JANUARY
1947

In This Issue:

WEED TRAP

Homesteading—Then and Now

Public Power and Small Business

What of Tomorrow?

THE *Reclamation* ERA

OUR FRONT COVER

What of Tomorrow?

Your guess is as good as that of veteran Dave H. Law, Jr., his wife, or son David James. However, he has a slight margin of hope over most of us because of his reclamation farm on the Deschutes project in central Oregon. To help him develop his land, he and his family will have the advice and help of reclamation land specialists who are cooperating with State and national agencies to help new settlers such as these. Success will not come overnight—but there's a new year ahead.

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Front cover by Stanley Rassmussen, region I; back cover, National Park Service, U. S. Dept. of the Interior; page 3 photo by Barrow Lyons, Chief Information Officer, Bureau of Reclamation; page 4 (top) photo by Barrow Lyons; page 4 (bottom) photo by Ben Glaha, region II; pages 5, 6 and 7 photos by Stanley Rassmussen; page 9 drawing by John P. Underman, and photograph by Joseph S. Kingsberry, both of the Office of the Chief Engineer, Bureau of Reclamation, Denver Colo.; page 10 photo of mural in the new Interior Building, Washington, D. C., by the late John Steuart Curry; page 11 (top) photos by Wesley Guderian, Herald News photographer, Klamath Falls, Oreg., (bottom) lower left photo by the Bureau of Land Management, United States Department of the Interior, and lower right photo by the National Park Service; page 12, three photos on left panel by the Bureau of Land Management; center bottom photo by the Bureau of Land Management; upper right photo by Frank B. Pomeroy, region I; lower right photo by Ben Glaha; pages 14 and 15 photos by the National Park Service; and pages 16, 17, and 18 photos by the Bonneville Power Administration, U. S. Dept. of the Interior; page [illegible] cartoon by Tom E. Lawlor, Spokane, Wash.

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Credits

Art work by James D. Richardson, Georgie Petty, and Mary Edmondson, Bureau of Reclamation, Washington, D. C.

RECLAMATION'S RECORD

From June 1902 through June 1946

In Return for Less Than 1 Billion Dollars ($993,056,468) in Federal Funds Invested in Reclamation Projects.

THE BUREAU OF RECLAMATION HAS

IRRIGATED more than 4,000,000 acres of arid and semiarid lands
and
OPERATED 52 reclamation projects,

WHICH IN TURN *PRODUCED*

Over 4 billion dollars ($4,442,792,686) worth of crops from 1902 to 1945.
Over 400 million dollars ($435,184,395) worth of crops in 1945 alone.
A record yield of $103.72 per acre in 1945.

BUILT. . . . . 31 power plants
GENERATING. . . . . . over 13 billion kilowatt-hours (13,172,988,977) annually,

WHICH BROUGHT IN POWER REVENUES

Amounting to nearly 113 million dollars ($112,843,610) from 1909 through 1946.
Over 21 million dollars ($21,158,862) in 1945 alone.
And make the Bureau the largest single power producer in the world.

MADE CONSTRUCTION HISTORY BY CREATING:

World's *Largest* Power Plant	BOULDER (Arizona-Nevada) generating capacity, 1,034,800
World's *Largest* Concrete Dams	GRAND COULEE (Washington) SHASTA (California) BOULDER (Arizona-Nevada)
World's *Largest* Man-made Lake	LAKE MEAD (Arizona-Nevada) capacity of 31,141,755 acre-feet
World's *Longest* Man-made Lake	FRANKLIN D. ROOSEVELT (Washington) 151 miles long
World's *Longest* Irrigation Tunnel	ALVA B. ADAMS (Colorado) 13 miles long

BUILT BY JUNE 30, 1946

15,325 miles of irrigation canals
168 storage and diversion dams
355 tunnels with a combined length of 566,521 feet
219,670 canal structures
3,143 miles of waste water ditches and drains
13,902 bridges
23,816 culverts
6,244 flumes
335 pumping plants
2,516 miles of transmission lines

And Also

Excavated	625,574,739 cubic yards of material
Rock-Poured	34,123,144 cubic yards of concrete
Used	38,870,583 barrels of cement

P. S. *The Bureau is now building the world's highest earth-fill dam, ANDERSON RANCH DAM in Idaho, and the world's longest irrigation canal, the FRIANT-KERN CANAL in California (156 miles long).*

Letters to the Editor

As Maine Goes . . . . .

OCTOBER 21, 1946.

GENTLEMEN: I am happy to say that the magazine RECLAMATION ERA is arriving regularly without very much delay.

I am very much pleased with this and find the RECLAMATION ERA as interesting as it was before the war. I shall be very glad if the Bureau of Reclamation will send me any interesting materials, for I am deeply interested in the teaching of geography and of conservation.

Yours very truly,

ERNEST JACKSON,
Professor, University of Maine.
Orono, Maine.

Canadians Have Weeds, Too . . .

CRESTON, BRITISH COLUMBIA,
CANADA,
SEPTEMBER 26, 1946.

DEAR EDITOR: In your June issue we find an illustrated article entitled "The War Against Weeds," which pertains in particular to weeds in ditches and their eradication.

In our drainage districts we are very much bothered with weeds and therefore much interested in the new method of chemical warfare which you illustrate in the above issue.

Will it be possible through the RECLAMATION ERA to obtain more information on this chemical treatment and the apparatus required? If this is not to be so would you advise where I can address Mr. Balcom, the writer of the article in question?

Thanking you in the above.

Yours very truly,

GUY CONSTABLE,
President, Kootenay Valley.
Associated Drainage Districts.

(Editor's note: Canadian reader Constable's attention has been called to the Bureau of Reclamation's preliminary issue of Control of Weeds on Irrigation Systems, a comprehensive manual listed in our RECLAMATION READING section. Although there is only a limited supply of this publication, a revised version will be issued later for wide distribution.)

On Corralling the Colorado

NOVEMBER 19, 1946.

DEAR MR. MARKWELL: I am deeply indebted to you for your very great kindness in sending to me the RECLAMATION ERA for September, October, and November, which I have perused with the greatest interest and which contain the thrilling and romantic story entitled, "Corralling the Colorado," of which development I had a more or less important part, in a legislative way, covering a 10-year period.

I also enjoyed reading the article by Frank A. Banks on the Columbia River project, with which our Committee on Irrigation and Reclamation had a great deal to do during its initial stages, having visited with the committee on two occasions the projected improvement, especially the Grand Coulee dam site prior to my retirement from Congress, in March 1933.

The photographs are also most interesting, especially the one on page 243 of the November issue taken in the rear of the White House on the 21st day of December 1928, on which date President Coolidge signed the bill making the Colorado improvement possible. It is said to observe that of the six men in the photograph only former Congressman Swing and myself survive.

It is most gratifying that you and your associates, most of whom have come into the service since my retirement from Congress, are enthusiastically and successfully carrying on the reclamation policy initiated nearly a half century ago. No other policy of the Government has accomplished as much toward contributing to the general welfare of the people of the Nation, and created more real wealth and comfort for the masses, from what was theretofore worthless. The history of the accomplishments of the Reclamation Service is a monument to the initiative and industry of farseeing men of courage, and the skill of the engineers and their coworkers. I am proud of having been, in a small way, one of those who participated in the bringing about the great development of the arid West.

Sincerely yours,

ADDISON T. SMITH,
Attorney at Law, 1852 Columbia Road.
Washington, D. C.

(Editor's note: Mr. Smith was formerly chairman of the House Committee on Irrigation and Reclamation.)

So We're Vital!

NOVEMBER 21, 1946.

DEAR EDITOR: We will be only too glad to exchange with your publication, the RECLAMATION ERA, for our magazine, bimonthly, *Public Ownership of Public Utilities.*

We are so happy to again be receiving the ERA. Its new form and style is vital and extremely interesting and inspiring!

Sincerely yours,

ELEANOR SPAETH,
Assistant Secretary, Public Ownership League of America.

For Your Art Collection

Write to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C., for photographs suitable for display or framing which appear in this issue. *This does not apply to photographs which carry outside credit lines.**

CONTACT PRINTS, single weight glossy paper, are available at the following prices *only if size of negative permits.* Most Bureau of Reclamation negatives are 8 by 10 inches.

	Selling price (each)
4 by 5 inches (or smaller)	$0.15
5 by 7 inches	.20
8 by 10 inches	.40
ENLARGEMENTS:	
4 by 5 inches (or smaller) single weight glossy	.25
5 by 7 inches single weight glossy	.40
8 by 10 inches single weight glossy	.60
11 by 14 inches single weight glossy	1.25
11 by 14 inches double weight mat	1.50
16 by 20 inches double weight mat	2.50
20 by 24 inches double weight mat	3.00
24 by 30 inches double weight mat	5.00
24 by 36 inches double weight mat	6.00
30 by 40 inches double weight mat	8.00
	Per sq. ft.
Over 30 by 40 inches double weight mat	$0.85

Recent Project Maps

Published by the Bureau of Reclamation

Western half of the United States showing Reclamation projects and the 7 regions. Map No. 44–14, revised October 1945. Size 16 by 20 inches, FREE.

Orland project, California. Map No. 45–45 (supersedes No. 21880). Blue, green, and black. Size 8 by 10½ inches, price 10 cents.

Grand Valley project, Colorado. Map No. 45–40 (supersedes Nos. 23888 and 23888A). Green, brown, blue, and black. Size 16 by 26 inches, price 25 cents.

Klamath project, Oregon-California. Map No. 45–52 (supersedes Nos. 27450 and 27450A). Black, blue, green, and red. Size 16 by 20 inches, price 25 cents.

Motion Pictures

The Bureau of Reclamation distributes 16 mm. motion pictures relating to its activities. The films will be loaned the borrower willing to pay the express charges both ways. The list follows:

(Distributed from the Bureau of Reclamation Office, Washington 25, D. C.)

Boulder Dam	5 reels (silent)
Boulder Dam	4 reels (sound)
Reclamation in the Arid West	1 reel (sound)
Fundamentals of Irrigation	3 reels (sound)
Irrigated Pastures (Kodachrome)	2 reels (sound)
Fighting Weeds (Kodachrome)	3 reels (sound)
Measurement of Water (Kodachrome)	3 reels (sound)

**Note.* In ordering maps or photographs, please do not send postage stamps. Make check or money order payable to the Treasurer of the United States and address your order to the Commissioner, Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C.

I Finally Struck It Rich

by C. deVERE FAIRCHILD

Reclamation Farmer, Yakima Valley, Wash.

The Land of the Midnight Sun has been an emotional inspiration to writers of prose and poetry for many decades.

To me—one who spent several years in the frozen North during the Klondike gold rush—the green trees, the fertile fields, and the homes of the Yakima Valley in eastern Washington, while much less spectacular, are far more inspiring. Let me tell you why.

The world was electrified by the discovery of gold in the Klondike, and the mad rush that resulted was a natural reaction to the lure of the Yukon. In the year of 1898 I stood for the first time on Gold Hill, a portion of the glacial drift which had transformed gold bearing quartz ledges into the placer form of nuggets and gold dust. These, deposited in the various pay-streaks, made the Klondike famous.

As I gazed upon the scene, my imagination carried me back into the ages of antiquity when the mighty glacier was alive, and then through the periods of time when the musk ox and the mastodon grazed the area.

At last I had reached the end of the Yukon trail. It was thrilling to see the cluster of log cabins on each 500-foot claim along Eldorado and Bonanza Creeks, and the winding defile among the abrupt sloping hills. The Eldorado flowed into the Bonanza at the foot of Gold Hill. Twelve miles downstream, the latter creek emptied into the Klondike River, which in turn, 2 miles below, ran into the Yukon. At the confluence was situated the city of Dawson.

I was thrilled by the knowledge that 90 feet below where I stood, miners were thawing the frozen pay streak and "rocking" the pay dirt. I felt well rewarded for the laborious packing over Chilkoot Pass, the backaches from "whip-sawing" on the shores of Lake Lindeman, the nervous strain of "shooting" Miles Canyon, White Horse, and Five Finger Rapids, and for the physical monotony of rowing a boat 600 miles.

Forty-eight years later, in the year 1946, I stood on one of the scenic high points overlooking the Yakima Valley. Hundreds of homes were visible. The orchards and irrigated fields in their regularity of alinement exemplified human accomplishment and it was an inspiration to know that the highly productive, farm-studded areas below the canal had been transformed from sagebrush, such as I could see above the canal, entirely through man's own endeavor.

As I visualize the Yakima Valley of today, having owned and operated orchards for 34 years without a crop failure, I find social and economic comfort in contrasting it with the 5 years which I spent in the Klondike on Gold Hill, Bonanza Creek, Cheechako Hill, Adams Hill, Dominion Creek, and Magnet Gulch.

In comparing the economic worth of the Klondike glacial drift with the Yakima River I want to emphasize that there was but one "pay-streak" deposited by the glacier, and when that was mined the final chapter had been written, whereas the Yakima River and its tributaries every year deposited a "pay-streak" over the 400,000 acres of the Yakima Valley and in all probability they will continue to do so for centuries to come.

Terming the agricultural and horticultural activities of the Yakima Valley a "pay-streak" can easily be justified. I submit as proof the accompanying table showing factual data of crop values of a small portion of the valley; namely, the Tieton Division of the Yakima Federal Reclamation project, covering a period of 34 years, from 1912 to 1945, inclusive. It shows how much an acre-foot of water is worth in crops produced. The figure is most impressive.

The Tieton Division, an area of approximately 25,000 acres, devoted largely to fruit production, was completed by the Bureau of Reclamation in 1911, and water was available to the entire division in 1912.

In the table, for the sake of brevity and to afford a simplified analysis of the economic aspect of the area involved, I have called the first 4 years of agricultural activity a development period, and listed the remaining 30 years in three columns, each covering a decade of operation. The summary shows the total and average values of crops per acre and per acre-foot, and also includes separate data for the year of 1945.

The table reveals some startling facts. It shows that the average acre-foot of water of the 2,388,775 acre-feet applied to the land over the 34-year period was worth $55.24 in crops. Saying it another way, every second-foot of water for 24 hours has brought crop returns averaging $109.56. In 1945, with wartime prices in effect, the average value in crops of every per-acre foot of water actually delivered to the land skyrocketed to a record peak of $255.70.

Every year of the 34-year period the average annual crop returns of $3,880,771 have exceeded the total construction cost of the Tieton Division by $418,291.54.

(Continued on page 7)

Striking it rich again, here is Mr. Fairchild and his attractive wife who helped him make a success of the farm

VALUE OF WATER ON TIETON DIVISION—YAKIMA PROJECT

	Development period	Operation period			Total—34 years	One year
	1912–15	1916–25	1926–35	1936–45	1912–45	1945
Average number of acres	19,090	27,097	26,694	25,084	25,444	24,679
Average acre-feet diversion	59,243	92,437	92,116	95,888	89,451	98,717
Average acre-feet delivered to land	40,115	66,955	75,733	80,144	70,258	82,046
Total crop value	$1,631,968	$21,323,343	$26,032,663	$82,958,245	$131,946,219	$20,979,434
Average crop value per year	$407,992	$2,132,334	$2,603,266	$8,295,824	$3,880,771	....
Average crop value per acre	$21.37	$78.69	$97.52	$330.73	$152.52	$850.09
Average crop value per acre-foot	$10.17	$31.85	$34.37	$103.51	$55.24	$255.70

Weed Trap

Mustard and thistle, when forced into a detour, never finish their ride

by THEODORE NELSON

Irrigation Manager, Black Canyon Unit, Boise Project, Region I, Boise, Idaho

"I am trapped," said the Russian thistle to the Jim Hill mustard. And sure enough he was.

Bureau of Reclamation operation and maintenance employees of the Black Canyon unit of the Boise project in southwestern Idaho again this past summer got a record yield from their traps. Only it was not animals or birds for which the carefully planned snares were set. It was weeds—mustard and Russian thistle which are so often seen floating along canals in the area.

Literally tons of these weeds were removed from Black Canyon canals by specially designed weed traps. These trapping operations have paid off by removing the cause of breaks and structure failures—weeds clogging the canals.

Several years ago, after a heavy windstorm, the Black Canyon canals carried mustard and thistle so thick that the only water to be seen was along the edges where stems pushed the heads back into the stream.

Today only a few of the floating weeds can be seen in the canals and it is a better-than-even bet that they too will be piled high on the floor of one of the traps before long. A poor weed just has not a chance any more.

The weed trap shown in the diagram has proved an effective and economical way of removing floating weeds from Black Canyon canals. It was designed by Bureau operation and maintenance personnel and probably can be adapted for use in other areas in which floating weeds constitute a real threat to efficient irrigation.

On the Black Canyon unit the main canal runs for about 30 miles, contouring low hills and plateau land, which is covered mostly with cheat grass, mustard, and Russian thistle, plus a few sagebrush stumps and an occasional patch of unmolested sage.

Two secondary canals take off from the main canal and the three together form a complete circle around nearly 50,000 acres of grazing land, covered with a growth similar to that along the main canal. The location of these large areas of mustard and thistle make it certain that no matter which way the wind blows, some growth will land in one of the canals—often in all of them.

The danger of clogging checks and syphons and an ever-decreasing water volume made it imperative that something be done to remove floating weeds from these canals before a jam caused a serious break. To shut off the water would have been an easy answer, except that the damage would have been done before the "drop" reached the danger points.

First attempts to design a structure to overcome this hazard consisted of building floating booms at an angle across the channel where there was no bank on the upper side and this back-up would provide room for weed storage. A schedule was arranged calling for a truck with three men, Jackson fork, cable, lights, pitchforks, and miscellaneous equipment to go to each boom whenever the wind blew hard, regardless of the time of day or night.

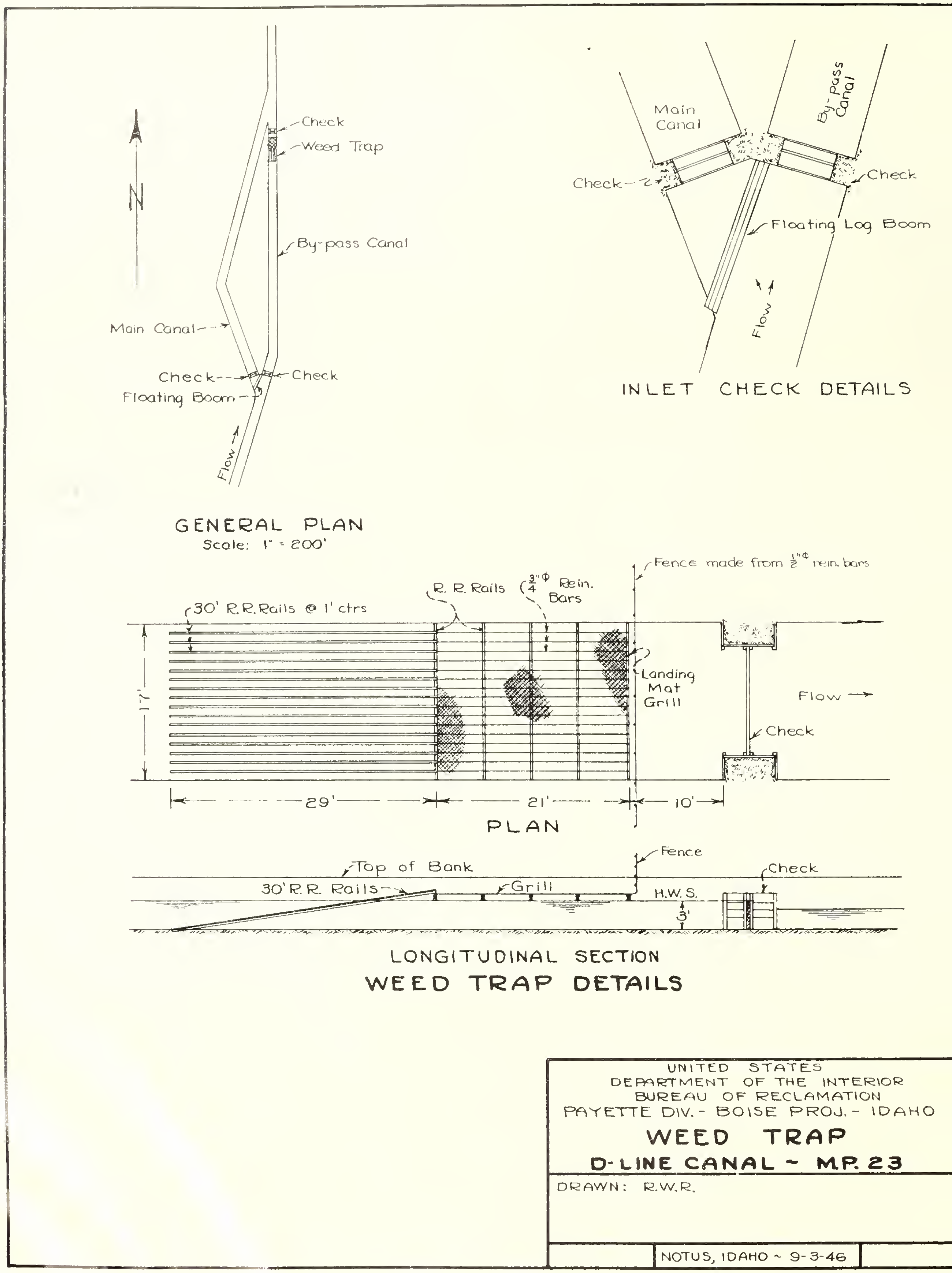
Key men were left free to patrol vital structures and the intervening ditch areas. Because the weeds were wet it was necessary to use a considerable quantity of fuel oil to keep a fire going and thus eliminate the necessity of stacking them.

