federal-aid highway through the Reservation division of the Yuma project. This is a part of the southern transcontinental highway which passes through Yuma and crosses the Colorado River at this point.

ON THE Sun River project inquiries continue to come in from prospective settlers. At the expiration of the 90-day soldier preference period 21 farm units of the 87 recently opened to entry were available to the general public. On that date 25 applications for farms were received and several were filed later. A number of applicants are on the waiting list and in the event that some of the successful applicants fail to complete their filings, it is believed there will be no difficulty in disposing of the entire tract opened.

A 95-ACRE farm near Deelo, Minidoka project, was recently exchanged for improved property in Rupert. A highly improved 20-acre tract near Rupert sold for $4,650, and a small 2½-acre tract adjoining the same town brought $1,050. The small tract was also improved.

90 Public Land Farm Units Opened to Entry

Orders have been issued by the Secretary of the Interior opening to entry on November 9, 67 public land farm units on the Tule Lake division of the Klamath project, Oregon-California, and on November 19, 23 public land farm units on the Gravity division of the Minidoka project, Idaho. Six of the units on the Gravity division are 20 acres or less in irrigable area and are designated as "Farm Labor Allotments."

For the period of 90 days after the date set for each opening only ex-service men are eligible to apply for the units. After the 90-day preference period, any remaining unentered farm units may be applied for by the general public. Each applicant, including ex-service men, must have at least $2,000 in cash ($500 in the case of farm labor allotments) or equivalent assets, such as farming implements, livestock, etc., deemed by the examining board to be as useful to him 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., the Superintendent, Bureau of Reclamation, Klamath Falls, Oreg., or the Superintendent, Bureau of Reclamation, Burley, Idaho.

ON THE Okanogan project apple prices have been fair. Selling organizations are quoting $1 on extra fancy Jonathans and $1.40 on extra fancy Delicious, f. o. b. cars.

THERE has been considerable development this fall in the town of Tulelake, Calif., Klamath project, which is now a town of 52 people. The Siskiyou Tractor & Implement Co. completed the construction of a grain warehouse 56 by 200 feet (equipped with the latest type of grain-handling and weighing equipment), at a cost of $12,000. The D. W. Ferguson Co. has also completed a grain warehouse 50 by 150 feet and a 50 by 50 foot hay warehouse at an expenditure of $10,000, and is now constructing a potato storage plant with a capacity of about 40 carloads.

AT THE close of September the contract for the Owyhee dam, Owyhee project, was 84 per cent completed.

THE Black Hills Beet Growers Association has been organized on the Belle Fourche project with Jesse Greers, of Vale, as president and W. D. Buchholz, of Newell, as secretary. The immediate purpose of the organization is to fix local hauling rates and to cooperate with sheep feeders in promoting the beet and feeding industry.

MARKETING on the Belle Fourche project this season concerns principally sheep, dairy products, sugar beets, potatoes, and pickles. Butterfat has made a good advance and is now up to 27 cents. Potatoes are a profitable cash crop this fall at an average price of $1.25 per hundredweight, and sugar beets at $5.50 per ton will bring in good returns as compared with other farm products.

THE sugar-beet harvest on the Belle Fourche project started on September 30 and the factory began operations on October 3 on what was expected to be a 70-day run. Although the crop will fall below that of last year in cash returns, the gross income to project farmers from this source should be about $400,000.

Policies with Respect to Reservoirs [1]

By Dr. Elwood Mead, Commissioner, Bureau of Reclamation

EXPANSION OF IRRIGATED AREA DEPENDS ON STORAGE

THE growth of the arid West involves an increasing use of water and a greater demand on streams to supply it. It is needed for farms, for cities, and for factories, and that increase in need will continue until the West ceases to grow.

So far as irrigation is concerned we have about reached the limit of dependence on the natural flow of streams. More water means more storage. It is not surprising, therefore, that the demand on the Reclamation Bureau for the construction of storages is far greater than ever before, and that is not a temporary demand. It is destined to grow in intensity for many years. It has been accentuated during the last five years by a diminishing supply. In nearly all the arid region there was either a drought or serious shortage during the past two years. The total yearly run-off of streams was sufficient to meet needs if the floods had been held back until they were needed, but to do that required reservoirs, and the reservoirs have not yet been built.

We have an illustration of this need in the Laramie River in Wyoming where at present there are no storages, but where 200,000 acres depend on the natural flow of the river for irrigation and domestic uses. Early in the season both the main Laramie and the Little Laramie had more water than was needed, but in September, the Little Laramie was entirely dry and the main stream carried only 4 cubic-feet of water a second.

The Colorado, which is one of the most important rivers of the arid region, is as yet unregulated. Throughout its entire watershed, which embraces parts of seven States, there are no reservoirs of consequence. What is the result? In the early part of this year enough water ran to waste to more than meet all requirements, but in September the flow of the river available for the Imperial Valley dropped to 300 cubic feet a second, which is about one-tenth of the water needed to protect the crops in the United States, to say nothing of Mexico.

I have said that water is needed for cities, for factories, and for farms. The needs of cities and of factories for water can be supplied by the local agencies. Cities can impose taxes on people able to pay them. The revenues from power make the building and operating of power plants a favorite investment for capital, but it is otherwise with the reclamation reservoir. In the case of reservoirs built to irrigate raw land it takes a long time to put the land in condition to use the water, the returns in the early years are small, and the capital of the irrigator is still smaller. Payments sufficient to meet interest on the investment and pay off the principal in a lifetime are not possible without imposing burdens on the settler which ordinarily he can not meet or ought not to be asked to assume. Reservoirs to irrigate highly improved land stand in a more favorable financial position, but even there experience has shown that while payment of the principal can be relied on, payment of interest would be an economic burden that the irrigator can not meet.

FINANCING IRRIGATION RESERVOIRS

The building of these reservoirs involves, therefore, a subsidy in the payment of interest. It means the investment of a large amount of money with a small direct return. The justification lies in the stability that it gives to agriculture, the increased population which it supports, the taxable values it creates, and the ability to grow high-priced crops.

What is needed, therefore, is some added source of revenue that will contribute to the reclamation fund and enable development in the future to more nearly keep pace with the demands for reclamation works. That source of revenue is to be found in the development of the power possibilities of reclamation projects, and especially those projects which have coupled with them the regulation of the water supply through storage. At first power as a feature of irrigation development was not regarded seriously because the demands for power were small and uncertain, but in recent years the returns from power plants built as adjuncts to irrigation works have been large and they are constantly growing.

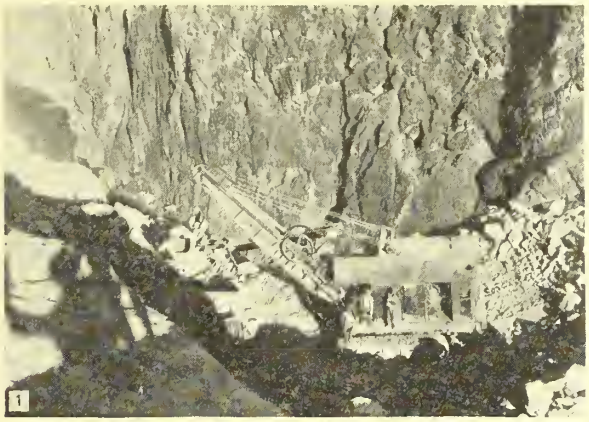
The first power plants were turned over to the water users, like the drag lines and other features of construction no longer needed. But for the last five years it has been evident that we need a new policy for the operation of power plants which are a part of irrigation works and the disposal of power revenues. The new policy is that the revenues from power plants shall be used to supplement the payments of the irrigators until the entire first cost of the works is returned. After that the power revenues should go into the reclamation fund as the leases from oil lands now go into it, and be used for the construction of additional works.

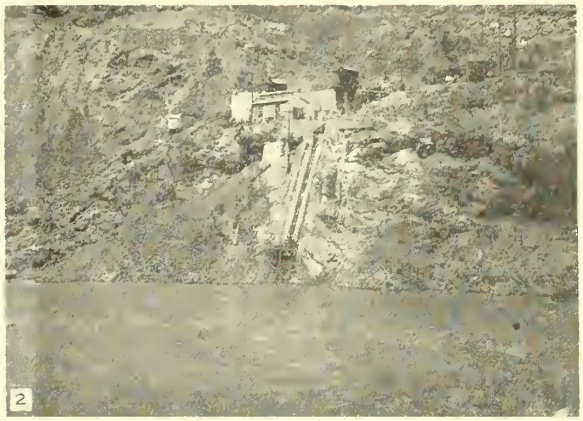
I have no objection to those revenues being applied within the State or the drainage area where the power is developed, but I regard the plan of some of the older works, of turning over the power revenues as a perpetual gratuity to the water users on the project as a gross misuse of Government generosity. We have power plants which were built entirely with Government money, where the annual revenues are now practically repaying the entire yearly construction charges. We have others where they are paying a large part of it, and when the works are fully paid for, then a development, for which the irrigator has paid nothing, and in some cases has not even agreed to pay anything, will be operated for the exclusive benefit of the water users and the profits paid to them as dividends in perpetuity. That money is needed to build new works and to turn those plants with their profits over to the people on the project who have been helped in paying for their water rights by the power revenues is a gift which can not be defended as sound public policy.

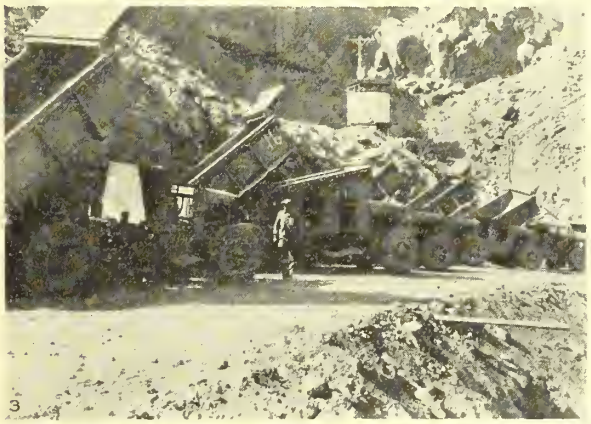
Up to 1925, all power revenues on a project were treated as the perpetual possession of the water users on that project. Since that time the bureau and the Appropriations Committees in Congress have been seeking to incorporate a doctrine of using these revenues, first to pay for the power plant, next to help pay for the project, and after that to go into the reclamation fund. In pursuance of that policy, the Deadwood Reservoir is being built without any part of its cost being imposed on irrigators. The Kennewick Reservoir is being built on the same principle. The contracts for repayment on the Shoshone project do not include the power plant and it is being operated by the Government and the revenues disposed of as above outlined.

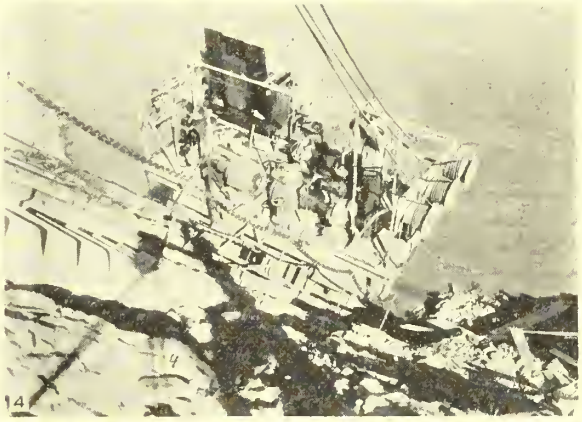
The plans for the Boulder Canyon project are in accordance with the above principles with the exception that payments from power are to be made to Nevada and Arizona in lieu of revenues they would receive from taxation. The ultimate disposal of these revenues after the works have been paid for is left in doubt, but it is my conviction that when the time comes to dispose of them we will have so grown in wisdom that they will be made available

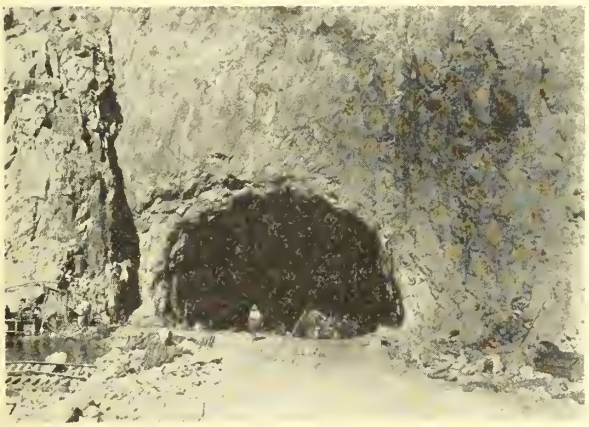
[1] Paper presented at meeting of the Association of Western State Engineers, Sacramento, Calif., Oct. 28-31, 1931.

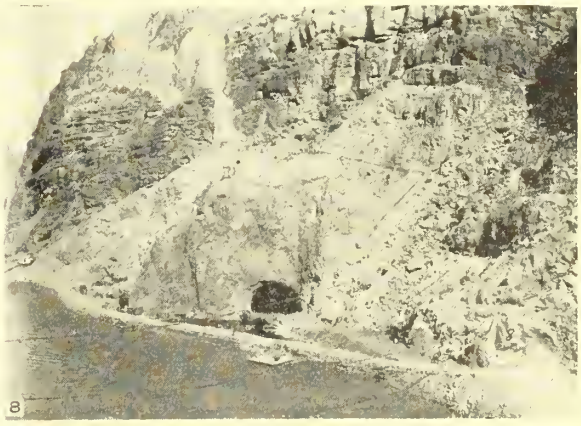












BOULDER CANYON PROJECT

1. Shovel excavating Black Canyon Highway; 2, general view of river intake pumping plant and presedimentation basin from Arizona side; 3, rolling stock of Carl K. Bryan, subcontractor, ready to go on shift at tunnel outlets—view taken on Construction Road on Nevada side; 4, installation detail—river intake pumping plant—car at bottom of incline; 5, drill carriage loaded on motor truck, used by Six Companies in upper 36 feet of full 50-foot diameter tunnel bore; 6, shovel in outlet of Arizona spillway tunnel starting excavation of upper 36 feet of full 50-foot diameter bore; 7, detail of upper 36 feet of 50-foot diameter bore at outlet of Arizona spillway tunnel, 8, outlets of Arizona tunnels—view from Nevada side showing start of 50-foot diameter outer Arizona spillway tunnel.

for the extension of irrigation and the building of new works within the watershed of the Colorado River, and not be made a source of dividends to the water users of Imperial Valley and the other lands irrigated below the dam. The furnishing of free storage to Imperial Valley provided for in the law is in accordance with the legislation which imposes no charge on irrigators for the building of the Deadwood Reservoir.

WATER RIGHT QUESTIONS ON INTERSTATE STREAMS

Where reservoirs are built on interstate streams they give rise to difficult water-right questions that can not be dealt with under any existing law. The water-right situation on all interstate streams brings out clearly the foresight of Major Powell, the first great irrigation planner. He favored dividing the arid region into water districts, the boundaries of which would be drainage lines. The water rights within a watershed would all be based on actual beneficial use, with a priority based on time, as are most of our water rights, but the location and construction of the works would be according to a systematic plan.

Instead of this uniform system, our present water laws and administration of streams have been left to be formulated by each State. The conditions of the arid region and the problems of these rivers are remote from Washington and few legislators realize the future overshadowing importance of water. The boundaries of States ignore drainage lines or the requirements of water administration. They cut across river channels and as a result widely differing water laws determine the ownership and control of the supply of water.

Already the controversies over interstate water rights have broken down the fiction of exclusive State jurisdiction. Since we failed to foresee the future and did not create a water administration based on drainage lines, I believe in the local or State administration of water so far as is possible, and did as much, perhaps, as anyone to make State ownership and control of water within the boundaries of a state a reality. However, I have seen it break down in Wyoming, not by the action of the Federal Government, but by the action of the people of the State. The constitution of Wyoming declares that all waters of the State are the property of the State. Congress approved that constitution. I was one of those who believed it was a doctrine that could be maintained, and I knew the importance to Wyoming of having it maintained, because the State was located on the headwaters where development would be slow as compared to that on the lower valleys of the rivers which rose there.

The Reclamation Bureau has from the start scrupulously followed the requirements of the water laws of this State. The destruction of the fiction of exclusive State ownership followed diversions in Colorado of the Laramie River, which latter State also claimed exclusive State ownership. Wyoming held that water belonged to her because it was first appropriated there; that the water in Colorado was not the property of Colorado, but the property of older irrigators in Wyoming. That issue was taken to the Supreme Court of the United States and that tribunal said that priorities in a lower State can and should be enforced against the later water rights in the upper State, and now, Nebraska having the older priorities on the Platte River calls upon the authorities of Wyoming to shut off ditches and send the water down. This doctrine of enforcing rights of a lower State against an upper State was not first announced in the case of Wyoming *v.* Colorado, but in the case of Kansas *v.* Colorado, and it has been affirmed in the case of Twin Falls Canal Co. *v.* Wyoming. Thus the doctrine of exclusive State rights has been shot to pieces by the courts, and whatever it may be as a doctrine it is full of grief for irrigators because there is no administrative body to enforce rights across State lines.

For several years, the Reclamation Bureau instead of being a body overriding State laws, as some think, has been a mediator between States in an attempt to prevent friction and ill feeling, and help the worried irrigators on both sides of a State boundary to get through a season.

As many reservoirs have been built on interstate streams and more are destined to be built, here is a situation that calls for improvement. One improvement which has been suggested is compacts, but I have yet to see a State which has surrendered anything of its rights in order to secure an agreement. Most of the negotiations end in a recommendation that the United States shall build more storages so as to meet all the needs instead of seeking to create an administrative body to protect rights. Even if the United States builds the reservoirs asked for, it only postpones an issue that must be settled in some orderly way, because if we provide for all the needs of to-day we will not provide for the needs of 50 years from now.

EXAMPLES OF PRESENT ACTIVITIES OF RECLAMATION BUREAU

The Bureau of Reclamation is to-day engaged in the construction of five costly and important reservoirs. The number would be several times this if funds for construction were available. Practically all these reservoirs are being undertaken at the request of the States. The only exception would be the opposition of Arizona to the construction of the Boulder Canyon project, but there it is a case of six States favoring and one opposing, and Congress acted on the assumption that the economic arguments and necessities are with the six States.

All reservoirs being built are to be paid for under the requirements of the reclamation law, but the conditions under which payments are made vary widely.

The American Falls reservoir, completed two years ago to hold back the floods of Snake River, was originally planned to insure an adequate water supply for the Minidoka Federal reclamation project, and to provide for the extension of that project, but before construction began there was a request from the Twin Falls district, a Carey Act project, and one of the largest and most prosperous irrigated areas in the country, that the reservoir be enlarged in order to meet its storage requirements. This request from Twin Falls was echoed by a number of smaller districts. When the enlargement of the reservoir came before Congress, a condition was inserted by the Appropriations Committee that the payment for the enlargement to meet the demands of Twin Falls and other districts should be in cash, and this condition has been complied with. Bonds were sold and the money paid over to the Treasury of the United States.

A few years ago this reservoir was not regarded as a necessity. The storage which had been provided at Jackson Lake at the head of the river was regarded as all that was necessary. It probably would not have been started when it was, had it not been for the intention to extend the irrigated area. Before the reservoir was completed, a serious decline in the run-off had shown its necessity. Last year the flow of Snake River was the lowest of record, and this followed a year of low flow. Without the reservoir there would have been a calamitous loss of crops on over half a million acres of land. With the reservoir the crops were fine and even with the low prices, the value of this water in one season was greater than the total cost of the storage.

Another feature of last year's experience in the operation of American Falls shows the future significance of storage. The canals to water additional land from this reservoir have not been built. The Government holds over 400,000 acre-feet of the reservoir capacity to serve this land when the canals can be constructed, but this season the lands already irrigated needed all that the reservoir held, and the

irrigators are now hoping for an opportunity to purchase a part of this reserve.

In 1926 the bureau formulated what has since been known as the 10-year program of construction. It included works begun but not completed and a few works the necessity for which had been determined by careful investigation, and which had been made a part of the program of the department. Among these is what is known as the Salt Lake Basin project, for which $15,000,000 was allocated. The program was intended to absorb the entire construction income of the fund for 10 years, and while it was never formally adopted by Congress, it has been the guide for our development in subsequent years.

The $15,000,000 for the Salt Lake Basin project was to provide for the construction of four reservoirs needed to improve the water supply of the Salt Lake Basin between Provo and Cache Valley. All or nearly all of the land included is a part of present irrigation development and the farms are highly improved and cultivated.

The selection of these four reservoirs was the result of years of cooperative study between the irrigation authorities of Utah and the Reclamation Bureau, and it was left for the State to determine the first reservoir to be built. The one chosen was Echo, located in the channel of Weber River and intended to store its floods for the irrigated lands between Ogden and Salt Lake City. Its capacity is 70,000 acre-feet, its size being determined by the flood waters which now run to waste in average years. Before the reservoir was started, the water was contracted for by cultivators who needed it to finish off their crops, a large part of which was fruits and vegetables. Practically all the purchasers of water have rights in the natural flow of the river. They have purchased only a supplemental supply, and this averages less than an acre-foot of water to an acre of land. The cost of these water rights is $45 an acre-foot, which is greater than the owner of unimproved land could pay or that could be paid for a complete water supply. This is in striking contrast to the cost of storage at American Falls, which is less than $5 an acre-foot. The water of both storages is in demand, and both will have greatly increased value in the near future.

HOOVER DAM CONSTRUCTION SHOWS VALUE OF WATER

The construction of Hoover Dam to regulate the flow of the Colorado and store 30,500,000 acre-feet of water is the greatest undertaking of its kind in any country. The pressure for the construction of the dam came from the harassed irrigators of Imperial Valley who are menaced some years by floods and in others like this year, by drought. The dam is needed to meet the demands of the coast towns of southern California for an increased domestic and industrial water supply, and to provide for the irrigation of additional lands in Arizona and California. Here is one of the most striking illustrations of the value of water. It means a new era for Nevada, Arizona, and California, because it means cheap power for mines and mills and additional homes in a region where soil and climate give irrigated agriculture an exceptional profit and where the attractions of outdoor life create an increasing demand for homes.

The reservoir at Hoover Dam is to be paid for out of the profits from power, with a nominal payment for the water supplied to cities and towns. No charge whatever is made to the Yuma project, or to the Imperial and Coachella Valleys for storage, and it is unlikely that any charge will be made for water used in irrigation. Power will pay for the reservoir, with interest.

PURPOSE OF OWYHEE AND CLE ELUM STORAGES

Over in the Northwest, contract for the Cle Elum Dam has just been let, and the construction of the Owyhee Dam to store the flood waters of the Owyhee River is approaching completion. Both these reservoirs are being built to give more and cheaper water supply to land now improved and cultivated and to provide water for some additional lands. The Cle Elum will be the sixth of a series of storages on the Yakima River which form the water insurance of that project.

When the Yakima development began, no one foresaw a city of 30,000 people with office buildings costing over half a million dollars. They did not foresee the succession of towns and villages extending for nearly a hundred miles up and down the valley, all of which are the creation of irrigation as much as the orchards and potato fields under the canals.

The Owyhee storage would have had to wait longer than it has if it had not been for the necessity for more and cheaper water for small ditches built when it was thought that the natural flow of a great river like the Snake would be ample.

In the early building of reservoirs, the idea of irrigators was to buy as little water as possible. Now the idea is to have the reservoir large enough to meet the extreme needs of dry seasons because those are the times when water is valuable. In fact, during the present year, the value of water has frequently been likened to the value of the water which puts out a fire, measured by the value of the property saved.

Since 1914, the Reclamation Bureau has had its construction program determined by Congress. In nearly all cases the action of Congress has been based on results of cooperative investigations and agreements with the intending water users.

Andrew J. Wiley, 1862-1931

The Bureau of Reclamation and the engineering profession have met with a great loss in the death at Monrovia, Calif., on October 8 of Andrew J. Wiley, for many years a valued consulting engineer in connection with important irrigation projects, not only in the United States, but also in India from October, 1927, to February, 1928, when he was consulting engineer to the British Government.

Andrew J. Wiley was born at New Castle, Del., July 15, 1862, graduated at Delaware College, Newark, in 1882, from which he received his Ph. B. degree; served in an engineering capacity with several railroads and irrigation companies; and has been connected with the Department of the Interior since April 23, 1904, holding an appointment as consulting engineer from February 1, 1920, to the date of his death.

During the past 11 years Mr. Wiley's services have been utilized in a consulting capacity in the construction of the following dams: Echo, Salt Lake Basin project, Utah; Guernsey, North Platte project, Nebraska-Wyoming; Agency Valley and Warm Springs, Vale project, Oregon; Gibson, Sun River project, Montana; Stony Gorge, Orland project, California; and the great Hoover Dam, Boulder Canyon project, on which construction has just begun. In 1928 the Indian Bureau called on Mr. Wiley to make an inspection of Coolidge Dam, Arizona, and in the fall of 1930, at the request of the Governor of the Panama Canal, he was detailed to the War Department for consulting services in connection with Madden Dam.

Mr. Wiley was an engineer of exceptional ability, and his death marks the close of an unusually crowded and useful life.

ABOUT 10,000 persons attended the formal opening of the A. E. Larson Building, Yakima's tallest office structure. The building, costing $600,000, fully equipped, is a 12-story concrete structure with brick and stone facing, beautifully designed, and reputed to be one of the most modern, as well as the most artistic, buildings of its kind in the Northwest.

Boulder City Building Activities

"ALTHOUGH Boulder City is a part of the Hoover Dam project, it is a big enterprise in itself, where a permanent city with all modern municipal improvements is being built to house 5,000 or more people, while 2,000 men and a few women and children are trying to work and live in the middle of it," says the Western Construction News in its issue of September 25.

In describing the achievements of the contractors for the dam and power plant in building a camp to house their 2,500 employees during the 7-year construction period, the News gives an interesting account of the results of the past five months' work.

In Boulder City the Six Companies has completed the 1,000-man mess hall; steam laundry; machine shop; garage; warehouse; clubhouse; company store (to house various stores); Boulder City building (housing temporary post office); five out of six of the 172-man, 2-story dormitories; 115 of the 127 cottages, 3-room; office; office-employees' dormitory; seven out of ten of the 5 and 6 room cottages; a 104-room, 2-story, dormitory for mess-hall employees (upper story for women); started construction on the hospital, and also on the Executives' Lodge on top of a knoll opposite the knoll on which is the main water-storage tank. This lodge is to be quite elaborate; hacienda style, stucco and tile roof, with six or more suites, kitchen, etc. The dormitories are 2-story with wide, covered verandas around both stories, on which the men can sleep if they desire. Each dormitory has a shower room, lavatory, etc.; and, what is equally important, each is equipped with a combination cooling and heating system—the large galvanized-iron air ducts extending along the ceiling of the hallways with branch ducts to each room. The air-washing and cooling plant reduces the temperature 22°. A 500-man camp, including mess hall, dormitories, etc., is in full operation in the canyon at the base of Cape Horn.

THE 1,000-MAN MESS HALL

As a famous general stated: "An army moves on its stomach," so it can be said here, the mess hall is the stomach of the Hoover Dam project. It is interesting to note the increased importance given to the feeding of men on construction jobs during the past 10 or 20 years. In the old grading camp days no thought whatever was given to the housing and feeding of the mule skinners. The cheapest food obtainable, with little variety beyond meat, potatoes, beans, and pies, was good enough. To-day, "construction stiffs" sit down to a variety of only the best brands obtainable, well cooked and cleanly served, and not excelled by any hotel.

No wonder then that both the Six Companies (Inc.), and Anderson Bros. Supply Co., which has the subcontract for feeding all the employees, are proud of this 1,000-man mess hall. The building cost $46,000 and the equipment $65,000—or $100 per man. The mess hall is similar in style to the rest of the buildings, being of frame construction with smooth stucco exterior and asbestos-shingle roof, supported on light-steel trusses. The center section, containing the storage and refrigeration rooms, kitchen, etc., is 54 by 194 feet, and the two parallel dining-room wings on each side are each 45 by 142 feet. The laundry, also to be operated by Anderson Bros., is adjacent to the kitchen, and contains an 80-horsepower boiler which furnishes steam for the mess-hall kitchen, thus enabling the chefs to cook with steam, oil, or electricity.

FIRST-CLASS FOOD SERVED

Only the very best brands of groceries, canned goods, meats, etc., obtainable are purchased. These are secured in truckloads or carloads direct from whatever packing plant or cannery packs the best grade. The same thing is true of vegetables, fruits, and meat. The finest of beef, veal, lamb, and pork, in full "sides," double wrapped, is brought from Reno, in 20,000-pound lots, by truck, packed in dry ice, and is immediately run into the meat-storage refrigerating room. Eggs are similarly brought from Reno. Some canned goods come from Utah, some from San Francisco, and some from Los Angeles; the same is true of vegetables and fruits. Anderson Bros. have some of their canned goods packed especially for them either by the packers of Del Monte, S. & W., or other well-known brands. Coffee is purchased in 5-pound vacuum cans. Fresh vegetables and fruits are picked over in a screened room before being put in the cold storage rooms.

As there are no dairies in southern Nevada, and it was impossible to keep milk hauled from Reno fresh, Anderson Bros. purchased a 160-acre alfalfa ranch 80 miles away at Mesquite, near Logandale. They installed a water and sewer system, electric and refrigerating systems, a steam plant, four 50-cow semiroofed corrals, and a 50-stall concrete-floored milk barn, white enamel painted. Milk, cream, and butter are shipped daily in ice-cooled trucks, which make the trip to Boulder City in 2½ hours.

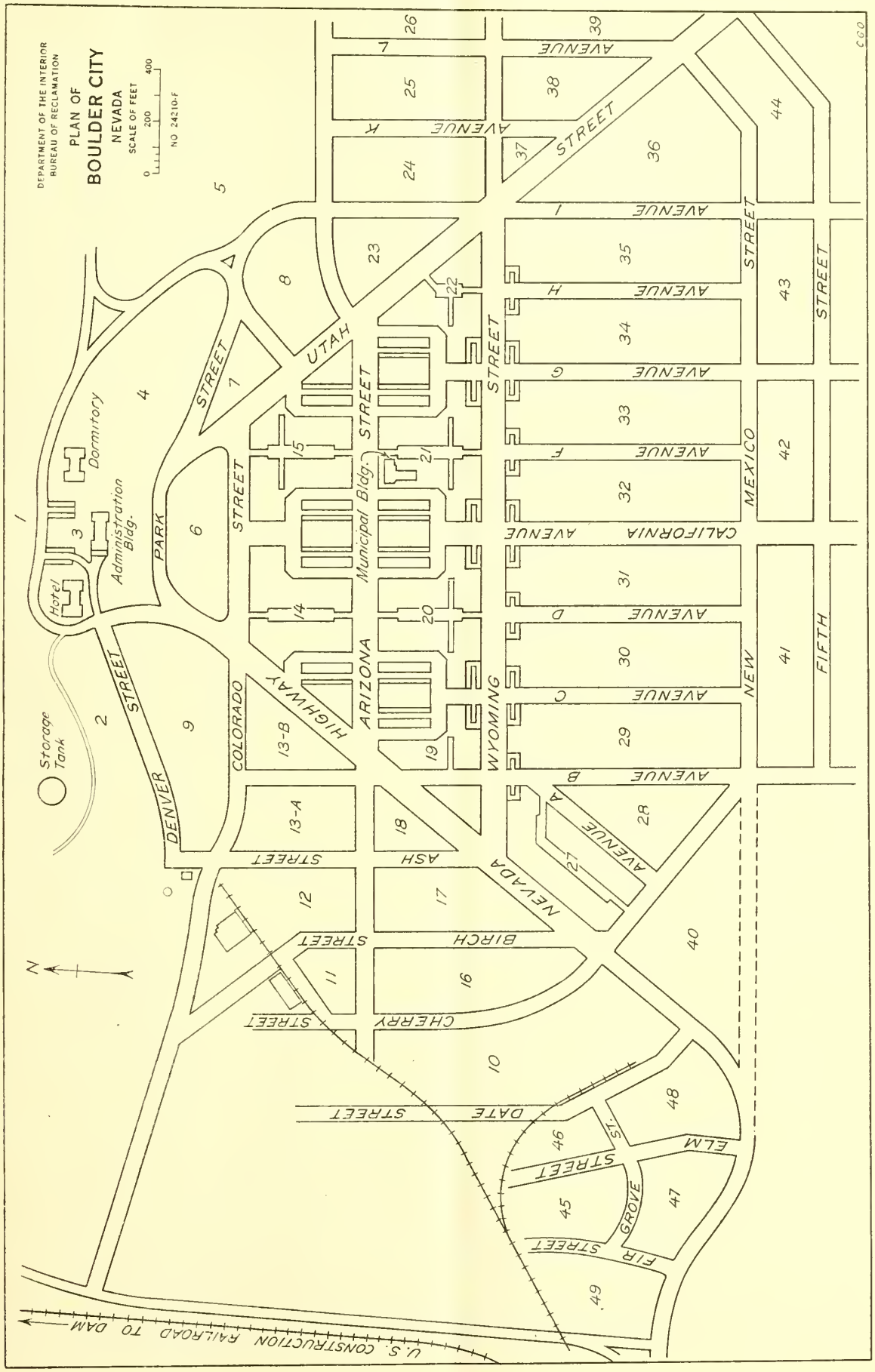
At the rear end of the central or food-preparing section of the mess hall there is a special door and platform for unloading trucks and another door for carloads, with an overhead track leading from each to the meat-storage refrigerator. There is a large basement for storage of non-perishable goods, in which there is a 20-ton ice plant which supplies refrigeration for nine cold storage rooms, makes 3,600 pounds of ice per day, and furnishes circulating ice water throughout the kitchen and dining halls. Before this was installed it cost $2,100 per month for ice hauled from Las Vegas. All steam and refrigeration piping is asbestos covered. The nine cold-storage rooms are cork insulated and white enamel painted.

The entire operation of food preparation, from raw products to meals served, is streamline. The meat-cutting room is screened and has its own cold-storage room, and so have the vegetable and fruit preparation quarters, and also the pastry department. The kitchen has facilities for cooking six whole steers at once, by steam, oil, or electricity.

All pots and pans are aluminum, all drawers and cabinets are metal, all table tops are hardwood or metal. There are numerous drains and grease traps in the floor and as much of the equipment as possible is on rollers to facilitate cleaning. There are two steam tables with electric griddles between. The service containers for coffee, iced tea, lemonade, milk, buttermilk are all Monel metal. The dish-washing machine, of the latest type, leaves the dishes polished. Coffee and tea stains are first removed from cups, etc., by hand with a scouring powder.

The two dining rooms, which can seat 600 each, have 8-man tables with composition tops, and chairs instead of benches. The floors are covered with brown Mastipave. Each dining room has 54 large electric fans. The tables are furnished with paper napkins and glassware—both unusual in construction camps.

One of the unique features is the cafeteria-style lunch-basket room. The men file through, take an empty box, and fill it with whatever they wish. Sandwiches, pieces of pie, etc., are all wrapped in waxine bags. If a man wants only six pieces of pie, he can have them. By this method all are satisfied and there is none of the proverbial grumbling about the grub in the lunch boxes.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ELM
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U.S. CONSTRUCTION RAILROAD TO DAM

Economic Aspects of Federal Reclamation[1]

By George O. Sanford, Assistant Director of Reclamation Economics

IN THE discussion of the economic aspects of Federal reclamation I am fully aware that you are wondering what relation there may be in the problems confronting a section of the country where the annual precipitation is about 50 inches and the difficulties that must be overcome in agricultural communities where the rainfall ranges from 5 to 15 inches. The basic principles of success are the same in either case. There should be a well balanced program of diversified agriculture. You must have competent men to till the soil. Social advantages must be present, so as to provide an attractive place in which to live, and markets must be established for the disposal of crops and livestock. The principal difference is that in one case nature supplies the water; in the other case, man. It is my hope that a discussion of our efforts to place Federal reclamation on a more successful basis may be of some assistance in working out a practical and successful solution of the problems that confront you in the South.

DIFFICULTIES EXPERIENCED

Federal reclamation was started 29 years ago with the idea that if the canal system were constructed and water brought to the land some one would be ready to establish a home and grow crops that would return a sufficient margin to pay living expenses and the cost of constructing and operating the project. At first anyone with a homestead right and sufficient cash to pay the initial installment could settle on an irrigated farm. As a result there were a large number of men, and in many cases women, who attempted to establish homes on raw land without sufficient experience and capital to carry them through the development period. Under this system many failures resulted, and when construction charges became delinquent and steps were initiated to cancel entries, as provided by law, a pathetic appeal was promptly filed with congressional Representatives to have relief granted. Conditions were rapidly changing from bad to worse and the future success of Federal reclamation was very much in doubt. A committee of special advisers on reclamation was appointed by the Secretary of the Interior to make a thorough study of the situation, determine the defects, and suggest the necessary remedies. In April, 1924, Dr. Elwood Mead, who had served on this committee, assumed charge of the Bureau of Reclamation, and under his able leadership steps were immediately taken to enact remedial legislation for the purpose of placing reclamation on a sound economic basis. Congress authorized a readjustment of annual construction charges, and provision was also made for the selection of settlers who must have had farming experience, good character, good health, and sufficient capital to establish themselves and go through the first crop season. These two essential steps have had a very wholesome influence in improving conditions on all of the projects.

NECESSITY OF FARM ADVISERS

There is still one more matter of importance that Doctor Mead recognized from the beginning, and that is the necessity of farm advisers to assist the men who are trying to establish homes under new and trying conditions. When the necessity of this assistance was first suggested, it was met not only with strong opposition but even with ridicule. When the question of paying for the services of men of this class was first submitted to the Comptroller of the Currency, he ruled that there was no authority in law for such payment out of the reclamation fund. The proposal was not received favorably on several of the projects. I distinctly recall a statement made at a meeting held on one of the projects for the purpose of inaugurating a better farming program centered around dairying and livestock production. This particular man wanted no help or advice, and said: "If you Government men will look after your affairs outside of my fence and see that I have water when I need it, I'll be responsible for what goes on inside the fence, and as to the dairy business you are trying to put over, it's my idea that two cows is enough for any woman to milk."

With the opposition that developed on all sides, it has been a slow and discouraging proposition to convince Congress that this assistance and advice to the farmers is just as essential as the construction of a good canal system, and it was not until 1928, or 26 years after the passage of the reclamation act, that an appropriation was made available for starting this work. The ultimate success of any project must rest upon the success of the individual farmer. If he does not prosper and can not pay the annual charges as they become due, then the project is a failure. The difficulty of getting the money returned is greater than spending it, and anything that can be done to speed up the revolution of the reclamation fund is a good investment and a wise administrative policy, and it was for the purpose of assisting in this work that I was recently transferred to the Washington office after a long experience in the construction and operation of projects in the Northwest.

With this brief statement covering some of the difficulties that have confronted the Bureau of Reclamation in administering the law, I believe it will be worth while to describe briefly what led to its enactment and some of its achievements.

FEDERAL RECLAMATION POLICY

On June 17, 1902, Congress established the policy of Federal reclamation by the passage of the reclamation act, which provided that money received from the sale of public land in the 17 Western States was to be used in the construction of irrigation projects, the cost to be paid in 10 annual installments by the landowners, without interest. The money so returned was to be used as a revolving fund in constructing other projects. The time of repayment was extended in 1914 to 20 years and in 1925 to not to exceed 40 years. The increased time allowed for the repayment of construction charges slowed up the revolution of the fund and materially retarded the construction program. In order to speed up the work, Congress in 1910 granted a loan of $20,000,000 from the General Treasury. One-half of this sum has already been repaid, at the rate of $1,000,000 per annum. To further augment the amount available for construction purposes, the act of February 25, 1920, provided that 70 per cent of all oil royalties on past production and 52½ per cent on future production were to be credited to the reclamation fund. To June 30, 1931, there had been received from the sale of public lands about $111,000,000 and from oil royalties a little over $40,000,000.

There has been a good deal of criticism because of the non-interest-bearing feature of the reclamation fund, and it has often been described as a Government subsidy of agriculture. But let us consider just where this money comes from and where and how it is to be used. No portion of it has been raised by general taxation. It comes entirely from the sale of public lands in the Western States and from oil royalties which, with the exception of about $87,000, are received from States to which the reclamation law applies. It is true that had there been no Federal reclamation projects the receipts of the General Treasury during the past 29 years would have been increased by nearly $152,000,000. The construction of these

[1] Paper presented at Southeastern Economics Conference, Savannah, Ga., Oct. 19–22, 1931.

Government projects does not mean that there has been a definite loss to the Treasury, but only what might be termed a somewhat indefinite suspension of payment into the Treasury, during which time the money is used in the construction of irrigation projects in the States from whence it came. The Western States, in view of the many adverse conditions confronting them, feel that they have a legitimate right to the use of this money, and this right was conceded when Congress passed the reclamation act, which received the whole-hearted support of Senators and Representatives of the Southern States.

To cite a specific case: The city of Casper, Wyo., at one time had a population of over 20,000. Its growth and prosperity was based largely upon the discovery and development of the Salt Creek oil field adjacent to the city. While the oil field was in full production Casper was a prosperous community. When production began to slow up the city began to feel the effects, and in 1930 had dropped to second place in the list of Wyoming cities, with a population of a little less than 17,000. Portions of the city have already been abandoned, and there is a certainty that the population will continue to decrease unless some new industry can be established. But Wyoming has contributed to the reclamation fund from oil royalties a little over $30,000,000, and nearly all of this has come from oil produced in the area adjacent to Casper. There is an insistent demand that a portion of this money that the Government has obtained from the expendable natural resources of Wyoming shall be used to construct an irrigation project adjacent to the city, where land and water are available. When oil and other minerals are once taken from the earth they can never be replaced, and the community whose prosperity is based on such activities knows that in due course of time there is an end to such prosperity. Agriculture is the principal basic industry that can be carried on with the full knowledge that under proper methods of farming there is no end to the wealth that is created. Under the circumstances it is easy to understand why Casper is so anxious to switch from oil to irrigation.

BENEFITS OF RECLAMATION

With this brief justification of Federal reclamation, let us see what the results have been. The accretions to the fund from land sales, oil royalties, and other miscellaneous revenues have been $151,700,000. Congress has loaned in all $25,000,000, of which sum $10,000,000 has been returned, which makes a total of $166,700,000. Expenditures to July, 1931, have been $263,400,000, the difference of $96,700,000 being made up of repayments by the project farmers on the construction and operation accounts and miscellaneous collections. Twenty-seven projects have been constructed in whole or in part, and in addition there are a large number of private projects dependent for their water supply on reservoirs constructed by the United States. Until the present depression the annual value of crops produced on these two classes of projects have been nearly equal to the cost of constructing the canal systems and storage reservoirs.

The work of the Bureau of Reclamation has resulted in the establishment of homes for 600,000 people on the farms and in the towns that have been established as trading centers for the adjacent farming communities. Taxable property valued at about $1,000,000,000 has been created, and the crops produced on these projects have an average value of two and one-half times the average of the entire country, and yet it is only 1 per cent of the total value of all crops. Pacific coast cities furnish the principal market for livestock and dairy products. Vegetables and truck are shipped mostly to local or western markets, and shipments to eastern markets, comprising principally fruits and vegetables, arrive during the winter and early spring months, before eastern farms come into production, as is the case of lettuce and cantaloupes from projects in Arizona and California.

COTTON PRODUCTION RELATIVELY UNIMPORTANT

Cotton has been an important crop on the four projects in Texas, New Mexico, and Arizona, but in 1929 and 1930 comprised only a little over 1 per cent of the total production of the United States, and nearly all of this cotton has a length of 1 inch or over. Full returns for 1931 are not yet available, but reports from Yuma show a reduction from 25,000 bales in 1930 to about 8,700 bales in 1931. Carlsbad, in New Mexico, has dropped from 17,000 bales to 12,600. Without doubt there will be corresponding reductions on the Rio Grande project in Texas and New Mexico and Salt River in Arizona, so that the total production will be considerably less than 1 per cent of the total cotton crop. Another matter that hardly needs to be emphasized at this conference is that the greatest distress on Federal projects is being felt on the cotton-producing projects. The projects that are in the best condition are those where the major activities center around livestock production and dairying, and particularly the sugar beet, which furnishes one of the best cash crops that can be produced on the northern projects and fit in well with livestock feeding where the beet tops, pulp, and molasses can be mixed with hay and grain to make a high-grade balanced ration.

DISTRIBUTION OF BENEFITS

And now a word as to how the benefits coming from these western projects are distributed to all sections of the country. A careful study of the distribution of the wealth that is created each year shows that the money received for crops passes very quickly through the hands of the original producer. Local labor receives its share. The merchants exchange their goods for the farmers' money; transportation takes its toll, and when the story is fully told we find that the farmer's dollar is divided and distributed over all sections of the country. Statistics have been compiled showing the distribution of purchases on Federal projects, and in one year there was shipped in to Boise, Idaho, 674 carloads of commodities, and, with the exception of 62 carloads from Colorado, the balance came from Central and Eastern States, and 147 originated in States south of the Mason and Dixon line. These figures apply to but 1 of the 27 projects. These purchases have given employment to mechanics and laborers in the humid sections, who in turn have purchased the farm products that come from the agricultural areas tributary to the manufacturing centers.

Government projects have enjoyed years of prosperity and have had their share of adversity, and they certainly have not escaped the setback that has hit all farmers during the present depression. Financial distress has been most severe on the 1-crop farms, especially cotton. The projects that are coming through in best shape are centering on livestock and dairy products. There has been some recent improvement in the price of butterfat, and prices in September, which on the different projects ranged from 25 to 32 cents per pound, showed an increase in the 30-day period of 4 cents. On one project feeder lambs are being contracted at 4 cents, with a repurchase price of 5 cents after a 90 days' feeding program. Farmers who disposed of their forage crops in this way in 1930 received a fair price for feed and were well paid for their labor, nor are they discouraged at the prospects this fall. The sugar-beet farmers will come through in good shape, as this crop is contracted for before planting at an average price of $5.50 per ton, and while this is about $2 less than was paid in recent years, there has been a reduction in the cost of production. In other words, the farmer who plans his farm program so that a sufficient area is planted to cash crops to provide necessary funds to cover taxes, water charges, and other operating expenses and confines his major program

to the production of crops that are fed on the farm, and where he has a steady job and where a regular monthly income is received from the cream check, is in fairly good shape. He may not be making a profit, and in many cases he is not getting any interest on his investment. His purchasing power has been sadly reduced, but he has a job; he has enough to eat and the prospect of joining a bread line does not worry him. Furthermore, he has neither lost his hope, his courage, nor his steadfast belief that conditions are going to improve. I fully appreciate the fact that you in the South know wherein your principal trouble lies and that this conference is called for the purpose of assembling all the facts and applying a remedy. I have briefly described the most uniformly successful type of farming on Government projects which centers around the cow, the pig, and the hen, and I hope that it may be of some help to you in reaching a practical solution of your difficulties.

FUTURE PLANS

In view of the overproduction of staple agricultural products, the guiding policy is not to bring new lands into production that would compete with established farming areas, but rather to extend a helping hand to well-developed communities where there are serious shortages of water that have not only reduced crop production, but unless some relief can be secured may result in the destruction of homes and productive farms. Some of the oldest private projects in the West have experienced an unprecedented water shortage for the past two years. There was very little snow fall last winter, and as a result many streams went dry in June, and in some sections there was only enough water to save orchards, to say nothing of producing a crop. These sections need storage reservoirs to hold the early flood water for the irrigation of crops during the latter part of the growing season. Most of the investigations now under way have for their objective the construction of reservoirs that will insure an adequate supply of water for these developed communities.

In conclusion I want to emphasize these ideas: First, that we can not expect to have this country enjoy a full measure of prosperity until the basic industry of agriculture becomes prosperous; second, that the payment of a fair price to the original producer for his products is not going to hurt the ultimate consumer; and, third, that while the farmers can do much to help themselves, there is a real need of the best possible advice and assistance available in working out the numerous problems that confront the man on the farm. I know from my studies of what you are trying to do to better conditions here in the South that you have taken hold of the work with courage and intelligence. Your appreciation of some of the difficulties confronting you is well evidenced by the statement of Dr. W. W. Long, of South Carolina, when he said:

"The bringing in of settlers has been left entirely to private and corporate speculators in land. In the past private colonizers have given little thought to the needs of settlers. They have bought land and sold farms as they would buy anything for speculation. * * * Their ability has been mainly shown in writing alluring advertisements and working sell-

(Continued on page 239)

VIEWS OF WASHINGTON D C AND VICINITY

SCENE ON THE MARYLAND SIDE OF THE GREAT FALLS OF THE POTOMAC NEAR WASHINGTON

LINCOLN MEMORIAL

MEMORIAL BRIDGE SPANNING THE POTOMAC FROM LINCOLN MEMORIAL TO ARLINGTON

INTERIOR DEPARTMENT BUREAU OF RECLAMATION ON SIXTH FLOOR WEST WING, LETTER "C" MARKS COMMISSIONER'S ROOM

Photos by George A. Beyer

Colorado River Planning Commission Meets

A conference of the Colorado River Planning Commission was held on September 14 at the State Capitol Building in Salt Lake City, Utah, for the purpose of considering the tentative draft of the General Plan for the Investigation of the Colorado River Basin, dated August 14, 1931, that had previously been submitted to the several State representatives.

The plan as outlined in the draft was read and discussed item by item by those present and a few minor additions suggested, mainly to make the meaning more specific. The changes suggested in no way altered the meaning or the purpose of the plan, which, with the few changes suggested, was adopted by the conference. There was some discussion about the amount of funds that would ultimately be needed to carry out the proposed work. A resolution was finally passed that the several States should bring to the attention of their Senators and Representatives to see that sufficient appropriations were made under the present authorization to carry on the work as planned. Those present were very much interested in the work being done in Wyoming in the classification of the lands as the main basis for determining the feasible projects in the Colorado River Basin.

Arizona and Wyoming were not represented at the conference; New Mexico was represented by George M. Neel, State engineer; Nevada by George W. Malone, State engineer; Utah by W. W. Wallace, chairman, W. D. Beers, engineer, member Utah Colorado River Commission, and George M. Bacon, State engineer; Colorado by M. C. Hinderlider, State engineer; and the Bureau of Reclamation by Porter J. Preston, in charge of Colorado River Basin investigations.

Mr. Preston is moving his survey parties from Wyoming to Arizona for work this winter.

Federal Reclamation

(Continued from p. 238)

ing devices. * * * The time that they usually give for paying for a farm is too short and the interest rate too high."

The same troubles have been experienced in the West, and it has been found very difficult to eliminate speculation from the Government projects. Our most promising line of endeavor has been not to make men rich but to give them the opportunity to establish a comfortable home, where they may enjoy life and provide the family with the social advantages that make up the essential features of our American standard of living.

Columbia Basin Board Convenes at Spokane

On October 15 a board composed of seven members, five engineers of the Bureau of Reclamation and two Army engineers, held a meeting at Spokane, Wash., to go over the Columbia Basin project and consider the various set-ups in the reports of the bureau and of the Army engineers.

Representatives of the bureau included H. W. Bashore, with headquarters at Spokane, in charge of the Columbia Basin investigations; H. J. Gault, who made previous examinations; R. B. Williams, who has been appointed chief of the engineering division of the Washington office and will shortly assume his new duties; E. B. Debler, hydrographic engineer; and C. N. McClellan, chief electrical engineer. The Army engineers were Lieut. Col. James M. Robins, in charge of the district in which the Columbia Basin project is located, and Maj. John S. Butler, who was in charge of the Columbia Basin investigations for the War Department and whose report was submitted to the bureau for study.

Boulder City Organizes American Legion Post

On October 12 an American Legion post came into existence in Boulder City, on the Boulder Canyon project. Because of the fact that several hundred ex-service men eligible to membership are now employed on the project, the prospects are very favorable for a large active post.

Temporary officers have been elected for a period of three months in accordance with the rules of the American Legion. They are as follows: Post commander, George Cass; adjutant, H. C. Looze; first vice commander, R. S. Skinner; second vice commander, J. A. Steele; service officer, W. E. Hamilton; sergeant-at-arms, R. C. Thaxton. Three of these officers, Messrs. Looze, Skinner, and Thaxton, are members of the Bureau of Reclamation staff. The executive committeemen and chaplain will be elected at the next meeting of the new post.

A temporary constitution and by-laws were adopted at the meeting on October 12, with 76 men voting. The new chapter will probably be known as Boulder City Post, No. 31.

IT WAS expected that the Otato Corporation on the Minidoka project would start the operation of its potato meal mill at Burley during October. A test run was made last season with satisfactory results.

A Disinterested View of Hoover Dam

Mr. J. S. Sheafe, of the Sheafe Engineering Co. (Inc.), Chicago, Ill., recently visited Hoover Dam site and Boulder City, and after a thorough inspection of the work commented as follows:

"God's Desert heat about 120°.

"Food, to all alike such as I have never seen before. There was so much and such a variety that I found it difficult to decide what I most wanted. There was wonderful food, even celery, corn on cob, pickles, etc. The tables groaned. All hands are served in the same splendid dining room and from the same supply.

"The kitchen is as modern as any new hotel has. The 'cooler' is the last word. The various rooms where food is handled are all screened and ultraclean.

"Dormitories having even the most improved ventilating system into each room.

"Short shifts and good pay for these times.

"Frigidaire water coolers down on the job.

"Electric light everywhere. Tunnels with forced draft from brand new Ingersoll Rand compressors.

"Comfortable autos to take the men directly to their work.

"Hospital with splendid physicians.

"Clubhouse for the men. Similar to those in western mining towns for the officers and white collars. It has a bar serving all soft drinks and near beer at a nickel a drink.

"A store with fair prices. A drug store and cigar store also.

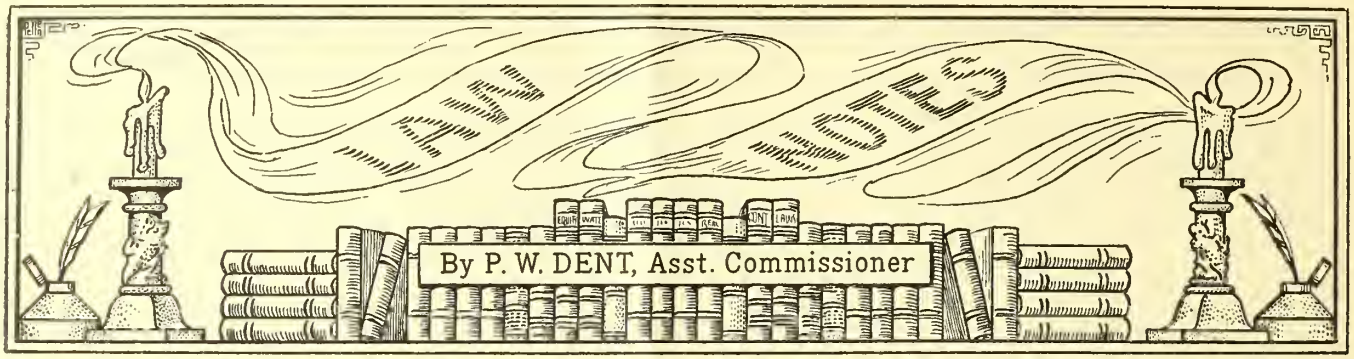
"Sewer system and modern plumbing almost finished.

"Everything that could be put in is there. Boulder City is located on a mesa of Nevada-Arizona rock. It is a hard location but a good place to work for him who wants work."

SOME fields of onions on the Uncompahgre project are reported in excellent condition with good yields, ranging around 200 to 225 sacks per acre.

A PROGRAM is under way on the Uncompahgre project to establish a dairy cooperative, and it is reported that they have about 1,500 head of dairy stock signed up at the present time.

THE early yield of Irish potatoes in the Deming section of the Mimbres Valley, Luna County, N. Mex., approximated 60 cars. El Paso (Rio Grande project) dealers bought the crop.—*The Earth.*



Recent Reclamation Legislation and Decisions in Idaho, Oregon, and Washington

FROM the viewpoint of Federal reclamation, the legislation enacted by the State legislatures of Idaho, Oregon, and Washington during their legislative sessions of 1931, is not of great importance, irrespective of the general proposition, based on the National Constitution, that in the absence of consent by Congress local laws can not dominate Federal laws and regulations pertaining to Federal reclamation projects.

As will be noted from the summary of new laws enacted in the States of Oregon and Washington, as hereinafter cited, the popular demand for a limitation of liability of irrigation district lands which ebbs and flows with the economic times is responsible for considerable new legislation perfecting the procedure for the funding of the bonded indebtedness of districts and giving a promise, which may prove illusory, of a limit of liability for payment of the funded debt.

Following is a summary and citation of some of the 1931 session laws of Idaho pertaining to irrigation districts and water and water rights:

FOR IDAHO

Joint resolution submitting to the coming election a proposed constitutional amendment permitting a property ownership qualification of irrigation district electors. (1931 Idaho Session Laws, p. 462.)

Amending section 2751, Idaho Compiled Statutes, providing a penalty for failure to install fishways in dams across natural streams. (1931 Idaho Session Laws, ch. 211.)

Providing a representation in watermaster elections upon a basis of water deliveries for the preceding year. The operation of the law is limited, however, to districts having 50 or less adjudicated water rights, and hence is unimportant to the administration of Federal projects. (1931 Idaho Session Laws, ch. 94.)

Empowering irrigation districts to generate electric power for the use of the district and to dispose of excess power in the commercial field. (1931 Idaho Session Laws, ch. 22.)

Permitting irrigation districts to cancel delinquent assessments and accept water rights appurtenant to lands in lieu of assessments thus canceled. (1931 Idaho Session Laws, ch. 34.)

Authorizing irrigation districts under contract with the United States to cancel operation and maintenance assessments when water rights are canceled by the United States. (1931 Idaho Session Laws, ch. 37.)

Granting irrigation districts the powers of drainage districts upon certain procedural steps taken. (1931 Idaho Session Laws, ch. 163.)

FOR OREGON

The provision of the Oregon State Constitution for payment by the State of interest on obligations of irrigation and drainage districts was repealed by amendment to the constitution adopted by the people at the general election, November 4, 1930. (1931 Oregon Session Laws, p. 6.)

The procedure for funding of bonded indebtedness of irrigation districts is amended by 1931 Oregon Session Laws, chapter 50; chapter 276.

The legislature has fixed a period of 10 years within which irrigation districts must foreclose certificates issued for delinquent assessments. (1931 Oregon Session Laws, ch. 262.)

Sales and transfer of water rights by counties to irrigation districts are authorized and ratified by 1931 Oregon Session Laws, chapter 267.

FOR WASHINGTON

Amending the procedure provided by the previous session of the legislature (ch. 120, sec. 4, session laws 1929) for the funding of indebtedness of irrigation districts and the issuance of refunding bonds which are assumed to be limited in the extent of the security for their payment.

Amending election laws for irrigation districts.

Advancing date of delinquency of district assessments and increasing amount of interest and penalty upon delinquent assessment.

Specifically authorizing the collection of a toll charge to pay charge due to the United States or the State of Washington, and providing that tolls may at once become assessments and collectible by the county treasurer.

Amending the procedure for confirmation of bonds or contracts with the United States to authorize the confirmation of funding bonds as well as those of original issue.

Authorizing and providing the procedure for dissolution of insolvent irrigation districts on consent of holders of 51 per cent of the district bonds and defining an insolvent district as one in which 50 per cent of its irrigable lands are held by the district for delinquent charges and not redeemed within a year. (1931 Washington Session Laws, ch. 60.)

Authorizing the State director of conservation to compromise district bonds held by the State and to accept refunding bonds. (1931 Washington Session Laws, ch. 43.)

An act relating to the election of irrigation district officers. (1931 Washington Session Laws, ch. 41.)

Of the court decisions rendered in the States of Idaho, Oregon, and Washington during recent months, the three most important to reclamation under the Federal statutes are those of Twin Falls Canal Co. *v.* American Falls Reservoir District No. 2 (49 Fed. (2) 632), arising in Idaho; United States *v.* Union Gap Irrigation District (39 Fed. (2) 46), arising in Washington; and Enterprise Irrigation District *v.* Enterprise Land & Investment Co. (300 Pac. 507); arising on the Klamath project, and now pending before the Oregon State Supreme Court upon a petition for rehearing.

The first mentioned is important because it applies the principle laid down in the condemnation of roadways across railroad rights of way, as in the case of C., B. & Q. Ry. Co. *v.* Chicago (166 U. S. 226, 41 L. ed. 979), and by the State courts of Utah in the condemnation of a right to enlarge and use an existing irrigation ditch, as in the case of Tanner *v.* Provo Bench Canal & Irrigation Co. (239 U. S. 393; 60 L. ed. 307), to a situation where an enlarged use of a diversion dam can be made without injury to the owner thereof.

The case arising on the Yakima project is important because it confirms the operation and effect of agreements limiting the diversions of water. Without limiting agreements on nonadjudicated streams, such as the Yakima River, the relative rights of private appropriators and of the Government would be chaotic.

Two of the above cited cases have already been reviewed in the pages of the New Reclamation Era—the Twin Falls case at page 121 of the June, 1931, issue and the Union Gap case at page 166 of the August, 1931, issue.

The case of Enterprise Irrigation District *v.* Enterprise Land & Investment Co., arising on the Klamath project in Oregon, is important because the decision of the Supreme Court (300 Pac. 507), if adhered to, will reverse a policy of that State covering a period of more than 20 years.

In an action of foreclosure brought by the district to foreclose delinquency-assessment certificates issued for delinquent assessments over a period of several years, the defendant land and investment company, owner of more than 160 acres of irrigable land within the district, interposed a defense of fraud on the part of the district directors. These officers were charged with constructive fraud in assessing benefits to lands which could not possibly receive water for irrigation from works constructed by the United States because of the ineligibility of the owner to receive water under rules imposed by Congress in limiting the furnishing of water from such works to lands in single ownership in excess of 160 acres.

The defense was denied by the trial court whose decision was reversed by the Supreme Court, the latter holding that the answer stated a valid defense to the foreclosure action. The chief objection to the Supreme Court decision is that it permits a collateral attack upon the organization of a district and its obligations in an action by the district to enforce the collection of assessments necessary to retire those obligations, and places the powers of the district to make such necessary collections upon an unstable and wholly unsatisfactory basis, subject to readjustment at the whim and caprice of every landowner in a defense to foreclosure actions.

As previously stated, the opinion of the Supreme Court is at variance with a clear policy of the State, only recently confirmed in a decision of the same court rendered a little more than two months before in the case of State ex rel. Sondheim *v.* McClain (286 Pac. 590; 298 Pac. 211; 298 Pac. 213).

The court's change of front is best illustrated by quotations from the two decisions. In State ex rel. Sondheim *v.* McClain, it was held—

"An assessment against irrigable lands is properly an assessment against lands 'that can be irrigated; susceptible of, or suitable for, irrigation.' Webster's New International Dictionary." (298 Pac. 212.)

"It will be useful here to note the following pertinent excerpt from an instructive discourse upon assessments and taxation of land in irrigation districts appearing in 40 Cyc. 824, where the editor says: 'All lands within an irrigation district are subject to assessment according to the benefits received to pay the bonded indebtedness of the district, and it is the duty of the directors of the district to make an annual levy and assessment of taxes to meet the current interest on the bonds and the principal of any bonds which mature in that year. * * * The tax is to be assessed on all the real property of the district not exempt by law, and the directors are empowered to determine the benefits received by particular property.' * * *

"It is manifest to our minds that the burden of taxation imposed upon the owners of irrigable lands within this district is heavy, very heavy. Nevertheless, to permit any irrigable lands to escape their lawful burden of taxation would but add to the load borne by the taxpayers who meet their assessments." (298 Pac. 213.)

And further in contempt proceedings against the district directors for failure to assess lands, title to which had passed to the district, and certain "pasture land," the court said:

"It is asserted by the directors of the district, in effect, that the assessable lands of the district have been assessed. We can not concur in this contention. It clearly appears from the record that, in exempting certain lands of the district from taxation for operation and maintenance, they have not proceeded in accordance with the following section of our irrigation district law: 'Until such time as the water rights appurtenant to any tract of land within an irrigation district shall be acquired by the district the assessments against such land, except for operation, maintenance, and drainage, shall be in the same proportion to a full assessment as the additional water right to be supplied to such tract bears to a full water right, and for operation, maintenance, and drainage, each irrigable acre in the district shall be assessed the same as every other irrigable acre, except as hereinafter provided.' (Gen. Laws of Or., 1917 ch. 357, p. 759, sec. 24.)" (298 Pac. 215.)

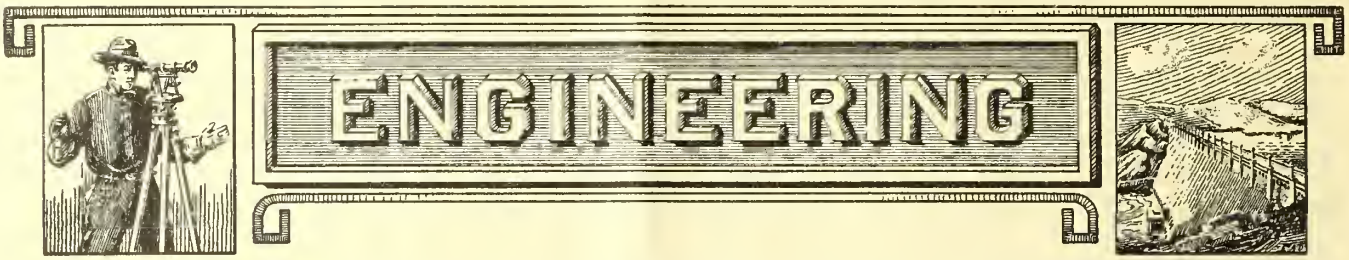
In the case of Enterprise Irrigation District *v.* Enterprise Land & Investment Co. we find the same court holding—

"It [the defendant] also alleged that, by reason of defendant's ownership of the 159.9-acre tract under the Klamath project and of a water right therefor not fully paid for, it was prohibited from using any water which had been obtained under said contract by the district from the United States for the irrigation of its lands within the district, and that the district likewise was prohibited, both by the provisions of the Federal statutes and the express provisions of its own contract with the United States from furnishing water to defendant for the irrigation of lands within the district. This, coupled with the denial by the defendant that the district had ever furnished any water to it for the irrigation of its lands, or that defendant had ever accepted or used any water for said purpose, would, if true, and these facts are admitted to be true by the demurrer, be a complete defense to plaintiff's right to maintain the suit and entitle defendant to equitable relief." (300 Pac. 509.)—*B. E. Stoutemyer, D. C.*

Federal Reclamation Laws Annotated

A new edition of Federal Reclamation Laws Annotated has just been issued by the bureau. This is a volume of 462 pages and supersedes the editions of 1927–1930, being a complete compilation to date of the public statutes of the United States, with annotations, relating to the Federal irrigation of public lands. It contains the organic reclamation act of June 17, 1902, and all of its permanent amendatory and supplementary acts, with digests of the numerous decisions which have been rendered annotated in connection with the laws to which they are applicable.

The Boulder Canyon project act will be found on pages 335–352. Portions of this act have been construed by the United States Supreme Court, the Comptroller General and the Attorney General of the United States, and the Department of the Interior. Notes of such decisions applied to the appropriate sections of the act are appended. The Colorado River compact, signed at Santa Fe, N. Mex., November 24, 1922, which must be read for a proper interpretation of the Boulder Canyon project act, is also contained in the volume.



Construction of the Milner-Gooding Canal

By E. B. Darlington, Superintendent, Minidoka Project, Burley, Idaho

WOOD RIVER VALLEY, in Idaho, is separated from Snake River Valley and is also in itself divided by extensive basaltic lava flows. The Milner-Gooding main canal crosses the lava fields and a large amount of rock was unavoidably encountered in its construction. The nature of the materials that had to be excavated and the topography, characteristic of volcanic eruptions, presented many perplexing problems in location and design. Along some reaches of the canal, however, the rocky formation was of distinct advantage. All structures could be founded upon sound rock and it was entirely feasible to avoid the construction of concrete or masonry drops. The latter circumstance was especially fortunate in the descent from a divide between the Snake and Wood River drainage areas. Here the grade of the canal had to be lowered approximately 60 feet in a distance of about 4,000 feet. In general, a natural draw was followed and a moderate amount of earth and rock excavated to form a channel. Heavy riprapping of earth slopes above the rock line, with material excavated from the canal prism, affords excellent protection from erosion. An average discharge of more than 650 cubic feet per second passed through the chute during the latter part of the 1931 irrigation season. (See photo No. 1.)

At Little Wood River a combined turnout and crossing structure provided a means of diverting 500 second-feet into the stream channel and carrying 550 second-feet under the river through an inverted siphon. (See photo No. 2.) This reinforced-concrete structure was built on a dry area at the neck of a horseshoe-shaped meander in Little Wood River, thus avoiding the difficulty and expense of coffer damming and pumping. After the concrete was poured a new channel to carry the stream over the siphon barrel was excavated.

FLUME SECTION

Beyond the crossing for about three-fourths of a mile the canal is in earth section, but a large part of the terrain between Little Wood and Big Wood Rivers consists of bare lava, so broken with pressure ridges, folds, domes, and fissures as to make a continuous reach of excavated canal impracticable. It was therefore decided to traverse the major part of the distance by means of several reaches of reinforced-concrete flume, connected by united rock sections. The total length of flume, including transitions, is 11,520 feet. (See photo No. 3.)

The longest reaches of flume have an inside width of 14 feet 9 inches and a depth of 6 feet 5 inches with an additional 1-inch depth, or subgrade, at the center. The normal thickness of concrete in the base is 7 inches at the center and 7 inches at the walls. The latter are 6 inches thick at the top and 7 inches thick at the base. The flume is laid directly on a specially prepared subgrade (see photo No. 4) built up of hand-placed rock, afterwards topped out with gravel and sand, compacted by travel with material trucks.