Despite the efforts of the entire operation and maintenance crew, which, for several years, was kept on the alert during wind storms, a weed jam plugged a syphon and took out one of the booms. It was apparent that a more elaborate and more efficient weed trap was needed, and plans were drawn up for the present structures.

On one of the secondary canals there was a stretch on the upper side with very little bank and enough low ground to accommodate a pond 100 feet wide by 400 feet long. This location had the advantage of being below the areas which supplied most of the weeds—yet far enough upstream to have sufficient canal width for carrying capacity.

A bend in the main canal just above the low ground permitted construction of an auxiliary (or bypass) canal. The inlet was in a straight line with a 360-foot section of the main canal. This was desirable because floating material could be diverted straight into the auxiliary canal.

Beyond about 275 feet of normal size inlet throat, the new auxiliary section was widened to about 100 feet for a distance of 200 feet and then tapered into another 125 foot stretch of normal width section and brought back into the old canal on an angle which would tend to merge the two streams without turbulence and back wash.


Check
Weed Trap
By-pass Canal
Main Canal
Check
Check
Floating Boom
Flow
N
GENERAL PLAN
Scale: 1" = 200'
Main Canal
By-pass Canal
Check
Check
Floating Log Boom
Flow
INLET CHECK DETAILS
Fence made from ½"Φ rein. bars
R. R. Rails
¾"Φ Rein. Bars
30' R.R. Rails @ 1' ctrs
17'
Landing Mat Grill
Flow
Check
29'
21'
10'
PLAN
Fence
Top of Bank
Check
30' R.R. Rails
Grill
H.W.S.
3'
LONGITUDINAL SECTION
WEED TRAP DETAILS
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PAYETTE DIV. - BOISE PROJ. - IDAHO
WEED TRAP
D-LINE CANAL ~ M.P. 23
DRAWN: R.W.R.
NOTUS, IDAHO ~ 9-3-46

As the weeds pile up, they are removed from the racks.

Check structures were placed in the old canal, and at the head and outlet of the auxiliary canal. Directly above the outlet check and in the normal-width section, a sloping rack of 30-foot railroad rails was placed with the flat bottoms up. The lower ends were set on mud sills and held in place by spacers far enough below canal grade to keep low floating weeds from collecting on the ends of the rails.

The top of the slope was supported by a cross rail holding the upper end of the sloping rails about 4 feet above canal grade or 1 foot above high-water line. With the aid of the diverting boom and by proper regulation of the bypassing water, it was possible to lead weeds into the pond and onto the weed rack without manual labor. This system had the advantage of keeping the old channel open in case of a complete tie-up on the rack.

The arrangement was a big improvement over anything tried previously, but two problems immediately presented themselves. First, there was no storage space for weeds on the rack and the wet weeds could not be burned immediately, but had to be forked from rack to ditchbank. Secondly, the wide pond soon filled up with silt, stopping weeds before they reached the rack.

To provide storage space for the weeds, a 15-foot grill was built, leveling off from the end of the sloping rails and covering the entire width of the canal from 12 to 18 inches above water level. The grill was supported by four cross rails upon which were laid $\frac{3}{4}$-inch reinforcing steel placed at 1-foot intervals paralleling the canal. The grill itself was made of 5- by 10-foot steel airplane runway mats.

This permitted immediate drainage and eliminated considerable handling since many of the weeds moved up on the racks and spilled over onto the grill. The water level at the rack, regulated by the check immediately below, to a great extent determined the amount of forking necessary.

A few bars of reinforcing steel wired together were made into a fence at the downstream end of the grill, thus keeping weeds from rolling off the grill and back into the ditch. To take care of heavy runs, the bank was trimmed down and a Jackson fork used to get weeds from rack to ditchbank.

To eliminate the difficulty of weeds piling up on silt bars in the pond, the channel was cleaned and narrowed to normal ditch width. Thus, the two basic problems of the original design were overcome.

The bypass and steel rack arrangement permitted a night patrolman to handle fairly heavy weed runs without additional help. It also provided storage for all weeds on lighter runs without the need for manpower, making it possible for the day crew to take care of them.

Similar structures were constructed on other canals. They have removed tons of floating weeds which otherwise would have choked headgates and structures. The installations also have saved a great many man-hours and have not required much maintenance.

A good weed trap is an imperative aid for an emergency weed condition. In the long run, however, a program to control these weeds before they reach canals should, of course, be initiated. On the Black Canyon unit it has been found that range fire control, proper grazing, and range and canal bank seeding have all been outstanding in producing results along this line.

I Finally Struck It Rich

(*Continued from page 4*)

A careful study of the table shows that during the 34 years of operation each and every acre of the Tieton Division which was irrigated throughout the period produced crops valued at $5,185. In other terms, every 20-acre tract produced $103,700 in crops.

While the gross crop returns from Tieton Division admittedly are very high compared with average returns from Bureau projects in the 17 Western States, the figures nevertheless provide an impressive indication of the true value of water in western streams and of what the Nation is wasting in dollars and cents by not fully utilizing the run-off available.

Figures on production in the entire Yakima Valley for the three years of 1943, 1944, and 1945 also provide indisputable evidence as to the value of water as compared with gold in the Klondike. During the 3-year period the valley raised crops valued at $320,193,500—an amount greatly in excess of the Klondike production in its entire lifetime. During the last 20 years, from 1926 to 1945, inclusive, the productive valuation of the Yakima Valley was $900,000,000, or more than three times the total Klondike production.

Since we know that these irrigated areas will continue to produce through the centuries to come, it must be obvious to even the most casual observer that the recurring "pay-streak" which is created in irrigated land by making available flood waters stored in Bureau of Reclamation reservoirs has and will continue to yield great wealth in the Yakima Valley, compared to which the gold of the Klondike is insignificant.

In retrospect, I remember sitting in my cabin on No. 8, below Discovery on Bonanza Creek and yearning for a fresh tomato, for an ear of sweet corn, and other delicacies from the "outside." As I looked upon the shelf where a considerable quantity of nuggets and gold dust was contained in some emptied "Extract of Beef" jars, I soliloquized, "Yes; you could sit here and look at all the gold in the Klondike and starve to death."

Now, as I view the Yakima River, the even flow of which is maintained by the Federal storage dams at Lake Keechelus, Lake Kachess, and Lake Cle Elum, I am overwhelmed by the thought of what a blessing irrigation is to the world. The wealth being produced from storing run-off of streams is in such a form that it directly assists in saving human beings from starvation. As I watch the water rippling on its course to the thirsty acres below I realize that water is the most essential item to the very existence of man and that controlled water, judiciously applied to fertile soil in a favorable climate, is the most valuable commodity on the face of the earth.

My Year in the United States

American Customs and Engineering Science as They Appear to a Chinese Trainee

By CHUNG-YU PAN

Assistant Engineer, National Resources Commission of China

First, no more chop suey or chow mein, please!

Perhaps you have seen my fellow engineers when they have visited your irrigation projects during the past year. We have wandered far and wide over these 17 Western States studying American methods and learning a little about that famous American "know-how." It has been a real pleasure for us to chat with so many western irrigation farmers. And our godfathers, the Bureau of Reclamation, under whose guidance we are training, have made sure we have not missed anything.

But to get back to that chop suey business. We don't like it. As for those big, thick, juicy steaks that usually make an American's eyes pop out—well, they appear to be just an unattractive chunk of beef. On the other hand, I adore the American hamburger. It is my belief that some of those adjectives your Hollywood likes to toss around, like "colossal" and "stupendous," might be better applied to the delectable and delicious hamburger. Our second ranking favorite in American dishes is pie a la mode. It may surprise you to know that when we came to this country, we soon learned to steer clear of Chinese restaurants. We prefer the good old American hamburger joint.

Our year of study in the United States has been wonderful. It was my biggest break when, along with a thousand other young Chinese engineers, I passed a competitive examination and was selected by the Chinese Government to visit the United States for a year of practical, on-the-job training. The State Department has sponsored our visit with all costs borne by our own government.

Our group left China in April of 1945. We flew over "the hump," made famous by American flyers, to Calcutta, India. Here we boarded a United States Coast Guard transport that took us all the way to the east coast of the United States via the Indian Ocean, the Red and Mediterranean Seas, and the Atlantic Ocean. Our ship took the wartime zigzag course for a journey that lasted one hot and monotonous month. I still remember the slow-moving, never-ending chow line and the not-much-to-our-liking KP duties.

Washington, D. C., was our first stopover. Here we had the opportunity to see democracy in action by witnessing heated debates in both the Senate and the House. We greatly admired the beautiful and dignified government buildings, monuments, and memorials. We enjoyed the privilege of visiting the famous Library of Congress. It was then arranged for a group of 19 Chinese engineers to go to Denver to study with the Bureau of Reclamation, the world-famous organization which, in a very short period of a few years, achieved such engineering marvels as Boulder, Grand Coulee, and Shasta Dams. The success of the Bureau in these spectacular and revolutionary dam-building projects has certainly changed the viewpoint of the entire engineering world and has started a new era of engineering yardsticks and economy. Engineers the world over, fascinated by the work of the Bureau, have flocked to the United States for knowledge and advice. It was indeed our great fortune to be able to study in this international center of advanced engineering.

My first impression was of a large but well-geared organization. It has the combined advantage of a centralized design and construction office under our good friend, Chief Engineer Walker R. Young, and the decentralized administration of projects by seven regional directors. The chief engineer's office in Denver not only has a concentration of expert technical personnel but the assurance of the highest type of engineering work on all projects. On the other hand, the regional and project supervision avoids the inefficiency of remote, centralized supervision.

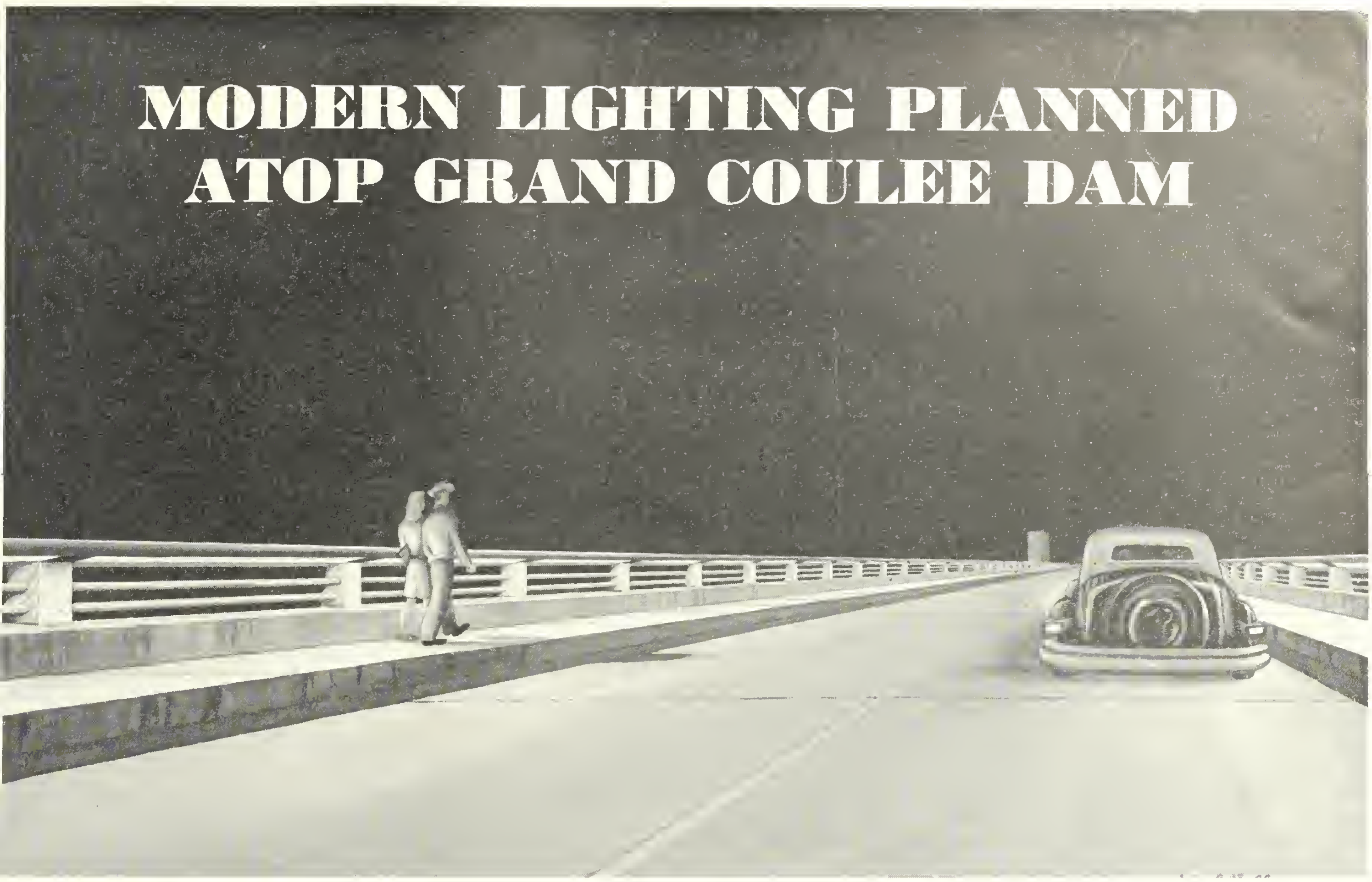
During my 1-year stay in the chief engineer's office, I have been greatly impressed by the detailed specialization of work, each under the immediate supervision of a top-flight engineer, usually a leading authority in his field. This facilitates the training of specialists, which in turn assures greater efficiency and enables research to be carried on under competent guidance. We in China, due to a great lack of technical men, are usually called upon to tackle any odd job in the profession. There is, however, a realization of this fact in Chinese engineering circles, with the result that we were instructed to specialize in one branch of engineering. That is what we have been endeavoring to do.

In addition to our studies in Denver, we also have been given the opportunity to see many of America's reclamation projects in a series of inspection tours throughout the Western States last winter. We saw miracle after miracle, where treacherous rivers were harnessed and barren deserts were turned into beautiful meadows. The green pastures and crops under cultivation, in contrast to the neighboring sagebrush, appeared like mirages in the desert. This at once reminded us of the great amount of work that should be done by us in our own China. We have a great wealth of resources, and it is our immediate responsibility to see that these are developed. The great results achieved in the United States should give us the inspiration and courage to follow through.

Our year in the United States has been most exciting and beneficial. We have been kept so busy we have had little opportunity to feel homesick.

We have learned to understand and respect the American people and their way of living. We have found that America today is not a happy-go-lucky nation as glamorized by Hollywood but a country with its feet on the ground as a result of a hundred and seventy years of pioneering and hard work. The present high standard of living is not merely a matter of luck but the justifiable return to a great and courageous people. God only helps those who help themselves.

I am grateful for the invitation to write this article for the RECLAMATION ERA because it affords me the opportunity to thank the irrigation farmers of the West and the American people for their helpfulness on so many occasions. We are especially thankful to the Bureau of Reclamation, their officials, engineers, and employees in all offices for their very sincere cooperation and for the friendship they have generously and graciously extended to us on every occasion.



What are believed to be the world's longest continuous lighted railings will be installed atop Grand Coulee Dam, man's largest concrete structure. More than 7,800 feet of fluorescent tubing will transform the 30-foot, top-of-the-dam roadway into a ribbon of glareless light.

The tubular lamps, 6 and 8 feet in length, will be placed in the semicircular top rail of glistening metal. Streamlined secondary railings will be placed below. Specifications call for aluminum, stainless steel, or monel metal.

The especially designed, dual-purpose crest railings, which are to replace temporary wooden buildings, will provide sturdy protection and adequate lighting without sacrificing beauty of line. And they will afford more than 40 percent unobstructed vision to motorists, in contrast with the frequently used solid rails or parapets which confine the view largely to the roadway.

Rectangular metal posts will be spaced 10 feet apart across the dam's crest. Intermediate horizontal rails, ovaliform in cross section, will be sloped so that their normal axes intersect at the approximate eye level of motorists driving across the dam. The semicylindrical top rail, also of shining metal, will house reflectors with flat refracting lenses, in addition to the tubular lighting units. A uniform and practically shadowless flood of light will blanket the entire roadway. The light will be below the eye level of both motorists and pedestrians. Advantages of the design adopted for the Grand Coulee Dam were demonstrated in full-scale laboratory tests.

There will be approximately 3,900 feet of lighted railing on the downstream side of the dam. This is less than the length of the dam's crest (4,173 feet), principally because four elevator towers eliminate the need for approximately 160 feet of railing. The lighted top railing on the upstream side will be approximately 10 feet shorter than that on the downstream side because it will end at the "wing" dam for the pumping plant, at the west abutment.

Here is the model of the continuous lighted railings planned for Grand Coulee Dam.

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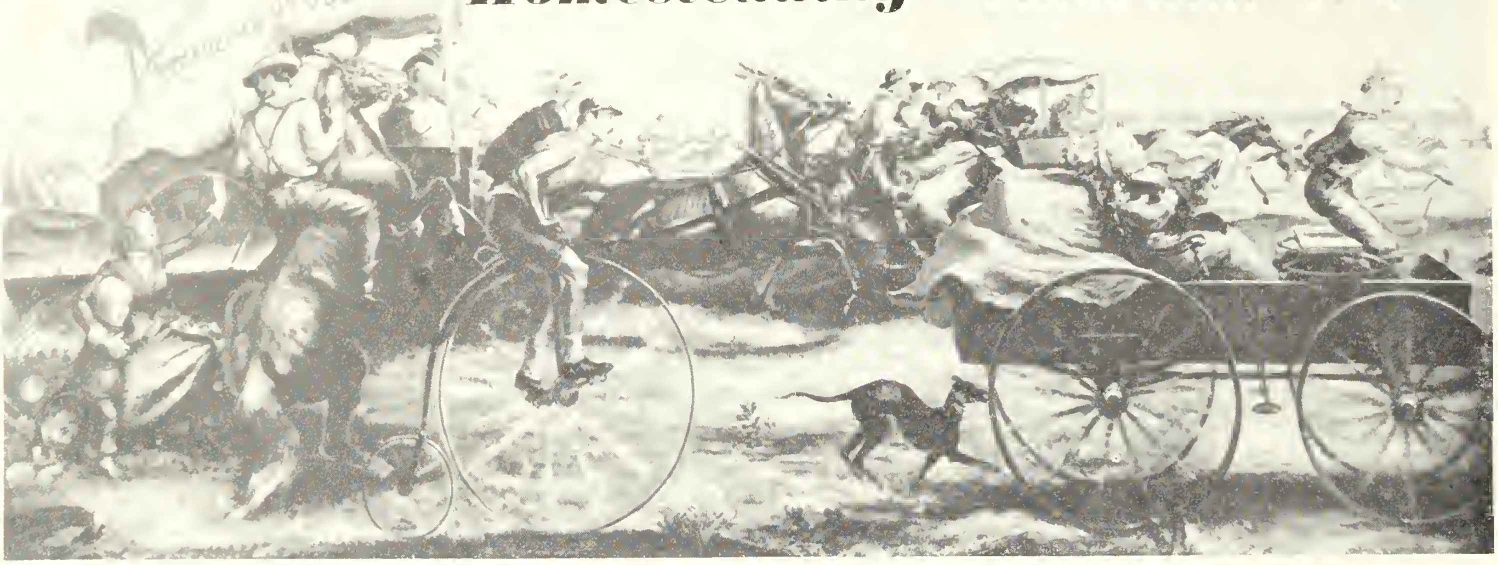
Homesteading—Then and Now



From a mural by the late John Steuart Curry.

by Paul D. Olejar, *Bureau of Reclamation, Washington, D. C.*

***G**alloping ghosts* of the Cherokee Rush and other races for homesteads fondly remembered in folklore and movie fare, might well stop to gape at the 1947 version of land settlement now under way in the West. The difference is enough to send the spirit of any scheming "sooner" of 1893 screaming back to the strip.

The 1947 version is positively calm. Instead of the turmoil, the shooting, knifing, and trickery that accompanied the wild dash of plunging horsemen, careening wagons and buggies, and foot-sore runners for free land, there is a quiet orderliness. Reclamation project homesteaders most likely to succeed are selected scientifically. The names of qualified applicants are turned over by local examining boards to gentle Lady Luck who still rules. A lottery bowl governs an orderly, democratic selection of farm winners.

This fall, the passing of the old ways on which the "sooner" thrived was completed. The occasion was the Bureau of Reclamation's opening of the Tule Lake division of the Klamath project on the Oregon-California border about as far west as a homesteader can go. This was the first postwar opening of public lands from a small group of reclamation farms, out of the several thousand which are to be irrigated, wrested from dry wastes, and offered to homesteaders in the next few years. And while on an acreage basis this first of several settlement opportunities to be created in the near future is small, it illustrates how great is the change from the early land rushes. ***While three times as many persons tried to settle in the Cherokee strip in 1893 as the available land could accommodate, there were 30 times as many applicants as there were available farms at Klamath.*** The pressure is still there—but the atmosphere is different. Science and democratic selection have changed the stampede of the 1890's into an unspectacular but equitable process of settlement.

Veterans of World War II were given first opportunity to take up the available lands opened by the irrigation works built in the area. Prospective entrymen had to have their applications in by September 15. They furnished evidences of character, farming experience, and resources (either in the form of cash or farm machinery or livestock) deemed sufficient by the local project board to carry them through. Names of the selected settlers were drawn by lot from among the list of qualified applicants—and in that drawing was perhaps the only real link to the haphazard settlements of the past in which luck played so important a part.