The gradient of the flume with dimensions above described is $s=0.0009$, developing a velocity of 6.87 feet per second and a discharge of 550 second feet. Two reaches of flume, aggregating 3,336 feet in length, are built on a gradient of $s=0.0013$. By reason of the increase in velocity to 8.36 feet per second, the width of these sections is reduced to 13 feet.

The quantity of concrete in the several sections of flume aggregated 6,553 cubic yards. Reinforcing steel averaged 109 pounds per cubic yard. Cement used was 5½ sacks per cubic yard. Fortunately, excellent gravel and sand were obtainable at a pit near Little Wood River. Cement was unloaded and stored at Shoshone. The average haul of materials was therefore not over 4 miles.

PLACING AND MOVING FORMS

An interesting method of placing and moving forms was used on the flumes. Panels 100 feet long were at first tried for molding the side walls. They worked very well on tangents but when curvature was encountered the panels had to be cut into 25 and 50 foot lengths. These forms were raised and moved ahead by means of a "Jumbo" that spanned the flume. (See photos Nos. 5 and 6.) The "Jumbo" was essentially a traveling crane running on rails outside the flume section. The concrete mixer was on a separate framework, traveling on the same tracks. Reinforcing steel was set at night for a day's run ahead, and when the pour for the day was completed the mixer was run ahead and blocked. The mixer engine, operating a drum and cable, was then used to pull forward the raised forms.

When in position for another pour, the form panels were lowered into place and bolted. Progress was at the rate of 100 to 150 feet per day. The walls were poured before the floor, the concrete being allowed to flow out for a foot or two upon the subgrade for the floor. When a 10-foot section of wall forms was completely filled, a 10-foot section of floor was poured. The latter was struck longitudinally with a straight-edge, floated, and finally trowelled.

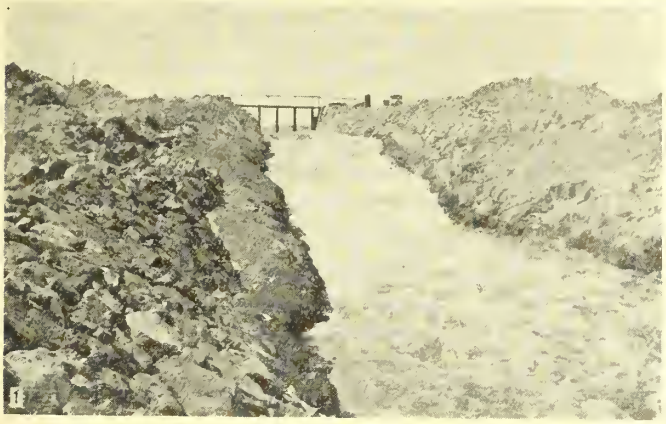
Curing of both walls and floor was done by the Hunt process of applying an asphaltum paint to retain moisture, on account of the difficulty and expense of obtaining water.

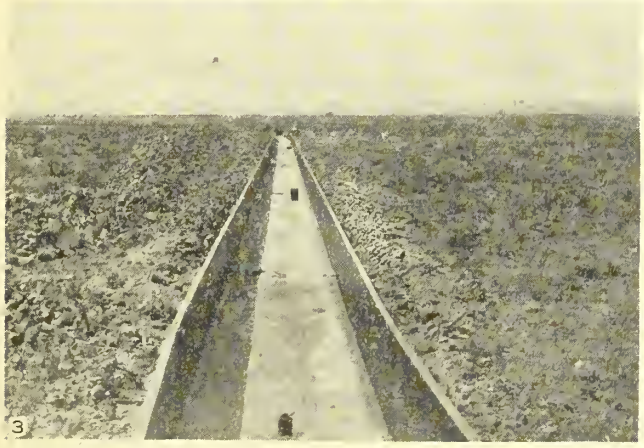
GUNITED ROCK SECTION

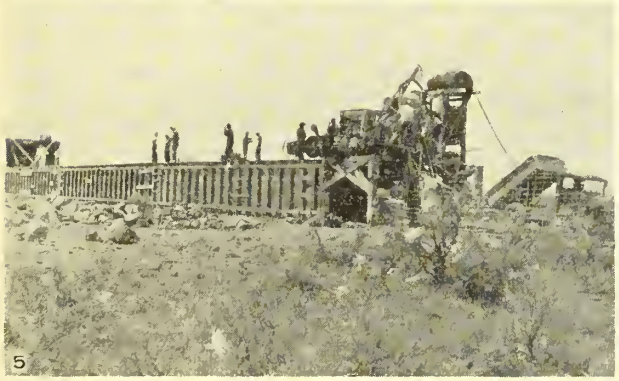
The typical gunited rock section was 16-foot base, with ¼ to 1 side slopes, and a concrete floor 5 inches thick extending to rock at each side, the subgrade being prepared in the same manner as for the concrete flume. The total length of gunited section was 2,388 feet. Masonry walls were constructed where the rock slopes were not high enough to retain water at normal depth.

Preparation of the walls for guniting consisted of first barring down all loose rocks, cleaning with stiff brushes and washing thoroughly with a pressure hose. A ¼ to 1 mix was used, requiring about 5.75 sacks of cement per yard. Well-graded sand was obtained from a local pit. Rebound was moderate. As all seams and fissures in the rock from the floor to 1 foot above maximum water line had to be closed to prevent leakage, a considerable amount of material was consumed, and it is probable that this type of con-

(Continued on p. 245)







MINIDOKA
IRRIGATION
PROJECT
IDAHO

GOODING
DIVISION
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MILNER-
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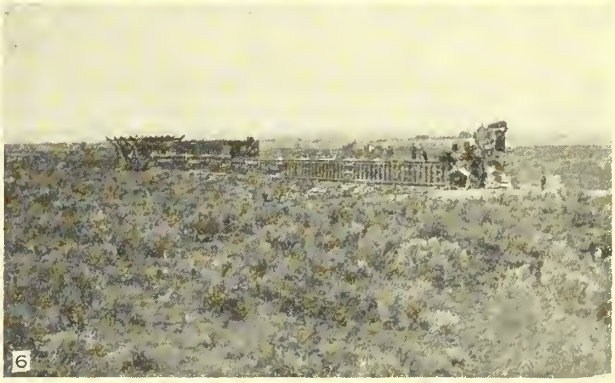

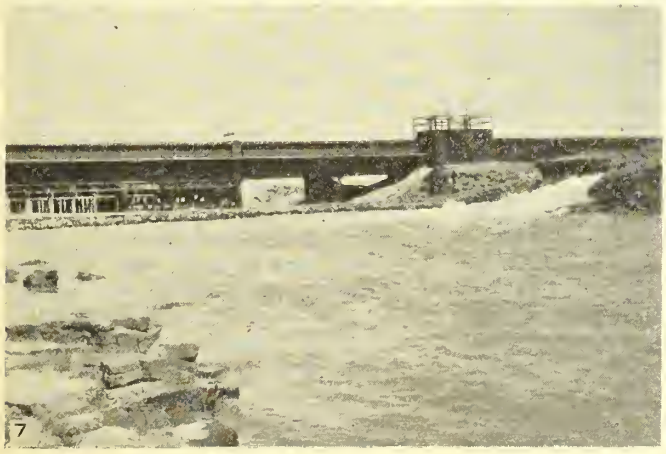

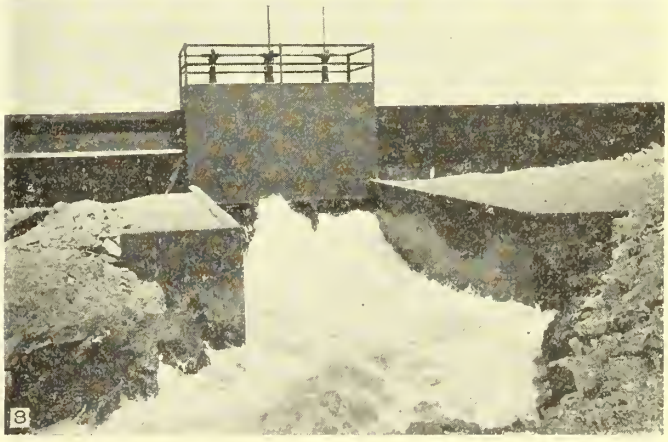

1. Rock drop, 60 feet in 4,000 feet—discharge 250 second-feet; 2, diversion to Little Wood River at crossing structure; 3, completed bench flume across lava beds; 4, subgrade ready for gravel topping, bench flume; 5, concrete operations under way, bench flume; 6, bench flume under construction, portion of completed flume in background; 7, wasteway into Big Wood River at intake end of Big Wood River flume, discharge 250 second-feet; 8, same as No. 7. Diversion of 250 second-feet for lands on North Shoshone and North Gooding tracts

Notes for Contractors

Boulder Canyon project.—Bids were opened at Las Vegas, Nev., on October 5 (specifications No. 534–D) for constructing a water-purification plant and sewage-disposal plant in Boulder City. Stearns-Rogers Manufacturing Co., whose bid was $37,930, has been awarded the contract. The water plant will consist of a series of reinforced-concrete tanks, chambers, and compartments constructed principally below the ground level, with a 2-story building 19 by 54 feet over a part of the concrete work. The building will have a tank tower at one end and two 1-story wings over other portions of the concrete work. The sewage-disposal plant will consist of reinforced-concrete clarifier and digester tanks, a sludge-pump chamber, and a 1-story brick building 27 by 28 feet erected over the digester tank and pump chamber.

Specifications have been issued for the construction of nine 5-room residences at Boulder City and designs and specifications are being prepared for an additional group of 3 and 4 room residences.

Specifications have been issued covering the construction of a Government garage about 72 by 152 feet in size to be used as a fire station and for storage of Government automobiles and trucks.

Specifications have been prepared covering the furnishing and installation of a cooling system in the administration building at Boulder City.

Bids were opened at Las Vegas, Nev., on October 20 (specifications No. 540–D) for constructing one 7-room and three 6-room residences in Boulder City. The time allowed for completion is 100 days.

Yakima project, Storage division.—The Lahar Construction Co., of Boonville, Mo., with a bid of $198,875 was low among 24 bidders for clearing the Cle Elum reservoir site, at the opening at Ronald, Wash., on September 18. Under the original advertisement the lowest bid received at the opening on July 10 was $291,600 from Siems-Helmers (Inc.), St. Paul, Minn., and all bids were rejected as being too high.

Yakima project, Kennewick division.—Bids for furnishing hydraulic and electrical apparatus for the Prosser power plant and the Kennewick Highland pumping plant were opened at Denver on September 11, and 34 companies submitted bids. Awards for furnishing the various items have been made as follows, the prices given being f. o. b. shipping point: Item 1, one 4,200-horsepower hydraulic turbine, Newport News Shipbuilding & Dry Dock Co., $31,450; item 2, one 3,000 kilovolt-ampere alternating-current generator, General Electric Co., $23,546; item 3, one 3,000-kilovolt-ampere 3-phase transformer, Pennsylvania Transformer Co., $7,305; item 4, three 500-kilovolt-ampere single-phase transformers, Pennsylvania Transformer Co., $5,586; item 5, six 69,000-volt disconnecting switches, Graybar Electric Co. (Inc.), $432.60; item 6, three 69,000-volt disconnecting switches, no award; item 7, two 69,000-volt lightning arresters, General Electric Co., $2,590; item 8, one 69,000-volt lightning arrester, no award; item 9, two 69,000-volt air-break switches, Bowie Switch Co., $756; item 10, one pumping-plant switchboard, Wolfe & Mann Manufacturing Co., $523; item 11, one power-plant switchboard and auxiliary apparatus, Wolfe & Mann Manufacturing Co., $4,338; item 12, six 69,000-volt expulsion fuses, General Electric Co., $546; item 13, one horizontal centrifugal pump, Hendrie & Bolthoff Manufacturing Co., $1,320; item 14, two horizontal motor-driven pumping units, Worthington Pump & Machinery Corporation, $4,500.

Yakima project, Kittitas division.—Designs have been prepared for the Wippel pumping plant and specifications will soon be issued for the construction of the plant and the installation of the machinery.

Minidoka project, Gooding division.—Bids were opened at Burley, Idaho, on September 16 for earthwork and structures on the Milner-Gooding and North Gooding Canals (specifications No. 527). The lowest bid received was $117,551 from Haas, Doughty & Jones, of San Francisco, Calif. There were 12 bidders.

Grand Valley project.—On October 20, at Denver, bids were opened for furnishing hydraulic and electrical apparatus for the Grand Valley power plant, under specifications No. 528. The requirements for the plant are two vertical 2,300-horsepower hydraulic turbines; two hydraulic turbine governors and governor pumps; two 1,875-kilovolt-ampere vertical alternating-current generators; and one power-plant switchboard and auxiliary apparatus.

Bids were opened on October 12 at Grand Junction for lining with concrete 769 feet of the main canal, Canyon division (specifications No. 541–D).

Owyhee project.—Specifications have been prepared covering the furnishing and installing of a 9,000-pound capacity electrically-operated combined freight and passenger elevator for Owyhee Dam. The total lift is 271 feet with five landings.

Bids for furnishing 60,000 barrels of cement in sacks and 200,000 barrels of bulk cement were opened October 5 under invitation No. 16250–A. Of the first-named quantity, 7,000 barrels were for the Baker project. Awards have been

Photo by George A. Beyer

Left to right: Dr. Elwood Mead, commissioner of reclamation; R. F. Walter, chief engineer; E. B. Debler, hydrographic engineer; L. N. McClellan, electrical engineer; Roy S. Gill, of the Columbia Basin League, Spokane, Wash.

made as follows, the prices being f. o. b. shipping point: Item 1, 53,000 barrels of sacked cement, Idaho Portland Cement Co. $2.15 per barrel; 7,000 barrels of sacked cement, Oregon Portland Cement Co. $2.65 per barrel; item 2, 200,000 barrels of bulk cement, Oregon Portland Cement Co., $1.95 per barrel.

Vale project.—Under specifications No. 539-D, bids were opened at Vale, Oreg., on September 24 for lining 1,100 feet of the main canal with concrete. Gabby & McNeil, of Boise, Idaho, submitted the low bid of $8,364 and have been awarded the contract.

Milner-Gooding Canal

(Continued from p. 242)

struction was no more economical than continuous flume. The total quantity of gunite used was 493 cubic yards, measured in the cement gun.

Big Wood River is to be used as a wasteway in case of emergency, and a turnout and automatic siphon spillway structure was constructed at the upper end of the flume across that stream. (See photos Nos. 7 and 8.) During the 1931 irrigation season this structure was used to discharge water into the channel of Big Wood River whence it was diverted into various ditches having headings upon that stream. In the future the lands thus irrigated will be supplied through the system of the Big Wood Canal Co., with which the Milner-Gooding main canal will eventually make connection at a point about 8 miles beyond Big Wood River.

Power Plant for Grand Valley Project

On June 19, 1931, the department approved a contract between the United States, the Grand Valley Water Users' Association, and the Public Service Co., of Colorado, which provides for construction of the Grand Valley power plant on the Colorado River near the site of the Orchard Mesa pumping plant.

The power plant will have a maximum head of approximately 74 feet, and an initial capacity of 3,000 kilowatts, with two 1,500-kilowatt units. In connection with the installation and operation of the plant it will be necessary to line with concrete certain sections of the Grand Valley Canal between the headgate and the Colorado River siphon. It is estimated that the cost of the plant and the canal lining will be about $215,000.

The Bureau of Reclamation will construct the plant, while the power company will purchase the power, operate and maintain the plant and also build transformer station and transmission lines. It is planned to award contracts for the hydraulic and electrical equipment in November of this year, and award contract for construction of the plant in February, 1932.

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- Total cost of concrete in Owyhee Dam is only seven dollars a yard, Southwest Builder and Contractor, Sept. 25, 1931, v. 78, No. 13, p. 40.

Constructor:
- Two more large projects for the Southwest, maps of All-American Canal and Los Angeles Aqueduct, Constructor, September, 1931, v. 13, No. 9, pp. 22–25.

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- Way cleared for Cle Elum Dam construction. (Description of power development), Electrical West, Sept. 1, 1931, v. 67, No. 3, p. 140.

Engineering News-Record:
- Preliminary work begun on Colorado River Aqueduct (short), Eng. News-Record, Oct. 8, 1931, v. 107, p. 585.

Froehde, F. C.:
- Water scarce? Follow Pomona's lead and use sewage effluent for irrigation, illus., The American City, October, 1931, v. 45, No. 4, pp. 81–82.

Kubach, W. F.:
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Mason, Morris:
- Yakima irrigation project construction work (short), illus. (from October Proc. A. S. C. E.), Civil Engineering, October, 1931, v. 1, No. 13, pp. 1213–1214.

McClellan, L. N.:
- Electricity already playing chief part in construction work at Hoover Dam, U. S. Daily, Oct. 2, 1931, v. 6, pp. 1 and 7 (pp. 1745 and 1751).

Mead, Elwood:
- Engineers say Hoover Dam will stay put, drawings, Architect and Engineer, September, 1931, v. 106, No. 3, pp. 79–83.

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- Columbia Basin and overproduction (editorial), Pacific Builder and Engineer, Oct. 3, 1931, v. 37, No. 40, p. 17.

Schnurr, Mae A.:
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- Hoover Dam and Boulder City, illus., Western Construction News, Sept. 25, 1931, v. 6, No. 18, pp. 495–498.

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- The handout magnificent (comment on Public Domain Commission report), Harpers Magazine, October, 1931, v. 163, pp. 594–602.

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- Rio Grande being made to irrigate larger area in Maverick County, illus., Compressed Air Magazine, October, 1931, v. 36, No. 10, pp. 3610–3614.

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- Building of railroad to Hoover Dam site toughest job to date, illus., Southwest Builder and Contractor, Sept. 11, 1931, v. 78, pp. 38–40.

U. S. Daily:
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Wattis, W. H.:
- Obituary with portrait, Western Construction News, Sept. 25, 1931, v. 6, No. 18, p. 509.

Western Construction News:
- Madden Dam and power plant, tabulation of bids, Western Construction News, Sept. 10, 1931, v. 6, p. 44.
- Doctor Mead quoted on death of W. H. Wattis, Western Construction News, Sept. 25, 1931, v. 6, No. 18, p. 485.

Wilbur, Ray Lyman:
- Slide Rule Civilization—The engineering mind as an aid to progress, Technology Review, October, 1931, v. 34, No. 1, pp. 13–14 and 42, 50.

RESIDENTS of 19 States and 10 foreign countries had the pleasure last winter and spring of eating Arizona grapefruit, records of the Arizona Citrus Association show. Of a total of 313,809 boxes of fruit handled by the association during the past season, 246,641 boxes, or 78 per cent, were grapefruit. Oranges, lemons, and tangerines made up the balance.—*The Earth.*

Boulder Canyon Project Notes

A recent report states that physical examinations of employees of the Six Companies has been completed, and that of the 2,201 men so examined, only 101 were rejected for physical disabilities. Other items of interest in this report are that of the 2,100 men now working, 1,089 are married, only 53 are foreigners, 41 per cent are ex-service men, the average age is 34 years, and of the number employed 567 are from California, 253 from Nevada, 120 from Utah, 110 from Arizona, 99 from Idaho, and the remainder are from the other States of the Union excepting Vermont and Delaware.

United States Marshal Fulmer has just concluded a 10-day investigation on the project, which resulted in the arrest of about 20 persons on liquor complaints.

Building of the Six Companies' railroad continues to be concentrated on the line from the 3-way junction to a point across the river from the gravel plant. It is reported that Shanahan Bros. have completed to date about 8 miles of their contract for 20½ miles of track and that the forces of John Phillips Co. are now engaged in earthwork construction near the site of the proposed pile trestle bridge across the river. Steady progress is being made along the Black Canyon section of the road with crews working along the line and on the bench at the dam site. On October 4, 8 tons of powder were used to remove Cape Horn, a prominent bluff which obstructed progress of the railroad construction, and 276,000 cubic yards of rock were disrupted by a single blast.

Work is being pushed on the construction of the gravel plant at the 3-way junction. It is expected that only 90 days will be required for the building of this plant, the output of which is planned to be 500 tons of gravel per hour.

There has been practically no recent change in the number of men employed by the Bureau of Reclamation, Six Companies, and other contractors, the total remaining at about 2,600.

All of the first group of 12 residences are now occupied by tenants, the 7 buildings in blocks 2 and 9 having been completed on October 3, and the 5 in block 4 on October 10.

Three houses in the second group of 12 residences have all brick in place, and work has started on the roofs and partitions. In one other, the brick has been laid to the top of the windows, in another it has been laid to the bottom of the windows, and in the other seven the floor joists have been laid and are ready for brickwork to begin.

Water lines were laid on Arizona Street from Cherry Street to the Municipal Building, and on Nevada Highway from Elm to Park Street. The total footage of all sizes for one week was 5,180 feet. All service lines have been connected to the Government houses in blocks 2 and 4, and the Six Companies' cottages on avenues B and C are being connected without meters. The pumping plant was operated for a period of 15 hours to maintain a sufficient storage for the needs of the city. Award of contract to cover the construction of the filtration and treating plant has been made to the Stearns Roger Manufacturing Co., of Denver, the lowest bidder. The water purification plant will be situated immediately below the receiving tank at Boulder City. The time allowed for completion is 120 days after starting date.

A permanent committee, consisting of John C. Page, office engineer; J. R. Alexander, district counsel; and V. G. Evans, manager of the Boulder City Co., a Six Companies subsidiary, has been appointed to act in an advisory capacity to the construction engineer and Mr. Sims Ely, city manager of Boulder City. Several permittees have recently submitted plans for their buildings, and are actively engaged in preparations for building. Two additional lessees, Mrs. Browder and Fred C. Snell, have started actual construction in Boulder City.

The Six Companies are continuing construction of the dormitory in block 40 and the 2-room cottages in blocks 41, 42, and 43.

Award of contract has been made for rollaway beds under invitation No. 3260–A. A requisition for rock wool has been made up in the Denver office, and preliminary drawings of a schoolhouse have been started.

Records kept by the Boulder City police department and the reservation ranger service indicate that an average of 1,000 cars visit the Hoover Dam observation point weekly. More than 500 visitors' permits are issued on Sunday, and almost 100 on each week day.

Walker R. Young, construction engineer, delivered an address before 300 persons at a meeting of the Los Angeles chapter of the American Society of Civil Engineers on Wednesday evening, October 14. His discussion on the Boulder Canyon project and the Hoover Dam was illustrated by a group of lantern slides.

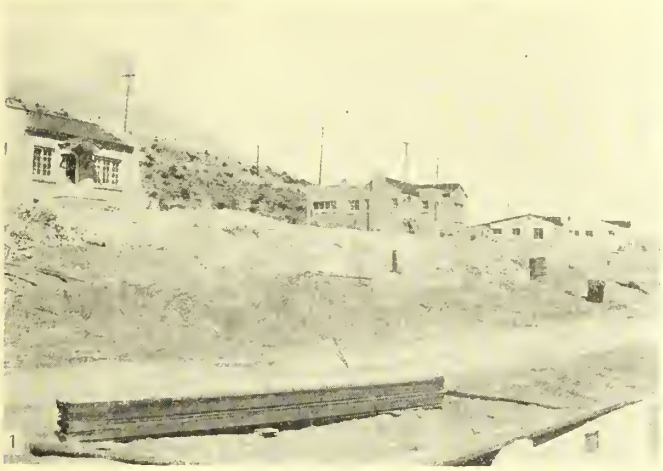
Progress on the pioneer tunnels to date: Tunnel No. 1, 1,325 feet; Tunnel No, 2, 2,973 feet; Tunnel No. 3, 3,115 feet; Tunnel No. 4, 1,255 feet; or a total of 8,668 feet.

Sims Ely Appointed City Manager Boulder City

Secretary Wilbur has appointed Sims Ely, of Arizona, city manager of Boulder City, Nev.

Mr. Ely has held responsible municipal positions in Arizona, has been identified with the preliminary work leading to the Colorado River Compact Commission, and took part in the drafting and presentation of suggested legislation for the States of Arizona and California and the national congress on storage and distribution of Colorado River waters. For five years he was editor of the Arizona Republican. More recently, for a period of about eight years, Mr. Ely has been director and treasurer of the Federal Land Bank of Berkeley, Calif.

The city manager will undertake the organization of Boulder City and its operation during the years Hoover Dam is being constructed. He will be responsible and report to Construction Engineer Walker R. Young, who is in charge of the Boulder Canyon project. An advisory commission composed of two Government employees, John C. Page, office engineer, and James R. Alexander, district counsel, and one of the contractor's employees, V. G. Evans, will serve without additional compensation and be subject to call by Construction Engineer Young in connection with the management of the town.



BOULDER CANYON PROJECT

VIEWS SHOWING PROGRESS

1. First 12 Government residences in Boulder City completed October 1, 1931; 2, Government residence completed October 1, 1931; 3, Six Companies' commissary; 4, Six Companies' area from bospital grounds. Municipal building foundation in middle foreground. Six Companies' commissary at upper right; 5, storage yards and plant of Standard and Union Oil companies at Boulder City—under permits and leases; 6, Six Companies' hospital—view from southwest; 7, view from soutb along Avenue C, Boulder City, showing Six Companies' cottages, seven under construction

Potomac River and The Nation's Capitol

By W. I. Swanton, Engineer, Bureau of Reclamation, Washington, D. C.

THE historic Potomac is closely associated with the history of the Nation's capital. Washington had his home at Mount Vernon on the south bank 26 miles below the city which bears his name. The south bank of the Potomac forms the boundary of the District of Columbia, which now has a population of about half a million with over 600,000 within the metropolitan district as defined by the Bureau of the Census. The area of the District of Columbia is 70 square miles, of which 10 square miles are water surface, including the Potomac, Eastern Branch or Anacostia River, and Tidal Basin.

Washington is at the head of navigation and of tidewater. The Great Falls of the Potomac are located about 17 miles above the city and the diversion dam for the two conduits furnishing water supply for the city is located at this point.

CHESAPEAKE & OHIO CANAL

The famous Chesapeake & Ohio Canal, which was flooded in 1924 and has not been used since for navigation purposes, lies along the north bank of the Potomac and is still used in its lower part for water-power purposes for industrial plants in Georgetown. The canal was built previous to the Civil War period and opened about 1850. It extends to Cumberland, Md., in the vicinity of the coal mines, a distance of 185 miles from Washington. While used for navigation purposes, an interesting trip could be made from Georgetown to Great Falls, passing through on the way 16 locks which are built of stone masonry with wooden gates. They are 100 feet in length by 15 feet wide, and have a lift of approximately 8 feet each. The total lift from Georgetown to the canal level at Great Falls is 128 feet and as there is a group of locks at Georgetown leading to the Potomac River, the total rise of the canal in the distance of 14 miles is 168 feet. There are 75 locks and 2 guard locks in the entire length.

The old Chesapeake & Ohio Canal is the successor of the disconnected series of canals built by the Potomac Navigation Co., of which George Washington was president, in 1785. On this canal which was chartered in 1824 construction commenced in 1832 and was completed to Cumberland in 1850. The canal has a minimum depth of 6 feet, the bottom width ranges from 31 to 41 feet, and the side slopes in embankment is 2 : 1 with a 14-foot width of bank or towpath, and a freeboard or height above the water surface of 8 to 18 inches. At one place near Cumberland there is a tunnel 3,000 feet long—about the length of the one built by the Bureau of Reclamation at Klamath Falls, Oreg. From 250 to 400 second-feet of water is constantly flowing in the canal for maintaining the water-power privileges of over 1,000 horsepower and other purposes. The canal was formerly operated on the principle of a toll road, and the towing company had about 65 boats hauling coal from Cumberland near the mines to tidewater at Georgetown. These boats were 93 feet long, 14 feet wide, and had a capacity of 115 tons (of 2,240 pounds) of coal each. A round trip took about a week, and usually three round trips were made a month, the motive power consisting of 4 to 6 mules working in teams of 2 or 4 each 6 hours.

Photo by George A. Beyer

Lock, Chesapeake & Ohio Canal Maryland

THE MEIGS WATER SUPPLY AQUEDUCT

This aqueduct built during the Civil War period by the War Department under supervision of General Meigs and opened in 1863 had not been unwatered except for short periods when necessary repairs were made, since built until the new aqueduct described later on was completed. The aqueduct is 11 miles long, of which 1½ miles were unlined tunnel and the rest consisted of a 9-foot diameter circular brick or rubble masonry cut and cover conduit which follows approximately the contours of the north bank of the Potomac on a side hill location. The tunnel sections are now lined. The Conduit Road, which is a substantially constructed 8-inch bituminous macadam highway, 16 feet wide with tarvia surface is directly over this conduit for a large part of the distance.

This conduit flows into a receiving reservoir at Dalecarlia and thence to Georgetown Reservoir from which water is sent by tunnel to the slow sand filtration plant 4 miles distant on the easterly side of the city.

The capacity of the conduit, without additional head, is approximately 75 m. g. d., but by increasing the head at the intake its capacity can be increased to approximately 100 m. g. d.

It will be interesting to note in this connection that 65 m. g. d. is about 100 second-feet and the siphons on the Interstate Canal of the North Platte project have capacities of 1,400 second-feet.

One of the principal features of this aqueduct is the celebrated Cabin John arch bridge about 4 miles from the city, which was constructed about 1855 and was for 40 years the largest stone masonry arch in the world, with a span of 220 feet.

THE NEW WATER SUPPLY AQUEDUCT

Owing to the increased growth in population of the District of Columbia and

surrounding territory, an additional water supply for the city was needed and in 1922 the construction of a new aqueduct parallel with the old aqueduct previously described was commenced. This aqueduct extends from the same diversion dam at Great Falls to the Dalecarlia Reservoir in Georgetown. It consists of about 8 miles of cut and cover aqueduct and two tunnels and an inverted siphon at Cabin John Creek. The siphon is 9 feet in diameter. The tunnel sections are approximately horseshoe shaped, 10 feet wide and 9 feet 5 inches high. The cut and cover section has a width of 10 feet 6 inches and a height of 10 feet. This aqueduct utilizes the same dam at Great Falls as the early aqueduct and follows the same general line and grade, but is 20 to 30 feet nearer the river. It has a maximum capacity of about 110 m. g. d. The crossing at Cabin John Creek is made by an inverted siphon of ⅜-inch riveted steel incased in and lined with concrete, having an inside diameter of 9 feet. This construction was decided upon instead of the arch, as in the old aqueduct, being less expensive.

At the terminus of the aqueduct at the Dalecarlia Reservoir are located the chemical laboratories and the filtration plant which consists of 20 rapid sand filters with capacity of 4 m. g. d. each. These filters contain 16 inches of gravel and 24 inches of fine sand and are washed by reversing the flow every 20 to 30 hours. The water is conducted from these filters to the storage reservoirs and then pumped to the high service mains. A small hydroelectric power plant at the foot of the hill near the river with a head of 140 feet develops about 2,000 horsepower for pumping water and other power needs of the water system. The cost of this aqueduct with filter plants, etc., was about $8,725,000.

The two aqueducts have a capacity for a water supply for a population of over a million, and it is estimated that they will supply water for the District of Columbia and surrounding territory for another generation before additional supply works will be necessary. The present average annual consumption of water is about 84,000,000 gallons per day, or about 170 gallons per person per day. The maximum consumption for one day in midsummer was over 116,000,000 gallons.

THE demand for farm units on the Milk River project still exceeds the number of suitable farms available for sale. One project farm was sold on a recent date, the new settler being a farmer from the adjacent bench lands.

China Irrigates an Additional 300,000 Acres

The Saratsi irrigation canal, a joint project of the China International Famine Relief Commission and the Suiyuan provincial government, has recently been completed, the official opening taking place on June 22, 1931. This canal is situated between the Peiping-Suiyuan Railway on the north and the Yellow River on the south, in the vicinity of Saratsi, Suiyuan Province, China. About 300,000 acres of irrigable land lying on the southern edge of the Gobi Desert will receive water from the canal.

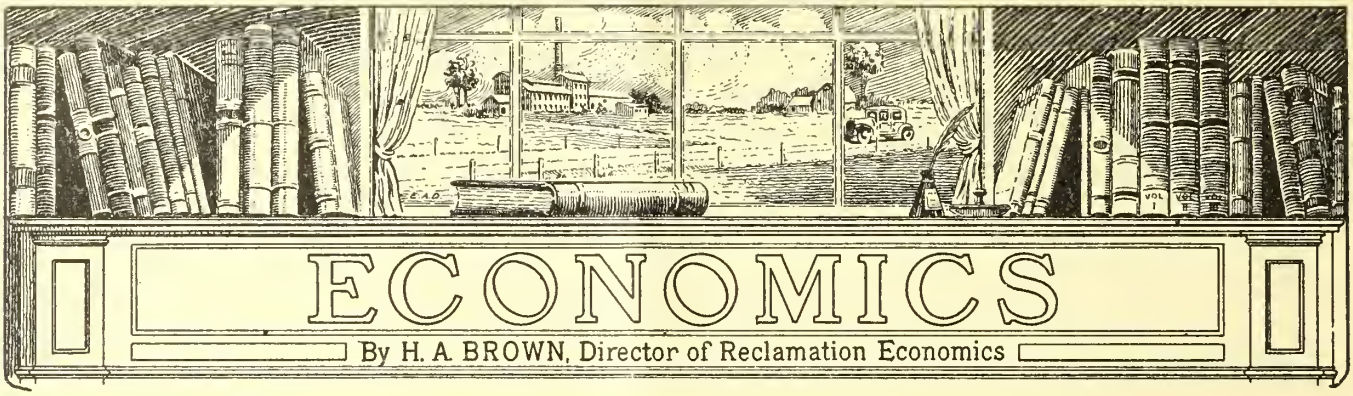
The main canal, which is about 40 miles in length, taps the Yellow River about a mile east of Tangk'ow. It has a bottom width of 60 feet at the intake, narrowing to 45 feet, side slopes of 1½ to 1, and depths varying from 10 to 8 feet. There are 14 laterals from the main canal. At the intake the flow of the Yellow River in times of low water is 4,000 second-feet, and during flood periods is approximately 150,000 second-feet. The silt content of the river varies from 0.1 to 1 per cent by volume. As navigation is an important development incidental to the project, the gates and bridges are planned so that shallow-draft canal boats may ply the main canal and laterals.

Through a change in meterological conditions, the central part of Asia is becoming more and more arid, with the result that the Gobi Desert has been advancing steadily southward into the northern part of China. As the desert advanced the farmers were obliged to retire and the abandoned farm lands were occupied by nomads as grazing grounds for their flocks. During the past 20 years or so, however, the centrifugal force of an increasing population has caused the farmers to cease retiring and even to make advances into the previously abandoned regions. To overcome the lack of sufficient rainfall, irrigation has been resorted to, but the water obtained from wells and melting snow has not always proved adequate. The droughts of 1927 and 1928 caused widespread suffering and misery among the argicultural community in the vicinity of Saratsi, resulting in thousands of deaths from starvation and pestilence. Women and children were sold so that their husbands and parents could obtain food for the sustenance of life. These conditions brought forth the Saratsi project, fostered by the China International Famine Relief Commission, its purpose being to provide employment, and postpone or even prevent a recurrence of a similar catastrophe.—(*Consular report, June 30, 1931.*)

THE discharge of the Colorado River at Yuma, Ariz., on September 24 dropped to a minimum of 66 cubic feet per second, which is a new minimum flow of record. September was the sixth consecutive low month of record in total runoff, being but 39 per cent of the previous low in 1924 and only 9.9 per cent of the 29-year average for September. It is interesting to note that the maximum flow of record is 200,000 cubic feet per second, and the minimum flow previous to this unusual month of September was 1,200 cubic feet per second. However, there was an ample supply of irrigation water for all project needs during the month.