The settler in Oklahoma sometimes found that his land was only dust—like that which caked his weary figure after his breathless dash. But the Tule Lake lands were first analyzed by experts to make certain they would make good farms, and not until they were classified as farm lands, was public notice of their opening given.

Some of these lands have already been farmed, although without an adequate supply of water. All have been examined by agricultural experts and deemed economically suitable for tillage.

The modern settler will know he is going onto land which is capable of producing a good living if he works it properly. And the Government knows that the man who is going onto the land it is giving away is qualified to make a success of his enterprise.

Preference for veterans, stipulated by the Congress for these reclamation areas, is the continuation of a policy of making public lands available to war veterans that goes back to ***Revolutionary War*** days. It opened up the lands in the Ohio Valley and other areas west of the original colonies. It pushed settlement and empire into the wilderness. It created new States. And it served many millions of people in all walks of life. Capt. Abraham Lincoln received 120 acres from the Government for his services in the ***Black Hawk War.*** Capt. Robert E. Lee, who later led the Confederate Armies, and Ulysses S. Grant, who defeated him, received land for services in the ***War with Mexico.*** Other historic gentlemen shared in the Government's bounty. Among these was Lafayette, who received 23,000 acres, including what is now the city of Tallahassee, Fla.

To induce enlistments in the ***Continental Army,*** in 1776 a bounty of land was offered, with acreage ranging from 1,100 for a general, down to 500 for a colonel and 100 for a private. That differential does not hold today. ***A buck private has the same chance as the highest "brass" in our 1946 democracy.***

In 1796, Congress set apart 2,500,000 acres in what is now the State of Ohio to handle these bounties. Later, ***Revolutionary War*** veterans could settle in Indiana, Illinois, and remaining portions of Ohio. For service in the ***War of 1812,*** 6,000,000 acres were set aside in Michigan, Illinois, and Louisiana Territories—in the latter territory, the lands were in what is now Arkansas. Only enlisted men and noncommissioned officers were permitted to share in this bounty. Officers in that war were not included until 1850. More than 5,000,000 of this acreage was taken up by

Stacks of application blanks for the board to classify.

That fishbowl again! This time a lucky number gets you a farm.

servicemen. There were 29,000 bounty land warrants issued. ***Campaigns against the Indians*** and the ***Mexican War*** offered other opportunities for providing bounty lands to soldiers.

The bulk of public domain lands was sold by the Government all during these years. More than 200,000,000 acres were disposed of in this manner, and the cash received helped to meet Government expenses. The military bounty land warrants disposed of an additional 60,000,000 acres.

Between 1847 and 1855 Congress enacted a series of laws which liberalized and extended bounty-land provisions. By 1855, a person who had served only 14 days in the militia or United States forces, or engaged in a single battle, could receive land. If he preferred, he could accept Treasury scrip instead. Widows or children of veterans who had died could also apply.

About this time opposition to this system became articulate. The original intent to reward for military service, supply land for establishment of homes by veterans, and settle the frontier for defensive purposes, was altered in part by the new liberalizing acts, and in part by the unwillingness or inability of many veterans to settle on the land. The act of 1852 made all bounty-land warrants assignable. This resulted in widespread speculation in land warrants.

The Homestead Act of 1862 marked a new era in pioneering and homesteading. It was heavily responsible for the sweep westward of settlement to the Pacific. In the course of time, 275,000,000 acres were transferred to settlers under its basic provisions.

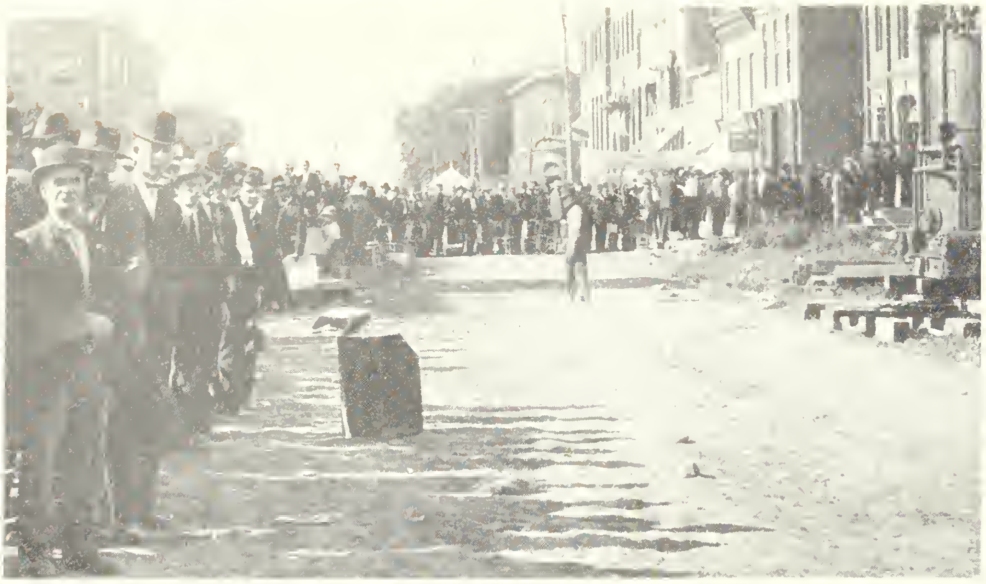
Daniel Freeman, the first homesteader under this act, was a Federal soldier who staked out a claim near Beatrice, Nebr., while on leave. He planned to file his claim when the act became operative January 1, 1863. Fortunately, he was on military detail in Brownville, Nebr., the seat of a Government land office, on December 31, 1862, when he received orders to proceed to St. Louis the next morning. He hopped on his horse and rode posthaste to a dance being held that night by prospective settlers, breathlessly sought out the assistant register, grabbed him from the dance floor, and persuaded him to permit the filing of his claim shortly after midnight. The papers were made out and Freeman left the next morning for St. Louis with homestead entry No. 1. After the war he returned and began residence on his claim. The farm now is a national monument.

After Freeman came hundreds of thousands more settlers. Among the requirements for "proving up" under the homestead law was that a "habitable dwelling" should be on the land at the time of proof. Investigations turned up a homesteader

Bounty Land Warrant issued to
ABRAHAM LINCOLN

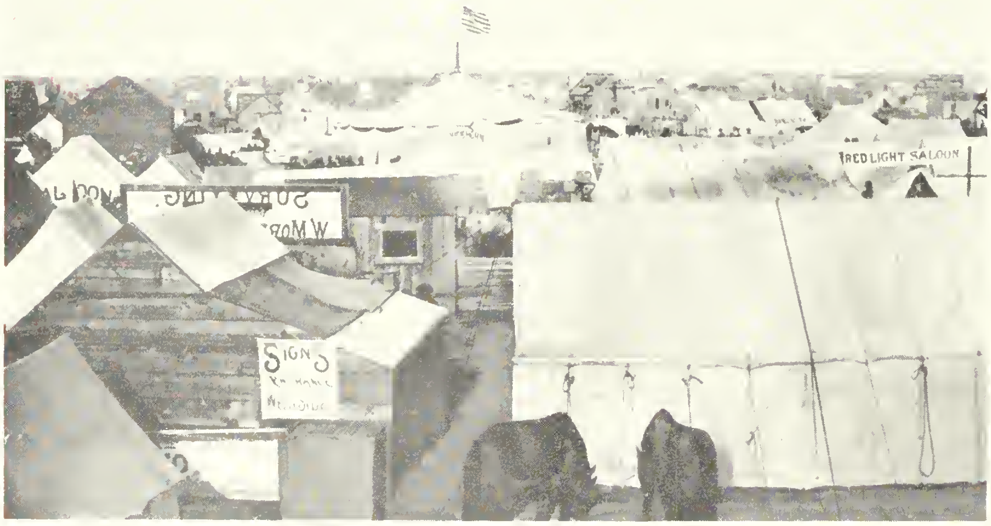
It was "veteran's preference" even then.

The first homesteader took a midnight ride.



Land rush—old style, Yankton, S. Dak., 1904.

Happy vets who got Tu



Mushroom town in the early days.

Morning of the opening, Lawton, Okla., 1901.

who proudly pointed to a bird house on his claim. Habitable it was and tradition has it that he kept his claim, as nothing was found in the law stating that the dwellings had to be habitable for humans. Other "habitable dwellings" for that particular climate were caves, sod huts, poles with extremely remote resemblance to roofs erected over them, and shaky lean-tos constructed of sagebrush and weeds which disappeared when the wind was high. ***These helter-skelter excuses for homes in past homesteading projects present a graphic and amusing contrast to present-day housing facilities.***

The homestead law was steadily liberalized until in 1916 a homesteader was allowed 640 acres and required to live on the land only 7 months in each of 3 years to obtain a title. While this system had discontinued bounty lands for military service, veterans were given special attention. In 1872, Union soldiers of the Civil War were allowed to credit military service in

When a tre

...ns by lease last spring.

determining the time required to perfect a homestead entry and this privilege was later extended to veterans of other wars, including World War I.

Some Indian areas were opened to homesteading as white settlements pushed forward, and Indian land needs decreased. The most important of these were in Oklahoma Territory. The principal requirement was that a prospective homesteader be a citizen of the United States or have declared his intention to become one. Spectacular scenes were common.

The Cherokee rush of 1893 was typical. To prevent parties with no rights from entering the lands, a registration system was adopted. Nine booths were erected for this opening and 45 clerks were detailed to duty. In 9 days more than 115,000 persons registered on the borders of the new lands, some intending to become farmers, others having their eyes on the lots in the

(*Continued on page 24*)

Home Again—a typical homesteading scene enacted by veteran Melford L. Woodword, of the Deschutes project, Oreg.

...d a home.

Modern residence near Tulelake, Calif.

WINTER IN THE WILDERNESS

OUR NATIONAL PARK SYSTEM—AND WINTER SPORTS THEREIN

by Isabelle F. Story
Editor in Chief, National Park Service

KING OF THE WINTER SPORTS—***On the beautiful Yosemite ski slopes in California.***

WHEN the National Park Service was created as a separate agency of the Department of the Interior, the Reclamation Service, as it was then known, had been in existence for about 14 years. As a big brother to the fledgling Park Service, it was especially helpful in furnishing photographs. This was a much-needed service which called public attention to the national parks, what they had to offer visitors, and their place in the national scene. Remember, this was before the days of wide-spread automobile use, before radio came into your homes.

Today, with both Bureaus well matured—the National Park Service this summer celebrated its thirtieth anniversary—the two agencies work more closely together than ever. As great lakes are formed in connection with power and irrigation projects, problems of recreational use arise, calling for careful planning and development. For, in the short span of 30 years, and particularly since the early thirties, the Park Service has become an acknowledged leader in the field of recreational planning.

In the early days of these two Federal Bureaus, national parks and monuments were located primarily in the West, many of them neighbors of reclamation projects. The western parks probably still are best known to the fortunate dwellers on reclamation areas. The scope of the National Park Service has grown, however, until its areas reach from the Atlantic to the Pacific Ocean; from the northern international boundary to the Mexican border; and up into Alaska and out into the Pacific to the Hawaiian Islands. In all, it includes 168 areas, among them the most spectacular scenery, stupendous mountain massings, interest-compelling scientific phenomena involved in world making and remaking. There are also significant historic areas connected with the history of man in what is now the United States from the time of the simple dwellers in caves and pits, through the development of extensive communal prehistoric dwellings on to modern times. Because of their variety, protection of the park areas, their maintenance and development for public use, and interpretation to the visitor, involve a working knowledge of nearly all the known sciences and techniques, from the study of fossils to the latest advances in radio communication.

In the first full travel year following the ending of the shooting war, with travel conditions and accommodations still an uncertain quantity, the number of visitors exceeded slightly the previous all-time high of 1941, reaching approximately 21,700,000. It is expected that during this winter those parks accessible to travel will draw many visitors, and attention is now being given to providing for winter sport use.

Most of the mountainous parks and all those of the North meet the requirements of the working skier. Those who ski for the fun of it may have to look around a bit for the right combination of topography, climate, and amount and type of snowfall. Here is a bird's-eye view of the wilderness parks in winter—their natural features, their accommodations, and their use.

The forested wilderness parks are unusually beautiful and inspiring in their winter setting of snow and ice. Mountains and valleys are transfigured; snow-laden forests offer striking spectacles. The opportunities for winter sports are superb and exhilarating alike to participant and to spectator. Outstanding among the accessible areas of heavy snows are Yosemite, Sequoia, and Lassen Volcanic National Parks in California; Mount Rainier National Park in Washington; Crater Lake National Park in Oregon; and Rocky Mountain National Park in Colorado. In them, facilities for snow sports vary almost as widely as does the scenery itself.

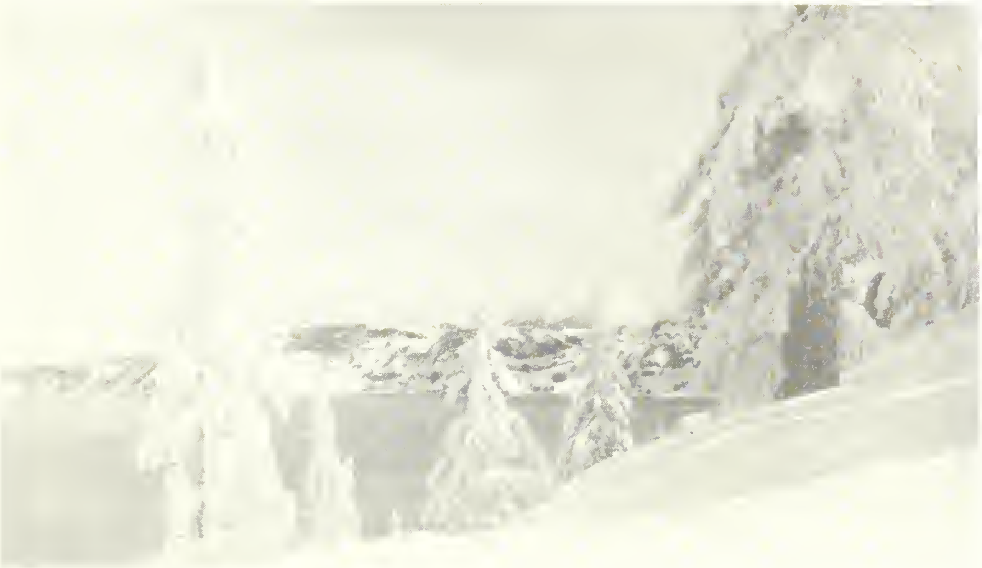
Yosemite Valley, in the park of the same name, has a breath-taking, dreamlike quality when cloaked in fresh snows. In the High Sierra above, the snows point up the beauty of Half Dome and other massive peaks. Yosemite Falls builds up a cone of ice. In the valley itself are the living accommodations and facilities for the milder sports—the skating rink, the toboggan slides, the horse-drawn sleighs and cutters, and the picturesque dog teams. The skiing center is high above the valley, at Badger Pass, only a short distance by motor. The broad terrace of the Ski Lodge there affords an excellent vantage point to watch winter activities. Beyond are the skiers on the main hill and on the "nursery" slopes. On the terrace itself, basking in the sun, one may lunch, wax skis, or just sit. The mechanical lift, called the "up-ski," takes skiers to a point where many of the runs start, nearly 1,000 feet above the Ski Lodge. A little way from Badger Pass is the Ostrander Lake ski hut, for the use of more advanced skiers. Some of the finest cross-country skiing to be had anywhere is in the Yosemite backcountry, but this is for experts only. Last winter nearly 82,000 persons visited Badger Pass, and during the skiing season which lasted from December to April approximately 106,000 visitors came to the park. It is hoped that the Ahwahnee Hotel, recently returned from duty as a Navy hospital, may be rehabilitated in time for the famous holiday Bracebridge dinner, an annual prewar event.

In Sequoia National Park, and the Grant Grove section of the Kings Canyon National Park, the giant sequoias are inspiring in their ermine-white mantles. Some of them have supported the snows for two or three thousand winters, possibly more. In keeping with the dignity of the big trees and the simplicity of developments in these two parks, winter sports are held to an informal basis. It is expected that overnight accommodations will be available again this winter, as before the war, and that family parties will continue to take advantage of the opportunities for skating, skiing, and tobogganing.

At Lassen Volcanic National Park, is our most recently active volcano (Lassen Peak, ceased its last eruption in 1921). With its fumaroles and hot springs, it is a queer quirk of nature that there is a longer skiing season there than at any other area in the United States. The terrain and snow conditions for skiing are, in the opinion of leading skiers at home and abroad, among the finest the world has to offer. Occasionally snow conditions permit a midsummer ski tournament. The problem of winter use is a comparatively simple one at Lassen, as much of the area developed for winter sports lies outside park boundaries. So do the overnight accommodations.

Crater Lake in winter is a fantasy of snow spendor. The great evergreens, bearing huge loads of snow, and the white-spattered colorful volcanic walls, frame strikingly the deep blue of the jewel-like lake. The roads into the park from the south and west are usually kept open with snowplows so that visitors may enjoy the view and that skiers may enjoy the slopes, steep and gradual, that afford skiing at various speeds. Simple meals and limited overnight accommodations, also emergency automobile service, probably will be provided this winter at park headquarters, as they were in prewar winters.

Mount Rainier National Park is another volcanic area. The great peak around which it centers—"The Mountain" to that portion of the Northwest—always is wrapped in heavy snows, and sustains an enormous single-peak glacier system that sends icy tentacles down into the forests below. Yet the hot breath of the dying volcano breaks through the summit snows. Paradise Valley in this park has been a popular winter center for several decades, and it is hoped that arrangements may be made to use it again this winter. Nature works against such use, as this high mountain valley becomes inaccessible without constant snowplow use when heavy snows come. Sometimes the drifts reach to the gables of Paradise Inn, and in mid-winter a tunnel must be cut through the snows to reach its door.



WINTER WONDERLAND—*Crater Lake National Park, Oreg.*

FINAL CHECK—*By skiers at Badger Pass Lodge, Calif., just before hitting the trail.*

SNOW SLUMBER—*Mount Rainier National Park, Wash.*

PUBLIC POWER and SMALL BUSINESS

WHAT THE AVAILABILITY OF LOW-COST PUBLIC POWER HAS MEANT TO SMALL BUSINESS AND INDUSTRY

by **FREDERICK P. ARPKE,** *Bonneville Power Administration, Portland, Oreg.*

There is a thrilling story about the way low-cost electric power is stimulating business enterprise throughout the entire Pacific Northwest—thrilling because it contains so much of the unexpected and because even the predictable future holds such great promise for still greater advances.

It is well known that throughout its entire career the Bonneville Power Administration, marketing agency for power generated on the Government's multiple-purpose projects on the Columbia River, has been opposed by certain interests whose chief argument was that additional electric power was not needed in this region—that Grand Coulee and Bonneville Dams would certainly become monuments to professional boondoggling—that they represented a sort of taxpayers' booby trap rigged up by scheming bureaucrats. Today these Federal projects can point to a brilliant war record that includes an important role in our phenomenal production of aluminum and magnesium and the planes themselves, plutonium for atomic bombs from the colossal Hanford project, ships that were spawned by the hundreds on the Columbia River, and a large array of miscellaneous products needed for prosecution of the war.

During the closing days of the war the same prophets of gloom predicted an almost complete collapse of industrial activity in the region and again urged a cessation of further construction of Federal power projects on the Columbia. But, again, their predictions have proved to be completely unrealistic, and their recommendations amount to placing this region in an economic strait-jacket—a planned economy in which the future has been overlooked. For the Pacific Northwest is in the midst of a business boom characterized by a long-overdue interest in manufacturing and processing which, believe it or not, is actually bringing the region face to face with a power shortage—the last thing that most persons would have expected.

A careful analysis of economic trends and potential load growth indicates the need for a speed-up in the construction of additional multiple-purpose projects on the Columbia River and its tributaries if we are to continue to provide adequate power facilities well in advance of actual market needs. Continuation of this policy is considered of fundamental importance by the Bonneville Power Administration in its program of making low-cost power an effective tool in developing the latent economic opportunities of the Pacific Northwest.

Ever since pre-Revolutionary days, when industry began clustering around the waterfalls of Massachusetts and other maritime colonies, manufacturers have gravitated toward a cheaper source of power, raw materials, or labor. Thus, we have the textile industry, with its high ratio of man-hours, migrating to the South to take advantage of cheap labor, while the electroprocess industries were attracted to Niagara Falls with its cheap power, and the shoe industry found itself drawn irresistibly nearer its raw material source. There is no reason to doubt the fact that the same fundamental factors are operating today—and we have only to look at what is happening in the Tennessee Valley and the Columbia Basin for an example of how low-cost power can revise the industrial directory of a region. But there are some who have refused to concede the pulling qualities of cheap power—and, strangely enough, these doubts have been expressed and advertised commercially by certain electric utility companies. Although the motive for this action is well understood, the unfortunate result is further confusion on the part of the layman as to just how low-cost power can serve to stimulate industry.

One of the most spectacular instances of industrial migration has been the way in which low-cost power has attracted electroprocess industries to the Pacific Northwest. These are the industries in which the consumption of electric energy is unusually great, running all the way from 30 to 75 kilowatt-hours per dollar value of product. In this group are aluminum, magnesium, electrolytic zinc, the ferro-alloys, calcium carbide, electrolytic caustic soda, and chlorine. These are precisely the industries which have been established in the Pacific Northwest during the last 10 years, the investment in which has already exceeded the total investment in the multiple-purpose projects that supplied the low-cost power for their operation. In describing these industries the National Resources Planning Board, in its study of "Industrial Location and Natural Resources," published in December 1942, stated in chapter 7 that: "The specifically power-oriented industries are few in number and limited in character. But where low-cost power and electroprocessing raw materials occur in conjunction, the ground work exists for industrialization on a substantial scale. This combination is the key to policy in industrial development around the public power projects of the Northwest and the Tennessee Valley."