Photo by F. C. Bohlson

Headquarters o Baker irrigation project, Oregon



The Need for Additional Water Supplies in the Irrigated Areas of the Western States

IN CONNECTION with the activities of the Bureau of Reclamation in furnishing supplemental water to meet the needs of irrigated areas having an inadequate supply for late irrigation, the recent report of the committee on irrigation of the American Society of Agricultural Engineers for the two years ending June, 1931, contains food for thoughtful consideration.

As a result of their investigation the committee finds that fully 50 per cent of the land now irrigated in the Western States is in need of supplementary water supplies, varying from the need for slight additional storage facilities to tide over the last of a series of dry years, to the need of almost an entire normal supply of irrigation water.

Needless to say, their investigation deals only incidentally with Federal reclamation projects where, in general, the storage facilities are adequate even under the trying drought conditions of the past years, but chiefly with irrigation development carried on by private companies and other non-Federal agencies.

The committee points out that—

"It is impossible to draw any sharp lines of demarcation between those irrigation projects which have an ample supply of water and those which have a deficient supply. Nearly all projects in well developed sections of the country find themselves somewhat short of water during extremely dry seasons. This is the normal condition and will always prevail, because it would not be sound economics to construct storage systems large enough to take care of the needs during the extremely dry cycles which occur at long intervals. Neither would it be economically sound to restrict the area of land irrigated to the supply available during such extremely dry periods.

"Maximum efficiency in the use of water can be secured only by means of excessive labor and excessive cost in the preparation of land and in the building of irrigation structures. For this reason there is a very definite tendency on most projects to use more water than is absolutely essential, so long as such excess water is available.

"Since the factors which govern the value of water on any project are not static, the economic limit of cost of water-conservation methods will also vary from time to time. For this reason no definite limit can be set for the economic duty of water on a project, much less for all projects.

"On the other hand, even when the landowners make economical use of the available supply, many projects in each of the arid States are short of water during slightly dry and even normal years."

The following data relate to the 11 Western States which need additional supplies of irrigation water for lands already under cultivation and partially irrigated:

ARIZONA

The accumulated deficiency in rainfall in Arizona since 1921 has revealed a half dozen large projects as having an inadequate water supply for such continued dry periods. In several cases where the need is great there are no unappropriated waters available, the only solution being to eliminate part of the project area. Elsewhere there are opportunities for storage of surface waters or for the utilization of ground-water reservoirs. Aside from the Colorado main stream and the Verde River, which will be stored for the benefit of Paradise Valley when the financing is finally arranged, the remaining development—much of it for supplemental irrigation—will approximate 100,000 acres.

CALIFORNIA

A large part of the 6,000,000 acres now irrigated in the State is in need of larger water supplies at certain seasons and in cycles of subnormal water supply. This is especially true of the southern half of the State, but occurrence of shortages is not confined to that area.

COLORADO

Studies of storage possibilities have been or are being made of the Poudre Valley, the South Platte drainage basin, and the Arkansas Valley. Some attention has been given to the question of diversions from the Pacific watershed. Supplemental water for irrigation is being provided in a small way by means of pumping from underground sources. Direct attention is being given to the matter of better administration of the present available supply through better and more dependable measurement. The main thought back of the proposed development of supplemental water supplies in the State is not that of expanding the irrigated area but of rounding out and strengthening junior appropriations.

IDAHO

The total irrigated area in the State is about 2,500,000 acres, over 30 per cent of which is not fully supplied with water. For part of this area there is no possible additional water in sight. In others, pumping of ground water offers some promise. On still others, additional storage and the installation and operation of drainage wells would satisfactorily insure the supply in short years.

MONTANA

There are no available data on the acreage with only a partial supply of water, although it is stated that these lands would be found mostly along the foothills, where use is made of the spring runoff from small drainage areas. It has been estimated by Harding that the average amount of water leaving the State

which could probably be used for irrigation is from 30,000,000 to 35,000,000 acre-feet annually. The total land area of the State is 93,568,640 acres. According to Harding, the total area susceptible of irrigation is 7,000,000 acres or about 7½ per cent of the total area of the State. The present irrigated area is about 1.8 per cent of the total area of the State. Hence, it may be assumed that the ultimate irrigation development of the State is about one-fourth completed.

NEW MEXICO–TEXAS

The largest river in New Mexico, the Rio Grande, is quite fully appropriated, but numerous communities are searching for small supplemental supplies. Below El Paso, the Rio Grande is augmented by large tributaries with numerous storage sites in its canyon sections, which await development to furnish a supplemental supply to the Brownsville area pending settlement of international treaty rights.

OREGON

There are about 1,000,000 acres of land irrigated in the State, at least 50 per cent of which probably does not have an adequate water supply.

UTAH

It is estimated that of the 1,320,000 acres irrigated in the State, about 900,000 acres have only a partial water supply. There is a total of 1,600,000 acre-feet of storage capacity in the State, which is only about 1½ acre-feet per acre for the total irrigated area. With the exception of the Sevier River district, water is available, if stored, to fully irrigate the present irrigable area in irrigation enterprises. There are in existing enterprises some 300,000 acres which are not at present being irrigated owing to lack of water. This will increase the total area needing water to 1,200,000 acres. It is estimated that not less than 1 acre-foot per acre additional will be required to complete the water supply on this area.

WASHINGTON

Fully 50 per cent of the 600,000 acres of irrigated land in the State is without an adequate water supply during part of the irrigation season owing to the fact that storage water is not available. In the case of lands depending on the natural flow of streams, even in years of normal precipitation, the supply is inadequate to meet the full needs, particularly where dependence is placed on small mountain streams.

WYOMING

About 1,000,000 acres are being irrigated, of which about 185,000 acres have only a partial supply. In some years there is no shortage on this land; in others it is quite severe.

WATER WASTING SHOULD BE PREVENTED

The committee points to the possibility in all the States of increasing the service of present water supplies through the prevention of waste. In most irrigated areas there are farmers who irrigate too heavily or too soon after the last watering, and whose practice is such that uniformity of distribution can not be obtained. With helpful technical advice and the use of a soil auger, production in the irrigated areas may be increased from 5 to 50 per cent without bringing in more water, and virtually without additional cost.

HOW THE BUREAU IS HELPING

The effect of supplemental stored water on crop fields and money returns is not in direct proportion to the increase in total water supply in the stream, as the time of application of irrigation water and variation in the amounts in accordance with crop requirements, both of which are largely under control when storage facilities are available, may and often do produce the difference between profit and loss in farming operations. What the Bureau of Reclamation is doing to provide an adequate water supply for projects whose supply falls short for late irrigation is indicated by the following examples:

SALT LAKE BASIN PROJECT, UTAH

Echo Dam was constructed by the bureau as the first unit of the Salt Lake Basin project, Utah, to furnish supplemental water for 60,000 acres of land in the lower Weber and Ogden Valleys, and for 20,000 acres in Provo Valley. The dam was completed on October 7, 1930.

The total estimated crop value in 1931 on the lands representing the 69,000 shares of stock owned in the Weber Valley amounted to $2,325,406. The estimated crop value without Echo storage is estimated at $1,627,785, so that the estimated increase in crop values on this project due to the supplemental storage provided by the bureau, amounted in 1931 to $697,621, representing 30 per cent of the total crop value.

SNAKE RIVER VALLEY

The Snake River Valley is another example of the beneficial effect of supplemental stored water furnished from reservoirs constructed by the Bureau of Reclamation. In 1930, the use of stored water from the Bureau of Reclamation's reservoir on Snake River was approximately 25 per cent of the total use of water for irrigation. On account of the advantages in having an adequate supply of irrigation water available at the right time and of being able to finish out the more valuable crops with stored water during the latter part of the growing season, it is conservatively estimated that yields and values were increased at least one-third through the use of storage.

A total crop value of approximately $27,000,000 was reported in 1930, for projects receiving water from Jackson Lake and American Falls Reservoirs. Assuming that this valuation was one-third greater than it would have been without stored water, the value of crops without storage was about $20,000,000, and the increase in value due to storage was $7,000,000. The total area in crop on the projects having storage rights was about 742,000 acres, and the increased value per acre was therefore nearly $10. About 1,380,000 acre-feet of stored water were drawn from the reservoirs in 1930, of which 800,000 acre-feet were from American Falls Reservoir.

Estimating similarly for the 1931 irrigation season, stored water constituted about 45 per cent of the total supply for irrigation in the Snake River Valley. Yields and values may safely be assumed to have been increased 60 per cent by the use of stored water. It is probable that the total crop value on projects with storage rights will not exceed $24,000,000. Hence the value of crops without storage was about $15,000,000, and the increased value due to reclamation storage was $9,000,000. About the same area was in crop in 1931 as in 1930, and on this basis stored water created a value of more than $12 per acre. About 2,100,000 acre-feet of storage were drawn from the reservoirs in 1931, of which 1,525,000 acre-feet were from American Falls Reservoir. The estimate for 1931 is probably ultra-conservative, as without American Falls Reservoir the crops on some of the projects would have been practically a total failure or have suffered severely.

NORTH PLATTE PROJECT

Previous to the construction of Guernsey Dam in 1926, the entire storage water supply for the North Platte project was furnished from Pathfinder Reservoir in central Wyoming. This reservoir is located 200 miles upstream on the North Platte River from the diversion point of the canals of the project. Storage water is supplied to over 200,000 acres of project lands and an additional 100,000 acres of irrigated lands having Warren Act storage rights in Pathfinder Reservoir.

With the reservoir located 200 miles above the diversion dam, which is located at Whalen, it was found that close regulation of river flow was impossible and that considerable quantities of storage water were lost down river owing to varying weather conditions and rates of canal

diversion. Tributary inflow of streams between Pathfinder and Whalen varies widely, owing to local summer rains, and diversions by canals may be changed on short notice owing to rains on the irrigated lands and varying demands for water by water users due to maturity of crops, etc. Three to four days' time is required for water to travel from Pathfinder to Whalen.

The Guernsey Reservoir, built in 1926, is located at Guernsey, Wyo., 10 miles above the Whalen diversion dam, and has a capacity of 70,000 acre-feet. This capacity is small compared to the more than 1,000,000 acre-feet capacity of Pathfinder Reservoir, but is found to be ample for river regulation. Guernsey Reservoir is ordinarily carried about half filled during the irrigation season so that varying demands can be promptly supplied and also any sudden increase in the river flow entering the reservoir can be stored and conserved for irrigation use.

During the years 1930 and 1931 the entire flow of the North Platte River passing both the Pathfinder and Guernsey Dams has been under complete regulation without waste of water over wasteways at either dam. The total storage draft on Pathfinder Reservoir for the 2-year period was approximately 1,395,000 acre-feet, being 736,000 acre-feet in 1930 and 659,000 acre-feet in 1931. The season of 1931 was exceedingly dry and Pathfinder Reservoir was entirely empty by the end of August in spite of careful use of water and restricted delivery previous to that time. Normal use of water in 1931 and a full water supply would have resulted in a draft of nearly 900,000 acre-feet on Pathfinder storage.

A conservative estimate of the water stored and saved through better regulation as a result of the construction of Guernsey Dam is 100,000 acre-feet per year, or 200,000 acre-feet for the 2-year period. An additional shortage in the supply in 1931 of 200,000 acre-feet would have been disastrous to project crops. The sugar-beet crop alone covers 60,000 acres and, on account of the late irrigation necessary for this crop, would have been damaged to the extent of at least $15 per acre or a total of $900,000. With the added loss on other crops the total loss to the project due to an additional shortage of 200,000 acre-feet of water would have exceeded $1,000,000 for the present season.

FOURTEEN prospective settlers were shown over the Riverton project during the month of September; 3 applications for farm units were received; 1 applicant was accepted and paid the water rental charge for 1932; and 1 man filed homestead entry.

Fossil Elephant Skull Unearthed on the Newlands Project, Nevada

By Dr. Chester Stock, California Institute of Technology, Pasadena

Skull of fossil elephant; to the left the lower jaw with teeth exposed

A fossil elephant skull found near Fallon, Nev., on the Newlands project, was discovered recently by H. C. Candee of that city. Mr. Candee and his family were on a fishing trip and on one of the small islands on the southern side of Lahonton Reservoir they noticed some small fragments of brown colored bone lying on the surface of the sandy floor of the island. Upon further investigation the party found the head of a thigh bone and a knee-cap of a very large animal. Sustained search at that time revealed nothing more than a large quantity of indeterminable fragments.

Mr. Candee returned to Fallon and informed J. S. Mills of his discovery, who immediately notified Dr. Chester Stock at the California Institute of Technology, who in turn instructed a group of his students, then engaged in summer field research in Nevada, to proceed to Fallon and investigate the occurrence.

Careful examination of the ground by the students disclosed a small piece of bone protruding from the sand on the floor of the island, and digging carefully with small knives and camel's-hair brushes it soon became evident that this small piece of bone was part of the top of the skull of a very large animal. Continued excavations disclosed the almost complete skull and lower jaw of a Pleistocene or ice-age elephant. The specimen measured approximately 4 feet from the tips of the nasals to the back of the cranium with a transverse diameter of about 2½ feet across the forehead.

As the skull was uncovered it was given several coats of thin shellac to prevent the bone from crumbling. It was then tightly wrapped with strips of burlap dipped in plaster of Paris. The hardened plaster inclosed the specimen in a firm "jacket" which protected it from any damage that might have occurred while it was being shipped to Pasadena.

After its removal from the ground the skull was hauled across the intervening sand of the dry reservoir bottom on an improvised sled, placed in a truck, and taken into Fallon for shipment.

At the California Institute of Technology the plaster "jacket" will be carefully removed and the specimen prepared for study and exhibition purposes.

THE new Federal building at Klamath Falls, Klamath project, was completed and ready for occupancy on October 15. The Bureau of Reclamation is established in this building and is occupying the entire third floor.

Raising Rabbits for Pets and Market

By Harold C. Owens, One of the Younger Employees in the Washington Office, Bureau of Reclamation

I GUESS at some time or other in our lives we have a love for a certain kind of animal. My love for the rabbit was inherited from my father who has always encouraged me in my work and has made me his partner in our little business affairs. In my opinion rabbits are the most satisfactory of all pets from the standpoint of cleanliness, and when properly housed and fed the owner is safeguarded against disease of any kind.

There are a great many breeds of this animal, among which are the New Zealand white and gray, Flemish Giant, and Checkered (black and white). At present I have only the New Zealand white and gray and Checkered varieties, 45 in all, and I am selling these, as opportunity arises, as pets and dressed for the table. However, my enthusiasm for the industry is growing, and at some future day I expect to engage in the business on a much larger scale, placing on the market the best breeds produced in the United States. The fancy breeds are useful principally for their fur, but they also make excellent pets.

BUSINESS REQUIRES CAPITAL

The capital required to start in the rabbit business can not be figured with pencil or pen, but common sense is a leading factor. A little money plus common sense and good hard work, with a full realization that this is no get-rich-quick scheme, will bring the desired results.

DESCRIPTION OF RABBITRY

My rabbitry, which runs from east to west, is 4 yards wide by 7 yards long. The hutches, of which there are 25 on the north side and 9 on the south side, are built 4 tiers high on one side and 3 on the other, each hutch being 2 feet wide, 2⅔ feet long, and 2½ feet high. The sides and doors are made of wire, the floors of wood, with windows at each end of the rabbitry. The doors leading into the rabbitry are half glass and half wood, as the rabbits require plenty of light.

FEEDING REQUIREMENTS

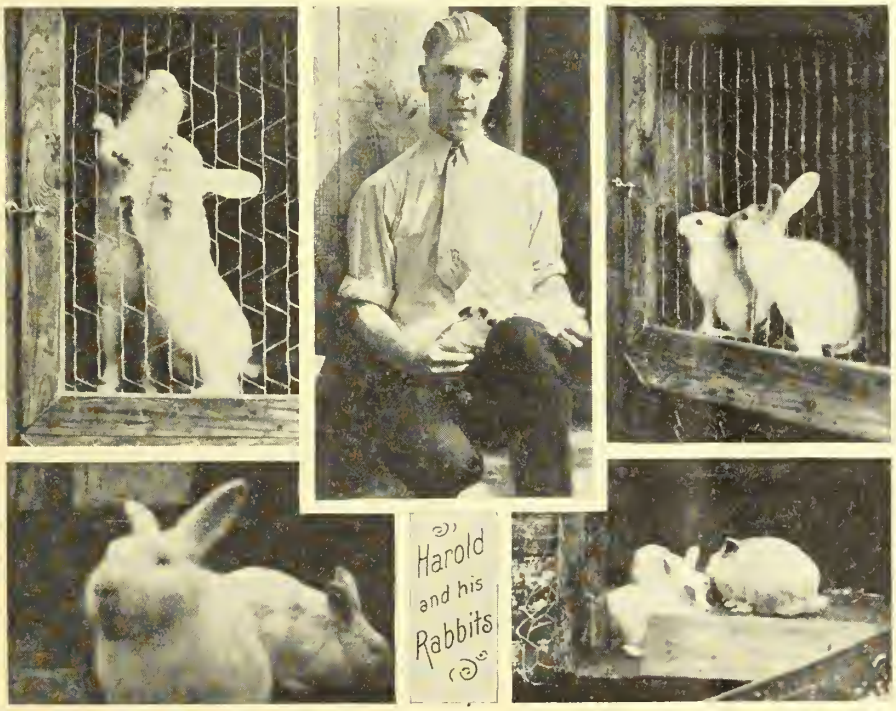
Although it is not absolutely essential, I feed my rabbits three times a day. In the morning their diet consists of rolled oats and fresh water, at noon oats and a little green food, such for instance as lettuce, cabbage, carrots, dandelions, or something similar, being careful of course to avoid poisonous weeds, and in the evening a good handful of clover hay and fresh water. They consume approximately 50 pounds of rolled oats each month, at a cost of $1.50. A bale of hay at $1.50 lasts three months or more. Other foods may be used with equal success, among which are old bread, providing it is good, remnants from the table, garden refuse and other discards having food value which do not add to the expense of feeding.

CARE OF HUTCHES AND BREEDING

I clean the hutches every day in summer and every other day in winter in order to avoid bad odors and unhealthful conditions. I breed my rabbits four times a year. To the lover of livestock, breeding is the most interesting part of rabbit keeping. So far I have been successful and I hope to be increasingly so.

A WORD TO PROJECT BOYS AND GIRLS

I am wondering if some of the project boys and girls would not be interested in a little friendly competition in rabbit raising. With the great out of doors you have a promising field in which to work. Why not make a start and see what you can do along this line? Perhaps you have some plans or suggestions that may help the other fellow. If so, send them in and let the ERA pass them along.



Riverton Wins Prizes at Fall Fairs

At the Fremont County fair held recently at Riverton, Wyo., the settlers on the Riverton project prepared a community booth under the direction of W. T. Peyton, gatekeeper at the diversion dam. Although the cultivated area on the project constitutes only a small fraction of the total cultivated area in the county, the individual exhibits from the project were awarded 24 first, 12 second, and 7 third premiums, all on farm produce. The booth was awarded first place for its potato, corn, and fruit exhibits. The potato exhibit was especially fine, being considered the best ever shown in the county. Of the 10 classes of potatoes listed, those from the Riverton project took 8 first and 2 second premiums. The great majority of the prize-winning exhibits were grown by Mr. Peyton.

At the 3-day State fair, held at Douglas, substantially the same potato exhibit won 8 first, 1 second, and 3 third premiums, and was awarded potato sweepstakes, being considered one of the very best potato exhibits ever displayed at that fair.

THE Mesilla Valley, N. Mex., had a very large apple crop this season, possibly the best in 20 years.—*The Earth.*

Our Government Is Interested in Your Welfare

Theodore Roosevelt once stated before the County Life Commission: "There is no more important person measured in influence upon the life of the Nation than the farmers' wives; no more important home than the country home."

THE farm home can not be neglected without agriculture and the entire Nation suffering. The farmer's living standard is one that has suffered less during the past year than that of large numbers of people in the cities, that is, where intelligent diversified farming has been carried on and the things that are needed for the sustenance of the farmer and his family are raised on the farm. The result is a rather gratifying demand for farms on our irrigation projects as they are made available.

Federal agencies are constantly engaged in research on matters that add to the well-being, happiness, and contentment of our people. Design and equipment of farm structures, beautifying of home surroundings, short cuts in the work to be done on the farm and in the home, selection and preparation of food, selection and manufacture of articles of clothing—these and many other subjects are studied thoroughly and the results of such studies passed on through the medium of bulletins, leaflets, and other Government publications, magazines and newspaper articles, and radio talks, as well as by answering letters from individuals.

In previous articles I have treated some of these subjects and passed on the findings of Government specialists, and in this article will give you the benefit of some of the Government studies in values of foods so that the greatest possible benefit may be derived in the planning of meals, both as to sufficiency of nourishment and balance of diet.

KINDS OF FOODS NEEDED

The number of different foods available in most parts of the United States is very great and is constantly increasing as a result of improved methods of agriculture, the invention of new manufacturing processes, the introduction of foreign food plants, and the cultivation of wild varieties. There is no one of all these many foods that can not be introduced into the diet in such a way as to contribute to its wholesomeness or its attractiveness, but the number of different kinds of food needed is very small. Many food materials, the various cereals, for example, are practically interchangeable in the diet. In fact, most of the common foods may be classified into five groups according to their composition and uses, namely, (1) vegetables and fruits, (2) meat, milk, and other foods depended on for complete or efficient protein, (3) cereals, (4) sugar and sugary foods, and (5) fats and fat foods.

A meal, a day's ration, or a weekly food supply made up from representatives of all these five groups is likely to provide all the substances required to make the diet wholesome and attractive, and for this reason the classification should serve as a guide in the selection of foods and the planning of meals. It should be of some help, too, in comparing the cost of different foods, for it separates foods that have little or nothing in common, and brings together under one head food materials that are enough alike to be compared in price. For example, to know that a pound of salt codfish costs 10 cents more than a pound of prunes does not make economical meal planning easier. It is helpful, however, to know that one kind of breakfast cereal costs 15 cents, while another that might be substituted for it costs 7 cents, or that a certain amount spent for an inexpensive kind of fruit will bring as good returns in food value as twice that amount spent for some out-of-season variety.

VEGETABLES AND FRUITS

Vegetables and fruits are depended on for flavor, bulk, mineral substances, particularly iron, and for vitamins, of which at least three kinds, called A, B, and C, are now considered necessary. Spinach stands out among the other foods of this group because of its exceptionally large percentage of iron. The green-leaf vegetables as a class, including lettuce, spinach, kale, dandelion greens, the green tops of turnips, or of beets, or of radishes, and many other vegetables commonly used for salads and greens are especially useful in supplying vitamin A, which is now believed to be necessary for normal growth and for the continued bodily well-being, even of adults.

Practically all the vegetables and fruits furnish vitamin B, which is, however, so widely distributed among natural food materials that it presents less of a problem to the housekeeper than either of the others. The two chief sources of it are the vegetables and fruits and the so-called whole-grain cereals. Many fruits have been found to supply vitamin C. Lemons, oranges, and tomatoes are considered especially rich in it, and some of the vegetables, notably cabbage, and some varieties of turnips, contain comparatively large amounts. White potatoes are also considered an important source of this vitamin in the diet, not because they supply more, pound for pound, than many other foods, but because being mild in flavor and comparatively cheap they are used in larger amounts in most families than any other one vegetable.

RAW FOODS, BEST VALUE

It is now believed that the vitamins are to some extent destroyed by drying and also by cooking, particularly in the presence of soda. Probably no two foods are affected to the same extent, and even if the effect on every food were known, the facts would be difficult to keep in mind. In the absence of definite available knowledge on this subject it is wise for the housekeeper to use regularly some uncooked fruits or tomatoes, fresh or canned, and some green-leaf vegetables. The last mentioned should be used either raw or cooked only enough to make them taste good and without unnecessary loss of their juices.

Canned and dried vegetables and fruits may all be used for the sake of economy or convenience or to give bulk to the diet, but never to the exclusion of green-leaf vegetables and fresh fruits. There is no way at present of measuring the exact amount of fruit juices needed for health. It seems probable, however, that it is not large, and the housekeeper who can not afford to serve whole oranges, grapefruit, or fresh tomatoes is probably on the safe side, if she makes a practice of introducing small amounts of orange or lemon juice or canned tomatoes into her bills of fare. An orange cut up with other fruits or a little lemon juice added to sliced bananas, stewed prunes, or other fresh or dried fruits is helpful. There are many desserts and beverages too in which small amounts of orange or lemon juice can be used, and many gravies, sauces, and soups that are improved by a little tomato juice. Regularity of supply is probably more important than the use of large amounts.

FOODS DEPENDED ON FOR EFFICIENT PROTEIN

Representative of the foods that furnish efficient protein are flesh foods, including lean and medium fat meats, poultry, game, fish, and sea foods; eggs; milk; cheese of various kinds; peanuts and soybeans. These foods, though differing much in other respects, are alike in furnishing a kind of protein that will serve to build the protein found in the tissues of the body.

Such foods as bacon, salt pork, fat pork sausage, and cream furnish the same kind of protein as the foods of this group but are too fat to be used as the means of supplying any considerable portion of the needed amount. Milk and cheese are very rich in lime, and meat and eggs in iron. Milk from properly fed cows and egg yolks are important sources of vitamin A. In spite of their differences, these foods may be considered interchangeable in the diet of the adult, but in the diet of children none of the ordinary foods can take the place of milk.

CEREAL GRAINS AND THEIR PRODUCTS

The cereal-grain foods are flour, meal, breakfast foods, bread, rolls, crackers, and all other foods that are made wholly or chiefly from the cereal grains such as wheat, corn, rye, rice, barley, and oats. These cereal foods are depended on to supply protein, starch, and, particularly if they are made from the whole grain, mineral substances, and vitamins. Vitamin B is found so near the germ that it is likely to be lost if the germ is removed. The mineral substances are found chiefly in the germ and in the outer coatings of the grain. It is generally agreed that cereal foods keep better if the germ has been removed, and many people prefer white to whole-wheat flour because it makes lighter bread. However, if white bread only is served, care should be taken either to introduce whole-grain cereals into the diet as breakfast foods or in some other way, or to provide an unusually large proportion of vegetables and fruits.

SUGAR AND SUGAR FOODS

The sugar foods are sugars of different kinds, including granulated, pulverized, lump, brown, and maple; molasses; honey; sirups; candy; sweet chocolate; rich preserves; jellies; jams; and marmalades. These foods can be depended on for fuel and flavor, but not for protein, vitamins, and mineral substances. They are therefore not so essential as the other groups. It should be said, however, that sugar at ordinary prices is an economical body fuel and a very economical flavoring material as compared with most extracts and even with spices. If sweets are used in proper proportions to other food materials and are not served in such a way as to destroy the appetite for other foods, they play an important part in the diet.

FATS AND FAT FOODS

Fats and fat foods include butter, oil, lard, suet, and other table and cooking fats; cream; bacon; salt port; pork sausage; chocolate; and rich or oily nuts. Most of these foods are prepared by separating fat from natural food materials such as meat, milk, olives, corn, and cottonseed. The advantages of using them in this separated form is that in this way the richness and flavor that they give to the diet are more easily distributed through the other foods. Some of the fat foods, especially butter and cream, furnish vitamin A and for this reason have great advantage over the other foods of the group, particularly when milk, eggs, and green-leaf vegetables can not be obtained in sufficient amounts.

PROPORTIONS OF FOODS NEEDED

All of the foods mentioned in the preceding paragraphs, and in fact all foods, furnish body fuel or material that can be burned in the body to give it energy and incidentally to keep up its temperature. The fuel supplied by vegetables and fruits is chiefly sugar and starch; that supplied by milk, meat, eggs, and cheese, chiefly complete, or efficient, protein and fat; that supplied by the cereals, chiefly protein and starch, the latter being usually six or seven times as much by weight as the former; that supplied by the sweets, almost exclusively sugar; and that supplied by the preceding paragraph, almost exclusively fat. As a rule, the diet will be sufficiently bulky and flavorful and will furnish the right proportions of starch, fat, and sugar for the taste of most people if the vegetables and fruits furnish about 20 per cent of the fuel; the meat, eggs, milk, and similar foods, 25 per cent; the cereal foods, 25 per cent; sweets, 10 per cent; and fats and fat foods, 20 per cent. It will also furnish satisfactory kinds and amounts of protein, mineral substances, and vitamins.

The proportions given in the preceding paragraph are especially adapted for persons who do about an average amount of muscular work. Those who do light muscular work or lead sedentary lives would naturally eat a larger proportion of vegetables, fruits, and efficient-protein foods, and a smaller proportion of cereals, fats, and sweets. On the other hand, those who do hard muscular work seem to need a larger percentage of energy-yielding foods, such as cereals, fats, fat meats, and sweets.

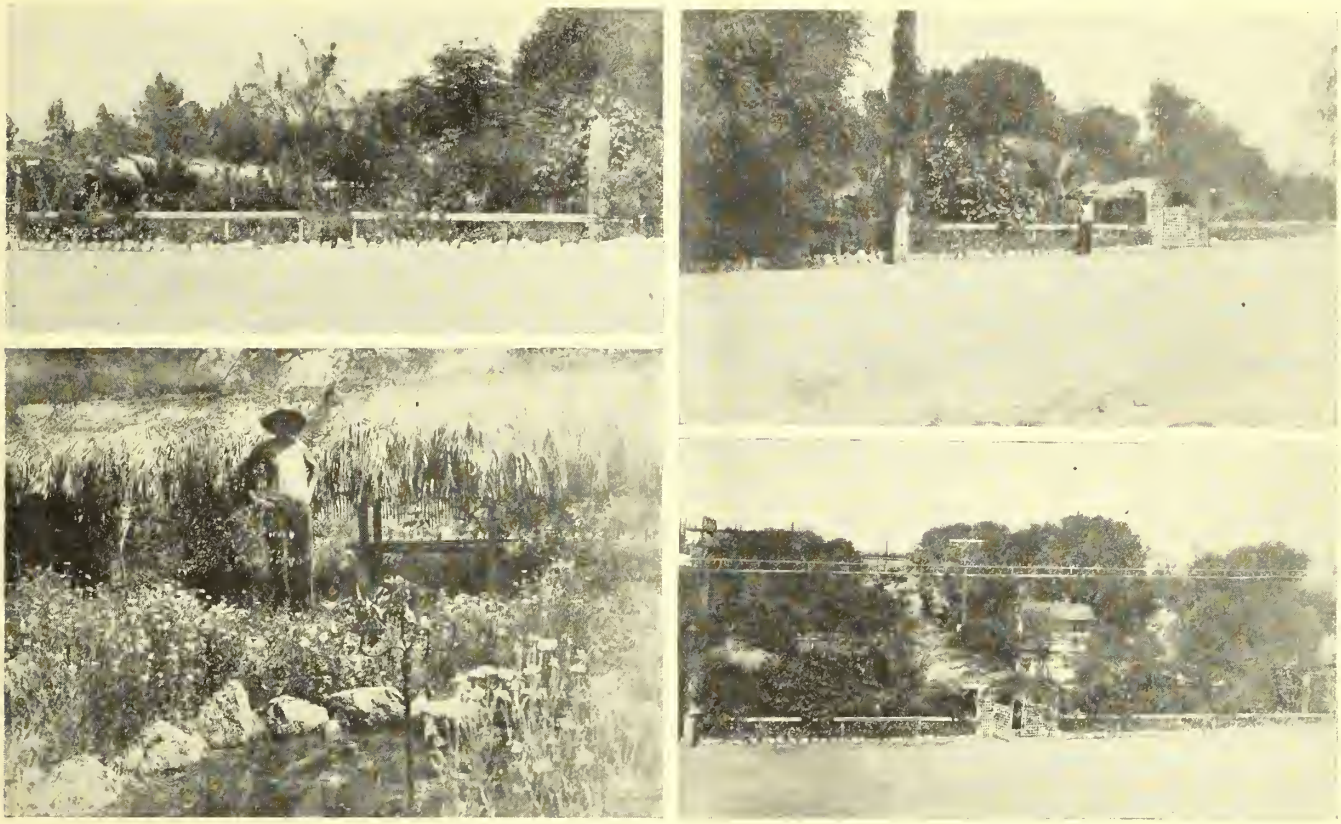
Four-room log house of Jim Preston, Riverton project, Wyoming. House, including inside finish, cost $500 Built in 1931

Relative distribution of vitamins A, B, and C

— indicates that the food contains no appreciable amount of the vitamin.
X indicates that food contains the vitamin.
XX indicates that the food is a good source of the vitamin.
XXX indicates that the food is an excellent source of the vitamin.

Vitamin A—Essential to growth and well-being at all ages.
Vitamin B—Necessary to proper functioning of digestive tract and sets up resistance to bacterial infection.
Vitamin C—Nourishes bones and teeth and makes one resistant to infectious diseases.

Item	A	B	C
Fruits:			
Apples, canned commercially	—	—	X to XX
Apples, cooked	—	—	— to X
Apples, raw, fresh	X	X	XX
Apples, raw, stored	—	—	X
Bananas, baked in skin	—	—	XX
Bananas, baked without skin	—	—	X
Bananas, raw	X to XX	X	XX
Cantaloupes	XX	XX	XX
Cherries, canned	XX	XX	—
Cranberry juice	—	—	X
Dates	X	XX	—
Grapefruit (or juice), fresh	X	XX	XXX
Grapes (or juice), fresh	X	X to XX	X
Lemon juice, concentrated	—	—	XXX
Lemon juice, frozen, stored	—	—	X
Lemons, cold storage	—	—	XXX
Lemons (or juice), fresh	X	XX	XXX
Lime juice, concentrated	—	—	XX
Limes (or juice)	—	—	XX
Orange juice, concentrated	XX	—	XXX
Orange juice, dried	XX	XX	XXX
Orange juice, fresh	XX	XX	XXX
Orange juice, frozen, stored	—	—	X
Oranges, cold storage	—	—	XXX
Peaches, canned	X to XX	X	X to XX
Peaches, cooked	—	—	X
Peaches, dried	—	—	X
Peaches, raw	X to XX	X	XX
Pears, canned (cold-packed)	—	—	— to X
Pears, raw, fresh	—	X to XX	X
Pears, raw, stored	—	—	X
Pineapples, canned	XX	XX	XX
Pineapples, raw	XX	XX	XX
Prunes, dried	XX	XX	—
Prunes, fresh	—	XX	—
Raisins	—	X	—
Raspberries, canned	—	—	XX
Raspberries, raw	—	—	XX
Strawberries, canned and raw	X	X	XXX
Tangerines	—	—	XXX
Vegetables:			
Asparagus, green, canned	XX	—	—
Asparagus, green, cooked	XX	—	—
Asparagus, green, raw	XX	XXX	—
Beans, kidney, raw	X	XX	—
Beans, navy, canned, baked	X	XX	—
Beans, navy, cooked	—	XX	—
Beans, navy, dried, raw	—	XX	—
Beans, string, canned	—	X to XX	— to X
Beans, string, cooked	—	X to XX	—
Beans, string, raw	XX	XX	XX
Beets, leaves	XX	XX	—
Beets, stems	—	X	—
Cabbage, head, canned	—	—	X
Cabbage, head, cooked	X	XX	X
Cabbage, head, raw	X	XX	XXX
Cabbage, leaves, green, fresh	XX	XX	XXX
Cabbage, leaves, white, fresh	— to X	XX	XXX
Carrots, cooked, old	—	XX	— to X
Carrots, cooked, young	—	XX	X
Carrots, raw, old	XXX	XX	X
Carrots, raw, young	XXX	XX	XX
Cauliflower, cooked	—	X to XX	—
Cauliflower, raw	X	XX	X
Celery, leaves, bleached	X	—	—
Celery, leaves, green	XX	—	—
Celery, stalks, bleached	— to X	XX	—
Cowpeas, cooked	—	XX	—
Cowpeas, dried	XX	—	—
Cowpeas, sprouted	—	—	XXX
Cucumbers	— to X	X	XX
Dandelion greens	XX	XX	X
Eggplant	X	X	—
Endive	X	—	X
Kale	XX	—	—
Kohlrabi	—	—	X
Lentils	X	XX	—
Lentils, sprouted	—	—	XX
Lettuce, head	X to XX	XX	XXX
Lettuce, leaves, bleached	X	XX	XXX
Lettuce, leaves, green	XXX	XX	XXX
Mushrooms, dried	—	XX	—
Mushrooms, raw	— to X	—	—
Okra	—	XX	—
Onions, cooked	— to X	X	X
Onions, raw	— to X	X	XX
Parsley	—	XX	—
Parsnips	— to X	XX	—
Peas, dried	X	XX	—
Peas, green, canned	XX	X to XX	XX
Peas, green, cooked	XX	X to XX	XX
Peas, green, raw	XX	XX	XXX
Peppers, green	XX	XX	XXX
Potatoes, baked	X	XX	X to XX
Potatoes, boiled 15 minutes	X	XX	XX
Potatoes, boiled 1 hour	X	XX	X
Potatoes, peel	—	X	—
Potatoes, raw	X	XX	XX
Pumpkin, boiled	XX	—	—
Pumpkin, raw	XX	X	X
Radishes	—	XX	XX
Rhubard	—	—	X
Rutabagas, cold storage	—	—	XX
Rutabagas, raw (Swedes)	X	XX	XXX
Sauerkraut	X	X	X to XX
Soybeans	X	XX	—
Vegetables—Continued.			
Spinach, canned	XXX	X	X to XX
Spinach, cooked	XXX	X	X to XX
Spinach, dried	XXX	XX	—
Spinach, raw	XXX	XX	XXX
Sweetpotatoes, leaves and shoots	—	XX	X
Sweetpotatoes, raw	X to XX	XX	XX
Tomato concentrate	XXX	XXX	XXX
Tomatoes, green, canned	—	—	X
Tomatoes, green, pickled	—	—	— to X
Tomatoes, green, raw, mature	X	XX	X
Tomatoes, raw, air-ripened	XX	XX	XX
Tomatoes, raw, vine-ripened	XX	XX	XXX
Tomatoes, ripe, canned	XX	XX	XX to XXX
Turnip greens, cooked	XXX	XX	— to X
Turnip greens, raw	XXX	XX	XX
Turnips, white	— to X	XX	XX
Watercress	XXX	—	XXX
Miscellaneous:			
Brains	X	XX	—
Buttermilk	X	XX	— to X
Cheese, American, cheddar	XX to XXX	—	—
Cheese, cottage, skim	X	—	—
Cheese, Swiss	X to XX	—	—
Clams	X	— to X	—
Egg yolk	XXX	XX	—
Eggs, duck, fresh	XX	—	—
Eggs, duck, salted (Pidan)	XX	—	—
Eggs, hen, fresh	XX	X to XX	—
Eggs, hen, storage	XX	—	—
Fish, lean (such as cod, haddock)	— to X	X	—
Ham	— to X	XX	—
Liver, calf, ox, sheep	XX to XXX	XX	—
Liver, chicken	—	—	X
Milk, cow's, skim, raw	X	XX	— to X
Milk, cow's, whole, condensed	XXX	XX	X
Milk, cow's, whole, dried	XXX	XX	— to X
Milk, cow's, whole, evaporated	XXX	XX	— to X
Milk, cow's, whole, pasteurized	XXX	XX	— to X
Milk, cow's, whole, raw	XXX	XX	X
Milk, cow's, whole, raw, irradiated	XXX	—	— to X
Milk, cow's, whole, scalded	XXX	XX	— to X
Milk, goat's	XXX	XX	X
Milk, human, dried	—	X	—
Milk, human, raw	XX	X	— to X
Oysters, cooked	—	X	—
Oysters, raw	XX	XX	X
Pork	— to X	XX	—
Poultry	— to X	X	—
Roe, fish, dried and fresh	XX	XX	—
Salmon, canned	X	—	—
Shrimps	X	—	—
Sweetbreads	X	X	—
Veal	— to X	X	—
Cereals and cereal products:			
Bread, rye	—	XX	—
Bread, white, milk	X	X	— to X
Bread, white, water	—	X	—
Bread, whole-wheat, milk	XX	XX	— to X
Bread, whole-wheat, water	X	XX	—
Corn (maize), bran	—	— to X	—
Corn (maize), white, whole	X	XX	—
(Corn (maize), yellow, gluten	XX	—	—
Corn (maize), yellow, whole	XX	XX	—
Malt, green	X	XX	XX
Oatmeal	— to X	XX	—
Oats, whole	— to X	XX	—
Rice, unpolished, brown	X	XX	—
Wheat, bran	X	XX	—
Wheat flour, white, patent	—	— to X	—
Wheat, whole	X	XX	—
Sugars:			
Glucose	—	—	—
Honey	—	—	—
Molasses	—	X	—
Sugar	—	—	—
Fats and fat-rich foods:			
Almonds	X	XX	—
Bacon	— to X	X	—
Beef fat	XX	—	—
Beef juice	—	X	— to X
Beef kidney fat	XX	—	—
Brazil nuts	X	XX	—
Butter	XXX	—	—
Chestnuts	—	X	—
Coconut	X	XX	—
Coconut oil	— to X	—	—
Cod-liver oil	XXX	—	—
Cream	XXX	XX	— to X
Filberts	—	XX	—
Hickory nuts	—	XX	—
Lard	— to X	—	—
Malt extract	—	X	—
Olive oil	— to X	—	—
Peanut oil	X	—	—
Peanuts	X	XX	—
Pecans	X	XX	—
Pine nuts	X	X	—
Tea, black	—	—	— to X
Tea, green	—	—	X
Walnuts, English	X	XX	—
Yeast	— to X	XX to XXX	



Grounds surrounding Yuma project headquarters

Making the Desert Bloom

During a recent visit to the Yuma project I was delighted with one of its show places. The grounds surrounding our headquarters, formerly a patch of white sand, have been transformed into a beautiful garden with pagoda, pool and fountain, stretches of lawn, and beautiful flower beds.

All this is the work of John Maloney Molonaux, a disabled World War veteran. He is a great lover of flowers and has a knack of making plants grow where others would fail. He planned and built the fences, pagoda, pool and fountain, as well as a tool house, the upper part of which he utilizes as a hot or germinating bed. John has been in the employ of the Yuma project since 1925, and all his spare time from sunup to sundown is spent in the upkeep and improvement of these grounds around headquarters.

Through the cooperation of Superintendent Priest I secured the four accompanying photographs, two of which show John beside his handiwork.

The pictures do not do justice to the accomplishment. The riot of color is missing and the atmosphere secured by a personal visit.

Yuma to Have Up-to-date Citrous Packing Plant

An extensive addition to the local citrus packing shed on the Yuma auxiliary project is under construction. This addition is to have a full concrete basement. The main floor, which, as well as the basement, will be used for storing fruit, will be hardwood surfaced owing to heavy trucking wear. With the basement the addition will provide 9,000 square feet storage space for fruit. Equipment ordered for the new addition includes belt conveyors from the main floor to basement and conveyors through the basement with an automatic lift to the packing floor, new sizing tables, washer, dryer, waxer, and a new lidding and strapping machine.

This equipment will be installed by October 10. The completed plant will represent an investment of $60,000 and will be one of the most modern citrus packing sheds in the Southwest.

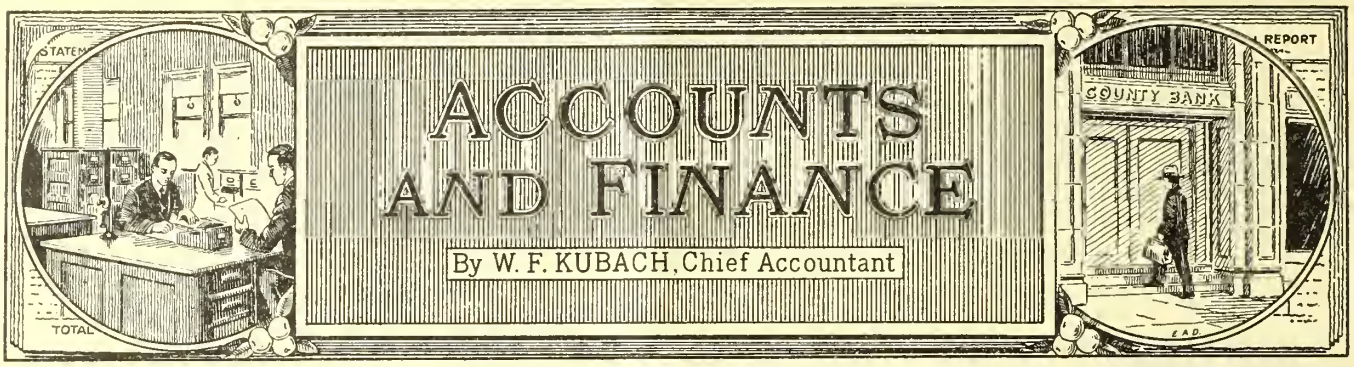
With the use of washing, drying, and waxing machines the appearance of the fruit will be greatly enhanced, which in turn is expected to increase sales and assist in establishing and developing ready markets for Yuma Mesa citrus fruit.

THE Arizona citrus growers handled 313,809 packed boxes of fruit during the season recently closed, a report issued by George H. Libbey, secretary of the association, shows. This was an increase of about 15 per cent over last year, and those familiar with the citrus situation in the Salt River Valley declare that a similar increase may be expected for this picking season. Fruit on the tree is of normal size and quantity; many groves are reaching maturity, while new trees are coming in to bearing.—*The Earth.*

THE total Arizona tame-hay acreage is estimated at 166,000 acres, or about 6 per cent more than that harvested last year, according to official reports. Of the 166,000 acres, 139,000 acres are alfalfa, and the remaining 27,000 are grain hay, sudan, clover, and timothy. Total tame-hay production for the year is placed at 597,600 tons.—*The Earth.*

A SINGLE car of precooled cherries shipped from Riverside County, Calif., to Washington, D. C., this season netted more than $2,100. The success of this trial shipment has paved the way for future shipments of this nature.—*The Earth.*

ONE of the most imposing bridges in Arizona now spans the Salt River at Tempe, on the Salt River project, having been completed at a cost of $437,368. The new bridge was under construction for 15 months and was dedicated July 4 with appropriate ceremonies. It was opened for traffic on July 15.—*The Earth.*



The Reclamation Fund

JUNE 17, 1902, the date of the approval of the reclamation act, marked the beginning of reclamation by irrigation on the part of the Federal Government. During the 29 years which have elapsed, 35 projects have been constructed in whole or in part and scores of secondary projects have been examined to determine their feasibility with the view of possible development later as funds become available. On June 30, 1931, the gross cost of construction of the reclamation projects amounted to $206,041,522, in addition to which there has been expended for operation and maintenance $44,067,641. Instead of financing reclamation work with direct appropriations from the Federal Treasury, which is the usual method adopted by Congress for financing Government operations, the reclamation act created the revolving fund by receiving, setting aside, and appropriating to this fund money received from the sale and disposal of public land in 16 Western States. The annual increments to the fund thus created have ranged from a peak of $9,430,573.78 during the fiscal year 1908 to $509,624.61 during the fiscal year 1926. At the close of the fiscal year 1931 a total of $110,957,828.48 has accrued to the fund. As time progressed the fund has been augmented by accretions under the following acts:

In October, 1917, Congress passed an act authorizing the explorations for and the disposition of potassium, which provided that all moneys received from royalties and rentals under this act, excepting those from Alaska, shall be paid into, reserved, and appropriated to the reclamation fund. From this source the fund has been enlarged at the end of June 30, 1931, in the amount of $80,029.12.

In February, 1920, Congress passed the oil leasing act, which provided that 70 per cent from past production and 52½ per cent from future production shall be paid into, reserved, and appropriated as a part of the reclamation fund. Under this

Accretions to reclamation fund from June 17, 1902, to June 30, 1931

States	Sale of public lands		Proceeds from oil leasing act		Potassium royalties and rentals [1]	Total to June 30, 1931
	Fiscal year 1931	To June 30, 1931	Fiscal year 1931	To June 30, 1931		
Alabama			$6,813.96	$66,941.09		$66,941.09
Arizona	$69,404.16	$2,522,995.87	50.65	50.65		2,523,046.52
California	80,917.18	7,982,729.56	511,554.33	8,048,301.91	$80,029.12	16,111,060.59
Colorado	53,422.21	10,143,785.80	47,086.58	367,584.77		10,511,370.57
Idaho	40,161.91	6,969,499.72	3,251.34	9,298.04		6,978,797.76
Kansas		1,032,764.48				1,032,764.48
Louisiana			1,939.23	22,352.94		22,352.94
Montana	62,652.71	15,177,076.43	52,158.99	963,105.06		16,140,181.49
Nebraska	1,174.15	2,094,928.51				2,094,928.51
Nevada	14,660.58	1,007,472.60	62.75	3,549.10		1,011,021.70
New Mexico	100,563.67	6,338,404.21	89,058.36	207,670.91		6,546,075.12
North Dakota	5,290.88	12,217,396.11	14,847.48	79,321.38		12,296,717.49
Oklahoma	1,114.59	5,926,388.90				5,926,388.90
Oregon	34,931.91	11,918,189.56				11,918,189.56
South Dakota	4,779.25	7,720,991.17	306.25	687.63		7,721,678.80
Utah	41,463.53	4,152,413.83	48,934.71	270,309.53		4,422,723.36
Washington	17,144.02	7,419,481.00	2,583.02	17,101.99		7,436,582.99
Wyoming	107,609.97	8,333,310.73	1,320,208.31	30,328,528.34		38,661,839.07
Total	635,290.72	110,957,828.48	2,098,855.96	40,384,803.34	80,029.12	151,422,660.94
Proceeds, Federal water-power licenses						[2] 271,423.78
Grand total						151,694,084.72

[1] Proceeds for fiscal year, $11,732.61.

[2] Proceeds for fiscal year, $212,063.43.

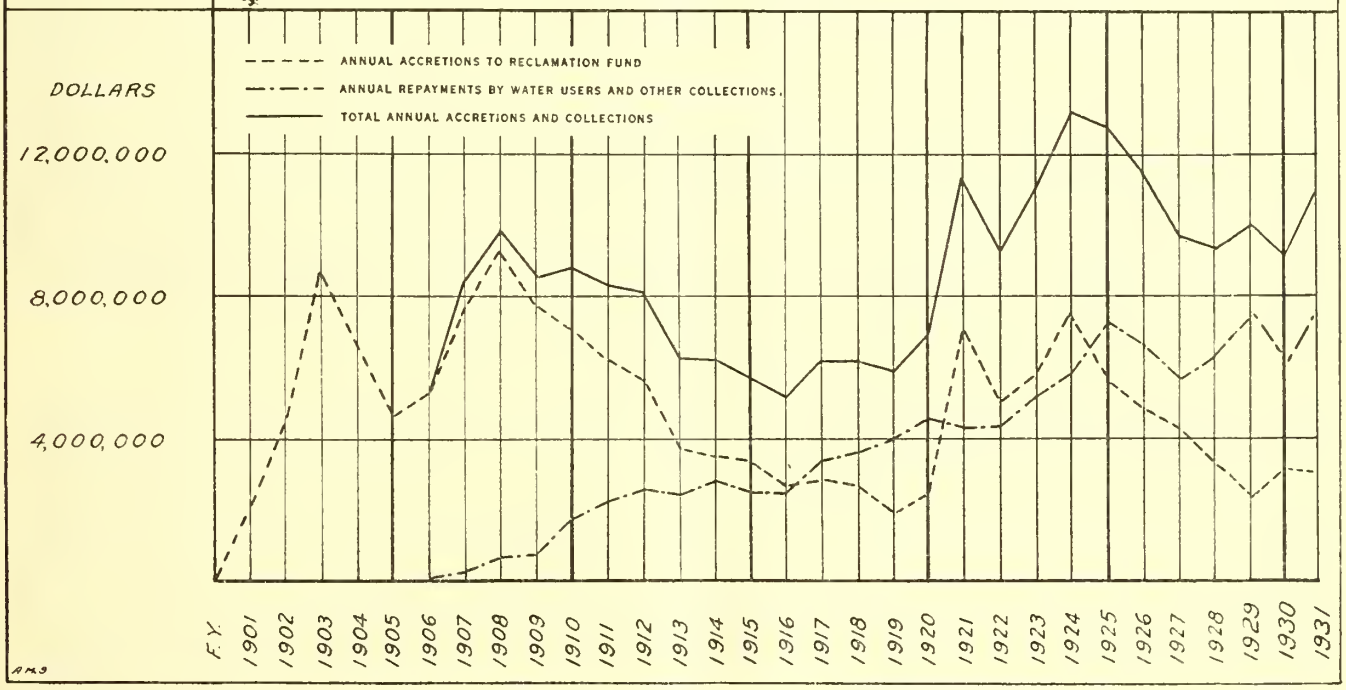
Reclamation fund collections by fiscal years

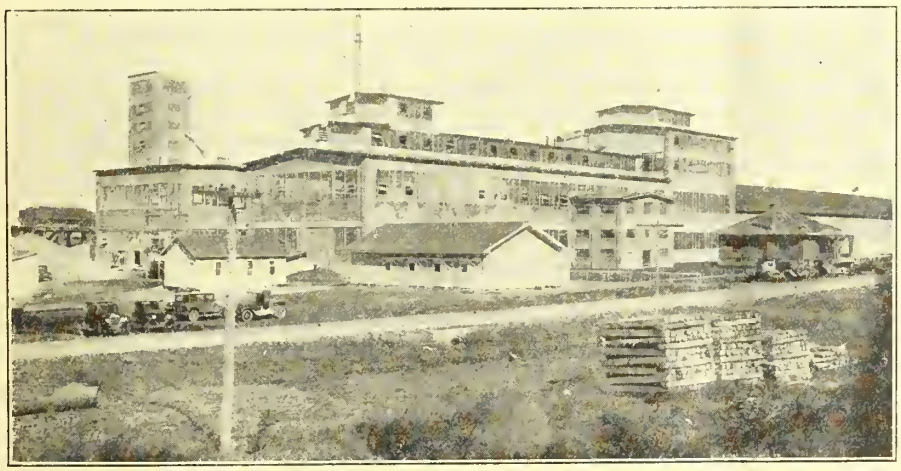
Fiscal year	Construction repayments	Operation and maintenance repayments	Miscellaneous collections [1]	Sale of reclamation town lots	Total
1907 and prior			$183,201.14	$61,535.00	$244,736.14
1908	$154,203.18	$15,114.53	361,648.49	12,864.06	543,830.26
1909	145,638.04	55,711.35	563,069.04	10,017.85	774,436.28
1910	602,981.03	178,811.31	1,000,898.79	60,112.86	1,842,803.99
1911	630,353.38	267,756.66	1,205,697.75	69,468.80	2,173,276.59
1912	623,559.12	360,139.97	1,486,348.71	15,224.10	2,485,271.90
1913	871,586.87	458,334.04	1,047,977.45	17,784.74	2,395,683.10
1914	426,404.64	559,960.02	1,771,074.06	15,280.25	2,772,718.97
1915	636,242.33	171,407.23	1,601,857.46	18,436.28	2,427,943.30
1916	786,171.13	380,859.98	1,203,176.95	21,189.28	2,391,397.34
1917	681,021.73	525,548.71	2,006,912.79	31,250.15	3,244,733.38
1918	1,409,136.59	851,290.26	1,260,009.71	60,990.56	3,581,427.12
1919	1,414,039.27	1,009,483.20	1,494,064.69	55,362.49	3,972,949.65
1920	1,824,540.76	1,628,139.97	1,009,685.68	43,813.21	4,506,179.62
1921	1,427,921.28	1,417,832.85	1,346,130.00	56,388.93	4,248,273.06
1922	1,299,635.12	1,576,485.35	1,418,386.87	18,645.08	4,313,152.42
1923	2,334,805.79	1,803,337.29	1,005,785.14	8,057.04	5,151,985.26
1924	2,715,523.50	1,855,953.54	1,172,358.67	5,739.32	5,749,575.03
1925	4,245,439.01	1,607,913.25	1,299,134.92	4,470.16	7,156,957.34
1926	3,438,382.58	1,734,295.77	1,428,020.94	967.88	6,601,667.17
1927	2,131,591.29	2,264,403.34	1,167,214.91	*7,801.96	5,555,407.58
1928	3,149,150.99	1,897,488.75	1,103,348.18	*22,767.56	6,127,220.36
1929	4,297,118.15	1,734,732.19	1,290,001.38	*153.83	7,321,697.89
1930	3,070,747.43	1,526,629.24	1,414,816.97	1,478.63	6,013,672.27
1931	4,337,611.14	1,327,053.28	1,742,024.77	3,034.65	7,409,723.84
Total	42,653,804.35	25,208,682.08	30,582,845.46	561,387.97	99,006,719.86

[1] Miscellaneous collections include water rentals, sales of power and light, rentals from grazing and farming lands, sale of surplus material and supplies, penalties on construction charges, etc.

enactment $40,384,803.34 has been received to the end of June 30, 1931. Under the provisions of the Federal water power act of June 10, 1920, the reclamation fund has also increased to the extent of $271,423.78. The accompanying tables disclose the total accretions and collections credited to the reclamation fund by fiscal years from the date of its inception to June 30, 1931, in addition to which the accretions as derived by States are also shown.

F.Y.	Annual accretions to reclamation fund	Annual repayments by water users and other collections	Total annual accretions and collections
1901	$3,144,822		$3,144,822
1902	4,585,520		4,585,520
1903	8,713,997		8,713,997
1904	6,826,254		6,826,254
1905	4,805,515		4,805,515
1906	5,166,336		5,166,336
1907	7,914,132	$244,736	8,158,868
1908	9,430,574	543,830	9,974,404
1909	7,755,467	774,436	8,529,903
1910	7,028,186	1,842,804	8,870,990
1911	6,135,548	2,173,277	8,308,825
1912	5,657,499	2,485,272	8,142,771
1913	3,737,911	2,395,683	6,133,594
1914	3,460,452	2,772,719	6,233,171
1915	3,268,058	2,427,944	5,696,002
1916	2,648,058	2,391,397	5,039,455
1917	2,865,386	3,244,734	6,110,120
1918	2,552,650	3,581,427	6,134,077
1919	1,959,497	3,972,950	5,932,447
1920	2,422,615	4,506,180	6,928,795
1921	7,096,662	4,248,273	11,344,935
1922	4,963,910	4,313,152	9,277,062
1923	5,777,995	5,151,985	10,929,980
1924	7,405,825	5,749,575	13,155,400
1925	5,588,785	7,156,957	12,745,742
1926	4,971,490	6,601,667	11,573,157
1927	4,125,311	5,555,408	9,680,719
1928	3,176,110	6,127,220	9,303,330
1929	2,529,740	7,321,698	9,851,438
1930	3,021,836	6,013,672	9,035,508
1931	2,957,943	7,409,724	10,367,667





Black Hills sugar plant Belle Fourche project, South Dakota

THE Vale-Owyhee Government Projects Land Settlement Association reports that 76 inquiries concerning project lands were received by mail during a recent month and 11 interested persons called at the office. One new settler purchased land at a private sale and at once commenced the erection of buildings on his farm in the Little Valley unit. Four settlers, three of whom were homestead entrymen, erected buildings and established themselves on the Bully Creek West Bench.

A SITE has been purchased in Phoenix, Ariz. (Salt River project), for the erection of a new Federal building.—*The Earth.*

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, accompanied by C. N. McClellan, chief electrical engineer, and Roy R. Gill, representing the Columbia Basin Irrigation League, went to New York on October 2 to confer with different parties interested in the development of the Columbia Basin irrigation project.

During Commissioner Mead's absence from Washington on October 2, Miss Mae A. Schnurr, assistant to the commissioner, was acting commissioner.

R. F. Walter, chief engineer, and L. N. McClellan, chief electrical engineer, returned to Denver by automobile early in October after an extended conference in Washington on budget matters. They made the return trip in about five days, making a short stop in Chicago.

E. B. Debler, hydrographic engineer, who was temporarily assigned to the Washington office and was in attendance upon various conferences in connection with the All-American Canal and Columbia Basin project, left Washington on October 7 for Denver.

Lester V. Branch, an engineer for a number of years connected with the Bureau of Reclamation, was a recent visitor to the Washington office.

Khaza Azeemuddin, assistant engineer of the Public Works Department of the State of Hyderabad, India, made a recent inspection of the irrigation works on the Kittitas division of the Yakima project.

C. H. Dodson, of the Colorado Agricultural College, has been assigned to the Grand Valley and Uncompahgre projects for soil experimental work. Experimental plots will be laid out here and there in cooperation with the project farmers in an endeavor to determine deficiencies in project soils, and other experiments will be conducted for the purpose of determining the best method to pursue in subduing grease spots and chico soils.

Charles Hebberd, of Spokane, Wash., called on the President on October 22, and on Secretary Wilbur and Commissioner Mead on October 23, in the interest of the Columbia Basin project.

Louis C. Cramton, special attorney to the Secretary, recently in charge of the issuance of permits and leases to carry on business in Boulder City, has completed his duties there and has been directed by the Secretary to investigate and determine the facts relative to the area of land susceptible of irrigation in the western Shoshone Indian Reservation, partly in southern Idaho and partly in northern Nevada.

W. A. Bechtel, president, and Felix Kahn, treasurer, of the Six Companies (Inc.), contractors on Hoover Dam, and Rufus Woods, editor of the Wenatchee Daily World, were among the recent visitors to the Washington office.

C. B. Elliott, office engineer on the Uncompahgre project, was in the Washington office early in October.

Senator and Mrs. Key Pittman; Congressman and Mrs. Sam Arentz; Marcel Gersaud, Commissioner of the Federal Power Commission; Worth M. Tippy, executive secretary, Committee on Church of Social Service of the Federal Council of Churches, New York; Hon. Thomas E. Campbell, former Governor of Arizona, and now president of the Civil Service Commission; and Phillip Schuyler, of Western Construction News, were some of the distinguished guests on the Boulder Canyon project on several recent dates.

Senators Thomas J. Walsh and Burton K. Wheeler met with the civic organizations of Chinook, Malta, and Glasgow, Milk River project, to discuss the problems of the locality, among which the Chain of Lakes storage was given major consideration.

Edward C. McMechen, director of publicity for the Colorado Association, and Mr. Soderstrom, photographer, spent several days on the Uncompahgre project collecting data on the resources of that region for use by the association in advertising the State of Colorado.

Luther C. Steward (president), and Miss Gertrude McNally (secretary-treasurer), of Washington, and John F. Fitzgerald (first vice president), of New York City, officers of the National Federation of Federal employees, recently visited the Yakima project and attended the annual reclamation picnic at Sunnyside. A luncheon at Ellensberg and a dinner at Yakima were given in their honor.

The American section of the International Joint Commission visited the Milk River project for the purpose of considering the apportionment of St. Mary and Milk River waters between the United States and Canada under the provisions of the treaty of 1909. The commission was conducted over the project, and particularly the St. Mary storage unit, after which they were met in Canada by representatives of the Canadian Irrigation Service and the Canadian Pacific Railroad and shown over the irrigation works of southern Alberta in the vicinity of Lethbridge.

Mrs. Angie L. Kaighn, mother of Mrs. J. C. Gawler, the wife of J. C. Gawler, retired, former fiscal agent of the bureau on the Yakima project, Washington, died at the age of 86 at Yakima on October 20. Mrs. Kaighn had lived in Yakima 15 years, coming there from Washington, D. C., where her home was for many years. She took a vital interest in Yakima civic affairs up to a short time before her death. Her daughter, Mrs. Gawler, is very active in Yakima women's club affairs and is a divisional head of the General Federation of Women's Clubs.

George O. Sanford, assistant director of reclamation economics, has returned to the Washington office after a trip to Savannah Ga., where he made an address on Economic Aspects of Federal Reclamation before the General Southeastern Economic Conference, comprising representative citizens from the nine southeastern States who are making a study of economic conditions with a view to providing ways and means for improving agricultural and business conditions in the South. The text of Mr. Sanford's address is given on pages 236–239 of this issue of the Era.

Charles B. Stafford, secretary chamber of commerce, Casper, Wyo., has been selected secretary of the State board of commerce and industry of Wyoming to succeed L. L. Newton.

As a part of the State Turkey Growers Association, 20 Klamath project farmers, or about 75 per cent of the turkey growers on the project, have organized a turkey pool. Project growers have signed up about 4,500 turkeys.

U. S. GOVERNMENT PRINTING OFFICE: 1931

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
R. B. Williams, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walker, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, 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	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.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			do	Do.
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.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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.
Salt Lake Basin (Echo)	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	Wm. J. Burke	Billings, Mont.
Yakima	Yakima, Wash	John S. Moore	Superintendent	R. K. Cunningham	C. J. Ralston	J. R. Alexander	Las Vegas, Nev.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr		do	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kennewick	Yakima, Wash	John S. Moore				do	Do.
Yakima, Kittitas	Ellensburg, Wash			Ronald E. Rudolph	C. J. Ralston	B. E. Stoutemyer	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.
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.
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	R. S. Hopkins	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.*

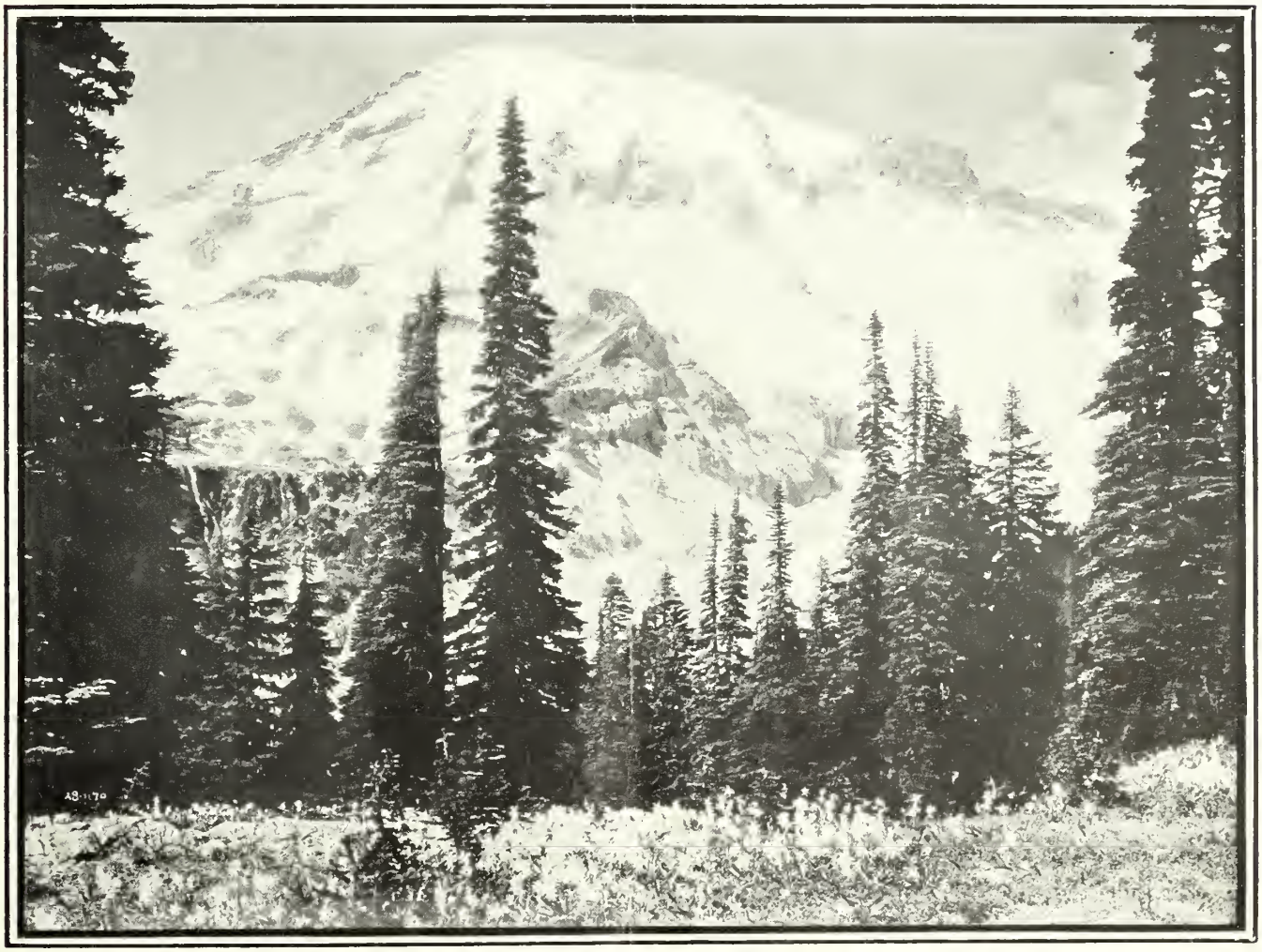
MEMBERS OF THE HOUSE OF REPRESENTATIVES SUBCOMMITTEE ON APPROPRIATIONS FOR THE INTERIOR DEPARTMENT, FEDERAL AND STATE OFFICIALS AT BAKERSFIELD, CALIF., ON THEIR INSPECTION TRIP OF RECLAMATION PROJECTS, NATIONAL PARKS, AND INDIAN RESERVATIONS, SUMMER OF 1931

Front row, left to right: Congressmen William E. Evans, California; Philip D. Swing, California; Burton L. French, Idaho; Henry E. Barbour, California; Frank Murphy, Ohio; Edward T. Taylor, Colorado; William W. Hastings, Oklahoma; Don B. Colton, Utah; Addison T. Smith, Idaho. Back row, left to right: Bradford Crittenden, State Senator, California; Horace N. Albright, Director National Park Service; Col. John R. White, Superintendent Sequoia and General Grant National Parks; E. K. Burlew, Administrative Assistant to the Secretary of the Interior and Budget Officer; William A. Duvall, clerk, Subcommittee on Appropriations for Interior Department; F. J. Bailey, assistant to the Director, Bureau of the Budget; Hugh A. Brown, Director of Reclamation Economics, Bureau of Reclamation; Northcutt Ely, Executive Assistant to the Secretary of the Interior: Edward Hyatt, State Engineer of California; Dr. Elwood Mead, Commissioner of Reclamation; Col. Walter E. Garrison, Director, Department of Public Works, California

U. S. GOVERNMENT PRINTING OFFICE: 1931

NEW RECLAMATION ERA

VOL. 22, NO. 12 DECEMBER, 1931



MOUNT RAINIER (WASH.) WATERSHED OF THE KITTITAS DIVISION, YAKIMA PROJECT

RECLAMATION POLICY

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IN the broader viewpoint, should not the attitude of the arid States be one of basing their respective Federal-aid projects on the soundest basis of finance and economics? The days have apparently gone by when the funds at the disposal of the Bureau of Reclamation will be materially increased from the original source, sale of public lands, and royalties. The conservation of this fund as a true revolving fund, which was certainly the intent of the original act, is wholly dependent on 100 per cent repayment, not only from projects now constructed, but those proposed for the future. Temptation to let down the bars is great, and will be continually present so long as pressure of various kinds can result in the expenditure of money from the reclamation fund on projects which will not pay out.