That this ground work has been firmly established in the Pacific Northwest is amply demonstrated by the rapid growth of subsidiary industries since VJ-day. The aluminum industry provides an excellent example. Scores of small manufacturing establishments are producing a wide variety of products from the aluminum produced in Northwest plants. Although low-cost Columbia River power made it feasible to refine aluminum in the Northwest that would stand high shipping costs to eastern fabricators, the vision of a completely integrated aluminum industry within the confines of the region has always been a principal motivating factor. Recent developments have exceeded even the fondest expectations. A preliminary examination of the Portland district alone indicates between 30 and 40 manufacturers of a wide variety of aluminum products including trailer and truck bodies window frames, irrigation pipe, griddles, pots and pans, sporting equipment, furniture, and castings for a variety of industrial uses. This list can be duplicated in Spokane, Seattle, and Tacoma—not to mention a considerable number in smaller towns scattered throughout the region. The aluminum industry is sinking its roots deep, and a gradual expansion in employment opportunities directly and indirectly connected with this basic product is bound to continue.

But what about the small power user? How does low-cost power affect him? Here the story is even more fascinating than in the case of the larger, more dramatic examples, because it is becoming clear that today we are in the midst of a revolutionary change in electric power utilization—one that is strikingly analogous to a similar change that took place 30 years ago and was brought on then largely by the demands of World War I. For it was the pressure of wartime steel scarcity that hastened the disappearance of the old inefficient factory with its multiplicity of overhead steel drive shafts, long flapping belts, and pulleys used to transfer energy from the central power plant to the machine. The system was so grossly inefficient and wasteful that a serious scarcity in steel for shafting was all that was necessary, in many cases, to tip the balance in favor of direct motor drives on individual machines. The advantages in economy, in flexibility, and over-all efficiency were so great that within a short time the old drive shaft became a museum piece.

Until recently, industrial methods of transferring heat, necessary in so many manufacturing processes, have remained in about the same relative stage of development as the drive shaft represented in transferring motive power. The central boiler, with its maze of insulated pipes transferring heat in the form of steam to various parts of the plant, is still a common sight along with a variety of other equally cumbersome devices. But in the modern factory, all this is changed—provided there is availabile low-cost power. For it is much more convenient to bring electric energy to the machine and there transform it into thermal energy by means of either electronic devices or resistance elements. These devices are proving to be much more flexible, more versatile, more easily controlled, speedier, and altogether more economical. A few examples will serve to illustrate the advantages: a nationally known company manufacturing shoe grease in McMinnville, Oreg., has replaced oil burning steam boilers with an all-electric process designed locally. Another company found that by the use of an electric steam box it was possible to form certain intricate wood and plastic shapes into an improved design for a Columbia River fishing boat. These boats are now being turned out at the rate of several a month, and fishermen claim that they are far superior to the old type. Not only are the new boats more economical than the old craft, but they are able to navigate water at a speed that could never be attained previously. The result is increased income to the operator, and a new boat manufacturing industry.

The experience of a small glove plant in Centralia, Wash., is typical of the large number of small businesses that require intermittent and usually small supplies of steam. The use of an electric steam generator has made it possible for this manufacturer to produce a high-quality glove without having to install expensive generating equipment. The experience of a cheese company in Stevenson, Wash., is typical of hundreds of food-processing plants that are switching to electric power principally for the advantages of cleanliness and sanitation, but finding that in the process they are actually saving money. The Stevenson plant is an all-electric plant where electric water heaters and steam generators have replaced a wood-burning steam boiler. Before making the change, the steam cost of this plant was about $230 per month. During 18 months of operation, the power bill for the completely electrified plant has not exceeded $80 per month. Other food processing plants that have experienced the stimulating effect of a completely electrified operation include milk-drying plants, a glucose plant which uses cull wheat and potatoes as a raw material, dehydration plants, canneries, grape-juice factories, etc.

Columbia River power puts speedy craft like this on the small business horizon.

The all-electric industrial plant is here. It has a special attraction for small industries with limited capital to invest in power equipment and a strong desire, backed by sound economic considerations, to buy all of their power, steam, and heat "over the wire." And it will certainly have just as much significance for the small industry manufacturing electroprocess equipment as the all-electric home had for the manufacture of appliances.

Without really low-cost power, most of the applications in the electrothermal field could simply not be considered. With low-cost power, however, a completely new field of activity is open to private enterprise, resulting not only in better ways of making the same product but of ways and means of making completely new products.

There are few industries in the country that are experiencing a more rapid increase in business activity than the manufacturers and distributors of farm equipment, and in the Pacific Northwest one of the "hottest" lines of farm equipment is that which is related to farm electrification. For example, at least a dozen firms, some of them completely new undertakings, are now manufacturing irrigation pipe and sprinklers to satisfy a growing demand for supplemental irrigation. Much of the irrigable land in the

This water-powered feed grinder is a far cry from the old-time hand-powered method.

No coal problem in the Northwest with this hydroelectric powered fireplace.

Pacific Northwest is of the type that can never be satisfactorily irrigated by a gravity system. Electricity is solving the problem by bringing the water to these areas via an electric power line, plus a low irrigation pumping rate. Thus, an irrigation project at The Dalles, Oreg., will use electrically driven pumps to irrigate 4,600 acres of orchard land and 1,800 acres of farm land. Pumping power rates are sufficiently low and flexible that with efficient apparatus it will be possible to use 126 kilowatt-hours per acre-inch pumping against a 700-foot head. For every difficult case such as this, there are scores of others where the problem is relatively simple. Aluminum pipe, also manufactured locally, has eliminated much of the labor cost in moving sprinklers; and when added to a low-cost power rate, the combination is unbeatable.

The electric hay drier has already proved itself in the Tennessee Valley, and is now doing the same in the Pacific Northwest. Not only is it making hay growing feasible in particularly moist areas where natural drying is difficult, but also it is producing a superior product with a much higher protein content that is claimed to more than make up for extra costs in processing.

The importance of electric power as a tool in stimulating new enterprise in the Pacific Northwest has been emphasized in recent years by significant changes that have taken place in the supply and price of competing fuels. Oil from California and sawdust waste from northwest mills have been the traditional stand-bys. Both have risen in price, while electric power rates have continued their downward trend. The result is a steady widening of the area within which electric power is an active competitor. It should be remembered that electricity becomes competitive with other energy sources before the cost relationship is in exact balance—principally because of the many advantages of versatility, cleanliness, controllability, etc.—the point at which it can be substituted depending upon the nature of the industrial process. Thus, a food industry will attach considerable value to the advantages of sanitation. Here electrification can be responsible for a superior product, and, therefore, what amounts to a new industrial opportunity with increased jobs and investment.

In a similar way electrification is extending business opportunities in the Northwest's chief activity—lumbering and wood processing. The completely electrified sawmill is rapidly becoming a common sight. It promises to be much more common as sawmills abandon the practice of generating their own steam and electric power by firing boilers with sawdust and other wood waste in favor of cheaper central station power. By doing so they eliminate their most serious fire hazard, save a high fire insurance premium, secure a dependable power source with no investment in generating facilities, in many cases pay less for the actual power itself, and also secure the use of an important raw material that used to be wasted but which has suddenly become valuable in the manufacture of pulp for paper, coating for plywood, industrial alcohol, and a growing list of other items. Here again electricity has released a raw material that can now become the basis for a large number of new and growing industries, most of which will themselves use electricity as their exclusive power source.

Low-cost electric power is responsible for another minor revolution in the Pacific Northwest, this time in the heating of homes. The idea has caught on in a big way. Power company officials agree that the only limiting factor at the moment is the capacity of distribution lines which must be almost completely rebuilt to take care of the huge potential market. This development is creating a group of new industries for the manufacture of space heating equipment. Within the last year at least five manufacturing plants have been started in the Portland area alone for the production of a central type heating unit. The same thing is happening in the other metropolitan areas of Seattle, Spokane, and Tacoma, Wash. This is in addition to the many other approaches to the problem of space heating, such as the conventional wall heater, panel heaters, floor and ceiling radiation, etc., all of which are being actively experimented on in this region. The modern home of tomorrow in the Pacific Northwest will definitely be electrically heated, and probably by a device designed and manufactured in a new industrial plant yet to be built in this region.

After watching the effects of low-cost power in the thousand and one new applications where it is being accepted, one sees that here is a new source of energy that is affecting business—large and small—in somewhat the same way as a blood transfusion can stimulate a recuperating patient. This new factory will gradually make itself felt in every part of the Columbia Basin where low-cost power is available, and small industries are bound to be the principal benefactors.

A nonbackbreaking cranberry picker in operation.

PHOTO CONTEST WINNERS

If you have been wondering what inspired many avid camera fans to devote considerable time to obtaining unusual photographs during the past summer and fall, here is what they were shooting for: the Bureau of Reclamation camera contest.

Photographs by Ray M. Reynolds, photographer of region V, Amarillo, Tex., won first and second place in the professional class. George O. Bonawit, photographer of region III, Boulder City, Nev., won third place in that class. The best picture of all classes in the amateur competition was one by Howard L. Kink, engineer at Parker Dam. The contest closed September 1, 1946.

Awards were made in 8 of the 10 subjects listed in the announcement of the contest. The winners in each subject are:

1. Irrigation farm—Taylor J. Leaming, engineer, Denver, Colo.
2. Recreational benefits—Howard L. Fink.
3. Electric power production—Mr. Leaming.
4. Flood or drought—John E. Bernhard, draftsman, Ephrata, Wash.
5. Life on an irrigated farm—Joseph W. Gorrell, electrician, Grand Coulee Dam.
6. Engineer at work on project—H. E. Winchester, geologist, Salt Lake City, Utah.
8. Workmen (action picture)—Faye E. McCumber, chief power house operator, Cody, Wyo.
10. Mechanical equipment—Bert F. Wilson, engineering draftsman, Denver, Colo.

No awards were made under subjects 7 and 9.

Honorable mention was given to LeRoy Parks, gate tender, Morton, Wyo., and to Harold R. Lee, power manager, Denver, Colo.

The first place winners in each group will receive certificates of merit. A traveling exhibit composed of the best photographs submitted will be sent to all regional headquarters, and to the larger project offices. The prize winning pictures appear in this issue of RECLAMATION ERA, and outstanding pictures will be used by other publications.

FIRST PRIZE—*Mr. Reynolds' unusual shot of hydrographer E. E. Cerny in the middle of Conchas Canal, N. Mex., measuring the water flow.*

SECOND PRIZE—*Mr. Reynolds catches the lighter side of multiple purpose development in a fishing scene on Altus Lake, near Altus Dam, Okla.*

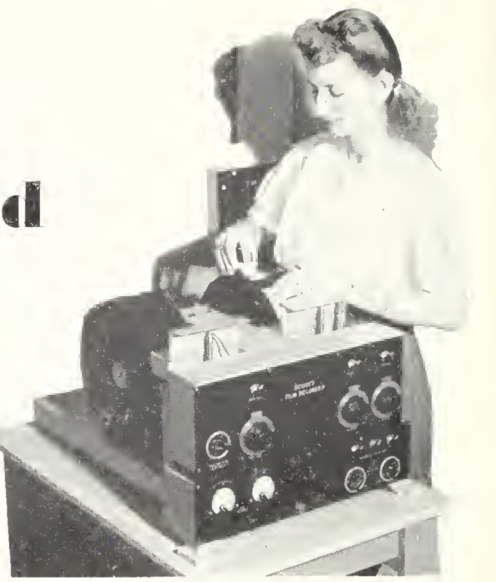
THIRD PRIZE—*Mr. Bonawit's composite photo of the Arizona Canal, with the roadway on the side and the mountains in the background, presents a serene irrigation setting.*

FOURTH PRIZE—*Mr. Fink's study in animal life. A group of desert bighorn sheep near a summit of the Buckskin Mountains of Arizona.*

An Earthquake Is Recorded

by Dr. D. S. CARDER, *Geophysicist, Coast and Geodetic Survey, Department of Commerce,*

and THOMAS C. MEAD, *Chief, Program and Reports Unit, Region III, Boulder City, Nev.*



Do the tremendous loads imposed on the earth's crust by reservoirs behind large dams such as Boulder, Grand Coulee, and Shasta cause local earthquakes and, if so, is there a chance that these earthquakes may be of destructive nature?

Perhaps the first time that the Bureau of Reclamation had this question posed was when authorization was sought for the building of Boulder Dam. Opponents to the building of a high dam asserted that the large reservoir created would be the cause of severe earthquakes. From general engineering principles the engineers and geologists of the Bureau of Reclamation expected some measurable yielding of the earth's crust but not of hazardous proportions—otherwise the building of Boulder Dam would not have been considered. But being practical scientists, the Bureau engineers and geologists proposed to measure exactly what took place so as to have the answers in case larger dams and reservoirs should be proposed.

To carry out this program the Bureau of Reclamation first cooperated with the Coast and Geodetic Survey in the installation of strong motion accelerographs at Boulder Dam. Then the Bureau entered into a formal cooperative agreement with the Coast and Geodetic Survey to operate seismographs in the Lake Mead area to locate the origin of earthquake shocks and establish their relationship to the dam. The National Park Service cooperated in the latter work. More recently similar programs on a lesser scale have been instituted at Grand Coulee and Shasta Dams, one seismograph being installed in each locality.

It may be well to explain that a seismograph is an instrumental assembly for recording earth vibrations or waves. A complete seismograph station, such as the one at Boulder City, will have instrumental devices to pick up earth waves or vibrations in three directions at right angles. From the pick-up devices the earth vibrations are transmitted electrically to a recorder which photographs on movie film each of the vibrations as the path of a vibrating beam of light.

In every well-defined earthquake the record will show several different recognizable types of earthquake waves, each of which travels at a different speed. From the difference in time of arrival of the first two types of earthquake waves, the distance of the seismograph station from the point of origin of the earthquake shock can be determined. When the station is equipped to record motion in three directions at right angles the direction of the earthquake origin also can be determined.

To measure earthquake forces at Boulder Dam three strong-motion accelerographs were installed in and near the dam. These are special type seismographs which record vibrations during strong earthquakes only. They are especially designed to facilitate determination of acceleration, knowing which, an engineer can compute the force exerted by the earthquake on an engineering structure.

Nearly all earthquakes are vibrations caused by the rupture of the earth's crust along some line of weakness, termed as a "fault." The point of rupture may be on the surface or any distance below the surface up to several miles. It is of importance to know where active faults are. Ordinarily, important engineering structures will, if at all possible, be located so as to avoid active faults.

To locate the active faults in the Lake Mead area, three seismograph stations were constructed at Boulder City, Nev., Pierce Ferry, Ariz., and Overton, Nev. These stations form the vertices of a nearly equilateral triangle enclosing Lake Mead, which triangle serves as a convenient framework from which to locate the origin of the various earthquake shocks.

In the Boulder Dam area the first earthquakes recognized as such were felt late in 1936. The first seismograph was installed in 1938. Since 1936 about 550 shocks have been felt by local residents, and since 1938 about 4,000 have been recorded by the seismograph station in Boulder City. The heaviest shocks were barely strong enough to crack plaster or overturn unstable objects; the smallest shocks recorded were only equivalent to the explosion of about 100 pounds of dynamite at a distance of several miles. The energy of all of these shocks put together would be less than one percent of the energy expended by any one of the destructive earthquakes which have occurred in recent years elsewhere in western United States.

There is fairly definite evidence that a large number of small shocks were caused by the settlement of the floor of the reservoir under the great load which was placed fairly suddenly upon it. This load was over 40 billion tons at the time of highest water in 1941. The earthquakes were first felt after the reservoir had partially filled and, until 1942, maximum earthquake activity was definitely associated with seasonal peaks in water load. This association has not been so evident since 1942; but following 1942 the seasonal peaks have been relatively low. The points of origin of about 400 earthquakes in the Boulder Dam area have been located. These have been heavily concentrated in the general area of the lower lobe of the Lake Mead reservoir, or that part of the lake between Boulder Canyon and Boulder Dam, which part contains about 30 percent of the total weight of the water. Most of these earthquakes have their origin along the base of the granitic mountains which lie southeast and southwest of this part of the lake. Precise levels that were run when the reservoir started to fill, and again after it had filled, indicated that during the interim the lake basin had settled several inches with respect to the bordering mountains. This settlement is probably along faults which separate the mountains from the lake basin. We have then the direct cause of local earthquakes, namely, the slipping of the loaded lake basin along faults which separate the basin from the adjoining mountains. It is of interest to note that all of the active fault zones bypass Boulder Dam by at least a mile.

At Shasta Dam the water load is not nearly as great, although several known faults are located in the vicinity. In 1944, when the reservoir started to fill, a swarm of local shocks was recorded on the nearby seismograph. Some of these were strong enough to be felt. It may be possible that the added impulse or trigger force which set off these shocks was supplied by the sudden load on the reservoir but, if so, this action soon expended itself because since 1944 few shocks which could be attributed to reservoir loading have been recorded, even though the total load has been somewhat greater.

At Grand Coulee Dam no known faults are near the dam: the dam is in a relatively unfractured formation. Hence the load of the reservoir would be expected to bend the earth's crust downward a small amount rather than rupture it along faults: there would be no sudden yielding resulting from the load, and few, if any, local earthquakes would be expected to occur. The records of the seismograph bear out this supposition. Few local earthquakes of any consequence have been recorded.

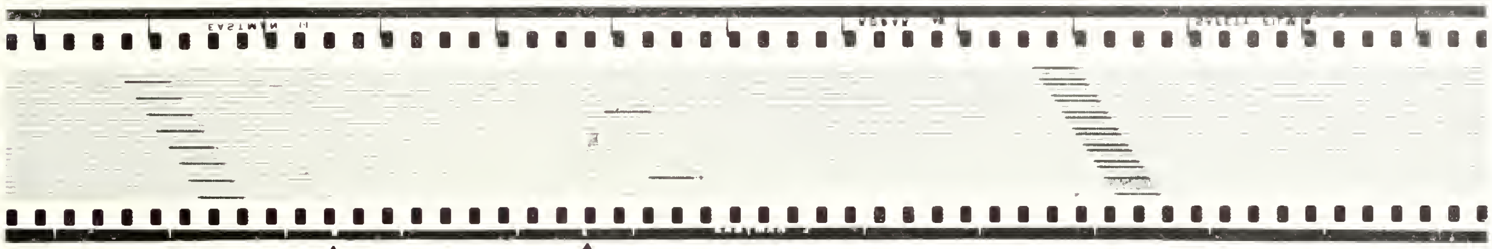
It appears that some of the answers we have been seeking are shaping up:

(*a*) In the Lake Mead area, earthquakes are associated with definite faults, none of which happen to be nearer than one mile to Boulder Dam or other important structures.

(*b*) A reservoir in the process of filling can be responsible for small earthquakes if conditions are right: namely, the load must be concentrated over a relatively small area and the underlying rock must already be fractured along definite fault lines, produced by large dynamic forces of the geologic past. Unless the rock is already faulted, loading alone will not produce earthquakes, for the extra load of the reservoir water is too small to cause new faults.

(*c*) If an area is visited by a severe earthquake, the earthquake would have occurred regardless of reservoir loading, because forces sufficient to produce a shock of this type are disproportionately greater than the inconsequential load of any reservoir which man can make.

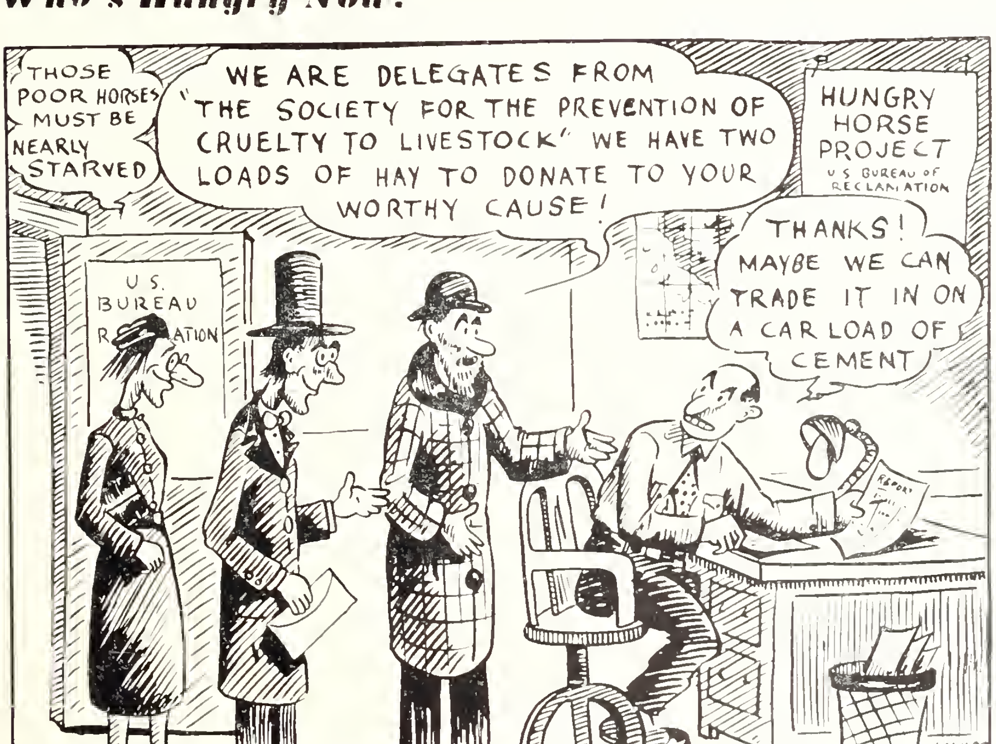
Recording of an earthquake at Boulder City, March 14–15, 1946



About mid-height of record—felt local earthquake originating approximately 5 miles from Boulder City seismograph station.

Near bottom of record—trace of strong California earthquake originating about 175 miles from the Boulder City seismograph station.

Who's Hungry Now?



With massive Hungry Horse Dam about ready to become a leading figure in western Montana's economic life, an enterprising Columbia Falls newspaperman decided it was high time to make a few discreet inquiries into the giant's parentage. Specifically, he set out to learn for whom the structure, and the small creek which flows into the South Fork of the Flathead River at the dam site, were named.

It should never have been a secret. Hungry Horse Dam and the creek which bears the same title were named after two fine horses—Jerry and Tex. Years ago, in the winter of 1900–01 to be exact, David and William Prindiville were freighting oil drilling equipment from Belton, on the Great Northern main line, to a spot up the Flathead's North Fork, where there was an oil rush on at the time.

One day they had just crossed the South Fork of the river on their way to Columbia Falls when they discovered that two horses—Jerry and Tex—were missing. A month later, the horses were found belly-deep in snow and "nothing but skin and bones." A trail had to be broken and oats fed to the horses before they had strength enough to walk out.

Thus the name Hungry Horse. But the story has a happy ending and both Jerry and Tex, like their namesake to be, performed valuable services to the community. For many years Jerry pulled a Kalispell fire engine while Tex drew a delivery wagon for the Kalispell Mercantile Co.

(Editor's note: For the complete story on Hungry Horse see the February issue of the ERA.)

Contract awards soar as a result of the recent increase in the Reclamation construction limitation by the Bureau of the Budget. Contracts have been awarded for more than 22 million dollars covering construction, equipment, and supplies. Nine contracts were included in the total and five projects were affected. They are Columbia Basin, Central Valley, Colorado-Big Thompson, Deschutes, and Tucumcari. More than $16,000,000 of the total awarded will be spent on Columbia Basin, the largest job being the Potholes Dam, a key feature of the development costing more than $9,000,000. Other work includes the construction of the first section of the East Low Canal, and Long Lake Dam on the Columbia Basin project, further construction on the Delta-Mendota Canal project, the Central Valley project, the Hudson Canal and lateral system unit No. 5 on the Tucumcari project, penstocks for Mary's Lake and Estes Park power plants of the Transmountain Colorado-Big Thompson project, and additional construction work on the North Unit Main Canal of the Deschutes project. These represent the largest bulk of awards since the quarter ending with the close of the 1946 fiscal year, June 30, 1946.

Marshall Ford Dam's supervision is localized in keeping with the Bureau's decentralization program. The general supervision of Marshall Ford Dam in Texas has been transferred from the chief engineer's office in Denver to region V director, Wesley R. Nelson, at Amarillo, Tex. As a result the people affected and benefited by the Reclamation development will have a better opportunity to contact the official in charge, the primary objecive of decentralization. Detailed operations will remain under the supervision of the lower Colorado River authority of Texas.

International commission on high dams is being reorganized. The following have been nominated to serve on the Executive Committee: Michael W. Straus, Commissioner of the Bureau of Reclamation; S. B. Morris, general manager and chief engineer, department of water and power, Los Angeles, Calif.; J. L. Savage, consulting engineer, Denver, Colo.; C. P. Vetter, Chief, Office of River Control, Bureau of Reclamation, Boulder City, Nev.; and F. A. Banks, district manager, Bureau of Reclamation, Coulee Dam, Wash.

Columbia Basin lands acquired.—Purchase of almost 50,000 acres of land from the Columbia Highlands Co. under the Columbia Basin Project Act is now under consideration. If the purchase materializes, it will be the first large acquisition under the act. Almost 14,000 acres had been purchased by early fall and offers to buy had been sent out during July to landowners who will be included in the initial irrigation blocks comprising the Quincy-Winchester-Ephrata areas in the northern part of the project, and Pasco pumping locality at the southern end.

Story of the year—We nominate for the "Story of the Year" the following conversation reported at last year's celebration near Coeur d'Alene, Idaho, marking official delivery of water to the 3,500-acre Post Falls unit of the Rathdrum Prairie project.

Ernie Jorgenson, farm editor of radio station KFPY, Spokane, was interviewing two young boys, ages about 5 and 7, prior to broadcasting the official ceremonies. The conversation went something like this.

JORGENSON. "And here we have two young gentlemen who are helping to celebrate the delivery of water to this fine project. Tell me, what do you think of this irrigation, Jimmie?"

JIMMIE. "Boy, it's great."

JORGENSON. "And what about you, Tommie?"

TOMMIE. "My dad says we'll all make good now and maybe I can go to college."

JORGENSON. "Tell me, Jimmie, what do you expect to grow now that you have the water?"

JIMMIE. "Oh, potatoes, alfalfa, hay, beans, and wheat."

TOMMIE. (Speaking aside to his companion) "You dope, don't you know they don't grow wheat on an irrigation project?"

Grand Coulee's left powerhouse came a step closer to completion as the Westinghouse Electric Corp. was recently awarded a contract for the last three of nine 40,000-kilovolt-ampere transformers and component parts for use in hydroelectric power development. The last three generators required to complete the powerhouse are now being built. This will only constitute half of the ultimate power output from the dam, as the left powerhouse ultimately will also have 9 generators, making a total of 18 108,000-kilowatt generators in the complete system. These machines are the largest hydroelectric generators in the world.

High price of construction calls for a thorough study of how much money water users are putting back into the coffers of the Federal Government in return for the benefits of reclamation, and on the other side of the coin how much they should have to pay in the future. This is the result of a report submitted to the Secretary stressing the need for this study before new reclamation legislation may be considered.

Bureau to operate Buffalo Rapids under a memorandum of understanding between the Departments of Interior and Agriculture. The Second Division of Buffalo Rapids project, Montana, has been designated as a WCU project under the act of October 14, 1940, as amended. Through this designation the Bureau of Reclamation is responsible for the operation and maintenance of the irrigation works and for the formulation and administration of the necessary repayment contracts relating to irrigation works constructed by the Bureau of Reclamation.

Wanted! Asce Proceedings and Transactions.—If you have any copies of the American Society of Civil Engineers Proceedings or Transactions, please send them to the Bureau of Reclamation library in Washington, D. C., to help complete our files. The Bureau's library is visited and used by engineers from all over the world. You will be contributing to engineering knowledge by helping the librarian to maintain a full record of the proceedings and transactions of this important group of scientists. The volumes desired are as follows:

TRANSACTIONS:

- Vol. 89—1926
- Vol. 96–100, inclusive—1932–1935
- Vol. 108—1943
- Vol. 109—1944
- Vol. 110—1945

PROCEEDINGS:

- Volumes 58–61, inclusive—1932–1935
- Vol. 62, No. 1–5, inclusive—1936
- Vol. 63, No. 4—1937
- Vol. 64, No. 2, No. 4, Pt. 2—1938
- Vol. 65, No. 10—1939
- Vol. 66, No. 4, Pt. 1, No. 9—1940
- Vol. 67, No. 2, No. 7—1941
- Vol. 70, No. 9, No. 10—1944
- Vol. 71, No. 2, No. 3, Pt. 2, No. 4, Pt. 2, No. 8, No. 9, No. 10—1945
- Vol. 72, No. 1, No. 6—1946

Mail them to the United States Department of the Interior, Bureau of Reclamation Library, Washington 25, D. C.

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Approved Missouri River plan map.*—Color map of reservoir and dam sites in the basin construction program in Colorado, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

2. *Annual Report of the Commissioner, Bureau of Reclamation, to the Secretary of the Interior* (for the fiscal year ended June 30, 1945).

3. *Maps of seven States showing water resources development of the Missouri River Basin.*—Maps of Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming with locations (in color) of dams, reservoirs, canals, irrigable areas, and other works proposed as parts of a unified plan for the development of the water resources of the Missouri River Basin. (Also available from regional directors, Bureau of Reclamation, region VI, Billings, Mont., and region VII, Denver, Colo.)

3. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Table showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

4. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

5. *Fourth Report of Operations Under the Boulder Canyon Project Adjustment Act for Year Ended May 31, 1945*, published January 4, 1946. Fourth annual financial statement of the Commissioner of Reclamation transmitted to the Secretary of the Interior concerning operation, maintenance, and construction activities of the Boulder Canyon project during the year ended May 31, 1945. Ten cents a copy.

6. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals*, by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, seven-page mimeographed study with graphs.

7. *Settlement Opportunities on Irrigated Farms.*—The outlook for veterans and others who would homestead on irrigated public land or purchase an irrigated farm. (Also available from your nearest regional director.)

8. *Boulder Dam.*—Illustrated folder on the world's highest dam. (Also available from the regional director, region III, Boulder City, Nev.)

Available from the Superintendent of Documents, Washington 25, D. C.

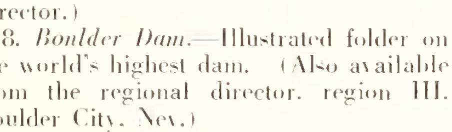
1. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

2. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest releases are:

Problem 14, Financial Aid for Settlers—25 cents.

Problem 23, Rural and Village Electrification—25 cents.

Problem 26, Recreational Development of Roosevelt Lake—75 cents.



Miscellaneous Publications

"500-Mile, 230-Kv. Series Compensated Transmission," by S. E. Schultz, chief engineer, Bonneville Power Administration, in *Electrical World*, August 17, 1946, page 70. Bonneville Power Administration study in the theoretical and practical aspects of series capacitance in long 230-kilovolt lines as solution to power transmission from remote hydrodevelopments.

Physical Land Conditions in the Matanuska Valley, Alaska, by W. A. Rockie, Soil Conservation Service, Department of Agriculture. Physical Land Survey No. 11, issued in 1946. 32 pages with illustrations. Bulletin contains brief descriptions of the physical features, climate, native vegetation, and existing agriculture in the Matanuska Valley, Alaska. 15 cents a copy from the Superintendent of Documents, Washington, D. C.

"Standardized Turbine Generator Units," by J. R. Carlson, Central station steam engineer, Westinghouse Electric Corp., in *Public Power*, September 1946, page 8. Illustrated. The author discusses whether "turbine standardization is just another restriction inflicted upon us, or if it is an actual benefit to users of electrical equipment."

Proceedings of California Water Conference, compiled by Irvin M. Ingerson, associate hydraulic engineer, Division of Water Resources, Department of Public Works of the State of California. A record of the California Water Conference of 1945, called by Governor Earl Warren, and held in the State Capitol, Sacramento, on December 6 and 7, 1945. 504 pages with alphabetical list of registered attendance and index of speakers. For further information write to the Division of Water Resources, Department of Public Works, State of California, Sacramento, Calif.

"An Engineering Approach to Construction Safety," by Robert L. Moore, staff representative, construction section, in *National Safety News*, August 1946, page 32. Illustrated. The importance of a sound and well-planned safety program as a means of preventing accidents on construction jobs. (*National Safety News* is a monthly publication of the National Safety Council, Inc., Chicago, Ill.)

Prewar World Production and Consumption of Plant Foods in Fertilizers, issued by the Bureau of Plant Industry, Soils, and Agricultural Engineering, Department of Agriculture, Miscellaneous Publication No. 593, April 1946. Twenty cents a copy from the Superintendent of Documents, Washington, D. C.

"Man vs. Atom—Year 1," by James H. McGraw, Jr., president, McGraw-Hill Publishing Co., Inc., in *Power* August 1946, page 91. Illustrated.

Homesteading—Then and Now

(*Continued from page 13*)

seven towns the Government had laid out.

One clerk later reported that he registered a blind man. Dubious as to how he could make the race, he was told that the man would stand on the line, make one jump as the gun was fired, and plant his flag. He, with others, spent 2 or 3 days in the line, sleeping on the ground. Hot winds were blowing, and sand dust billowed in clouds. The heat was terrific during the day and the nights were cold. Water was scarce. Still, the registration system, though bringing hardship to many because of the conditions that arose, probably prevented many frauds. Though it was every man for himself, chivalry was not missing. At one booth several ladies asked to be allowed to register without standing in line. A red-headed Kentucky colonel spoke to the crowd and pleaded for the ladies. The men consented. In a few moments, 986 women were in line. The eyes of the men began to bulge, some groaned, but on the whole they faced the racket quite well.

When the race began, some 150,000 persons were on the line. They went helter-skelter. There were young and old of both sexes, the strong, the sick, the crippled, deaf, dumb, and blind. Some went on horseback, some in vehicles of every conceivable description, and of no description, some by train, and some on foot.

The trains were loaded. Every inch of the rooftops was covered and many hung from the sides, holding to window sills. First one man dismounted and planted his flag. In an instant, another. Then perhaps a woman and then in a moment more they were dismounting by the hundred. They came down like raindrops. They were here, there, and everywhere. Now and then a sooner (a person who went on the land too soon) would be found. Gunshots often settled the issue.

Tricks, subterfuge, and strong-arm tactics were prevalent even though the Government had set up a careful system to adjudicate conflicting claims. One man, seeing a woman behind him on the same piece of land, left it and ran for another. When he was out of sight, the woman pulled off her wrapper and there stood a man, in full and indisputed possession of a nice tract of land.

At noon when the race started, not a house or tent could be seen except the land and postoffices and a few small railroad houses. In a few hours large towns were in working order, under tents, and making preparations to annex the suburbs. One night a man slept on the ground. The next, he was in the second story of a bunkhouse. The "wild west" scenes that were enacted have been recalled to many through story and song. And by 1894, Oklahoma had a population of 212,000, and a university and other schools in full operation.

As the surveyed public lands gradually were being settled and turned over by the Government to its people, there slowly evolved a conservation and reservation theory in public land administration.

When the Reclamation Act of 1902 was enacted, much of the land and resources that the pioneer could develop without help had been settled. The Reclamation Act provided for construction of reservoirs and water-supply ditches to irrigate arid lands where the problem of water supply was too big for private interests to solve. Other expressions of this theory were the reservation of large areas for forest reserves, wildlife preserves, the withdrawals of mineral lands, and extensive classification of the soils.

An important factor was the desert land act which disposed of about 10,000,000 acres of desert and semidesert lands in Western States, useless without irrigation.

By 1940, the public domain remaining in the United States was 402,000,000 acres title to more than 1,000,000,000 acres had passed from the United States to private individuals. Of the remaining 400,000,000 acres, 203,000,000 acres were set aside for forests, national parks, Indian lands and reservations, and military, naval, and miscellaneous reservations. Grazing districts accounted for another 135,000,000 acres. About 123,000,000 acres are still unsurveyed, much of it mountain and desert land without much likelihood of becoming arable or otherwise useful to industry and agriculture.

The World War II veteran does not have the same frontier in lands that other servicemen of previous wars had. But there is a frontier, not so extensive but nevertheless one of profit to the settler, in the reclaimed lands irrigated by Reclamation Bureau projects. It is these which are giving the serviceman first, and others later, the opportunity of the past. Further, the modern settler's opportunity is richer and fuller.

The greater certainty of sufficient water for the crops is a basic element. Very few lands still unclaimed by the people can be farmed without irrigation. The sufficiently watered areas have long since been settled. Further, in certain sections to be opened, such as at the Heart Mountain division of the Shoshone project in northern Wyoming, the settler will receive the coordinated help of Federal and State agencies. The nature of help that the Bureau of Reclamation can give, beyond creating reservoirs of water by its system of dams and canals, is specifically stated by legislative and executive actions of the Government. Nor will these actions permit such help in all areas. Therefore, the Bureau may assist at times in clearing and rough leveling of land and roughing-in drainage systems. Beyond that, the Department of Agriculture and the State agricultural agencies can advise on soils, crops and general agricultural problems. The net result will be that the settler will get a quicker start in bringing the new farm unit into profitable production, and begin to repay construction charges and other expenses the Government is meeting.

No wonder then, that the rampaging homesteader of earlier years, elbowing rivals from a tract of land, might gape at the new order. The old land frontier is gone. But the frontier that now exists on irrigated farms still is one of opportunity to add to the stability and economic gain of many thousands of our people.

OUR BACK COVER

On the Way to Paradise Valley

Beautiful? Yes—but no place for a tenderfoot. The long trail from Mount Rainier to Paradise Valley in Mount Rainier National Park, Wash., looks very inviting, and is—provided you are in condition for some real outdoor exercise.

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U. S. GOVERNMENT PRINTING OFFICE 1947

Notes to Contractors

Contracts Awarded During November 1946

Spec. No.	Project and State	Date of award	Description of work	Contractor's name and address	Contract amount
1316 [1]	Boise-Anderson Ranch, Idaho.	Nov. 29	Penstocks, penstock header, and 36 jacks.	Southwest Welding & Manufacturing Co., Alhambra, Calif.	$683, 942. 50
1316 [2]	do	do	do	Western Pipe & Steel Co., San Francisco, Calif.	11, 319. 84
1361	Columbia Basin, Wash	Nov. 1	Aluminum doors and window frames	Seattle Bronze Co., Seattle, Wash	19, 718. 00
1404	Parker Dam, Davis Dam, Gila All-American Canal, Ariz.-Calif.	Nov. 27	4 sets carrier-current telephones	General Electric Co., Denver, Colo	22, 641. 50
1410	Missouri Basin, Nebr	Nov. 1	Construction Enders Dam, dike, and relocation Highway 61.	Wunderlich Contracting Corp., Jefferson City, Mo.	4, 109, 927. 00
1417	Columbia Basin, Wash	Nov. 6	3 overhead cranes and 1 lifting beam	Whiting Corp., Harvey, Ill	211, 000. 00
1419	do	Nov. 12	Crest railing and lighting fixtures	Columbia Electric & Manufacturing Co., Spokane, Wash.	146, 799. 65
1440	do	Nov. 13	Materials for 1 steel warehouse	American Bridge Co., Denver, Colo	130, 412. 00
1448	do	Nov. 5	1 all steel silo, 3 hoppers, 3 elevators	Noble Co., Oakland, Calif	60, 762. 00
1455 [3]	Kendrick, Wyo	Nov. 8	Electrical equipment for Medicine Bow and Hanna.	General Electric Co., Denver, Colo	32, 301. 26
1455 [4]	do	do	do	Allis-Chalmers Manufacturing Co., Milwaukee, Wis.	11, 224. 00
1455 [5]	do	Nov. 12	do	Westinghouse Electric Corp., Denver, Colo.	18, 239. 16
1475	Columbia Basin, Wash	Nov. 1	Preparation of concrete aggregate, Adrian.	H. F. Greene & Co., Spokane, Wash	373, 612. 50
1482	Shoshone, Wyo	Nov. 27	Construction, Heart Mountain-Garland transmission line.	S. H. Reither, Aitkin, Minn	177, 586. 50
1487	Boise-Payette, Idaho, and Colorado-Big Thompson, Colo.	Nov. 12	High pressure gate assemblies	Joshua Hendy Iron Works, San Francisco, Calif.	76, 027. 00
1491	Davis Dam, Ariz	Nov. 29	Construction Davis Dam—Kingman transmission line.	Donovan, Inc., St. Paul, Minn	91, 969. 00

[1] Schedule 1. [2] Schedule 2. [3] Schedules 1, 3, 4, 5, and 11. [4] Schedule 6. [5] Schedules 2, 7, 10, and 12.

Construction And Supplies For Which Bids Will Be Requested During 1947

Estimated date bids to be invited [1]	Estimated bid opening date [1]	Project	Description of work or material
Jan. 2	Feb. 6	Boise, Idaho	100-inch butterfly valve, Anderson Ranch Dam.
2	do	Columbia Basin, Wash	18-inch hollow jet valve, Potholes Dam.
2	do	Provo River, Utah	30-inch and 18-inch hollow jet valves, Jordon Narrows pumping plant.
2	do	Rio Grande, N. Mex	8.5 by 10-foot fixed-wheel gate and frames, Elephant Butte power plant.
2	do	Missouri Basin-Hardin, Mont	Exploratory tunnels and drilling, Yellowtail damsite.
7	Feb. 11	Central Valley, Calif	Shasta Dam to Summit City highway, and left abutment parking area.
10	Feb. 14	do	Earthwork, lining and structures, Contra Costa Canal, station 1993 to 2321, and Clayton and Ygnacio Canals.
15	Feb. 19	do	Motors and condensers, Delta-Mendota pumping plant.
15	do	Colorado-Big Thompson, Colo	76-inch butterfly valve, Granby pumping plant.
15	do	do	2 turbine-governors, Estes power plant; 1 turbine-governor Marys Lake power plant.
15	do	do	Switchyard equipment, Granby pumping plant.
15	do	Columbia Basin, Wash	Bus structures, Grand Coulee power plant.
15	do	do	Unit substation for caisson power supply for spillway bucket reconditioning, Grand Coulee.
15	do	Davis Dam, Ariz.-Nev	25-ton crane, Davis Dam and power plant.
15	do	do	Draft tube bulkhead gate, frames, and cast steel pier noses, Davis Dam and power plant.
15	do	do	Five hydraulic turbine-governors, Davis power plant.
15	do	do	Control and station service power equipment, Davis power plant and Davis switchyard equipment.
15	do	Klamath-Tule Lake, Calif	Construction of pumping plant "G."
15	do	Shoshone, Wyo	Generator protective equipment, Heart Mountain power plant.
15	do	Yakima-Roza, Wash	Earthwork and structures, lateral pump areas 1 and 9.
15	do	do	Transmission lines for pumping plants.
22	Feb. 26	Central Valley, Calif	Extension of Los Medanos wasteway, station 74+00 to 110+30.5, Contra Costa Canal.
22	do	Riverton, Wyo	Earthwork and structures, Wyoming Canal, station 883 to 1606 and laterals.
24	Feb. 28	Boulder Canyon	Pipes, fittings, valves, and strainers for Boulder City water supply system.
30	Mar. 6	Missouri Basin, Frenchmen-Cambridge	Two 60-inch hollow jet valves for Enders Dam.
30	do	Tucumcari, N. Mex	Earthwork and structures, Conchas Canal, station 3582 to 4452+46.3 and lateral unit 6.