GEORGE M. BACON,
State Engineer of Utah.
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NEW 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. 22, No. 12 DECEMBER, 1931

Interesting High-Lights on the Federal Reclamation Projects

THE weather this fall has been ideal for the harvest of the beet crop on the Milk River project there being neither rainfall nor severe freezing, and although the crop harvested is the greatest in the history of the Chinook factory, the harvest was completed about 10 days earlier than usual. Approximately 49,000 tons of beets will be sliced by the factory, representing the yield from about 4,700 acres. With the present sugar market the price paid for beets will be $6 per ton. The project growers, as a rule, are well pleased with the season's crop, and an increase in acreage is in prospect for 1932.

THE Minidoka project telephone system has been connected with the Shoshone exchange of the Mountain States Telephone & Telegraph Co. Through a cooperative agreement with the Big Wood Canal Co. a branch line to Dietrich Forks, for use of the company, has been connected with the Government line.

TWELVE prospective settlers were shown over the Willwood division of the Shoshone project during the month of October. Six applications for farm units were received, 1 applicant was accepted and paid the water rental charge for 1932, and 1 man filed homestead entry.

BEETS on the Huntley project will average 12 tons per acre, with a sugar content averaging 17 per cent. That means that about 50,000 tons of sugar will be produced by the Billings factory this season.

AFTER grading and preliminary processing at Orland, the olive crop has been shipped to southern California and sold under a contract negotiated by the local association of growers.

SHIPMENT by the local subsidiary of the California Almond Growers' Exchange of the final car of the 1931 almond crop on the Orland project brought the total shipments this season to 395 tons, on which the growers have been advanced an initial payment of more than $41,000. A slight additional payment is anticipated later as determined by grading operations at the Sacramento plant.

Bureau Contributes Quota to Unemployment Relief

THE Washington office of the Bureau of Reclamation reports 100 per cent in its contribution for the unemployment relief fund, each employee having pledged one day's pay for each of the months of January, February, and March, 1932.

In transmitting his report to Assistant Secretary John H. Edwards, Chairman for the Interior Department, District of Columbia Unemployment Committee, Doctor Mead said: "It is a great satisfaction to me, as I know it will be to you, to transmit this fine showing for the Bureau of Reclamation."

CONSIDERABLE activity is evident among the new settlers who have purchased farms on the Milk River project during the past six months. Several new buildings are being erected and much preparation of ground for the 1932 crop is in progress. The demand for project farms by dry farmers still continues.

HARVESTING of sugar beets on the Uncompahgre project indicates that notwithstanding the fact that the contract minimum is less than usual, sugar beet growers this year will receive good returns because of the increased yields. The acreage devoted to this crop will be decreased approximately 50 per cent.

ON THE Sunnyside division of the Yakima project a new concrete highway has recently been completed linking the towns of Sunnyside, Grandview, and Prosser. This road saves 10.8 miles in the distance from Sunnyside to Kennewick and eliminates 18 right-angle turns, the new highway having none. It is also noteworthy that there are no railroad grade crossings on the new route. At the celebration opening the highway, which was attended by about 3,000 persons, it was pointed out that the State of Washington has spent $1,583,224 on road construction in Yakima County during the past year.

THE new $65,000 cold storage plant of the Tieton Storage Co., on the Yakima project, has been placed in operation. This plant, which is of concrete construction, has a capacity of 140 cars and was built to replace the old wood frame building, which had a capacity of about 80 cars and was destroyed by fire in August.

AS usual, a great many more applications than there are farm units available have been received for the public lands opened to entry on the Tulè Lake Division of the Klamath project on November 9. Up to November 25 the 67 units available had been applied for by 189 qualified applicants and the farms will be allotted to those having the highest average on the basis of capital, experience, industry, and character.

AS A means toward relieving the unemployment situation on the Umatilla project several residents are being employed by the Oregon State Highway Commission and Morrow County to work on roads.

Further Reclamation of Arid Land Essential to Western States Development[1]

By John W. Haw, Director of Agriculture, Northern Pacific Railway Company

IN A discussion of the wisdom of embarking on a program of further reclaiming arid lands of the West a long-range viewpoint is essential. Such viewpoint is necessary in order to properly discount the world-wide depression and the current discussion of agricultural surpluses. The "man in the street" is inclined to generalize and dismiss as ridiculous a program which will increase production of farm products anywhere at a time when there is belief that agriculture is universally and primarily suffering from a vast overproduction of the products of the farm.

NEED FOR ADDITIONAL AREAS

This paper is confined to a discussion of the future need of bringing additional acres into production only in the seven States west of the Continental Divide; namely, Washington, Oregon, California, Idaho, Utah, Arizona, and Nevada. The main range of the Rocky Mountains is not only a physical barrier, but an economic and climatic dividing line which has created to the West a region of common problems demanding similar treatment and differing widely from those in the balance of the country. If we of the West are to make an intelligent analysis of agricultural production even of to-day, and particularly as to need in the future for acreage expansion or contraction, we must focus down to its relation to the West. Unfortunately, among our own western people there is failure to particularize—failure to consider this problem in light of our specialized agricultural production and from the viewpoint of a long look ahead into the future requirements of this area.

There is widespread failure to realize among our own people that the premises in a decision to expand or not to expand irrigated lands are not reposed in conditions now existing, but rather they are those which will obtain many years hence when the new projects now contemplated are constructed, settled, and have come into production. Proposed projects, particularly the large, difficult ones, require many years for completion of surveys, economic and engineering, for construction of reservoirs, canals and other structural works and additional years for securing sound settlement. It apparently requires 8 to 10 years in case of small projects and 10 to 25 years in case of large projects before construction is completed, settlement secured, and they have found themselves agriculturally and are making any substantial contribution of farm products beyond their horizon. It is, of course, a staggering thought to visualize either construction of some of the proposed projects as a unit or settlement of so vast a tract in a few years or development of marketing facilities and markets for the products produced. No sane man, however, considers development would come in that way. When finally built, they will unquestionably be built in units. The lands of these units would be slowly settled and very gradually come into full production. Proponents of these projects feel that after authorization, 25 years would be required before they get under reasonable head. If deductions can be drawn from a comparison with rate of construction, settlement and production program of the Yakima Valley, 50 years would be a better figure than 25. There is also failure to realize that anything but an affirmative hand toward a program of irrigated land expansion will, from a practical standpoint, have the effect of bringing about an actual shrinkage in present irrigated area. A negative attitude on this question can not possibly mean maintenance in production of even our present irrigated area for the projects are listed in the hundreds which were critically short of water during the past season and there is not a State represented here that does not have a project, some of them many projects, which can not continue unless additional storage for spring run-off is constructed. This is an age when the low-cost producer only can survive. Maximum production is a prerequisite to low cost and maximum production is not possible under drastic water restrictions. We are also familiar with many projects which must have financial rehabilitation in the very near future. Lands in these projects will only remain in production if bonded debt is reduced and new money added to put the physical plant in order. If the above reasoning is sound, those who settle back in their chairs and take a neutral attitude on this question with the assumption that the present irrigated area is sufficient, are in fact lending their support to a program of contracting our present irrigated area. I assert that nothing but a vigorous, affirmative stand will keep many present projects in production, say nothing of making a beginning on new projects.

RESERVOIR CONSTRUCTION SHOULD PRECEDE DEVELOPMENT

It has not been until recently that the phrase "water consciousness"—coined by Secretary Wilbur—even began to take hold on the West. The cycle of dry years through which we are now passing has confronted us with the fact that if years ago we had played safe and made a beginning toward storage of the total yearly run-off of many of our western rivers through reservoir construction preceding irrigation development, irrigated land would not be suffering from an inadequate water supply and certain municipal and industrial water supplies would not now be threatened. It is a display of such foresight that I would plead for to-day.

Now that we have reached about the limit of dependence on natural stream flow for the uses of irrigation we begin to realize that further industrial expansion and growth of urban communities are allied with irrigation projects in the necessity for water storage through reservoir construction on the headwaters of our streams. We must consider the advisability of irrigated land expansion from the standpoint of this interdependence as well as strictly on the basis of our need for additional irrigated acres.

Should we not at this time analyze the underlying reasons for the phenomenal population growth of the West and take stock of the possibility for absorbing in gainful pursuits a similarly large population growth in the years just ahead? I would suggest that this territory has enjoyed its growth, to a large extent, through turning into cash a wonderful heritage of minerals, timber, and petroleum. Such industries are depletion industries and although they are far from exhausted we are compelled to admit that the cream has been skimmed, and they are now quite definitely on the wane. We should beware of the common tendency for an area which has enjoyed prosperity from merchandising its natural resources to live in the past, assuming that the future will take care of itself. The story is told of a visitor to Australia who noted a peculiar bird flying tail first. Inquiry of a native as to its name and its peculiar habit of

[1] Address delivered before Western States Governors' Conference, Portland, Oreg., Oct. 28, 1931

locomotion developed the reply that it was called a fillopo—that it flew tail first because it did not care where it was going so long as it could see where it had been. Can that possibly typify the attitude of the West? The mines, the oil wells, the fisheries, and the lumber mills are all very well for the present. Properly managed and with careful conservation of what is left of nature's heritage they will provide new wealth and employment for some time to come. On the other hand, it is inconceivable that these industries can absorb 4,000,000 more people by 1940 or 10,000,000 more by 1950, which, as I will indicate later, is the prospect if the present rate of population growth in the West continues. If not, what are these people going to do? To be sure, the West has a great resource in its climate, and although people of comfortable means will come here as they have in the past for that reason alone, still the great bulk of our future increase in population will have to work at something, since enjoying a climate is not a livelihood. Will manufacturing and allied industries alone provide employment for our population growth? There are many advantages enjoyed by the manufacturing plant or industry located in this area—one might almost say every advantage—except a market. But this matter of markets is a rather important consideration. I have previously spoken of the Continental Divide as an economic barrier and so it has been found to be for most manufactured products except those which are consumed in the West or which are constructed out of raw materials the West alone can produce. Let us not deceive ourselves—market for most of our manufactured products must be created right here in the West, unless the Orient not only awakens but gets out of bed.

AN AGRICULTURAL FOUNDATION FOR A BALANCED CIVILIZATION

The underlying basis for an industrial expansion out here is in the last analysis found in our agriculture. Agriculture is the only foundation upon which a balanced civilization can be built. Without its expansion there is no chance for expansion of local markets for the production of industry. Just as it is difficult for us to get East with our western manufactured products, so the East can not get West with its products. The Continental Divide is, therefore, in effect a tariff wall, which may be turned to our advantage if we can but create an expanding self-sufficient civilization in this western country. I said that such a self-sufficient civilization had its foundation in agriculture. Let us analyze this statement. Students of this problem assert that one farm family supports a family in adjacent towns and cities and another family in remote cities and industrial centers. As an example, on the Minidoka project in Idaho the farm population is 7,091 and 7,950 people reside in project towns and villages. Although difficult to prove, as an indirect result of its production of farm products and the manufactured articles which the 7,000 farm people and the 8,000 people in project towns and villages buy, 7,000 more people are sustained in both eastern and certainly in western manufacturing districts. This project is a laboratory test of this contention as it was created out of desert and it is now solely an agricultural community.

Again, the State of North Dakota, purely an agricultural State, is another proof of this contention. There are 385,000 people who live on farms and 310,000 in the towns and villages of the State. Were North Dakota wiped from the map, Minneapolis, St. Paul, Chicago, and eastern industrial centers would all feel the blow and at least another 300,000 people would be out of work.

Coming closer home, Yakima would not be a city of 30,000, and Seattle, Portland, and Spokane would be vitally affected if it were not for the 300,000 irrigated acres in the Yakima Valley.

Certainly, when the West is casting about for a basis to gainfully employ its steadily mounting population and to provide jobs for those now employed in industries which are petering out because of the exhaustion of nature's subsidy, it must set up a basis for agricultural expansion. From this foundation a superstructure of industrial expansion can then be built. The farm multiplies in compound ratio the opportunities for the professional man, the business man, and the industrial worker, and it alone provides a basis for confidence that we can continue to absorb our natural population increase and the swarming migration which in the future is coming to the West in search of a soft climate, better living conditions, and opportunities for themselves and their children.

POPULATION TREND

Let us glance for a moment at the population trend as indicated by the 1930 census. Prior to the official announcement of this census economists were discoursing on the dwindling rate of population growth in the United States and its effect upon our future markets for farm and manufactured products. A stationary population, or nearly so, was predicted somewhere between 1950 and 1975. In any event, the percentage increase of population in this country was, according to their calculations, definitely on the wane. They were, however, disarmed by the official population count of 1930. In 1930 there were 16,987,570 more people than in 1920, a percentage increase of 16.5 per cent. The rate of growth in the previous decade was 14.9 per cent. These figures, however, are not quite comparable because of a slight difference in the elapsed time between the counts 1910–1920 and 1920–1930. Reduced to the accurate basis of months, the rate of population growth was 15.7 per cent in the decade just passed as compared to 15.4 per cent in the decade 1910–1920, still a slight increase in rate over the previous decade and in the face of declining population gains through immigration.

How about the seven States already mentioned? Their population at the time of the 1920 census was 6,859,702. The census announces for 1930 a population for this area of 9,661,900—an increase of 2,802,198 or 40.8 per cent. Further emphasizing rapidity and character of population growth in this area as compared with the rest of the country, immigration statistics show a net average increase in population in the United States by admission and departure of aliens of 247,778 for each of the last five years. In the report of the Commissioner General of Immigration the following statement is found: "Of the new arrivals only 12.7 per cent settled in the Western States." In other words, although growth in population in the United States during the past 10 years from immigration has amounted to approximately 3,000,000 people, these aliens largely remained east of the Rocky Mountains, only 12 per cent filtering through to the West. A growth in population of 40.8 per cent thus becomes more significant when we understand that responsibility for the 16.1 per cent growth in the country was to an extent dependent upon immigration in which the West had but a small share. It is a matter of statistical computation, not a flight of fancy, to say that the population of these Western States will be close to 20,000,000 in 1950. From 1910 to 1920 the population growth of this same area was only 30 per cent. There is much evidence that relatively the drift will continue to show a gradual percentage increase provided they can be absorbed in profitable occupations.

WESTERN AGRICULTURE HOLDS UNIQUE POSITION

If agriculture is to be the basis for a civilization which will absorb these millions of families in the next 25 years, inquiry may well be made as to the place which western agriculture now has and may expect to retain in the farm commodity production program of this Nation. Fortunately, western agriculture holds now, and there is no reason why it can not retain, a unique position in this program; unique in that it promises substantial profits, limited competition, and rather remote danger of anything but seasonal overproduction of certain commodities.

Western agriculture has a logical dual rôle in providing this Nation's food supply. First, it should furnish in the main food requirements of people residing in the West. The staple food requirements of our own people should be met from production reasonably near at hand. Year by year the breaking point between west and eastbound shipments of staple food crops has been pushed further east as this western demand has expanded. Pork and corn, dairy products, particularly butter, and certain types of wheat now move to Pacific coast markets from Mississippi Valley States. The Pacific coast consumer is thus increasingly forced to pay mid-west prices plus transportation costs on many staple agricultural products. Potatoes, wheat, meat animals, and dairy products, as well as fruits, vegetables, berries, and other specialty crops, should be produced for western people on western lands. It is obvious that compelling the western consumer to pay eastern prices plus transportation costs inflicts on them an economic handicap which would surely in the long run curb its natural industrial development. With a population growth in the West previously mentioned, a very large expansion of production will be necessary to provide these staple food articles for the local western market. The average American eats three bushels of potatoes and 16.9 pounds of butter per annum. A 4,000,000 population increase in the next 10 years in this area will require 12,000,000 additional bushels of potatoes and 67,000,000 pounds of butter. Approximately 400,000 additional cows must be maintained to provide the requirements in butter alone and 75,000 additional acres of potatoes. Considering the array of other food articles consumed annually by 4,000,000 people, it is safe to assert that 1,000,000 additional acres must be brought under cultivation in the next 10 years in this region if the Pacific slope is merely to be self-sustaining agriculturally.

The second part of the dual agricultural rôle of this area concerns provision of fruits, vegetables, berries, nuts, and other specialized products which either it is impossible to produce at all or can not be produced at certain seasons in the territory east of the Divide. The American's diet now demands a year-round supply of quality products of this character. Western irrigation projects with an extensive range of climatic and soil conditions are gradually being articulated into the general scheme of production of these crops. Our production of these crops is filling in seasonal gaps in a year-round, adequate program of supplying these indispensable food articles to the general American public. If such production program is not expanded in the West, it must be expanded elsewhere in the Nation to meet increasing demand occasioned by both population growth and the unmistakable tendency of our diet toward increased consumption of such products. Improved varieties, better culture, and efficiency in production methods will accomplish something but there must also be acreage expansion somewhere.

INCREASING POPULATION DEMANDS ADEQUATE LIVESTOCK

There is also the question of maintaining an adequate supply of wool, lambs, and beef animals for the steadily increasing population of this country. We now import about one-half of our wool requirements. Our imports of beef cattle have now risen from 172,910 head, valued at $4,654,943, in 1925, to 492,609 head, valued at $19,972,192, in 1929. Furthermore, after importing nearly 500,000 head of live cattle in 1929, we were still short of beef and veal, and we imported 128,089,183 pounds of canned, chilled, and frozen beef and veal. Compare such situation with that prevailing 25 years ago, in 1904. In that year we exported 593,000 live cattle and 414,902,000 pounds of beef and veal, or not far from the equivalent of 1,500,000 head of cattle. The question may well be asked where beef, veal, and wool requirements for this Nation are to come from in 1940 with 20,000,000 additional consumers.

It is in the range areas of the Western States that a large portion of these products have previously originated, but if livestock is to be increased out here, the area of land irrigated must be expanded and expanded rapidly since the limiting factor in connection with complete utilization of range areas is late fall and early spring pasture and available feed for wintering. Alfalfa hay, beet tops, pulp, and molasses, together with barley and oats, constitute such feed for wintering, but it takes irrigated land in this section to produce these crops.

We can well consider growth in westbound shipments of hogs and dressed pork products. In 1929, 9,727 carloads of live hogs, or approximately 875,400 head, were moved into the State of California from points east of the Divide for slaughter. This constitutes 55 per cent of all the live hogs slaughtered in California. Again, Oregon received 29 per cent of its slaughter hogs from Idaho, 9 per cent from Montana, and 6 per cent from North and South Dakota. Washington received 250,000 head of live hogs from other States and in addition imported 12,000,000 pounds of green, frozen, and cured pork products. The western consumer of pork and pork products appears likely for some time to pay Middle West prices plus carrying charges from Missouri River markets and the farmer in the West is thus selling in a market protected by a tariff measured by present freight rates. Such lack of providing our own feed supply is a growing handicap to western development which is steadily gaining ground as population on the west coast mounts without simultaneous and commensurate growth of crop area, which of course must be irrigated area. To sum up the situation: If we are going to assume that good markets, good prices, and fair profits depend upon a constant, vigorous demand, it would seem that the western farmer occupies a secure position in the future. He is assured of a local market on staple products in excess of prices prevailing in the Middle West. He is assured of a demand for feed crops in valleys adjacent to the range and he is finally assured of increasing demand east of the Continental Divide for specialty crops which this area is particularly endowed by nature to produce, provided quality is maintained and skillful merchandising practiced. Yes, there is every sound reason for agricultural expansion in the West.

RECLAMATION EXPANSION FURTHERED BY EDUCATION

In a consideration of expanding irrigated area in the West, much skepticism of eastern people must be overcome providing Federal funds are to be used or irrigation district bonds are to be sold for financing such expansion. Although irrigated agriculture is the most ancient of all types of farming, there still is a feeling on the part of the public east of the Divide that it is an artificial practice that circumvents some fundamental law. To them it is perfectly proper to control floods or drain land that is too wet or apply lacking elements of plant food, thus enabling eastern and southern areas to become productive, but there is something not quite natural about raising water out of a river to be supplied to arid land to make it productive. In current discussions of agricultural surpluses and necessity for limiting production, the finger of condemnation is usually pointed at what is called marginal production on arid western lands. No consideration is given the question as to whether irrigated lands produce surplus crops. The mental process of the public in this connection seems to be that the Almighty preordained the rainfall regions as the farming country; if they can not supply the market, then, and then only should the westerner on his artificially watered farm be allowed a chance. This warped reasoning is a very real problem in expanding irrigated land. It dissipates good will in the securities markets where irrigation bond issues must be floated, it militates against continued sanction by Congress of our present Federal reclamation policy, and it prejudices

the consumer against western products. The West must educate the public of this country to consider costs of supplying water under irrigation farming with the same matter-of-fact resignation that necessity for flood control, application of fertilizer, draining, or terracing is accorded in the East and South.

NECESSITY OF POWER PRODUCTION

Of course the question of construction of many irrigation projects now proposed will be found utterly unsound on the basis that the areas watered must liquidate the entire cost, reservoirs included. On the other hand, if as large by-products hydroelectric power is generated, municipal and industrial water supplies insured, seasonal floods brought under control, and river navigation made possible, many seemingly unsound irrigation developments will take on a new cloak of financial practicability. Perhaps, as at Hoover Dam, these things which have heretofore been considered as by-products of irrigation will become the compelling motive for beginning construction and bear the large burden of expense, with reclamation of land an issue of lesser importance and bearing only a proportion of the expense.

In Japan the Government contributes 50 per cent of the cost of construction of irrigation works as outright subsidy, and in Spain the Government bears 40 per cent of the construction cost and two-thirds of the interest on the remainder. State and Federal Governments and power interests can and should assist irrigated land in lifting the burden of construction costs which neither could nor should bear alone.

It is going to require farsighted statesmanship in our State capitals and in Washington, forward-looking business acumen on the part of western financiers, and an abiding faith in the future agriculturally and industrially of the Pacific slope to begin construction of great irrigation-hydroelectric projects in anticipation of a market at the time of ultimate completion for the products of the land and the power created. I argue that if this faith is not evidenced by beginning new projects in the near future and rehabilitating sound ones now in difficulty, the West is going to be left sitting beside the road while other parts of this country capitalize their lesser natural opportunities. I believe there is reason to feel concern as to whether expansion of irrigated area can be financed with sufficient rapidity to meet the demand locally and in the East for irrigated farm products.

In a consideration of the financing of future projects, it is increasingly apparent that the Federal Government's outright support, interest free, of reclamation will be confined to the use of the reclamation fund which fortunately it is now generally admitted should be available for erecting the permanent industry of agriculture, since the fund in the first instance was derived from sale of the natural resources of this western country. To be sure there is some hope that this fund may be augmented in the future if as now proposed revenues from power plants are returned to the Federal reclamation fund or to a State reclamation fund after they have been used to supplement payments of irrigators to the place where the original first cost of the dam and, of course, the electrical plant has been retired. The fund thus augmented, however, will be far inadequate to finance the necessary water conservation and utilization plans of the Western States.

STATE COOPERATION WITH FEDERAL GOVERNMENT

Apparently, large appropriations from the Federal Treasury can not be expected unless the State or States immediately concerned underwrite repayment of the loan or unless flood control or navigation is the paramount consideration.

No doubt participation in these ventures by States would at this time be looked upon with disfavor, first, because of unhappy experiences in the past, and second, because of general lack of appreciation of the benefits to an entire State flowing from irrigated land developments by the public. The Western States must set themselves to the education of their people as to these general benefits. There is reason to believe that when such a viewpoint is understood by our people some direct form of levy for financing irrigation development and water storage in Western States will meet with favor. Do our western people realize that through the expenditure of $195,000,000 by the Federal Government in irrigation it has created a property for us now valued at more than a billion dollars? Do they realize that for the past several years Federal projects have created new wealth yearly nearly equal to their total cost?

No one would wish to discount the benefits of our ambitious program of joint Federal and State road building, but I should like to advance the suggestion that if the States would spend a similar amount in development of irrigation they would in time secure the return of most of their capital investment, would create an enormous amount of new taxable property and add tremendously to the States' yearly income from sale of agricultural products. They would have builded for the future. I would not suggest that road building was unwise or should be abandoned but the reasons are equally as sound for using State money to finance reclamation through the matching of Federal funds.

I would be the last to deny that money, both Federal and private, has been squandered in illy conceived, poorly constructed irrigation developments in years gone by. The East may think, and has expressed itself as believing, that arid land reclamation is simply another "noble experiment," but we of the West know that the successes far outnumber the failures—that 16,000,000 acres of irrigated land west of the Divide is the back-log not only of our agriculture but our present and certainly our future civilization. We all know that we have in the past 25 years added greatly to our knowledge of the technique of irrigated agriculture and the economic factors necessary for ultimate success. The mistakes of the past will not be repeated in the future.

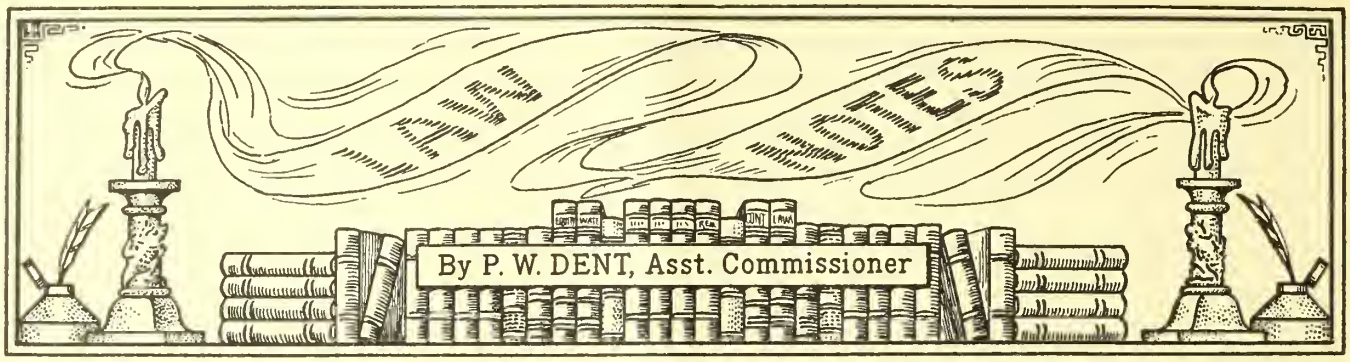
In closing, let me suggest that the location of agricultural and industrial production is not static; it is, rather, migratory, shifting with population growth, changes in human food and clothing requirements, transportation facilities, machinery developments, and by advances made in preservation and refrigeration. But of this we can be confident, western irrigated land has unique advantages in production of certain agricultural commodities and if we are to supply our own local market and maintain our present position in supplying the rest of the country with specialty products, we must be forehanded, we must keep ahead of, certainly abreast of the demand.

I assert that a program of bringing in irrigated land in anticipation of the demand of a growing country is now and will be for many years to come sound policy for this country and certainly for the West and that it should have the positive, vocal support of every westerner.

Kingman-Hoover Dam Highway Opened December 3

On December 3 the opening of the Kingman-Hoover Dam Highway was celebrated with a barbecue and appropriate program on the Arizona side of the Colorado River near Dam Site. Large delegations from Nevada, Utah, California, and Arizona attended the celebration.

NOTWITHSTANDING the extremely hot weather and shortage of water that prevailed on and near the Uncompahgre project during the irrigation season of 1931, it is reported that Montrose County will have 23 members in the 600-bushel potato club this year, of which 13 members will be located in the Bostwick Park area, a private district adjacent to the project, and 10 members on the project. This is an excellent showing because of the fact that so far as can be learned there is only one other member in the State of Colorado in the 600-bushel potato club this season.



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

THE act of March 17, 1931 (Ch. 88, S. L. 1931), provided an appropriation of $10,000, to be used in cooperation with the United States (provided an equal or larger sum be contributed by the United States) for making further surveys and investigations to determine the best method of utilizing the Gila River and its tributaries above the San Carlos Reservoir.

The act of March 18, 1931 (Ch. 98, S. L. 1931), made numerous minor additions and amendments to the irrigation district law, and while these changes do not materially affect the operation of the law in connection with activities of the Bureau of Reclamation, they are briefly summarized below: Section references relate to chapter 81, Revised Code, Arizona, 1928.

Section 3332 relates to the election of directors. The amendment provides that in districts embracing 35,000 or more acres of land when the petition proposing said district shall so request, or, in case of districts already organized, by resolution of the board of directors, the board of supervisors shall name three or more qualified electors in each of the three divisions of the district, such additional directors to be elected at the next regular election; one in each division to hold office for 3 years, one for 2 years, and one for 1 year. Thereafter, at each regular election each year, one director to be elected in each division to hold office for a term of three years.

Section 3341. Powers of board of directors. In addition to the powers already enumerated by this section of the Revised Code, the 1931 amendment recites the following additional powers:

"To refer to the qualified electors of the district any optional or administrative measure or method of procedure or any other matter or proposition as to the board may seem necessary or advisable; to establish tolls or charges for service of irrigation, domestic water, electricity, and other commodities; to control the finances and property of the district; to appropriate money and provide for the payment of the district debts and expenses; to exercise exclusive control over the laterals, ditches, canals, rights of way, and other property of the district, including the right to prevent the encumbering thereof, to abate and remove all encumbrances and obstructions thereon, to improve the same, to vacate any right of way not necessary for the further use of the district, and to protect the same from encroachment and injuries; to erect and maintain transmission and pipe lines, culverts, roads, and crossways, and to prevent obstructions thereon; to provide the district with water, electricity, and other public conveniences and necessities, and to engage in any and all activities, enterprises, and occupations within the powers and privileges of municipalities generally; to apply surplus money in the district treasury to the liquidation of district debts or to the creation of a sinking or reserve fund for the district; to make, amend, or repeal any and all resolutions, by-laws, and regulations necessary for the government of or for the carrying into effect of the power vested in irrigation districts or any department or officer thereof, and to enforce the observance of the same by the imposition of penalties; provided, that no penalty in excess of $100 shall be imposed by said board."

Section 3343, Revised Code, 1928, provides that rules and regulations adopted by the directors shall be printed in convenient form for distribution and that they shall become effective from the time of giving public notice of their adoption. The section as amended in 1931 reads as follows:

"The minutes of the proceedings of the board of directors, or an abstract of such minutes, may be published whenever the board, by resolution entered upon the minutes, may so direct. All by-laws, rules, regulations, or resolutions of a general nature, governing drainage ditches, laterals, canals, and the use and distribution of irrigation water or other commodities, shall be posted at least five days in at least two public places in each division of the district, or published twice in a newspaper published within the county in which the office of the district is situated, as the board may order. By-laws, rules, regulations, and resolutions of the board shall become effective at the time designated by the board, and in the absence of such designation, then upon the adoption of the same."

Section 3352, relating to the cancellation of bonds, is enlarged by the addition of the following provision (p. 245, S. L. 1931):

"In any district in which the major plan shall have been carried out and in which there may remain unsold any bonds of a subsequent issue, authorized for any special purpose or purposes, and the purposes for which said bonds were intended shall have been fulfilled or carried out in some other manner, and such unsold bonds shall have a par value of less than $500,000, the board of directors may by resolution, passed by a two-thirds vote, cancel and destroy said unsold bonds, in which event the board shall cause its resolution of cancellation to be recorded in the office of the county recorder of the county in which is located the office of the district, and a certified copy in any other county in which lands of the district may lie."

New sections, 3353a and 3353b, have been added as follows:

"SEC. 3353a. The provisions of Sec. 3386 and Sec. 3387 shall apply only to the use of bonds or the expenditure of monies derived from the sale of bonds issued for major purposes agreeable to the provisions of Sec. 3350, and no provision of this article relating to authorization, issuance, delivery, or sale of bonds shall be taken to preclude the financing of district needs and purposes by other means, under any express or implied power and authority granted to irrigation districts.

"SEC. 3353b. Bonds of an irrigation district organized under the laws of this State, which are proposed to be issued for

the purpose of carrying out the general plan of such district for the building and development of its works, and which shall have heretofore been declared by the board of directors to have been authorized by the electors of such district, are hereby declared legal and valid for the purpose for which they have been declared by the board of directors to have been authorized; and regardless of whether there was any mistake in the notice of election to authorize such bonds, or in the ballots used at such election, or as to the date of maturity of the bonds or otherwise, such declaration by its board of directors shall, in any proceeding questioning the validity of such proposed bond issue, be taken to be conclusive evidence of the legality of the bonds, and that all acts and things prerequisite to the issuance and sale of the bonds were duly performed and done in accordance with law; and any such bonds so declared by the board of directors to have been authorized may be legally issued and disposed of, with maturity dates within the limits prescribed by law, and upon being so issued and disposed of shall be valid and binding obligations of the district."

Another new section, designated 3354a, has been added. This section provides that the board of directors of any irrigation district may, whenever expedient, issue refunding bonds to refund the bonded indebtedness of the district, and sets out details of procedure in connection with the issuance, sale, and delivery of such bonds.

New section 3356a provides for special tax levy or levies payable in a single year or by annual installments not exceeding five years, funds for the purpose of paying district indebtedness, repairing or improving irrigation works, or extending the same or installing new works or systems.