[1] Subject to change.

On the Way to Paradise Valley National Parks Photo

EBRUARY 1947

n This Issue:

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lore Power to UTAH

y Governor Maw

●

SCIENCE Against SILT

by Koelzer and Leopold

●

GOLD MINE in the SKY

(Story of the amath Land Rush)

THE *Reclamation* ERA

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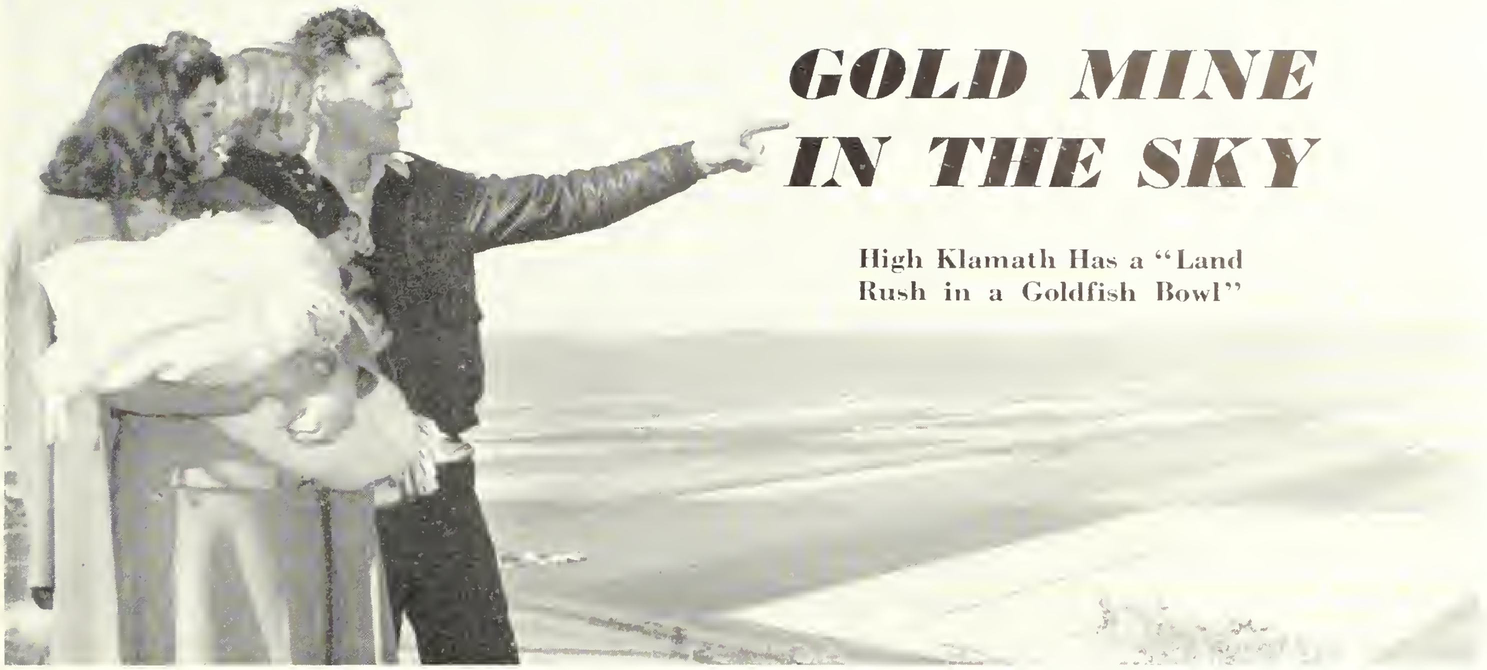


GOLD MINE IN THE SKY

High Klamath Has a "Land Rush in a Goldfish Bowl"

by Orin Cassmore, *Region II, Sacramento, Calif.*

A fanfare from the Klamath High School Band crashed up against the armory ceiling, shattered back down on a thousand eager heads crowded around the boxing ring below. Then, dead silence.

There was only the sound of the goldfish bowl, of dismal memory, creaking round and round, with the little capsules churning softly inside. It jerked to a stop. Legionnaire Olney Rudd turned his head away, grimaced as he groped inside for the first capsule. Despite his grimace, this time he drew forth not Fate, but Fortune.

Fortune indeed—for 86 fantastically lucky veterans. Eighty-six, out of a total of 1,305 whose farm experience and unencumbered assets had qualified them from an original field of 15,000, for a chance in a lottery. The prizes were 86 homesteads carved out of 7,500 acres on the Tule Lake division of the Klamath project, snuggled up against the California-Oregon border in the shadow of Mount Shasta.

Fortune, however you figure it, says things like, "I homesteaded 60 acres in 1937. Got an offer of $35,000 cash the other day," or "once they become established, settlers may expect a gross annual income of about $9,000, with a labor income in the neighborhood of $3,500." How much money would it take to bring in $3,500 at the current 2 percent? Comes to $175,000, doesn't it?

A fortune in the making, coming from a capsule, impartially bestowing its favors across the land. Eighty-six fantastically lucky veterans from the West coast, the Middle West and the East.

The Klamath project is a string of little basins and flood plains, mostly along the Lost River, which wanders through the broken hills where the Cascade Range dwindles out onto the high plains of eastern Oregon.

By and large, the project has been steadily productive, although it is nearly a mile high and can count on only 95 growing days and 9 inches of precipitation a year. The 408 entrymen of 1922, 1927–29, 1930–31, 1937, with their 26,000 acres, have done well. The other project farmers, whose 120,000 acres of private land have been taking project water for many years more, have been prosperous. The whole countryside is full of the fine homes that mean fine farms.

OUR FRONT COVER

Photo by Ben Glaha, Region I

***FORTUNE SMILED** on Fred and Velma Robison. Because we wanted our readers to see that others shared their joy, here is the full picture from which the cover was made. Although Fred had to wait until number 61 was drawn before hearing the good news, you can tell by those big grins that it was well worth it. Robison served with the 195th Field Artillery from D plus 2 until they met the Russians on the Elbe.*

Photo by Ben Glaha

Closeup of "The Pot of Gold"

Photo by Ben Glaha

Check and double check! No mistakes here.

The new entrymen will be getting some of the very best land, the vast bed of an ancient marshy lake into which Lost River finally empties after ducking in and out of the ground on a 100-mile circular course that ends up only 6 miles away from its source in Clear Lake. The land is lake-laid sedimentary stuff—sandy loam, loamy sand, peat—very deep, and rich as devil's-food cake. It has proved productive. Much of it was leased for a decade or more at from $20-$75 an acre, while the full drainage system to unwater the lake was being constructed.

Getting back to the fight arena, Klamath project superintendent E. L. Stephens cracked open the capsule with a mallet, handed the folded slip of paper with the number on it to Olney Rudd, himself an old homesteader. KFJI manager Dave Hoss shoved his mike close to Olney to make sure that the whole Mutual-Don Lee chain from Canada to Mexico and east to the Rockies heard the first number and name, which was "1—2—8, one-twenty-eight." There was a pause to get the name from Ten Broeck Williamson of the Bureau of Reclamation's Branch of Operation and Maintenance, who was checking numbers against names—"*Robert L. Smith of Banks, Oregon.*" Not among the 200 veterans and their wives, agog in the special section of seats right in front of the mike. Not there at all. Later we found that he's a veteran of the China-Burma-India theater, there for 3 years as an AAF private. Mr. Smith, at the time of the drawing, was helping his folks, the Arthur Smiths, on their 45-acre strawberry and filbert farm near Forest Grove, Oreg.

The spell of silence was broken with that first name. There was a brief silence to hear the second name—Gewin McCracken of Arlington, Va., an Easterner, who, we later learned, really comes from Alabama. But his pretty wife is a Virginian. We thought of the famous novel as the long-distance lines sped the message to the people back East. A Navy flier, a pilot who had served at Guadalcanal and Bougainville, married in April last year and in December had won a fortune for his bride. McCracken, 28, didn't really expect to get a farm—but now he is full of excitement. He will make a quick trip to Klamath very soon to look the land over. Yes, McCracken will become a homesteader.

When the first Klamath Falls name was called, fifteenth on the list, there was "stomping, whistling, shouting and near fainting as the returned warriors found the other end of the rainbow at the old Armory Building . . ." to quote the Oregon Journal, which headlined the drawing in Portland, 400 miles away. That name was Ernest M. Lindsay, the assistant county agent (of all things), a smooth-faced, thinning-haired man of 30 in a smart tweed topcoat. Ernie was evidently popular.

Here's one who didn't make it—Darrell Vernon, the missus, and little Darrelle will try again next time.

Photo by Ben Glaha, Region II

In on the ground floor. Winner No. 70, farmer Capt. Dale Sprant, has already worked a Klamath farm under lease.

Photo by Jon Brenneis of Cal-Pix, San Francisco

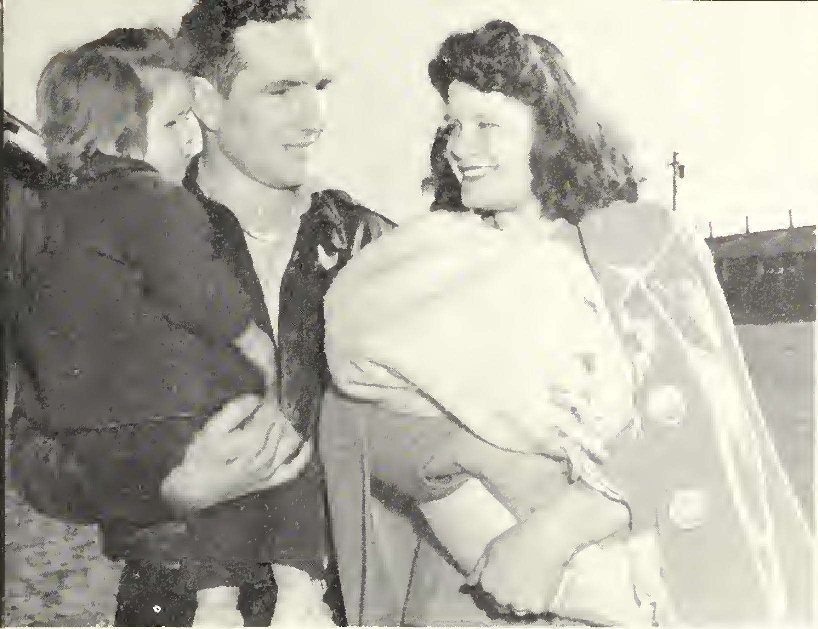


Photo by Ben Glaha, Region II

***WESTERN WINNER!* Philip Krizo, his wife and family, residents of Tule Lake, will feel at home on their new homestead.**

Photo by Glenn Pent, Interior Department, Washington, D. C.

***EASTERN WINNER!* Mr. and Mrs. Gewin McCracken of Arlington, Va., talk over the future with Commissioner Straus.**

Over the cheers and kidding he told us. "I was never lucky in my life before; can't even win at Old Maid."

But the people's real choice was number 254. called nineteenth. merry little Elmer Robert Metz. Jr., of Wellington. Kans. "Feeling lucky," he had just blown into Klamath for the drawings and was staying with his brothers at their Tule Lake machine shop. Elmer was honeymooning and it may have been that he was looking dreamily at Mrs. Marjorie Cook Metz. who is cute and almost 19; or he may have decided to get philosophical and resigned about his chances; but anyway he didn't recognize his number when it was called. Marjorie did. though. She punched him with her elbow. Then, she whirled in her seat and shook him: "Elmer! Wake up Elmer! It's *your number!* Wake *UP*, Elmer!" Elmer woke up. Elmer bounced to his feet with a whoop, beat himself on the chest and yelled out above the cheers: "That's ME! Elmer Metz. Folks. *Here's Elmer!*"

When we (the press. Bureau photographer Ben Glaha. Lifotographer Jon Brenneis. and Pathé News cameraman Frank Vail) got to know this couple better that afternoon. we found that this slight kid. looking all of 16 although he has just turned 21, was discharged from the Navy a year ago this Christmas as a motor machinist's mate. first class. The Navy took him just after his graduation from Wellington High (1942) and he was in on five invasions—Kiska. the Marshalls. the Marianas. Pelelieu. and the Phlippines. "In on" is right—*LSI 81* (Elmer said. "be *sure* and get that number in. so my shipmates will know it's the same Elmer Metz") was either putting troops on the beach or lying just off-shore. firing rocket salvos every time.

Even before he put his name in for a farm. Elmer had decided to come out to Tule Lake. where his father and older brothers had moved in 1936. after his father's heart went bad and he had to quit his Kansas farm.

Elmer got the necessary $2.000 to qualify for a farm by saving his money in the Navy. "The only places we got ashore. there was no place to spend it." he said.

"How do you feel?" we asked him some hours after the drawing. "Still a little numb. I've wanted a farm so hard so long. I can't believe I'm not still just wanting it." Marjorie feels fine. however. quite at ease about having everyone take her picture. She is from a farm outside Fulton, Mo. But she was working as a window decorator in town last spring and got into the background of a shot of Mr. Truman and Mr. Churchill that came out in *Life*.

Elmer's plans: To plant barley the first year to give him time to build a house from

Mac Epley and Lois Stewart of the Klamath Herald-News who put the drawing in the limelight and kept it there.

Photo by Wesley Guderian, Klamath Herald-News photographer

Pre-drawing broadcast over station KFLW. Bob McCarl, announcer, Ray Best, Bureau of Reclamation, and veteran Dean Abbott.

Photo by Wesley Guderian, Klamath Herald-News photographer

the two barracks at the old relocation center each veteran gets for building material.

Does he plan to make a lot of money? He says he isn't worried or even particularly interested about that. He is just interested in making a good home for the pretty girl he married, and the children they are going to have.

Number 25 to come up was Bert Buckingham of Fresno, Calif. We got a chance to talk to Mr. Buckingham, the only middle-aged winner in the crowd, only long enough to learn that he was in the draft for World War I, but wasn't called up—just made it this time, when over 40. He has been trying to get a good farm for some years, is presently working in the potato sheds.

be called. Brett sent the Bureau the Christmas telegram you see reproduced on page 29. Bob Burrows of Eugene, Bill Crawford of Corvallis, John Byron of Roseburg, Harlan Meyer of Sunnyside, and Theodore Godlewski of San Francisco, Calif., did so, too.

The Fred Robisons, who drew No. 61, just hugged each other and laughed fit to kill. Fred took time off from his glee to tell us that he was in the ETO with a howitzer company of the One-hundred-ninety-fifth Field Artillery battalion. They fought through from D plus 2 until they met the Russians at the Elbe; were out of action only 4 days in that 11 months. Quite often in that 11 months, he said drily, he didn't think his name would ever come up on anything except a grave roster. Fred was from Shedd, Oreg.; always wanted a chance at a homestead drawing.

Photo by Wesley Guderian, Klamath Herald-News photographer

Folks, here's Elmer!

No. 58 was Eleanor Jane Bolesta of Everett, Wash., a Wave, born and brought up on a farm, with a disabled veteran husband. We can tell you nothing more about Mrs. B., except that we are glad she won, because nobody has been able to find her yet. The Everett paper says they have moved to Stockton, and a radio search was going on as this issue went to press.

Then a middle-aged man with a heavy foreign accent, whose farm-winning boy wasn't there, was interviewed over the floor mike. He choked with tears. "Goot luck to all of dem. I wish dere was more farms. I homesteaded out here long ago. I yust hope the boys have the two 'know-hows' we had: Know how to do things; know how to do *widout* dem. Den dey'll succeed."

Brett Law of Fresno was number 60 to

We came at number 69, to Philip Krizo, 28, slow-talking, straight-looking, long-jawed redhead, from Tule Lake; his pretty wife, Barbara; an elf called Dorothy Marie, 2, with blond hair and brown eyes; and 8-weeks-old David, also sharing the income of a small radio shop that cannot get new sets to sell.

Philip Krizo's dad came out here from Czechoslovakia in 1912. He worked several places and finally homesteaded in the Tule Lake country when it was "just slush and thistles, with the lake water coming up to the edge of the yard." After graduating from Malin High School in 1935, Phil farmed with his father and brothers until he went off to war.

He was in the AAF 4 years, went to radar school and wound up as a radar officer navigator on P–61 night fighters in the CBI, after serving in Italy. He made some 20 intruder missions over Myitkyina and Bhamo in the late stages of the campaign in the East. He met Barbara, a Klamath Falls high-school girl, at a dance at Keno, just after Pearl Harbor. They were married more than 3 years ago, just before he went overseas. "What did you think about, overseas?" "Coming back here. I had a feeling I would make it in this Klamath country sometime."

He is going to put his land in barley or hay until he has time to build a house, then will work out a diversified farm plan, which he feels is the key to successful farming in this high country. He is sure he can make a go of it. Now he hasn't a care, except for the big thing both of them were worried about: how in the world they were going to get a baby-sitter for New Year's eve. "We haven't been out for I don't know how long," Barbara said, "and this is one celebration we sure aren't going to miss. Baby-sitters are hard to find. Seems like the girls don't want to work the way they did when I was young." She is 21 now.

Last of the local boys interviewed was Dale Sprout of Tule Lake. Dale is a tall lean youth with lank black hair, dressed in blue levis and a black-and-white-checked wool shirt hanging outside his pants. He looks just about like any other local boy should look—as if he ought to be holding up a post somewhere, shooting the breeze with friends, or playing pool, or slouching in a soda fountain, kidding with the other youngsters. He is a little older than he looks, though—23. And he spent his twentieth and twenty-first years in a P–51 with the Thirty-first Fighter Group of the Fifteenth Air Force, escorting bombers over Austria, South Germany, and Rumania. He started to work at that job just after "the bad raid" on Ploesti. He was a captain, has the D. F. C., the Air Medal with five clusters, and a Presidential Unit Citation. Went in as an enlisted man and on to cadet school after graduation from Tule Lake High School in 1941.

He married Iva LaSalle, a schoolmate, just about that time, and they have two kids—Larry, 3½, normally kept out of mischief and helped over rough territory, dangling by the middle from his father's right hand, like a B–4 bag. Lynn, a 2-year-old-girl, toddles after.

In 1946, Dale's first year out of the Army, he and a partner farmed some of this land on lease. They will make, he figures, about $10,000 between them, from beets and onions. He would like to enter the same piece of land, but figures: "My luck's just about out." The family is now living on the LaSalle place, homesteaded in 1938, which already has a nice white house. They are going to "take it easy" for the next year by planting grain while Dale gets their own house built. Did he think about getting a farm here while he was away at war, a reporter asked? "Bud, I didn't think about anything else."

And here is one who did not make it. The wistful-looking young fellow in the flight jacket, holding the little girl, sitting near his intent, red-haired wife. His eager grin finally faded as number 86 passed. But there was nobody readier to congratulate the people who did get farms. "Man, I wanted one of those for the wife and kid. But I'm glad so many of my friends made it. We'll get one next year. Seems like a man that wants to work to build up this fine country we have out here ought to be able to get a chance to do it."

Maybe he *will* have better luck next year, when another 7,000 acres in the Coppeck Bay region, former arm of Tule Lake just south of present lands, is opened up.

It's tough that luck has to play such a big part in getting these guys farms. For they are the kind of people who would make a fine addition to any community. They know their stuff. They are young and eager—that was the one thing that stood out about the veterans who got farms, or were hoping to get farms that day. As Lois Stewart, city editor of the Klamath Falls, Oreg. *Herald-News*, kept saying: "They're so young. They're so *young*. Why some of them don't look like they shave regularly yet."

It was hard to realize that they had been even younger a year and a half and 2 and 3 years ago. These very young men deserve well of their country. But they don't think much about that, a fact that was pointed out to the writer by Mac Epley, managing editor of the *Herald-News*, whose relentless publicity was largely responsible for the attention given this great show. "It isn't that we want to do something for them, or that they are looking for a handout. This isn't charity. It's giving a chance to the people who can build this country up. I saw most of the timber that was once our great wealth here, go. I saw boom and bust. I know that the real wealth of this country comes from what you can grow on this land every year, not once a century. The future of this whole Klamath region depends on setting it up with owner-operated farms, people who have a stake here—no *get-rich-quick-get-it-and-get-out* stuff. We've passed that phase, I hope." Mac should know: he has been here since 1931, has a smart newspaper, and the reams of publicity he has carried have been carried because he wants to put that message of stable, wealth-bringing development across. He tells you that part of the region's prosperity (that will be reflected in continued prosperity for his valuable paper) will come from the crops these farms grow to ship elsewhere, part from the existence of hundreds of thousands of farm families settled on land that will earn a good living for them; an income that will be spent largely in the Klamath area. He hopes some day to see a Klamath project of 400,000 or 500,000 acres.

Lawrence Carr of Redding, of the California State Veterans' Affairs Council, representing thoughtful Gov. Earl Warren, spoke more formally to the same end:

Here a grateful Nation is rewarding its men whose sacrifices so recently brought us this greatest of victories. This Nation, however, is not merely giving some veterans a chance to become owners of valuable public land. You are being given an opportunity to become self-reliant, independent, American farmers—an opportunity to join that great army of men and women who pursue a most noble and honorable profession.

We observe today the American tradition of public land to the returning serviceman. But the importance of the traditional policy of public land to the veterans, which is being carried out here today, is dwarfed by the importance of another national land policy which is in evidence on this occasion. That other policy is the encouragement and establishment of family-type, resident-owned and operated farms, on newly irrigated areas through the wise application of the Federal reclamation law. This fundamental policy—a vital part of the reclamation law—was valiantly defended in its early history by an eminent Congressman who came from among you, the late Judge John E. Baker, of Modoc County.

The Congress then knew, as we now know, that one of the greatest bulwarks against the destruction of democracy by false philosophies of government is the love of freedom possessed by the average American farmer living on his own family farm.

"Well said, we think," commented the *Herald-News*.

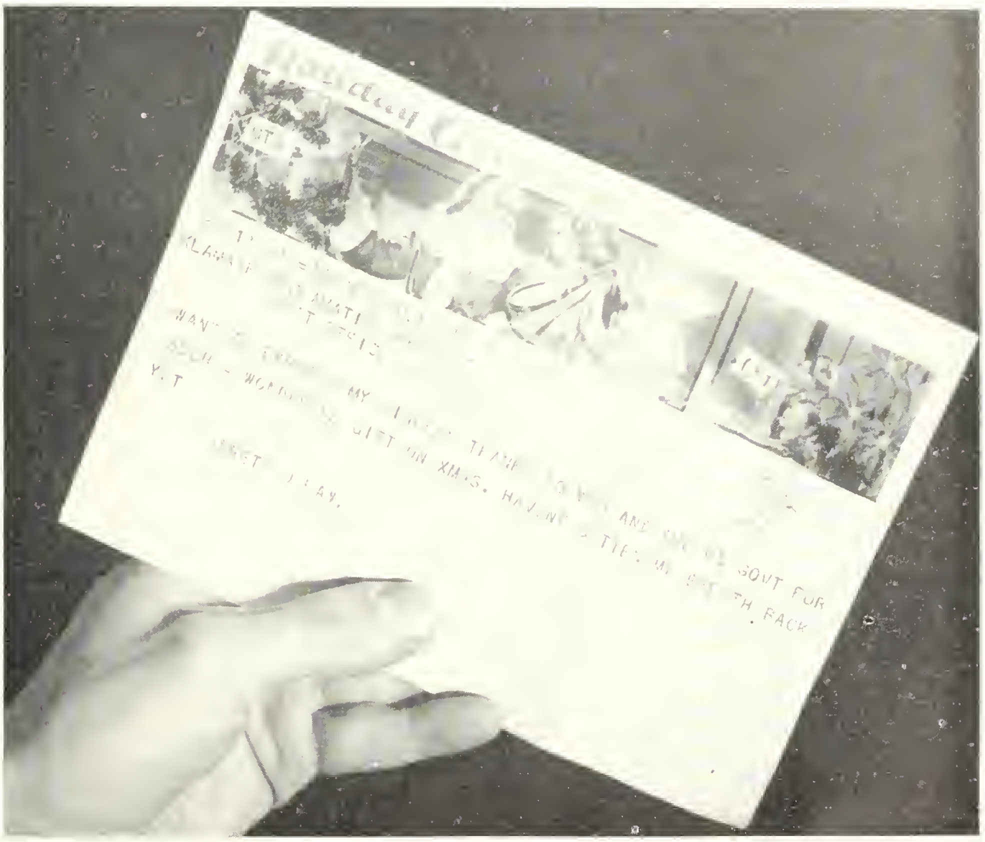
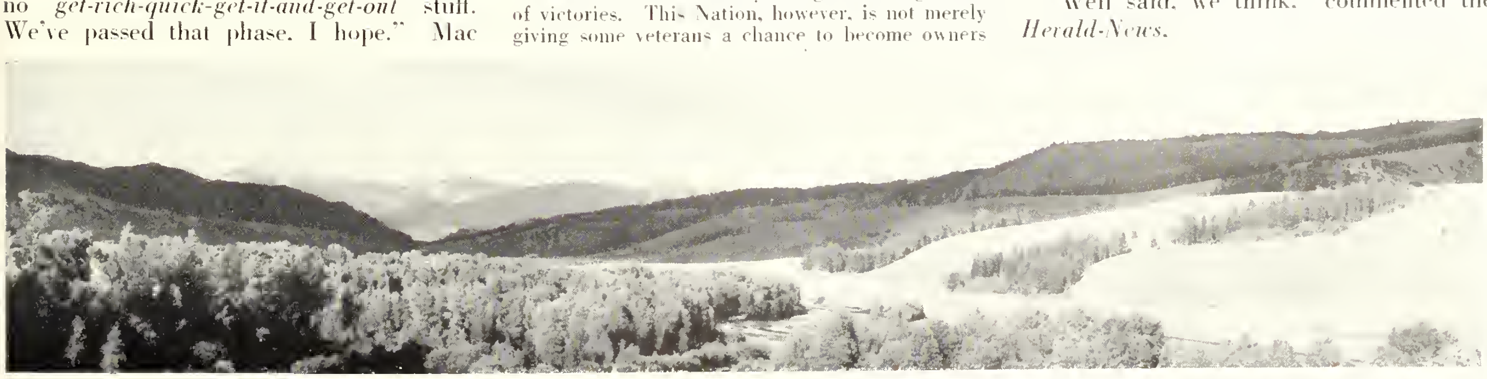


Photo by Ben Glaha

Only one of the many.



World's largest open cut copper mine. Low-cost hydroelectric energy could provide a new industry here at

MORE POWER TO UTAH . . . From the

by The Honorable HERBERT B. MAW

Governor of the State of Utah

Utah is on the threshold of a new era . . . one that can change us from a "poor little rich State" to a "rich little rich State."

The time is coming when our sons and daughters will no longer have to leave their native State to seek opportunity elsewhere . . . there will be plenty right here at home.

I am happy to say that the promise of this new era is not so far distant that its benefits will come too late for our returned servicemen who so richly deserve the right to the prosperity which they fought to enjoy.

I sincerely believe that with firm leadership the long dreamed-of expansion of industry, mining, and agriculture—the production side of Utah's economy—is near at hand. In fact, we have already made an important beginning—the postwar operation of Geneva Steel Co., assured by its sale to United States Steel Corp.

Geneva Steel Co. is destined to attract many new industries and manufacturing firms to this State, utilizing close at hand the products turned out by the world's most modern steel plant. This is going to mean increased population with more consumer demand for everything.

Utah has plenty of room for this growth. And, with one exception, Utah has the necessary abundance of natural resources. The exception is water—the lifeblood of the soil and of daily living . . . whose energy is convertible into electricity, the "white coal" for our future industrial empire. Hydroelectric energy is a mighty force destined to play a principal role in "The New Utah."

Yes, Utah needs a "new" supply of water and needs it badly. The Beehive State in fact has only the remnants of a water supply still unused. Without new water the industrial giant in the making is going to bump his head against the inexorable ceiling of limited water supply . . . water for manufacturing . . . water for domestic use by Utah's 250,000 new inhabitants . . . water to double the amount of farm land under full irrigation . . . water to attract and hold new manufacturing firms with low-cost power!

This new water can come from only one source—the Colorado River Basin. Utah has a rightful share in the waters of the Colorado. And in my opinion, well within that share is the 600,000 acre-feet which can be brought annually into the Great Salt Lake Basin by means of the Central Utah project, being investigated by Bureau of Reclamation engineers . . . a plan for collecting the waters that flow south from the Uintah Mountains into a 110-mile conduit emptying by gravity flow into the Strawberry Reservoir . . . a plan that contemplates construction of a vast new dam on the Green River at Echo Park, 915 miles upstream from Boulder.

This could create a hold-over storage and power production reservoir from which water can be pumped to the Uintah Basin, supplying that comparatively undeveloped region with new irrigation in addition to thousands of kilowatts needed for development of the basin's mineral resources. The plan would include the possibility of constructing still another big dam farther up the Green River in Utah near Manila at the Flaming Gorge site for power purposes, and to bring water by gravity flow from the 5,980-foot elevation directly south through the Uintah Mountains to irrigate the Uintah Basin. This plan is alternative to the extent that it would obviate the necessity of pumping from Echo Park Reservoir.

Project to Drain Mines

Yes, despite its multi-million-dollar cost, Utahans must fight for the Central Utah project. It is a solid approach to a higher standard of living for every person living in the State as well as to development of great new benefits to the Nation in the form of increased purchasing power and greater production of the commodities of farm, mine and factory needed in other sections of the country. Everything points to the economic necessity of this huge undertaking.

Mining needs power for less costly pumping of rich workings flooded by underground water. More specifically, a tunnel carrying irrigation water from the Provo River underneath the Wasatch Mountains to Salt Lake County might prove to be feasible, at the same time draining some of the richest diggings of the Alta and Park City mining districts wherein pumping costs are becoming prohibitive.

Irrigation benefits to 70,000 acres of land along the Bear River would be possible with power from the Central Utah project supplementing the output of private power plants now using water that could be utilized by farmers upstream. A similar exchange could release power water for added irrigation from the Ogden and Weber Rivers.

These are only the highlights of the Central Utah project's many ramifications. Admittedly construction costs will be high, so high that financial feasibility depends on revenue to be derived from selling the ex-

Utah Copper Company photo

ingham, Utah.

Multi-Million-Dollar Central Utah Project

cess hydroelectric power the project will develop. Yet this crucial factor does not constitute a threat to Utah's well-established coal industry nor to our private power interests, as might be supposed, and as I shall point out later.

Two Billion Kilowatt-Hours

I am reliably informed that not more than 30 percent of the construction costs could be repaid by water users, leaving the bulk of the repayment burden to be financed by five or more potential power plants of the Central Utah project. These plants can be designed to produce more than 2 billion kilowatt-hours a year—more than one-third of the annual output of Boulder Dam.

Incidentally, we have the example of Boulder Dam to show that the lucrative returns from hydroelectric energy not only lend a big helping hand to agriculture but can pay back a rightful share of construction costs as well as put money in the bank besides.

High Reservoir Planned

You may well question that 600,000 acre-feet of water annually could produce one-third as much power as Boulder Dam which has 10,000,000 to 17,000,000 annual acre-feet of flow with which to spin its turbines. This is explained by the fact that the Central Utah project has the advantage of 3,000 feet of fall—from Strawberry Reservoir at 7,600 feet elevation to the floor of Bonneville Basin, 4,500 feet elevation—in which to make the water run a gauntlet of several hydro plants before being released for irrigation of lands extending from Salt Lake City on the north to Kanosh in Millard County on the south, the latter being more than 300 miles from the northeasternmost point where the imported water originates.

We must not forget that the primary benefit from this undertaking will be the irrigation of great stretches of land needing additional water and of many thousands of thirsty acres that could be transformed by the application of water for the first time.

Some of the most valuable new irrigation would result from bringing water to 25,000 acres of fertile land presently dry-farmed in the vicinity of Levan, Nephi, and Santaquin.

In all, approximately 450,000 acres of land will benefit from the project, thus making irrigation development the chief purpose in justifying the millions of dollars that must be spent for project construction.

Counting 40,000 acres of new land that could be irrigated in the Uintah Basin, 150,000 acres of the above total could be irrigated for the first time under the Central Utah project, 300,000 acres receiving supplementary water. Our present irrigation totals slightly more than a million acres.

Although power production is of secondary consideration, it is the work horse which must be relied upon to help pay the bill.

This brings up a question which is being voiced in some quarters, namely, "Where could we use all the power that the Central Utah project will produce?"

Surveys show that a power deficiency has been growing in Utah since 1924 and the inadequacy of Utah-produced electrical energy in 1943 necessitated the importation from Idaho and Montana of half our total power consumption.

In the Bureau of Reclamation's "Power Market Survey of Great Salt Lake Region," completed in May 1943, it is estimated that "within the next 40 years, additional requirements for electricity, together with the generation within the region of energy now imported, will create a market for 3 billion kilowatt-hours annually . . ."

And from the same source, " . . . Utah has long ranked among the leading mining States. In 1940, it stood first in the Nation in the combined value of gold, silver, copper, lead, and zinc produced. Utah copper is shipped to the Atlantic seaboard and Utah zinc to Montana for electrolytic refining. If low-cost power were available, electrolytic refineries might be established in this region. Refining of all copper mined in Utah in 1942 would have required approximately 113 million kilowatt-hours of electricity, and refining of the zinc milled in Utah in 1941 would have required 258 million kilowatt-hours of additional energy.

"A much greater potential demand lies in development of the magnesium (the Thompson, Utah, deposit of magnesium chloride is among the most promising in the Nation), phosphate, potash, and alunite resources in Utah. All require tremendous amounts of electricity for processing . . ."

A preliminary survey now being made by the Federal Power Commission and the Colorado River Committee of Utah indicates that an even larger consumption than the Bureau estimate is probable by 1980.

New Market for Coal

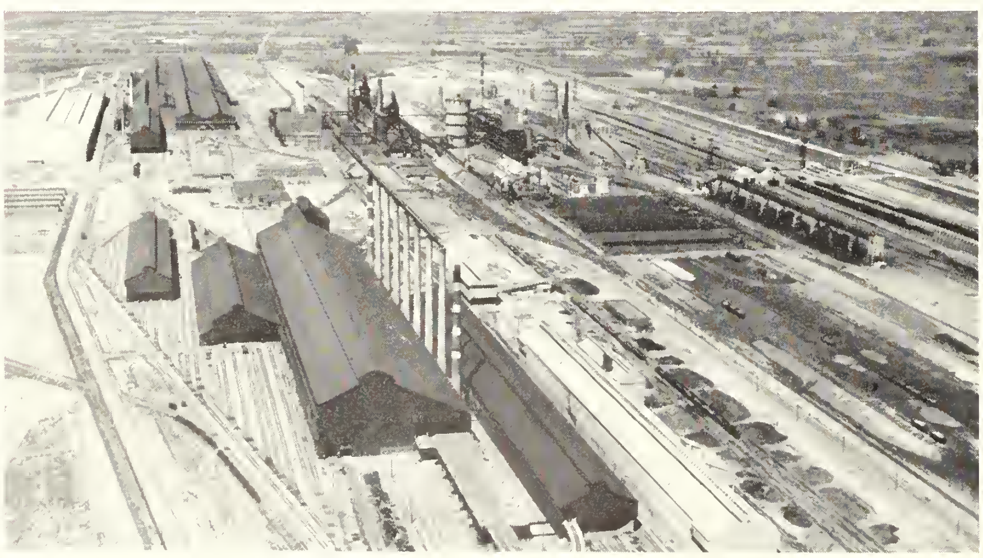
This talk quite naturally alarms operators of our great soft coal mines in Utah. "We are against Government subsidy of hydroelectric plants that will put coal miners out of work by competing with steam-generated power plants," they say. I say this is short-sighted. It seems to me that this viewpoint fails to take into account potential new coal markets implicit with the Central Utah project. It is my firm belief that necessary coal consumption by new industrial firms attracted by availability of ample water and power will more than offset any losses of market, not to mention the new domestic coal market represented by the

Photo by Utah Publicity and Industrial Development Comm.

Park City mines, victims of inadequate water.

Photo by Paul E. Norine, Region II

Enjoying water benefits on the Ogden River project—Utah.



Geneva Steel Company photo

Geneva steel plant—symbol of Utah's industrial future.

anticipated 50 percent increase in population.

An example of what I mean is the phosphate fertilizer industry. What kind of a new market for coal can be visualized when it is realized that for each pound of fertilizer produced by the electric furnace reduction method, three-fourths of a pound of coal is needed? Coke is used as an agent in this process.

Investigators who have studied possible uses of fertilizer estimate that the 11 Western States could use a total of 4,400,000 tons of phosphate fertilizer annually at present. The production of that amount of fertilizer would require approximately 3 million tons of coal for use as coke in the electric furnace method of producing phosphoric acid and also for the manufacture of electrodes to be used in the furnace. In order to produce phosphate fertilizer at a sufficiently low cost to the farmer, and at a cost which would insure the optimum use of fertilizer, it is estimated that electric energy must be made available at an average rate of between 2½ to 3 mills per kilowatt-hour at the electric furnace.

I have only to mention the fact that western soils are deficient in phosphate to give an inkling of what tremendous development the commercial fertilizer industry alone can bring to the West—provided the fertilizer can be manufactured at a cost within the reach of every farmer.

And what of private power interests, of which there are several in the State of Utah?

Wholesale Power Only

I have the assurance of the Bureau of Reclamation that it is interested only as a wholesaler not as a retailer of power. It is interested in fulfilling Congress' mandate which requires the Department of Interior to convey publicly produced power to the people at the lowest possible cost. There is no intent to drive private interests out of business or to regulate the power industry. This in certainly democracy at its best and not at the expense of free enterprise. This is true, especially when the water after all belongs to the State, and people are therefore entitled to the benefits therefrom free of exploitation beyond a reasonable service charge for production and distribution.

I am open to conviction on the best way of handling the situation in Utah. It may be that a State power authority is the logical answer. The main issue, however, is cheap electricity made available to industry and to the people.

In all events the greatest needs and welfare of the people should be served. The officials of our power utilities will be, I am sure, just as interested as I in meeting the great new power markets with Utah-produced energy rather than by further importations.

***Editor's Note:** This is the first of several articles which will appear in the ERA dealing with hydroelectric power development and written by prominent authorities in the Colorado River Basin States.*

Conference in Paris

by Leslie N. McClellan

Assistant Chief Engineer, Branch of Design and Construction, Denver, Colo.

Early last summer some 800 delegates from the four corners of the globe gathered at Paris, France, for the first International Conference on Large Electric High-Tension Systems since the outbreak of World War II in 1939. The organization, known familiarly as the C. I. G. R. E. (Conférence Internationale des Grands Réseaux Électriques á Haute Tension), was established in 1921 as a permanent international organization to promote the exchange of engineering information on technical matters related to the design, construction, and operation of large high-voltage electric power systems.

The C. I. G. R. E. meets biennially to advance the art of generation, transmission, and distribution of electricity. In addition, it serves to create and maintain friendly relations between engineers of all countries.

The air trip from New York to Paris was uneventful for Sol E. Schultz, chief engineer of the Bonneville Power Administration, and the writer, who were representatives of the Department of the Interior. Flying weather was favorable and the total elapsed time, including stop-overs, was about 18 hours.

On the return trip we were grounded 12 hours in Eire because of fog over Newfoundland. We spent the night at the little Irish town of Tipperary. On the bus ride from Tipperary to the airport we could see a little of picturesque and ancient Ireland with its feudal castles and two-wheeled farmcarts.

As we flew back over Newfoundland, the regular field at Gander was still fog-bound so we continued on to the extreme western side of Newfoundland. Just as we were over the alternate landing field at Stevenville, the cloud bank lifted and we landed without difficulty.

In Paris we were rather surprised at the relatively small amount of war damage. The old German embassy building was demolished and it was apparent that considerably heavy fighting had taken place at that point. Elsewhere in Paris pockmarks around windows and doors, caused by small arms fire, showed where sniping had occurred. Throughout the city markers indicated the spots where innumerable incendiary bombs had been dropped but either the damage had been slight or it had been repaired.

The program of the 1946 conference comprised fourteen technical sessions at which over 100 technical papers were presented for discussion. The discussions were carried on in either French or English. After each speaker concluded his talk, interpreters immediately translated his remarks into the other language. A few speakers, who were proficient in both French and English, chose to make their discussions in both languages.

Of particular interest were discussions of ultra-high voltage transmission lines of both alternating and direct current. The proponents of each of these types of transmission were about equally divided. Sweden and some other countries were primarily interested in direct current to serve the industrial load centers of Central Europe, while French engineers were primarily interested in alternating-current transmission. Because underground cables can be used in transmission of direct current, many favor this type since it is less susceptible to enemy action in time of war and does not disclose the locations of military targets as do the overhead tower lines. Another advantage of direct current transmission is the possibility of varying the speed of generating units to suit wide variations of head under which hydraulic turbines may have to operate at some generating plants, such as the one proposed at Assuan Dam on the Nile River.

However, considerable development remains to be done on high-voltage rectifiers and current interrupters before the transmisssion of large blocks of power by direct current at voltages of the order of 500,000 volts can be undertaken with assurance. The consensus seemed to be that direct-current transmission should be considered only in cases where the distance the power is to be transmitted exceeds 400 miles. For shorter distances, alternating current seems to be preferable because of lower cost, less development work required, and facility of tapping the line at intermediate points.

During the conference, inspection trips were made to the Arrighi steam generating station and the Chevilly substation, both near Paris. The Arrighi station is on the Seine River and, curiously enough, although it is one of the principal sources of power for the Paris area, it was not damaged during the war. It was forced to suspend operations just prior to the reoccupation of Paris by the Allies due to the lack of coal. After entering Paris, the American Army converted the plant to oil operation and for almost a year it was operated by fuel oil shipped from the United States. It has now been reconverted to coal burning.

The Chevilly substation is the terminus of a number of high-voltage transmission lines bringing hydroelectric power to Paris and its suburbs. It was severely damaged by bombing and fire during the war but has now been restored to service.

The conference was highly instructive and interesting to the 10 delegates from the United States because of the opportunity to exchange ideas and learn how other nations are solving their power problems. Aside from the technical value of such a conference, it contributes much to better understanding and cooperation among the nations of the world.

He went to Paris.

Unfortunately, attendance from the United States was limited because of transportation difficulties. The transportation situation should be normal by the time of the next plenary session in 1948, and everyone hopes that the Department of the Interior will be well represented and that the Bureau of Reclamation sends several of its engineers to present technical papers and participate in the discussions.