Section 3357 relates to the disposition of surplus funds raised by taxation, and the 1931 amendment provides:

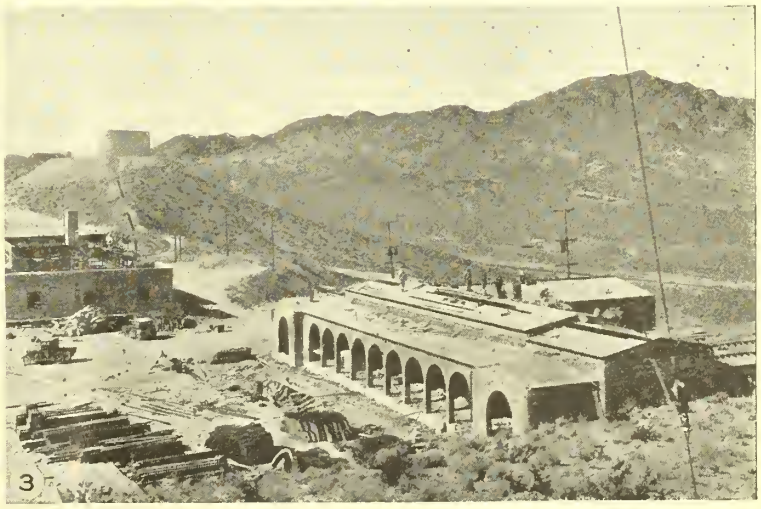
"Whenever the purposes of any fund for which taxes have previously been levied have been satisfied by moneys from any other source, and there shall be no outstanding warrants against the said fund, the district treasurer shall upon the order of the board deposit all moneys thereafter collected on account of the same into such other fund or funds as may be designated by the order of the board."

Section 3369, report of treasurer. This section, as amended in 1931, provides for report by the district treasurer to the secretary on the 15th of each month, of all moneys collected and warrants paid, registered warrants unpaid, and return of warrants paid during the preceding month.

Section 3370, report of board on financial condition. This section, as contained in the 1928 Revised Code (p. 787), provides for report at regular monthly meetings of board of directors in January of each year. As amended in 1931 (p. 222 1931 S. L.), provision is made for report at regular monthly meetings in January or July of each year.

Section 3372a. This section was added in 1931 and reads as follows:

"Whenever the district treasurer shall fail for a period of two years or more to enforce the provisions of law relating to the sale of lands for the payment of delinquent taxes, the district secretary of such district may, upon the order of the board of directors of any irrigation district, perform the acts and duties imposed by law upon the district treasurer with respect to irrigation district taxes, as ex-officio deputy district treasurer, with like force and effect, and for such purpose shall have access to the records of the county treasurer's office and to the conveniences and facilities thereof; provided, that in such cases sales shall be made for delinquent district taxes only, and the period for redemption from such tax sales of lands delinquent in the payment of irriga-



BOULDER CANYON PROJECT

1, Outlet portal Tunnel No. 4. Boulder City water intake plant in foreground; 2, dormitory building from southwest; 3, dormitory building from southeast.

tion district taxes shall be one year from the date of sale."

New section 3376a was added, as follows:

"Irrigation districts having a board of directors of nine members shall elect one director in each subdivision each year after the first election following the adoption of this act, agrecable to the provisions of section 3332 as amended; in all other respects the election in such cases shall be held and conducted as in this article provided."

Section 3389, payment of warrants; directors may borrow money. This section, as amended in 1931, is practically the same as before, except that the following provision as to form of warrants has been inserted:

"Nothing herein contained shall preclude the board of directors from the adoption of a special form of warrant fixing the time of payment and a lesser rate of interest, in which case said special warrants shall be payable only at the time fixed and shall bear interest only at the rate set forth on the face thereof."

In the same section the clause relating to the borrowing of money has been changed to read as follows:

"To meet necessary expenditures in anticipation of the collection of taxes the board of directors may incur indebtedness by borrowing money or otherwise, not exceeding the amount of taxes then levied and assessed, and at interest rates not exceeding eight per cent per annum, and as evidence of such indebtedness may issue, negotiate and sell its warrants or issue negotiable notes of the district payable from and at such times as it may be anticipated taxes for the satisfaction thereof shall have been paid in. Moneys borrowed on the security of taxes assessed for specific purposes then remaining unsatisfied, shall be applied only to the purposes for which such taxes were assessed; moneys borrowed on the security of uncommitted or unapplied taxes may be used for any district purpose."

New section 3402a reads as follows:

"Whenever petition shall be filed therefor as hereinbefore provided, and the board of directors shall be satisfied that the land which it is sought to have excluded is sterile, alkaline or for any reason unfit for profitable cultivation and not worth in productiveness the amount of the annual tax normally assessed against the same, and there shall be pending petitions for the inclusion of a like quantity of good agricultural land which may be included without detriment to the lands previously included in the district, and without decreasing the water rights or any other rights and privileges of such prior land, then such district land may be excluded and such new land included by concurrent action of the board, and in such case such unfertile and unsuitable land may be released from such obligations of the district as the board may see fit, and the obligations previously attached thereto may by action of the board be fixed and attached to said other lands included in lieu thereof, so that the securities of the district shall not be decreased by such exclusion and inclusion. A certified copy of the proceedings of the board including lieu and excluding former district lands shall be filed in the office of the county recorder in each county wherein said district shall lie."

Section 3403, petition for inclusion of lands; notice; hearing. The language of this section, as amended by the 1931 S. L. is practically the same as set out in the 1928 Revised Code, except that the following proviso is inserted after the provision that the district as changed and all lands included under the order of the board of directors shall be and stand liable for all existing obligations and indebtedness of the district: "*Provided*, That in the event said new lands can not, because of physical conditions, participate in, secure the benefits of or enjoy all the rights and privileges of lands previously included in the district, and in cases where the board of directors does not deem it advisable to admit said lands under terms of equality with lands previously embraced within the district, then said board may differentiate said lands by the designation of the same as specified units or additions and may fix the terms and conditions under which said lands may be included, the rights and privileges to be accorded the same, and the obligations to be attached thereto; *Providing further*, that no lands shall be admitted under terms or conditions, rights or privileges more favorable than those attaching to lands originally included within the district, nor which shall in any wise interfere with any existing rights or privileges or decrease the water supply of any lands previously included; neither shall any inclusion be made which shall in any wise reduce or interfere with any bond security or safety. The terms and conditions of an inclusion may be amended with the consent of the board of directors and the parties concerned, but such amendment shall be subject to all restrictions of the initial inclusion and the details thereof shall be similarly recorded."—*Richard J. Coffey, District Counsel.*

AT THE latest report from the Minidoka project the sugar factory at Burley had sliced 20,000 tons of beets, which was estimated at about half the total to be handled this season.

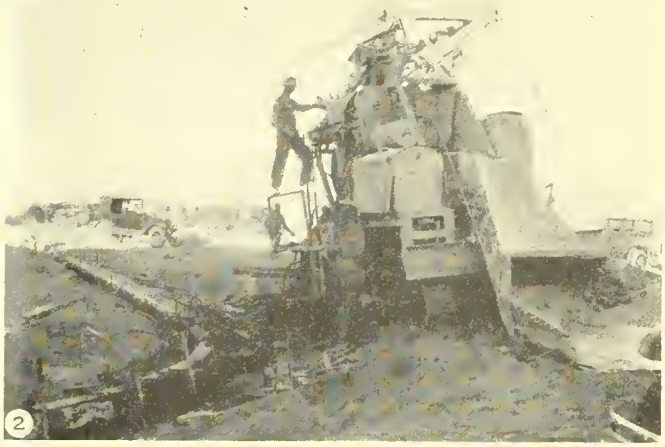
Secretary Approves Form of All-American Contract

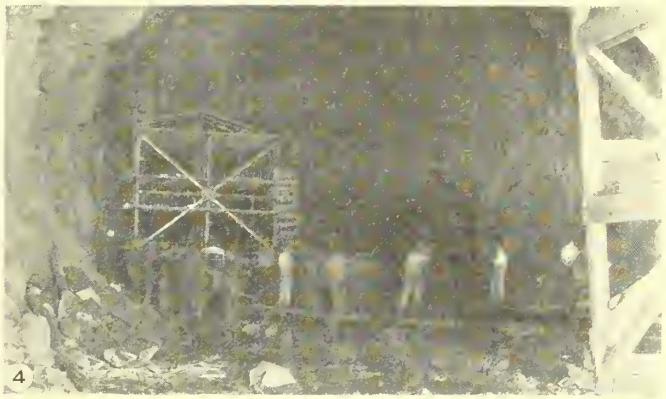
On November 4, Secretary of the Interior Wilbur gave his approval to the form of contract between the water users in the Imperial and Coachella Valleys of southern California, who will be served by the all-American canal, and the Government, under which $34,000,000 of Federal money will be spent in the construction of an irrigation ditch six times as big as Uncle Sam has ever dug before, and repaid in installments over a period of 40 years.

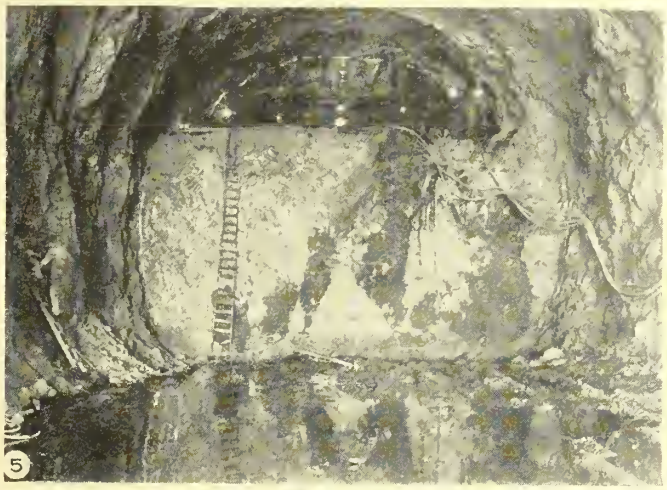
The contract is the result of months of consultation between representatives of the Bureau of Reclamation and the irrigation districts to be served. Following its drafting a public hearing was held in the office of the Secretary of the Interior on October 22, at which all objections were heard. Its acceptance by the department is a definite step toward executing the canal feature of the Boulder Canyon project which is second in importance only to Hoover Dam. The Boulder Canyon project act provides for the construction of the all-American canal, lying entirely within the United States and its use in place of the former Imperial main canal, which runs for some distance through Mexico. The contract now goes back for approval, through a special election to be held by the water users, when it will be ready for final signature by Secretary Wilbur and appropriations by Congress for actual construction.

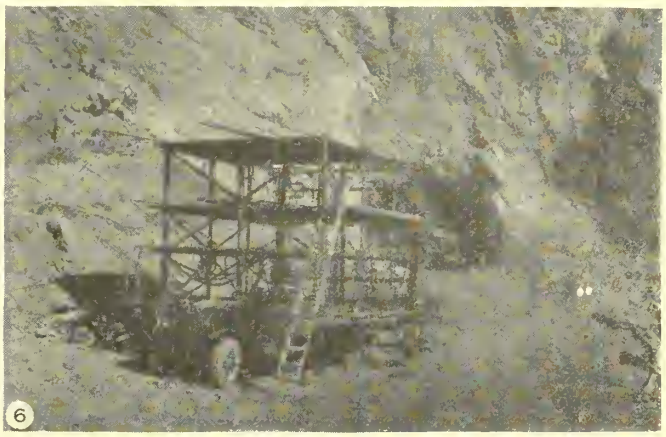
THE sugar beet crop on the Lower Yellowstone project was harvested in record time, being favored with excellent weather conditions and an abundance of help. There were 10,100 acres of sugar beets on the project, and it is estimated that the average tonnage per acre will be between 10.5 and 11 tons. The contracts provide a guaranteed payment of $5.50 per ton with the stipulation that $6 will be paid if the average sugar content reaches 16.5 or better. The average content indicated that the higher price would be paid. This would make the total payment to the project growers about $650,000.

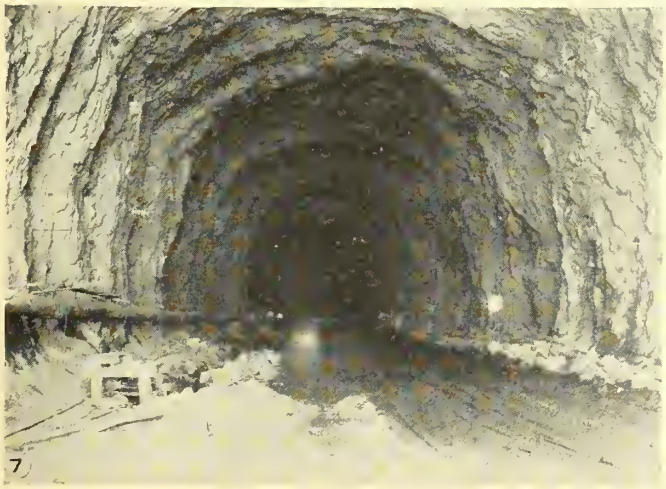
AT THE Southwest Stock Show recently held in El Paso, Tex., Rio Grande project, 59 yearling steers, besides hogs, were shown. All of the cattle shown were entered by members of the 4-H club in New Mexico and west Texas. The yearling first prize was $115. The first prize yearling was sold at auction at 30 cents per pound.











BOULDER CANYON PROJECT

1, Administration Building from southwest; 2, concrete mixer for curb and gutter construction; 3, finishing concrete curb and gutter; 4, 41 by 56 foot section at outlet of Tunnel 3, steel drill carriage in drilling position; 5, 41 by 56 foot section at heading in outlet of Tunnel 4; 6, outlet portal Tunnel 2, "Jumbo" drill carriage in foreground; 7, 41 by 56 foot tunnel. Outlet end of Tunnel 4; 8, outlet portals of diversion tunnels from the Six Companies' Highway.

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Earth Lining of Main Canal, Vale Project, Oreg.

By Chas. C. Ketchum, Superintendent, Vale Project, Vale, Oreg.

THE Vale main canal traverses a distance of 70 miles from a point about 1 mile west of Namorf, Oreg., on the Malheur River to Jamieson on Willow Creek. It will irrigate lands lying mainly on the north side of the river and of the Oregon Short Line Railroad, which extend its entire length. Its route is rugged along steep side-hills and rock canyons.

The formation of the country through which the canal passes is of disintegrated basalt, burnt lava, talus rock, diatomaceous earth, Payette formation, river gravel, and numerous other materials of a porous nature. In the Harper division, apparently an ancient river bed, hard lime materials were found underlaid with gravel or other porous material. There are stretches of stratified diatomaceous earth, through which the canal extends for a distance of as much as 4 miles. This material is interspersed with numerous streaks of a white shale varying from 1 to 3 feet in depth, and a cursory examination would indicate that the finer materials had been washed out, leaving shale.

After completion of preliminary surveys for the canal location, it was necessary to determine from observation, topography of land, and test pits, the type of construction best adapted for the various formations and conditions to be encountered. Often test pits were misleading, and even after excavation of the canal, it was difficult to determine which class of material was most impervious to water. Stretches of canal which, from first observation, gave evidence of a compact soil later proved porous, and, in many instances, soils which appeared loose efficiently resisted penetration of the water.

The various formations encountered in the test pits led to the adoption of open canal sections where possible, it being planned to line with earth those stretches which, after excavation, indicated porosity. The object was to thoroughly test the canal before resorting to reinforced-concrete lining, bench flume, or other construction, as it was thought that a considerable saving could be effected by this method, rather than to attempt to decide in advance the type of lining to be used.

FIRST-YEAR CANAL OPERATION

The Vale canal has been under construction since 1927, and 46 miles have now been completed, including 5 tunnels having a total length of 9,600 linear feet, three siphons totaling 7,500 linear feet, 1,600 feet of concrete-lined canal, and 42.5 miles of open earth canal section.

When the first 20 miles were completed in February, 1930, water was turned into the canal, and, as no lining had been provided, numerous leaks occurred, making it evident that lining was required in order to make satisfactory deliveries. There was insufficient time to make complete lining, as it had been planned to irrigate the lands of the first unit that season. Water was turned out of the canal, however, and the finest loam obtainable from the nearest borrow pits was placed in the bottom of the canal and up the sides as far as it was thought would be required the first year. In the operation of the canal very few leaks occurred in the embankments proper. The heaviest seepage took place where the canal intercepted numerous stratified materials in thorough cuts, although there were leaks in the draws where the canal was in fill and continued to where the embankment rested on rock. Cut-off walls were generally placed in such places to intercept the water under the embankments and to facilitate silting conditions.

After the water was again turned into the canal, it was found that much of the leakage had been stopped; not entirely, however, due to the lack of time in which to complete it. Leakage developed in the Harper Basin, particularly where the canal passed through pure gravel deposits. One stretch which was about 3,000 feet in length lost water to such an extent that the entire head in the canal disappeared. The water at first passed by this stretch, but in a short time the head farther down the canal began to disappear, and, on inspection, it was found that seepage had started at the canal and extended to about a mile below, which collected approximately 10 cubic foot-seconds of water. This condition developed about 6 weeks after water had passed this point. Above the Pacific livestock ditch, which is a private system located more than a mile below the Vale Canal, seepage also was disclosed. Approximately 10 cubic foot-seconds of water were running by the Pacific livestock ditch, and it was evident that it was coming through the Vale Canal. Water was turned out of the canal and through this stretch of gravel earth lining was placed varying in depth from 3 to 6 inches and up the slopes for 3 feet during the limited time available. Borings were made directly below the canal covering this area and the water table determined. In some instances the water had reached the ground surface, and the conclusions were that this stretch of canal was extremely porous, as indicated by the short time the water was in the canal.

After water was again turned into the canal it was apparent that the earth lining placed had been borne into the pores of the gravel to such an extent that the draw which formerly carried 10 cubic feet per second was completely sealed. The test wells indicate that seepage still persists, but the water table has not increased. Certain portions of the canal near this particular place require earth lining and until this lining is placed it will not be possible to make a complete report of the effect of the lining, it not being definitely known which part of the canal is causing the seepage. In an embankment section farther down the canal an area of seepage developed about 500 feet below the canal several weeks after the water had passed. As the season progressed, however, it was evident that water was seeping through the disintegrated lava rock, the outlets of which sometimes were as much as three or four hundred feet below the canal.

LINING METHODS

In general, lining has been placed in stretches of canal sections where seepage was greatest. On account of the necessity for irrigation of lands under the first 20 miles of completed canal, water could be taken out of the canal for short periods only, which necessitated concentration of the lining on the canal bottom and as far

up the sides as time would permit, the work to be completed to the required height after the water was taken out of the canal in the fall or spring. The bottom of the canal was puddled by hauling earth and running it into the crevices or places where a porous condition existed. At times as high as 20 cubic feet per second of water would disappear through the bottom after being primed. After earth lining has been placed and the water has passed the dangerous leaks are readily discernible by the earth being drawn by the action of the water into the holes in the shape of whirlpools.

Most of the work was done by force account with teams and fresnos where the hauls permitted, and by scrapers and trucks where longer hauls were necessary. It was generally considered that hauls up to 300 feet could be made with fresnos and that pits could be located within this distance. Longer hauls justified the use of trucks. During the irrigating season the work was carried on by force account, and after the water was turned out of the canal, minor contracts, under Specifications No. 492–D, were let covering earthwork, lining, and embankments of the canal. Under these contracts, canal sections were lined to a depth of approximately 6 inches on the sides and from 6 inches to 1 foot in the bottom, dependent upon the porosity of the material.

It was at first contemplated to purchase a small drag line for use in connection with this work, but it was deemed advisable to use traps and trucks instead because of the fact that suitable lining material could not be secured in close proximity to the section to be lined, necessitating in many instances hauls up to 3,000 feet and there being few places where the material could be placed directly with the machine within hauling distance. This method of handling the materials proved very satisfactory and economical.

HAND METHODS EMPLOYED

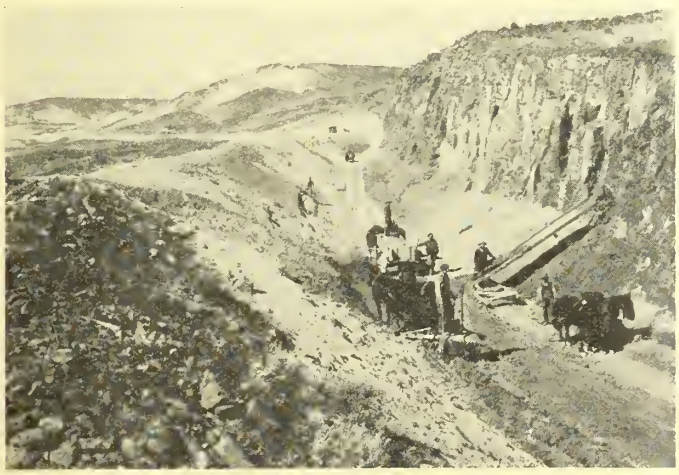
Of the various hand methods used in placing the earth lining, the following accomplished the desired results in an economical manner. Material, after being loaded into trucks by means of fresnos and trap, was hauled along the bottom of the canal and dumped at a point opposite the section to be lined. It was then elevated to the canal slopes by use of a lumber chute approximately 20 feet in length and 3 feet in width supported on the lower end by two runners, constructed in the form of a sled and on the upper end by a wheel which permitted it to be moved easily along the canal slope. The earth was elevated to the top of the chute by means of a team and slip and dumped through an opening in the upper end of the chute, permitting the dirt to take its natural slope for the lining, the slip team being also used to move the chute. An additional 2-horse team and fresno were used to keep the earth supplied at the foot of the chute and to level off the lining at the bottom. The continuous travel of the teams compacting the bottom was the equivalent of rolling.

The force used in connection with this work consisted of one 4-horse team and fresno at the trap, one 2-horse team and fresno, and one 2-horse team and slip with drivers, 2 Ford 1½-ton trucks with dump bodies, with drivers, and 1 slip holder and foreman. The cost of placing this lining was from 50 to 65 cents per cubic yard, depending on the length of haul. The method above described was used during the nonirrigation season. During the irrigation season, when it was necessary to keep the water in the canal continuously, the same method was used in obtaining the materials except that the trucks traveled along the canal banks, and in some instances it was necessary to construct temporary bridges for the purpose of crossing the canal to obtain materials and thus avoid extremely long hauls. Under this procedure enough material was dumped from the trucks along the lower slope to provide lining for the whole section, the material in excess of that required for the lower embankment being pushed to the bottom, where it was left until the water was turned out of the canal, when it could then be elevated to the upper embankment and also spread over the bottom.

RESULTS OF EARTH LINING

During 1930 water was run in the Vale canal for 31 miles, to which point construction had progressed. During 1931 water was run in the canal for 43 miles. In the operation of the canal for the past two years the river water has been free from silt, and consequently the only silt available was that picked up from the sections lined with earth and that obtained by the operation of two pumps for a short time. The use of the pumps was abandoned when it was found that satisfactory progress could not be made in the limited time available and because of the distance between stretches which had the heaviest leakage.

In general, the earth-lining methods of construction on the Vale project have been very effective. Much leakage has been stopped, although there are some sections which may require a more permanent type of lining in the future. It is apparent that as the years advance and more silt is carried by the river water the canal sides and bottom will be strengthened and there will be gradual decrease in losses. On the other hand, there may be stretches which will required concreting, but it is apparent that in many places where concrete would have ordinarily been recommended for lining, open section and earth lining are serving efficiently and will continue to so serve.



Construction on Vale Main Canal, Vale project, Oregon

Difficult Railroad Construction, Boulder Canyon Project

THE Southwest Builder and Contractor of September 11, 1931, gives the following interesting description of construction of the Boulder City-Hoover Dam railroad:

Building of the United States construction railroad at Hoover Dam, extending from Boulder City 10.23 miles to the edge of Black Canyon at the dam site, has just been completed. This has been one of the most difficult jobs on the project to date, largely because of the fact that about 4 miles of the line had to be built through isolated mountain crags, requiring the construction of five tunnels. Here power shovels, aided by blasting crews, had to cut their way up steep rock slopes to as many starting points.

The country traversed by the railroad falls away sharply from the summit at Boulder City, with an elevation of 2,500 feet, toward Black Canyon where, at the terminus of the line the elevation is 1,390 feet. On an air line the distance from Boulder City to the terminus of the railroad at the dam site is a little less than 6.6 miles. To accomplish the descent of 1,110 feet and maintain feasible operating grades, the engineers who located the line found it necessary to follow a rather tortuous course, which accounts for the 3.6 added mileage of the railroad. Several big loops were made in the route to keep down the grades, but at that the average runs from 2 to 3 per cent, which is rather steep for heavy hauling such as this road will carry.

For a distance of about 6 miles out of Boulder City the line of the railroad was easily accessible from the highway leading down to the boat landing above the dam site in Hemenway wash. There was no particularly heavy construction on that end of the line, the major portion of it requiring only ordinary grading with a few cuts and fills of as much as 15 to 25 feet.

As the heavy construction was on the lower end of the railroad the contractor selected a location about midway on that section at the foot of the mountain range extending along the south side of the wash for his construction camp and base of operations. This camp was accessible from the highway which skirted the base of another mountain range on the north side of the wash, 2 miles distant, which made it possible for the workers employed on the upper end of the line to get in and out of the camp without excessive hardships or too much loss of time.

ROAD CONSTRUCTION TO TUNNELS

Getting at the tunnel sections of the railroad was the most difficult and hazardous part of the entire job. This necessitated the construction of roads from the camp up the steep rock slopes of the mountains to each of the five tunnels. The longest of these, to the last tunnel on the line, was about 2 miles in length, and a large part of it was on a 15 per cent grade. This road was made 12 feet wide and its construction involved the blasting out of about 8,000 cubic yards of rock.

Twenty-one days were required for the construction of this road, working three shifts and using six powder gangs. A 75-B Lorain shovel, gasoline motor driven, with a 1½-yard dipper, followed up the blasting crews, digging its own way to a point where excavating for the portal of the tunnel could be started. This road was so steep that trucks could not pull up to the shovel, and oil and supplies had to be packed to it. Operating shovels on this job was not an easy task. One of them worked 80 continuous shifts with only minor hindrances, such as a clutch throwout and slight trouble with a collar and dipper bail. During this period, however, five operators had their try at the levers.

Roads to the other tunnels were shorter, about a half mile each, but all of them had to be blazed up steep slopes. Altogether the contractor had to build about 7 miles of construction road. The longest road at the lower end of the job was used also by the Six Companies (Inc.), and the contractor building the highway from Boulder City to the dam site.

There were heavy fills between each of the tunnels, some as much as 100 and 140 feet deep, and a few heavy cuts through jagged peaks, the deepest being about 120 feet.

Construction of the tunnels was done by an experienced mining contractor, Joseph Gordon, of Denver, under a subcontract. The tunnels are 18 feet wide in the clear and about 27 feet high. All of them were timbered and lagged, the roof being constructed with five segments on a 9-foot radius. The tunnels total 1,485 feet in length, 2 of them being 415 feet each, and the others 260, 230, and 165 feet, respectively. All are located within a section of the road less than 1 mile in length. Tunnel excavation totaled 26,000 cubic yards.

CHARACTER OF ROCK

Character of the rock excavation on the job varied considerably. All the rock in the region of Hoover Dam is of volcanic origin, that at the higher elevations being described as an andeseitic flow breccia. As the canyon itself is approached this rock increases in hardness and consists of larger blocks more firmly cemented together. Rock excavation for the roadbed amounted to about 280,000 cubic yards. About two-thirds of it presented no special difficulties, the rock breaking up with the first shot so that it could be easily handled by the power shovels. Secondary shooting was necessary for much of the last 80,000 cubic yards near the canyon. On the first shot the rock was broken up in large blocks and many of these had to be blasted again to reduce them to pieces which could be picked up by the shovel. Similar difficulty is being encountered by the Six Companies (Inc.), in blasting out a roadbed for its construction railroad in the canyon at the dam site.

The roadbed for the railroad was graded to an average width of about 16 feet inclusive of slopes and drainage ditches. A 6-inch gravel cushion was placed on all rock excavation. Gravel for ballasting was obtained from the Hemenway gravel pit about midway the length of the railroad, pit run material meeting the requirements of the specifications. The contractor employed his own tracklaying crew. In lieu of a locomotive crane a Northwest drag-line crane was mounted on a flat car and used to handle rails and other materials. The track was standard gage laid with 90-pound used rails.

CONSTRUCTION PROGRESS

Progress o' construction, despite a delayed start, proceeded on schedule and the job was completed within the time limit. Two shifts were worked throughout, the number of men employed ranging from 125 to 300. Intense heat common to that locality in midsummer greatly reduced the efficiency of workers. At the construction camp the temperature remained around 100° at night for many days and rose considerably above that mark during the day. Water was hauled into the camp from Las Vegas. Every effort was made to provide for the comfort of the workers. The contractor did not operate his own commissary, the catering being done by the Anderson Co. which is serving all the construction camps on the project.

The principal quantities involved in the contract were: Common excavation for roadbed, 380,000 cubic yards; rock excavation for roadbed, 280,000 cubic yards; overhaul, 1,750,000 station cubic yards; excavating and long-haul borrow, 125,000 cubic yards; hauling and spreading long-haul borrow, 184,000 cubic yards; tunnel excavation, 26,000 cubic yards; ballasting, 20,400 cubic yards; laying ties and track, 10.23 miles.

The contract was awarded to the Lewis Construction Co., of Los Angeles, Jan-

(Continued on p. 273)

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Brown, Dr. Hugh A.
Hydro power provides revenue for irrigation works, illus. with table of costs, Power, Nov. 10, 1931, v. 74, pp. 663–665.

Crowe, F. T.
Hoover Dam, "Ole Man River" sends down a small flood but Frank Crowe is ready, Western Construction News, Oct. 10, 1931, v. 6, No. 18, p. 537.

Kelch, Norman W.
Progress in erection of permanent buildings at Boulder City, illus., Southwest Builder and Contractor, Oct. 16, 1931, v. 78, No. 16, p. 38–9.

Lowther, Burton.
Water works for Boulder City, Nev., illus., Western Construction News, Oct. 25, 1931, v. 6, pp. 547–550.

Mason, Morris.
Construction work on a Federal reclamation project (Yakima-Kittitas), (very long illus. article), Proc. A. S. C. E., October 1931, v. 57, No. 8, pp. 1219–1264.

Mead, Elwood.
Hoover Dam project presents unusual engineering problems to builders, illus., Iowa Engineer, November 1931, v. 32, pp. 33–34, 48.
Reclaimed areas supply all food needed in menu, illus., U. S. Daily, Nov. 10, 1931, v. 6, p. 3 (p. 2055).

Sanford, Geo. O.
Reclamation work costs $263,000,000; taxable property valued at billion has been created by Federal projects (Savannah, Ga. address), U. S. Daily, Oct. 21, 1931, v. 6, p. 1 and 2 (pp. 1895 and 1896).

Six Companies (Inc.)
Organization of Hoover Dam management, illus., map and chart, Constructor, November 1931, v. 13, No. 11, pp. 30–34.

Skerrett, R. G.
America's wonder river—the Colorado, illus., Compressed Air Magazine, November 1931, v. 36, No. 11, pp. 3627–33.

Weymouth, F. E.
Preliminary work started on world's greatest water-supply project, map, Western City, October 1931, v. 7, p. 28–29 and 47.
Route of 265-mile aqueduct across California, map and brief summary of project, U. S. Daily, Oct. 28, 1931, v. 6, p. 5 (p. 1955).
Colorado River Aqueduct, illus., map and profile, Western Construction News, Oct. 25, 1931, v. 6, pp. 542–4 (brief editorial p. 539).
A $220,000,000 construction project for southern California, maps, Engineering and Contracting, November 1931, v. 70, p. 294–296.

Notes for Contractors

Boulder Canyon project.—Bids under specifications No. 540-D were opened at Las Vegas, Nev., on October 20, 1931, for the construction of one 7-room and three 6-room residences at Boulder City. Seven bids were received and the contract was awarded to the low bidder, Ferman W. Riddle of Los Angeles, Calif., for $10,913.50.

Bids under specifications No. 543-D were opened at Las Vegas, Nev., on November 10, 1931, for the construction of nine 5-room residences at Boulder City. Thirteen bids were received, the low bidder being I. M. Bay and H. D. Morrill of Junction, Utah, whose bid was $16,073.00.

Bids for the construction of a garage about 72 by 152 feet in size for Government use in Boulder City were opened on November 23, 1931, and bids for seventeen 3-room and twelve 4-room residences of timber frame construction will be opened on December 4, 1931.

Plans and specifications have been prepared for a group of 5-room residences of timber frame construction and for a school house.

Grand Valley project.—Contract under specifications No. 541-D for concrete lining portions of the main canal, Canyon division, bids for which were opened on October 12, 1931, was awarded to Clarence Ford and J. Lewis Ford of Grand Junction, Colo., for $2,650.00.

Klamath project.—Specifications have been issued covering the purchase of two motor-driven pumping units for Tule Lake drainage pumping plant No. 5.

Owyhee project.—Bids, under specifications No. 530, will be opened on December 23, 1931, for earthwork, tunnels and structures between Tunnel Canyon and the Owyhee River Siphon on the North Canal, Mitchell Butte division. Statement of the estimated quantities of work involved was given in a previous issue of the Era.

Yakima project, Cle Elum dam.—Specifications Nos. 548-D and 549-D have been issued covering the purchase of plate sheet tunnel lining and butterfly valves and operating mechanisms for the Cle Elum dam.

Yakima project—Kittitas division.—Specifications have been prepared covering the construction of the Wippel pumping plant, including forebay structure, penstock, discharge line, a flume section and the pumping plant. Machinery for the pumping plant has already been purchased.

Yakima project—Kennewick division.—Specifications No. 547-D have been issued covering the construction of the Prosser diversion dam, power canal and power plant. The work involves the removal of a portion of an existing diversion dam and the construction of a new section, the construction of a headworks structure, a power canal about two miles long together with bridges, wasteway structure, forebay structure and penstock and the power plant building. The hydraulic and electrical apparatus for the plant have already been purchased.

Elevator for Owyhee Dam

An interesting feature in connection with the construction of the 405-foot Owyhee Dam on the Owyhee project in eastern Oregon is the freight and passenger elevator. On December 4, at Denver, Colo., bids are to be opened for furnishing and installing this equipment. The requirement is for a 9,000-pound live-load capacity, automatic, electrically operated elevator, with a total lift of 270.5 feet. It will be of the push-button type and have a speed of 110 feet per minute with full load. The operating shaft will be 8 feet by 8 feet 10 inches in section.

The elevator will be used principally by the operating force at the dam for operation, inspection, and maintenance, transportation of visitors, handling comparatively light loads of materials, and, at rare intervals, at full-load capacity for handling large castings.

Difficult Railroad Construction, Boulder Canyon Project

(Continued from p. 272)

uary 28, 1931, at $455,509. Under the terms of the contract work was to be started February 13 and was to be completed September 7, 1931. There was a delay, however, in getting under way and work was not commenced until March 1.

All materials entering into permanent construction were furnished by the Government and were delivered f. o. b. at Summit, terminus of the Union Pacific line at Boulder City.

Interest-Bearing Farm Drought Loans Being Repaid Rapidly

NEARLY one-fourth of the $47,000,000 of Federal loans made to farmers in drought and storm areas during the past year already have been repaid and payments are now coming in at a rate of $2,000,000 or more a week, G. L. Hoffman, chief of the farmers seed loan office, Department of Agriculture, stated orally November 13.

After the office's announcement that cotton would be accepted as security for loans on the basis of 8 cents a pound, receipts of cotton as security took a sudden spurt, Mr. Hoffman said. In the week ended November 6, stocks given as security rose from 15,729 bales to 24,387 in 9 of the principal cotton States, he said. The following information also was given orally by Mr. Hoffman:

Repayments are coming in at such a rate that about 100 persons have been added to the force handling the checks and money orders in the past 30 days. More than one-third of the payments so are are on notes that are not yet due. The situation is "looking good" from the standpoint of settlement of the loans, Even in the Northwest, stricken by drought again this year, repayments had reached $386,000 on November 6, and collections are running $15,000 to $18,000 a week. About $4,000,000 was loaned in this area.

The Post Office Department has cooperated in facilitating the movement of funds from collectors to the central offices. Fees on money orders transmitting large sums previously were paid by the collectors from their personal funds, and the collectors were reimbursed through an expense account. The amount of the fees became burdensome on the collectors, however, so the Post Office Department arranged for transmission of the money orders on presentation by collectors of a voucher payable at the central office.

Repayments had reached $8,774,796 on November 6, having advanced from $6,809,322 on October 30. Payments in the current week are believed to exceed $2,000,000, and the weekly amount is steadily rising.

Mr. Hoffman has just returned from a tour of Virginia and nearby States to observe agricultural conditions. The peanut and tobacco crops appear to be in excellent condition, but prices are low. Should prices of these two commodities rise, the prospect for early payment of loans in these areas would be improved materially.

Loans to finance feeding of livestock in the Northwest this fall and winter have increased to $1,498,875, nearly all in North Dakota and Montana. These loans were authorized after the main body of drought loans had been made. They are due in September, 1932.

About $4,000,000 of loans in the Northwest fell due September 30, and about $20,000,000 in the South on October 30. The remainder of the $47,000,000 will be due on November 30. Payments are normally made by farmers, however, not on the basis of the due date of their notes, but on the basis of time of harvests. Those who pay before the loans are due receive a refund of interest, while those who pay after the due date are charged additional interest, to the date of payment.

GOVERNMENT BALE

Many cotton farmers have sent samples of their product to regional offices of the farmers' seed loan office, although there is no reason for such action. The amount received at the Memphis office, all in small samples, has reached such proportions that the director of the office intends to have it baled, and to have a full 500-pound bale which he will offer for sale. The money will go to the Federal Treasury. The regional director has inquired whether it will be necessary to ask competitive bids on the bale, as is required generally in sales of Federal property.

The volume of business in handling the repayments has increased tremendously. Checks and money orders estimated to cover $250,000 were being rushed through the Washington office on November 13, the personnel using 10 large tables almost hidden from sight by drafts, money orders, and cash. Night work is resorted to frequently to keep the work nearly current.

The force handling warehouse receipts for cotton has been increased from two to nine, and these are nearly swamped with work.—*United States Daily, November 14, 1931.*

Floating Gardens Employed in Kashmir, India

In Kashmir, a state in India, the farmers have a unique method of raising their produce which provides a system of natural irrigation, as well as doing away with any worry of droughts. They plant their gardens on hand-woven islands. The Kashmiri form their island by interlacing the reeds of the lake together and cutting away the roots. Then they gather the rich mud from the bottom of the lake, spreading it over the surface of the artificial isle, making a rich layer of soil for their seedlings. After this preparation the "floating garden" is then towed into position. With such a wonderful system of irrigation it is no wonder the Kashmiri have such remarkable success in raising rich and fruitful crops. To tend the gardens, the men row back and forth in small native boats.—*Washington Post.*

THE Holly sugar factory at Sidney, Mont., Lower Yellowstone project will have the largest run in its history. It is expected that the campaign now in progress will last until January, and that about 140,000 tons of beets will be sliced. This company will pay out for beets and labor about $1,000,000, which is a great asset to the community in a year of drouth and low crop prices.

Productive Qualities of Lands on Vale Project, Oregon

C. C. Ketchum, superintendent of the Vale project, Oregon, has sent to Doctor Mead a box of onions selected from a 120-acre field on the Bully Creek West Bench, grown on land in raw sagebrush last year. The onions as a rule were large, firm, and of fairly uniform size, as shown in the accompanying illustration, demonstrating the productive qualities of the land on the Vale project. This field was inspected by Congressman William W. Hastings, of Oklahoma, when the Committee on Appropriations visited the project last summer, and a photograph of the onions sent by Mr. Ketchum was forwarded to him, as well as to Congressman Frank Murphy, chairman of the committee, and Mr. F. J. Bailey, assistant to the Director of the Budget. Some of the onions were presented to the Secretary of the Interior, some to Mr. Bailey, and others were distributed among the officials in the Washington office.

The following editorial from the Gate City Journal of Nyssa, Oreg. shows that although onions brought unusual returns to growers on the Vale project this year, marked success was attained by the water users with poultry and other crops:

"There's nothing like success. There's nothing that will better advertise the Vale and Owyhee irrigation projects than the $60,000 onion crop of K. Morinaga. This farmer, who knew his business, produced a crop on 100 acres of land covered with sagebrush last February that will pay for his investment many times over in just one season. Morinaga paid from $10 to $30 per acre for his land. His crop is worth $600 per acre.

"However, the onion producers are not the only settlers who are faring well on new lands of the Vale project. Last year a poultry grower at Harper sold turkeys worth $2,500. New alfalfa has paid well. Every farmer has his dairy herd.

"Two units of land, 7,700 acres, have been sold to farmers at desert land prices, $5 to $15 per acre. If more than $15 is received, one-half the difference is returned to the land owner on paid-up water cost. Settlers have 40 years in which to make their payments on construction charges.

"It is reclamation under a new régime and colonization of the Owyhee will follow the Vale. There is no opportunity for the speculator, who does not buy a farm, to make a home but to sell to a real farmer and break his back with debt. There is opportunity for the farmer with sufficient capital to purchase a tract of land and develop it.

"Colonization of irrigated lands will benefit the Nyssa and Malheur country and the benefits will be far reaching. Farmers will use lumber to build houses and barns. Farmers will buy implements, furniture, and clothing. They will provide a market for industries."

Onions grown on land that was sagebrush last year

Work to be Rushed at Thief Valley Dam, Baker Project, Oregon

FIFTY-TWO business and professional men of Baker, 20 more than were expected to visit the Thief Valley irrigation dam site, Baker, Oreg., were recent guests of the W. H. Puckett Co., which is constructing the project. A sumptuous dinner was served the visitors at noon under the supervision of H. B. Laughlin of the Puckett Co.

A. A. Smith, president of the Baker County Chamber of Commerce, extended thanks to the company for the courtesy shown the Baker visitors. L. C. Miles, superintendent of the company, gave the response.

Dunham Wright, pioneer Medical Springs resident, explained why the section in which the dam is located was named Thief Valley. He said that a cattle thief was captured in that vicinity many years ago and was hanged to a tree by the three men who started with him to Idaho for trial. On a cold December day the men stopped beneath a group of trees for shelter and decided that the thief's case could easily be disposed of there. They took a vote and the thief was the only one of the four to object. The creek rushing near by was named Thief Creek as a result of the incident. From that developed the name Thief Valley.

Mr. Wright said he has received many inquiries from persons thinking they could settle on the Baker project, and has been asked if the section was named Thief Valley because of the type of people living there.

A total of 116 men are employed on three shifts at the dam, which when completed will consist of 24 small dams. One unit could thus go out without doing much damage. The work that would be affected by freezing temperatures will be completed in a month if good weather prevails, Mr. Miles said.—*The Baker Democrat-Herald, Baker, Oreg., October 31, 1931.*

Kittitas Potato Crop

By E. E. Mundy, Ellensburg, Wash.

THE harvesting of 4,000 acres of Netted Gem (Russet Burbank) potatoes is now completed in Kittitas Valley, according to reports from that district. The Kittitas project, now nearing completion, is adding 72,000 acres of fertile valley soils to the privately irrigated area of 35,000 acres. Water was delivered to about 40,000 acres this year and the entire project will be completed next year.

It is estimated that 1,500 acres of the potato crop were under the project while the remainder was under farmers' canals. The project acreage was chiefly under the South Branch and North Branch canals, and opportunities are very good for further expanding the potato acreage as a part of the regular crop rotation plan. Farmers under the Main Canal have indicated interest in producing certified seed stock for selling to commercial growers which it is hoped will develop into an important industry. The soil and temperature conditions under the Main Canal appear to be well suited to the production of seed potatoes as well as other crops. The lower areas under the branch canals will probably produce commercial crops of potatoes rather than seed stock.

The yields of the tuber this year varied from 8 to 20 tons per acre, depending on soil texture and fertility, irrigation practices, quality of seed used, and other factors. In most cases the yields were from 12 to 16 tons per acre and numerous growers reported a high-quality crop. Many fields averaged 70 to 80 per cent of the U. S. No. 1 grade. The color of the Kittitas potatoes is from light to medium and the size ranges from medium to large. Several carloads of the popular large baking potato originate in the Kittitas Valley. The tubers are firm, and hollow heart is practically unknown in the district.

According to potato growers' estimates of production costs, the Kittitas growers near the city of Ellensburg have the second lowest most economical production record for the State of Washington.

That portion of the crop which is not marketed during the digging season is stored in frost-proof warehouses and cellars. Both the Northern Pacific and Milwaukee railroads have built warehouses for storing a large tonnage, and cellars on the farms provide storage for a good portion of the crop.

Those who have witnessed the potato acreage increase from a few hundred acres to 4,000 acres during the past 5 years believe that the expansion will continue until about 8,000 acres are reached.

Irrigated Pastures on the Orland Project

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

Class in soils and crops, Orland project, California, on a field trip studying irrigated pastures. Class is sitting in a field of Ladino clover, which is at its maximum height and ready for pasturing

IRRIGATED pastures are coming into favor on the Orland irrigation project. The labor of cutting and putting up the hay is eliminated and the cows seem to enjoy harvesting the crop themselves.

John Pehrson, who has a 40-acre irrigated project ranch southwest of Orland, has tried out two different irrigated pasture crops during 1931, Ladino clover and sweetclover (melilotus alba). Two plots of about 3 acres each were planted side by side with the two crops, irrigated at the same time, and pastured alternately. Eighteen pounds of sweetclover seed to the acre were planted and 5 pounds of Ladino clover seed sown in February, and good stands of each were secured. The Ladino was first pastured on August 1, and on November 16 the cows were being turned on for the third time. Nineteen cows were pastured on the two plots alternately for four months' time, getting about half of their feed from the pasture.

In comparing the two pastures, the cows preferred the Ladino to the sweetclover. The sweetclover, which has coarser stems, did not seem o be as palatable. Mr. Pehrson plans to harrow the sweetclover plot and seed in Ladino this winter.

In an adjoining field of milo maize, burclover seed was sown after the last cultivation and a good stand was secured. In the spring this field will be pastured also.

As you have guessed, Mr. Pehrson is enthusiastic over pastures for dairy cattle.

Air Travel by Government Employees

One of the mail air lines operating on the Atlantic coast has recently made arrangements for the application of rail rates plus Pullman for official travel by Government officers and employees on transportation requests. These rates apply from air port to air port and will facilitate air travel without excess cost at the option of the traveler. The same arrangement is in effect on a number of other air lines. Information in connection therewith may be obtained at the several air ports or will be furnished upon request by the traffic manager of the Department of the Interior.

This more expeditious form of transportation will often enable the official traveler to use to better advantage the time thus saved.

A CHARITABLE organization of wealthy men in the State of Washington has subcontracted the clearing of 400 acres in the Cle Elum reservoir site with a view to employing men who, together with their families, are being cared for by charity in Seattle and Tacoma. The men will be shipped to the work and furnished tools, meals, and beds, and camp accommodations will be provided for 150 to 200 men. Four hours will constitute a day's work and compensation will consist in the provision of food and living quarters on the ground for the men and the care of their families where they live.

The better part of the wood from the clearing will be cut into stove wood and shipped to the coast cities without charge by the Northern Pacific Railroad for use by families of the unemployed. The railroad company has agreed to haul 30,000 cords free under this arrangement.

Tablet Marks Beginning of American Modern Irrigation

A BRONZE tablet, marking the half-acre of land within which modern irrigation was launched in America, has been placed at the northeast corner of Broadway and State Street, Salt Lake City, Utah.

Speakers during the ceremonies, held under the auspices of the Utah conference, Daughters of the American Revolution, included Gov. George H. Dern, Mayor John F. Bowman, Mrs. R. E. Bristol of Ogden, past vice president of the national society; Mrs. George R. Whitmeyer of Ogden, State regent; Benjamin L. Rich, president of the Utah society, Sons of the American Revolution, and George Albert Smith, president of the Utah Pioneer Trails and Landmarks association.

All praised the pioneers for their contribution to modern irrigation and discussed the value of irrigation to the development of the West.

"If it were not for irrigation there would not be a State of Utah today, and it is fitting to commemorate the beginning of irrigation by American citizens at this time," said Governor Dern.

"Daniel Webster, the great statesman, once called the country west of the Mississippi River a wilderness, unfit for human habitation. He was mistaken, because he did not reckon with the power of irrigation, which has truly made the desert blossom like the rose."

Mayor Bowman praised the D. A. R. organization for its work in providing the memorial tablet to mark the site of the experiment in agriculture inaugurated July 23 and 24, 1847.

"We commend the fine spirit of cooperation of the group that placed this memorial plaque," said Mayor Bowman. "It is typical of the new era of good feeling between all the people that go to make up the population of Utah.

"There were many other organizations in the State that could have done this, but it is a wonderful thing that an organization unrelated to the Latter Day Saints

(Continued on p. 280)

Commemorating the Beginning

in America of

MODERN IRRIGATION

In this Vicinity on July 23 and 24, 1847, by the

"MORMON" PIONEERS

*"Encamped near the bank of a beautiful creek of pure cold water * * * we began to plow, and the same afternoon built a dam to irrigate the soil.*

*"July 24, * * * This forenoon commenced planting our potatoes, after which we turned the water upon them and gave the ground quite a soaking."*

Orson Pratt thus records compliance with the instructions of Brigham Young who, with the main company, arrived about the time the irrigating began.

This tablet is within the half-acre of ground plowed, as identified by William Carter who held the plow.

Placed by the Utah State Conference, Daughters of the American Revolution, July 23, 1931.

"The wilderness and the solitary place shall be glad for them, and the desert shall rejoice and blossom as the rose."—Isaiah, 35: 1.

Tablet commemorating modern irrigation in America

Yuma Valley Pecan Day, Yuma Project, Ariz.

EACH year late in October or early in November, which is about the harvesting time for paper shell pecans in this territory, there has been set aside a day by the pecan growers for inspection and discussion of this development. This day is becoming recognized in all pecan-growing sections of the United States, and it is not at all uncommon to have visitors from the Southeastern States where the pecan is native, also many from other States.

The program for the day is a motorcade assembling in Yuma and following an outlined route, visiting as many groves as possible. At each stop short talks are made by the owner in which he states his experiences, varieties grown, age of trees, yields from the different varieties, and anything else he thinks will be of interest to encourage further development.

PROJECT WOMEN'S FORESIGHT

Because of the general hard times there was some talk of calling off Pecan Day this year. Finally though, through the influence of the women on the project, prompted by their intuition as to the effect on further development by omitting this celebration, it was decided to go ahead and have it on October 8, before the harvest, instead of late in November after the trees have been stripped of their nuts. This was a happy thought for the weather proved ideal. Attendance was fully as great as in 1930. There was no evidence whatever that interest in pecans had slackened at home or abroad.

There were 60 cars in the motorcade and luncheon was served in the open to about 170 people. Following luncheon short talks were made by members of the Pecan Growers Association and agricultural authorities who have made a special study of pecan development in other sections. These talks were very instructive, giving the growers an opportunity to profit by the experience of others.

PIONEER PECAN GROWERS SPEAK

The growers spoke of the problems confronting the pioneers in pecan growing in Yuma Valley. Among these was Mr. F. W. Creswell. He gave valuable pointers on his experience with different varieties and discussed pruning, cultivation, irrigation, and other operations involved in the growing of the best pecans. He graphically described to the Pecan Day party his many and costly trials to ascertain what varieties would produce profitably on the project. He stated that when he started in 1920 he had no one's experience to guide him and imported 300 trees of kinds supposed to be good in the South. Only 97 survived, but he replaced the casualties and at the end of his second season had 350. When 6 years had passed he realized that practically all the highly recommended varieties had failed.

Altogether Mr. Creswell has tried out 24 varieties. Now he has settled down to Burkett, Kinkaid, and Halbert. He admits there may be other good ones, but for the present he has ceased experimenting.

WAITING FOR THE PECAN CROP

One of the advantages of growing pecans is the permissibility of intercropping. When it is considered that from 12 to 17 pecan trees are planted per acre, the necessary area is only about one-third of the total. The remaining two-thirds can be cropped for a few years while the trees are young without doing serious harm.

The total acreage in pecans on the Yuma project is 3,000; of this about 1,000 acres were planted in 1931. The estimated yield for the year 1931 is 14 tons of nuts from 73 acres in different stages of production. The prices for the first grade are 60 cents per pound retail and 40 cents per pound wholesale.

The original pecan tree in this vicinity is a seedling more than 30 years old and has never failed to produce a crop. Records show that plantings 2 to 3 years old bear a few nuts, 5 years old 40 pounds, 6 years old 60 pounds, 7 years old 80 pounds, 8 years old 90 pounds; 9 years old 105 pounds, and it is estimated that the yield of one tree, not yet harvested, and which is now 11 years old, will produce 250 pounds of nuts this year. From this it will be seen that the production in this territory is very favorable and the quality is unsurpassed in size and flavor.

Acreage is increasing yearly. The first budded trees were planted in 1908, comprising 10 trees. In 1920 about 21 acres more were planted, and since that time the increase has been gradual until 1926, when there was a total of 113 acres planted to pecans. The following table shows the progress of this development:

Year	1927	1928	1929	1930	1931
Acres	293	478	1,189	2,024	3,000

It is anticipated that the acreage this coming spring will be as great as or greater than in the past year. The advantages of this territory for the growing of paper shell pecans are—assured crop every year, no pests, size and flavor of nuts, early production, large yield, and good marketing possibilities; and present indications are that this will become one of the major crops of this project, both in acreage and gross income.

OPPORTUNITY FOR WOMEN

It has been pointed out that the development of pecan groves on the Yuma project is an industry which women can very ably handle. It is by no means a new field to conquer as women are at present engaged in the development of successful pecan groves.

NEW METHOD DETERMINES OIL CONTENT

The oil content of pecans may be determined more quickly and accurately than ever before by a new method adapted by a Government chemist from the well-known Babcock test for cream.

Heretofore, the amount of oil, or fat, in these nuts has been ascertained by extracting it from the meats with ether—a time-consuming process, which also extracts other material and sometimes causes a loss in oil. In the new method, as in the Babcock test, diluted sulfuric acid is used to liberate pecan oil in a pure state from the nut meats. Only 30 minutes are required for the sulfuric acid method, as compared with two hours for the ether extract method.

The oil content of five varieties of pecans analyzed by the new method in the Department of Agriculture laboratory ranged from 73.77 to 77.58 per cent.

Pecans are rich in vitamins A and B (essential to growth, proper functioning of digestive tract, and resisting bacterial infection).

1, Pecan trees planted on the L. M. White place in 1927. Trees have a few nuts. Intercrop—a lettuce crop in the making. 2, a close-up of the Kinkaid pecan tree on the F. W. Creswell place, shown in picture No. 5; 3, pecan trees planted on the White place in 1929, showing a good maize intercrop; 4, intercrop of maize in a 2-year-old grove; 5, pecan trees planted on the F. W. Creswell place in 1920, 50 feet apart, showing the wonderful spread in 11 years. The tree on the right is a Kinkaid variety. The tree on the left is a Halbert variety. The lady is touching the Halbert; 6, part of the motorcade on Pecan Day after luncheon on the G. M. Sugden place. Boys in foreground are students of the Union High School agriculture and horticulture group; 7 and 8, showing size of the Golden Nugget variety

Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, addressed the Alpha Zeta Society of Washington, D. C., on November 5, speaking on the subject "The Boulder Canyon Project."

Commissioner Mead left for Chicago on November 14 to attend a conference on land utilization, November 19–21, called by the Secretary of Agriculture in collaboration with the Association of Land Grant Colleges and Universities. Doctor Mead addressed the conference on the 19th on "The Place of Federal Reclamation in a National Land Policy." He will discuss with various railroad officials and others the plans for the reclamation exhibit at the Century of Progress World's Fair. He will also speak on Hoover Dam at the Chicago Engineers' Club at luncheon on the 19th.

Mr. and Mrs. Roy R. Gill arrived in Washington on November 9, coming by automobile from Spokane, Wash.

J. Rupert Mason, formerly of the bonding house bearing his name in San Francisco, recently visited the Washington office after another round-the-world tour.

Andrew Weiss, former superintendent of the North Platte project and now with the J. G. White Engineering Corporation in Mexico, was one of the project's visitors on a recent date.

H. J. Ticknor, Mrs. Otto Wabbles, Mrs. W. F. Jinnette, Mrs. F. E. Johnson, and Mrs. Boyd Thacker were elected permanent directors of the Klamath Turkey Growers Association at a meeting in which the final organization of the association was completed. Efforts are being made by the association to increase the membership for this year's pool.

Samuel G. Neff, assistant engineer, Corps of Engineers, United States Army, called recently at the Lower Yellowstone project office for the purpose of investigating the deposit of silt in the Yellowstone River above the dam.

C. W. Burningham, assistant engineer, and Earl Salter and William Quinn, rodmen, on the Belle Fourche project, have been transferred to the Boulder Canyon project.

S. O. Harper, assistant chief engineer, spent two days on the Grand Valley project in an inspection of the Canyon division and power site relative to work which will be done under the provisions of the contract with the Public Service Company.

J. L. Savage, chief designing engineer; L. N. McClellan, chief electrical engineer; R. B. Williams, construction engineer; E. B. Debler, hydrographic engineer; H. W. Bashore, engineer in charge of the Columbia Basin investigations; and Messrs. Butler and Smith, Army engineers, recently visited the Prosser power canal and Kennewick Highlands pumping unit on the Yakima project.

Fileman C. Rodriguez, an engineer of the Philippine Islands, was a visitor on the Minidoka project, inspecting work on the Milner-Gooding Canal and the American Falls Dam.

THE WEST

With golden days and silver nights,
With rosy dawns and sunset lights,
With verdant vales and purple heights
She charms the traveler to rest,
She carries magic in her dreams,
She lifts our thoughts to higher themes,
She helps us realize our dreams—
The great, resourceful, smiling West.
—Mrs. Emma Cowan Barber, Grand Junction, Colo.

Maj. Gen. William L. Sibert, Charles P. Berkey, Daniel W. Mead, Warren J. Mead, and Robert Ridgway, members of the Colorado River Board, accompanied by Chief Designing Engineer J. S. Savage, Senior Engineers B. W. Steele and D. C. McConaughy, and Engineer E. W. Lane, went to Fort Collins, Colo., on October 30 to inspect the spillway model at that point, which is on a scale of 1 to 60, as compared with the model at Montrose, which is on a scale of 1 to 20. Test runs of 0 to 200,000 second-feet were made in 25,000 second-foot increments. Test runs were also made with different type baffles; and also a demonstration of the Madden Dam spillway model, with runs varying up to the maximum discharge of 280,000 second-feet. The board then went to Boulder, Colo., accompanied by Mr. Savage, Chief Designing Engineer Nalder, Senior Engineer I. E. Houk, and Engineer R. S. Lieurance, to inspect the model of Hoover Dam, on which measurements of strains and deflections are being made.

R. F. Walter, chief engineer, has returned to Denver from Las Vegas, Nev., where he inspected the progress of construction on the Boulder Canyon project and met with the Colorado River Board.

E. B. Debler, hydrographic engineer, who has been in recent conferences with H. W. Bashore, of the Columbia Basin project, on the investigations now in progress, and with Porter J. Preston at Yuma, in connection with the initiation of an investigation of the Parker-Gila project on the Colorado River, arrived in Washington, November 17, to assist on engineering matters and requests for moritoriums.

J. R. Iakisch, engineer, was in the field during the past month, on Milk River drainage investigations, reconnaissance examination of the Marias project, Beaver Head River Basin, Musselshell Basin, Victory irrigation district, at the mouth of the Big Horn, and projects in the Tongue River Basin, all in Montana, for various interests requesting advice of the bureau.

J. C. Beebe, engineer for the Forest Service, San Francisco, and Ralph R. Randall, engineer for the Federal Power Commission, recently visited the Klamath project to collect information for use in a report they are preparing on the Klamath River power possibilities.

Beginning of American Modern Irrigation

(Continued from p. 277)

Church or the pioneer organizations should have so honored the men who toiled here 84 years ago. That was a tremendous event that has resulted in a great West whose resources amount to billions."

The tablet was unveiled by Mrs. Bristol. Mrs Whitmeyer presided at the ceremonies, which commenced with the sounding of a bugle by Miss Grace Parks, an Ogden girl scout. Miss Betty Briston, another Ogden girl scout, presented the colors.—*Salt Lake City Tribune.*

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ADMINISTRATIVE ORGANIZATION FOR 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. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., U. S. Custom House

R. F. Walker, Chief Eng.; S. O. Harper, Assistant Chief Eng.; J. L. Savage, Chief Designing Eng.; E. B. Debler, 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	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.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	J. R. Alexander	Las Vegas, Nev.
Boise [1]	Owyhee, Oreg	F. A. Banks	Constr. engr			do	Do.
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.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	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.
Carlshad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	do	Do.
Rio Grande	El Paso, Tex	L. R. Fioek	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			B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	Denver office	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	C. M. Voyen	do	Do.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	Robert B. Smith	C. J. Ralston	do	Do.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	F. C. Bohlson	do	Do.
Salt Lake Basin (Echo)	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Yakima	Yakima, Wash	John S. Moore	Superintendent	R. K. Cunningham	Denver office	J. R. Alexander	Las Vegas, Nev.
Yakima, Cle Elum Dam	Ronald, Wash	R. J. Newell	Constr. engr		C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kennewick	Yakima, Wash	John S. Moore			do	do	Do.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph	C. J. Ralston	B. E. Stoutemyer	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.
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.
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	R. S. Hopkins	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.*

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COMMISSIONER
Elwood Mead.

ASSISTANT COMMISSIONER
P. W. Dent.

ASSISTANT TO THE COMMISSIONER
M. A. Schnurr.

Directs the investigation of irrigation resources, preparation of plans, and construction and operation of irrigation projects, including incidental power development.
Directs the administration of funds provided for under the reclamation laws, the settlement and improvement of irrigated lands, and the repayment of sums due to the Government from irrigators.
Directs the investigation of reclamation and farm development projects outside of the arid region and supervises the construction of Hoover Dam and the development of the Colorado River Basin.

2 professional, 2 clerical, and 1 custodial employees.

LEGAL DIVISION
P. W. Dent, Chief Counsel.

Advises the Commissioner upon all legal and related questions; supervises, regulates, and directs legal force in Washington and in the six field offices; drafts and gives advice concerning new legislation; prepares reports for Secretary's signature on bills referred to Bureau; confers and cooperates with Department of Justice, Solicitor's office, and other Federal agencies concerning litigation and other important legal matters; and drafts and reviews important contracts.

2 professional and 1 clerical employees.

FIELD LEGAL OFFICES

District Counsel at
- Denver, Colo.
- Portland, Oreg
- Billings, Mont.
- El Paso, Tex.
- Las Vegas, Nev
- Los Angeles, Calif.

7 professional and 8 clerical employees.

ENGINEERING DIVISION
Roy B. Williams, Chief.

Has charge of engineering work in Washington office, including review, for the Commissioner, of reports, plans, and estimates submitted by the Chief Engineer or other agencies of the Government.
Carries out engineering investigations of the Government in cooperation with the Denver office.
Is engineering adviser to the Commissioner on independent engineering investigations or studies.
Is contact officer in connection with other Government or outside engineering organizations.

5 professional and 2 clerical employees.

DRAFTING SECTION
J. H. Pellen, Chief Draftsman.

Has charge of engineering and cartographic drafting, illustrating, planning exhibits, and the reproduction of maps and drawings.

1 professional and 5 subprofessional employees.

DENVER OFFICE
R. F. Walter, Chief Engineer.
S. O. Harper, Assistant Chief Engineer.

Supervises investigations relating to irrigation development and water conservation; prepares plans and estimates for irrigation works; in cooperation with the Division of Reclamation Economics makes studies of soil, climate, water supply, and other economic data necessary to determine whether projects are feasible and whether they will repay the cost of construction.
Operates and maintains irrigation and power projects; supervises the surveying and engineering field forces.
Is the contracting officer in carrying out works approved by the Commissioner and the Secretary of the Interior.

150 professional and subprofessional, 25 clerical, and 7 registered and unclassified permanent and temporary employees.

ACCOUNTING DIVISION
W. F. Kubach, Chief Accountant.
H. R. Pasewalk, Assistant Chief Accountant.

Has charge of the accounting and financial work Chief accountant is Budget officer of the Bureau.

9 clerical employees.

CHIEF CLERK'S DIVISION
C. N. McCulloch, Chief Clerk.

Has charge of mails and files and stenographic sections, personnel matters, purchases and supplies; property and office equipment, stationery and printing; assignment of office space, and messenger force.

16 clerical and 2 custodial employees.

DIVISION OF RECLAMATION ECONOMICS
H. A. Brown, Director.
Geo. O. Sanford, Assistant Director.

Has charge of investigations to determine economic conditions on completed projects and the economic feasibility of proposed projects; of soil surveys and land classification to determine the ability of the land to repay the cost of construction; of work involving measures for promoting the settlement and development of the projects, including advice to settlers on agricultural, marketing, and development problems; of editorial work; and of the photographic laboratory.
Director is economic adviser to the Commissioner.
Director and Assistant Director are contact officers with States, railroads, and other agencies interested in settlement and development of projects and represent department or bureau on independent Governmental or outside advisory and research committees.

4 professional, 1 subprofessional, 5 clerical employees (whole time); 32 professional, and 109 registered cooperating employees (part time).

BOULDER CANYON PROJECT
(Includes Hoover Dam, Power Plant, and All-American Canal)
Walker R. Young, Construction Engineer.
Ralph Lowry, Field Engineer.
John C. Page, Office Engineer.

33 professional and 3 subprofessional employees (permanent), 11 clerical, 9 custodial, and 126 registered and unclassified permanent and temporary employees.

PROJECTS UNDER CONSTRUCTION AND OPERATION IN WHOLE OR IN PART BY BUREAU OF RECLAMATION

Project	In Charge	P. O. Address
Baker	F. A. Banks	Owyhee, Oreg
Belle Fourche	F. C. Youngblutt	Newell, S. Dak.
Boise	F. A. Banks	Owyhee, Oreg.
Boulder Canyon	Walker R. Young	Las Vegas, Nev.
Carlsbad	L. E. Foster	Carlsbad, N. Mex
Grand Valley	W. J. Chiesman	Grand Junction, Colo.
Klamath	B. E. Hayden	Klamath Falls, Oreg
Lower Yellowstone	H. A. Parker	Savage, Mont.
Milk River	H. H. Johnson	Malta, Mont.
Minidoka	E. B. Darlington	Burley, Idaho.
Minidoka Gooding	E. B. Darlington	Burley, Idaho.
North Platte	C. F. Gleason	Guernsey, Wyo.
Orland	R. C. E. Weber	Orland, Calif.
Owyhee	F. A. Banks	Owyhee, Oreg
Rio Grande	L. R. Fiock	El Paso, Tex
Riverton	H. D. Comstock	Riverton, Wyo.
Salt Lake Basin	F. F. Smith	Coalville, Utah.
Shoshone	L. H. Mitchell	Powell, Wyo.
Sun River:		
Greenfields Division	A. W. Walker	Fairfield, Mont.
Umatilla:		
McKay Dam	C. L. Tice	Pendleton, Oreg
Uncompahgre	L. J. Foster	Montrose, Colo.
Vale	Chas. C. Ketchum	Vale, Oreg
Yakima	John S. Moore	Yakima, Wash.
Cle Elum Dam	R. J. Newell	Ronald, Wash
Kennewick	John S. Moore	Yakima, Wash.
Kittitas		Ellensburg, Wash
Sunnyside	John S. Moore	Yakima, Wash.
Tieton	John S. Moore	Yakima, Wash.
Yuma	R. M. Priest	Yuma, Ariz.
Yuma Auxiliary	R. M. Priest	Yuma, Ariz.

188 professional and subprofessional, 89 clerical, and 1239 registered and unclassified employees.

A TYPICAL PROJECT CONSTRUCTION ORGANIZATION consists of construction engineer, office and location engineers, draftsmen, and clerical staff.

A TYPICAL PROJECT ADMINISTRATIVE ORGANIZATION consists of superintendent, clerical, and collection staff, and operation and maintenance staff.

COMPLETED PROJECTS OR UNITS THEREOF BEING OPERATED BY WATER USERS' ORGANIZATIONS

Projects	In charge	P. O. Address
Boise	Wm. H. Tuller	Boise, Idaho.
Grand Valley-Orchard Mesa		
Orchard Mesa I. D.	C. W. Tharp	Palisade, Colo
Huntley	E. E. Lewis	Ballantine, Mont.
King Hill	F. L. Kinkade	King Hill, Idaho.
Klamath-Langell Valley:		
Langell Valley I. D.	F. E. Thompson	Bonanza, Oreg
Horsefly I. D.	Wm. F. B. Chase	Bonanza, Oreg
Milk River, Chinook Division		
Alfalfa Valley I. D.	A. L. Benton	Chinook, Mont.
Fort Belknap I. D.	H. B. Bonebright	Chinook, Mont.
Harlem I. D.	Thos. M. Everett	Harlem, Mont.
Paradise Valley I. D.	R. E. Musgrove	Chinook, Mont.
Zurich I. D.	John W. Archer	Zurich, Mont.
Minidoka gravity		
Minidoka I. D.	R. L. Willis	Rupert, Idaho.
Minidoka pumping		
Burley I. D.	Hugh L. Crawford	Burley, Idaho.
Newlands		
Truckee-Carson I. D.	D. S. Stuver	Fallon, Nev.
North Platte		
Interstate Division:		
Pathfinder I. D.	T. W. Parry	Mitchell, Nebr
Fort Laramie division		
Gering and Fort Laramie I. D.	W. O. Fleenor	Gering, Nebr
Goshen I. D.	B. L. Adams	Torrington, Wyo
Northport division:		
Northport I. D.	D. R. Dean	Northport, Nebr
Okanogan	Nelson D. Thorp	Okanogan, Wash
Salt River	C. C. Cragin	Phoenix, Ariz
Shoshone		
Garland division		
Shoshone I. D.	J. O. Roach	Powell, Wyo.
Frannie division		
Deaver I. D.	Sidney I. Hooker	Deaver, Wyo.
Strawberry Valley	Kenneth Borg	Provo, Utah
Sun River, Fort Shaw	H. W. Genger	Fort Shaw, Mont.
Greenfields	A. W. Walker	Fairfield, Mont
Umatilla		
East division		
Hermiston I. D.	E. D. Martin	Hermiston, Oreg
West division		
West Extension I. D.	A. C. Houghton	Irrigon, Oreg

October 15, 1931

U. S. GOVERNMENT PRINTING OFFICE: 1931