EDITOR'S NOTE:

Mr. McClellan was the first Bureau engineer to participate in an international scientific gathering following the war. Mr. Roger Rhoades, chief geologist for the Bureau of Reclamation, participated in the Second Pan-American Congress of Mining Engineering and Geology which was held in Rio de Janeiro, Brazil, on October 1–15, 1946, where he presented a paper entitled "Geology in Civil Engineering."

Scientists and engineers have always valued technical conferences, as such meetings provide an opportunity to learn the latest developments by experts working in widely separated areas. Discussions are held, scientific theories argued, and ideas exchanged. International conference activities came to a standstill during the war, but scientists who worked on a variety of wartime pursuits now have an unlimited fund of technical information and ideas waiting to be utilized in new and better ways of peacetime living.

The value of keeping abreast with scientific thought throughout the United States and the rest of the world cannot be over-emphasized. The Bureau plans to have its most qualified technicians take an active part in such conferences wherever the Bureau data presented will advance scientific thinking and the Bureau can benefit through exchanges of ideas with the world's foremost scientists.

New Repayment Proposals for the Missouri River Basin

by Goodrich W. Lineweaver

Director, Branch of Operation and Maintenance

A new trail is being blazed toward modernizing the application of repayment features of the reclamation laws.

Regional directors of the Bureau of Reclamation in the Missouri Basin have opened negotiations for a proposed new type of combination water service and repayment contract with irrigation water users of Missouri Basin project units in Nebraska and North Dakota. A draft of a contract which forms the basis for those negotiations has been prepared in accordance with the Flood Control Act of 1944, under which the Missouri Basin project was authorized, and the Reclamation Project Act of 1939.

Although the contract draft applies particularly to the Frenchman-Cambridge unit in Nebraska, and to the Heart River unit in North Dakota, it points the way for others to follow as additional project units come forward in the Missouri Basin. Regional Director E. B. Debler at Denver, Colo., is in charge of the negotiations in Nebraska, and Regional Director H. D. Comstock at Billings, Mont., has responsibility for the North Dakota negotiations.

The draft was recently completed at a series of Washington conferences participated in by representatives of regions VI and VII, the Chief Counsel, the Director of the Branch of Operation and Maintenance, and the Director of Finance. The Commissioner of Reclamation, Michael W. Straus, then forwarded copies of the draft to all regional directors concerned, with instructions to use the drafts as the basis for negotiations with the water users.

Commissioner Straus, in urging full cooperation by the water users and other direct and indirect beneficiaries of the developments in expediting the contract negotiations, said that early adoption of suitable contracts by the irrigators would advance construction on many units.

"The Bureau of Reclamation is in the business of building projects to serve the people," he said. "In the Missouri Basin, we expect to transform 5,000,000 acres of dry land into irrigation oases that will combat recurring drought and enable the basin States concerned to support a larger population.

"Under the proposed contract, the water users agree to repay the distribution system construction cost as increased now by higher labor and material costs.

"The rate of repayment of those costs within the maximum period will be based on the repayment ability of the water users as determined by application of realistic analyses of agricultural and economic factors in each area. In addition, in return for the delivery of water to the irrigation districts, the water users also agree to pay a water service charge which will contain a construction component consistent with the increased costs of the water supply works.

"I have requested the regional directors concerned to press the negotiations to a conclusion with all the dispatch possible. The Congress expects the Federal Treasury to be assured of the repayment of the reimbursable costs allocated to irrigation. The Secretary of the Interior permits construction to proceed on initial features of a Missouri Basin unit such as a storage dam and reservoir on satisfactory evidence that the water users will enter into a suitable execution of the contract."

The Congress has authorized the appropriation of $350,000,000 to the Bureau of Reclamation toward the construction of the Missouri Basin project. Twenty-nine units were included in seven States in the initial list of units due for early construction.

On the basis of the original authorization of the Missouri Basin project, irrigators are to repay about 23 percent of the cost. A substantial part of project cost is to be met by nonreimbursable allocations to flood control and navigation. Power and municipal water users are to repay proportionate shares.

Part I of the contract draft as approved by the Commissioner for negotiation deals primarily with water service under section 9 (e) of the Reclamation Project Act of 1939. It provides for water service rates sufficient to cover the cost of operating and maintaining the storage and carriage systems for delivery of irrigation water to the distribution works of the unit.

In addition a construction cost element related to the cost of such storage and carriage systems is included. This phase of the contract extends for 40 years although a longer period will be necessary for the return to the United States of construction costs of such systems.

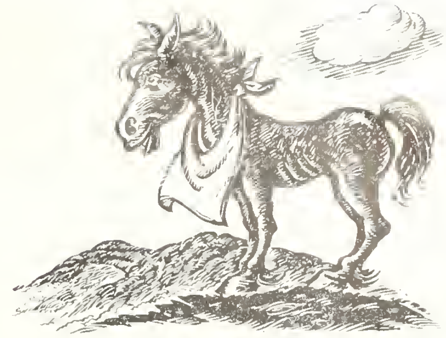
Part II is based on section 9 (d) of the Reclamation Project Act of 1939 and is

(*Continued on page 47*)

Photo by Glenn Peart, Washington, D. C.

Left to right Floyd E. Dominy, and Eugene D. Eaton, Branch of Operation and Maintenance, Assistant Commissioner William E. Warne, Commissioner Michael W. Straus, Operation and Maintenance Director G. W. Lineweaver, Chief Counsel Clifford E. Fix, Regional Counsel W. J. Burke, Billings, Mont., Assistant Regional Counsel Dan Young, Denver, Colo., John N. Spencer and Floyd M. Roush, Regional Operation and Maintenance staff, Denver, Colo.

HUNGRY HORSE



Hardy Pioneers Brave the Montana Wilderness As Work Begins on the Hungry Horse Project

by Lyle M. Nelson
Region I, Boise, Idaho

All Photos by Stanley Rasmussen, Region I

From the tree-covered slope across the river the snarls of a cougar and the barking of a dog could be heard. Just upstream two fishermen were busy hauling out hungry trout.

The low boom of a blast cut through the mountain air. Then all was silent.

Man, the giant, had invaded the wilderness of northwestern Montana. Although his coming would require a change in the habits of certain wild animals, heretofore almost sole occupants of the area, it also heralded the beginning of an new era for people of the region.

Working virtually in the shadow of towering Glacier Park peaks, Bureau of Reclamation pre-construction crews are preparing the way for multi-million-dollar Hungry Horse Dam, a structure which is scheduled to take its place alongside Grand Coulee, Boulder, Shasta, and other outstanding multiple-purpose reclamation works.

When completed the dam will be a key unit in a comprehensive, long-range program to insure full utilization of the waters of the Columbia River and its tributaries. Preliminary studies, subject to change, indicate that it will be between 340 and 500 feet high and will contain between 2 and 3 million cubic yards of concrete. It will store between 1,000,000 and 3,500,000 acre-feet of water, depending upon the height of the dam, and will support a total power installation at the site of between 142,000 and 286,000 kilowatts.

About 85,000 acres of potentially irrigable land near Kalispell may be served through the project. Besides stream regulation to increase the firm output of downstream plants (including Grand Coulee), it also will provide flood control and navigation benefits.

Project Engineer Paul A. Jones and his staff have been literally pioneering in the wilderness. Geologists are probing into the innermost secrets of the mountain fastness; diamond drillers are disturbing earth and rock formations laid down thousands of years ago; veteran-dominated crews are charting an age-old preglacial channel of the river in the proposed reservoir area. Still others are helping to build the roads, warehouses, and Government town which eventually will make possible construction of the dam itself.

Located on the South Fork of the Flathead River not far from the west entrance to Glacier National Park, the dam site is in a heavily forested mountainous area. Sites for the Government town, storehouses, and other buildings have been carved out of the forest. A road to the dam is being blasted in part out of solid rock, the nearest highway being 4 miles away.

Contracts for five big preconstruction jobs have been let. One contractor is building the road to the dam. The Government town is taking shape under two contracts, one for construction of 25 new five-room duplexes and the other for 50 prefabricated houses. Work on curbs, gutters, sewers, water-distribution system, and paved streets for the Government town also is progressing.

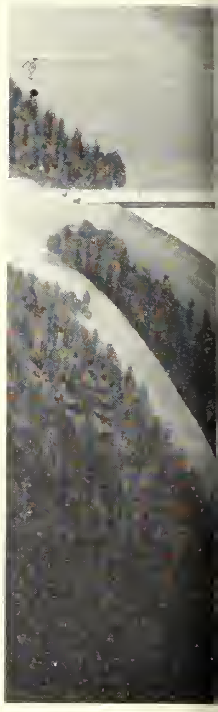
The Bureau is continuing with most of the preconstruction work so that plans can be drawn up and specifications written for the dam. This would make possible a call for bids on construction of the massive structure by July 1, 1947, if appropriations are made available.

Around the Government town other small towns are mushrooming. Already five have been plotted and four have occupants. One, Martin City, boasts 25 new buildings and has applied for a post office. Like Topsy, these new cities "jest grew." Despite warnings by the Kalispell Chamber of Commerce and the Bureau that construction of the dam had not yet started, new residents have flocked to the area. Old established towns such as Columbia Falls and Coram also have grown rapidly.

Most of western Montana's new citizens are World War II veterans and their families who see in construction of Hungry Horse a chance to make a dream come

On-the-spot news is their business.

Hungry Horse—Rec

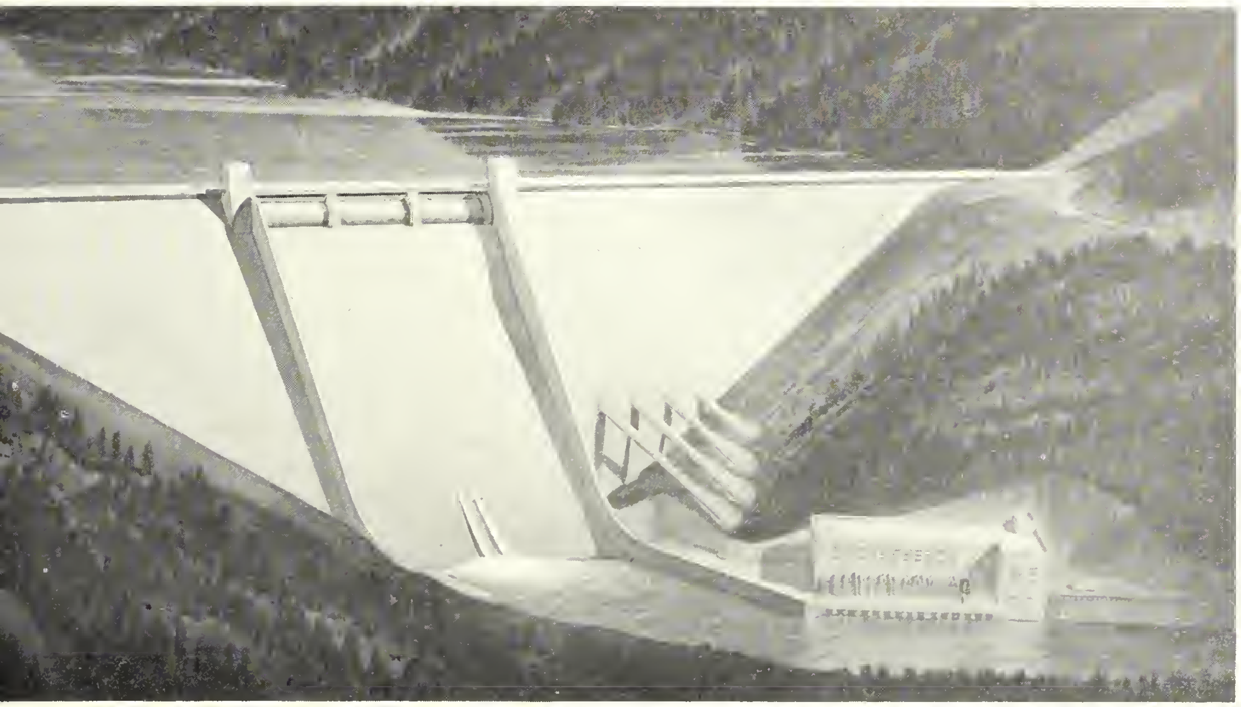


Far-sighted Engineers Richards and Hazen visualize a fuller tomorrow for Hungry Horse.

No way to beat wash day, even at the Hungry Horse project. First resident Mrs. Francis Warnock, a former easterner, displays her ability to cope with the rugged West.

Winter-resistant prefabricated homes like this one will provide a satisfactory answer to the housing situation at Hungry Horse.

ation Newcomer to the Northwest



onception of the latest multiple-purpose giant of the Pacific Northwest—Hungry Horse Dam.

posed dam site—at the south fork of Flathead River in northwestern Montana.

Yes, you guessed it! Pay day always draws a crowd.

Safety first! Pre-construction crews core drilling to test foundations at proposed site.

true—a business of their own. This and the desire to get in "on the ground floor" have been motivating causes of the migration.

Life in these towns, as on the project, has taken on a near primitive aspect. Streets are of dirt (and mud this winter) and there are no sidewalks. Many of the dwellings provide not much more than shelter, ranging from small trailers to partly completed prefabricated houses.

Perhaps typical of the newcomers is Navy veteran Francis Warnock, who brought his wife and small daughter to Montana from Boston, Mass., early in April. Warnock had lost 20 pounds in a foundry where he obtained work after discharge. His failing health and the desire to go West prompted the family to head for Montana.

Warnock arrived in Kalispell nearly broke and with no immediate prospects of a job. Housing then, as now, was a serious problem. But the family found shelter in an old deserted farm house several miles from town.

Today the housing problem is pretty well licked for the Warnock family. Appointed night watchman for the Bureau, Warnock moved his family into one of the new completed houses in the Government town. Thus, he became first resident of the new city.

Even now, however, Mrs. Warnock does her cooking on a small field-type gas stove. They eat and read by a kerosene lamp, and take their baths at night in an old-fashioned tub in the backyard, often with the eyes of deer and other wild animals peering inquisitively from the darkness.

And so it has been with many of the veterans. Used to far worse during the war, they have put up with the inconveniences and hardships without complaint. Besides the new stores and shops, the area also boasts its own newspaper, a lively little weekly established in Columbia Falls by an ex-Navy man, Melvin Ruder.

Ruder edited Westinghouse publications prior to the war and dreamed of a country weekly of his own. Now that he has it, the Hungry Horse News is doing well for a fledgling.

Studies of irrigation possibilities in the Flathead Valley are under the direction of Charles S. Hazen, Bureau project planning engineer, aided by Forrest E. Richards, who also has his offices in Kalispell. Preliminary studies made by Hazen's staff indicate that increased yields of agricultural products resulting from irrigation will amount to around 2 million dollars annually.

A large part of the potentially irrigable area is now dry-farmed, and of this approximately 30 percent is devoted to the production of wheat and other small grains. The rainfall, about 7½ inches during the crop growing season, is inadequate to produce the pasture and forage that is needed for a livestock industry. Such hay crops as are produced are usually limited to one cutting per year. Some potatoes and peas are grown under dry-farming methods on these lands, but the yields are low.

Of equal importance along with the increased yields, is the stability which irrigation will bring to the valley. The present agricultural economy is to a large extent based on the price of cash grain crops such as wheat, oats, and barley. With an assured water supply, diversified farming can be practiced, giving dairying, livestock, row and specialty crops an important place in the economy.

Plenty of low-cost hydroelectric power will be the key which will unlock a treasure chest of natural resources in western Montana, according to a citizen's committee headed by Don Treloar, Al Winkler, and Leon Phillips of Kalispell. These men, "Hungry Horse" Kelly, and other long-time leaders in the community, have worked tirelessly and effectively for the project.

Low-cost power will make possible pumping of water to several hundred acres of orchard and other land impossible to reach with gravity flow. It will furnish needed energy to electrify farms, and will encourage development of mineral, timber, and other resources. A stand of pulp timber in the area is sufficient with reforestation to operate a 200-ton paper mill.

Down-stream power plants which will benefit from storage at Hungry Horse are the Polson (Kerr) plant of the Montana Power Co., the Thompson Falls plant, also of the Montana Power Co., the Grand Coulee plant of the Bureau of Reclamation, the Rock Island plant of the Puget Sound Power & Light Co., and the Bonneville plant of the Corps of Engineers.

The Bonneville Power Administration, which will market the output of Hungry Horse, is engaged in preliminary surveys of a 115,000-volt transmission line from Polson to the dam site over which energy will be brought to the project during construction and to the Kalispell area to alleviate its power shortage.

Construction of the dam and power facilities will require between 4 and 6 years, depending upon the appropriations available. Between 2,000 and 3,000 persons, most of them World War II veterans, will be employed.

SCIENCE against SILT

Engineers turn the spotlight on sedimentation to help combat this menace to the Nation's water resources.

by Victor A. Koelzer
Engineer, Branch of Project Planning

and

Luna B. Leopold
Hydrometeorologist, Former Branch of Project Planning Engineer, Now With the Pineapple Research Institute of Hawaii

Photo by William S. Russell, Region III

Sediment deposits in Lake Mead, world's largest man-made lake, just above Boulder Dam.

Engineers and scientists call it sediment. Irrigation farmers know it is simply mud and sand carried into their ditches and over their lands. Whatever its name, it is insidious, persistent, and powerful.

Silt—soil carried from land into streams—long has been recognized as a problem. And as a problem it is growing, because present-day complex developments in reclamation are vitally affected.

Sedimentation is not necessarily bad. The fertile acres in the Imperial Valley of California were created by silt boiling over from the Colorado River during its rampages. But it can wreck man's activities and works. Silt begins with erosion, which oftentimes strips farm lands of their best top-soil, or cuts ugly, damaging gullies. This soil, carried into a stream by rain run-off, can take up valuable space in reservoirs intended for storage of irrigation water. It can clog irrigation canals. It can cover good crop-producing lands with layers of useless soil.

Man cannot eliminate the forces of nature which create sedimentation. He cannot stop siltation. Even if he could, it probably would be unwise to do so. But he can learn more about it, and its effects on irrigation works and operations. And with this deeper and wider knowledge, he can devise ways and means of lessening its bad effects, and using its good points so that they are turned to man's advantage.

That, in essence, is what the Bureau of Reclamation hopes to do. Reclamation engineers, in cooperation with engineers of other agencies concerned with this problem, are pooling their resources and technical skills. Investigations are aimed at reducing the effects of sedimentation, and thus preserving and protecting the investment of the farmer and the Federal Government in the irrigation works of the West.

The problem is a long-range one. Man sees only a small part of the erosion and siltation that occurs. Usually that is during times of flood or severe storm. But there is plenty of evidence, and the effects can be measured scientifically.

However, there is an immediate purpose in sedimentation investigations. That purpose is twofold. One is to help design and construct irrigation works that will meet the sedimentation problem better in the future. The other is to help relieve the farmer and other water users of present and potential troubles. For the long-time view, the quicker we can get a sure means of controlling sedimentation, the better off we will be.

Most people, especially those living in the East, have seen the deep damage to farm lands caused by erosion. The Department of Agriculture estimates 100,000,000 acres of farms have been abandoned or impoverished to submarginal status by erosion.

When this soil is washed into the rivers, troubles start. Eastern residents can see dredging going on in all navigable streams. Constant vigil is needed to clear the channels in streams which are overloaded with sediment. Most all have seen levees, and note that they are constantly being raised. Such effort is made necessary in some of these instances because sediment is raising the river bed, and higher and higher levees are needed to hold back the water. In time, a stream bed may be as high as the surrounding farm lands, and when that happens, drainage of the farms becomes impossible, or at best, difficult and costly. Then too, ground-water levels may rise so high as to waterlog the farm land, making it unproductive.

More directly affecting irrigation are the problems of sediment in reservoirs and canals. Irrigation pumping intakes may be buried and city intakes may become useless or subject to expensive maintenance. Even if a stream is stabilized so that there is a balance between the water's scouring effect and the building up of the stream bed, construction of an irrigation dam may generate new problems by destroying that balance. Sediment will be trapped in the res-

Photo by D. D. Suggs, former Region III engineering aide

Gulleys like this one near Tucumcari, N. Mex., are typical sources of silt in the Southwest.

ervoir. The clear water below the dam then will be able to pick up materials from the stream bed and carry them on down to deposit sediment elsewhere.

Silt in reservoirs, quite obviously, can be a serious problem in the course of time. The sediment-laden water can damage moving parts in power and irrigation pumping machinery, and choke canals. The supply of irrigation water can be so reduced that the lands cannot be supplied with water. As the years go by, the reservoir's storage capacity can become so small that either new sources of water must be obtained or some of the irrigated lands must be abandoned. And the process can continue indefinitely until either of two things can happen: all the feasible dam sites in the stream will be used up and only a series of sediment-covered structures will remain; or the highly developed communities and farm areas will be abandoned.

Of course, this is a long-range view of what could happen. It need not happen, and the Bureau of Reclamation investigations are designed to help prevent such a possibility. The abandonment of a reservoir because it is filled with sediment may not seriously affect the present generation. However, unless the present trend is changed, unless we as a nation take this problem seriously, future generations may well have cause to lament our unsuccessful efforts to control sedimentation. Continued use of the best reservoir sites without adequate control of sediment will, in effect, deplete our Nation's resources just as reckless cutting of timbered lands without regard to their restoration depleted our Nation's forests. Future generations might be presented with the incongruous picture of a dam, structurally safe for many more years of use, rendered useless because its water-storage capacity is gone.

The investigations now starting are by no means the first attention by the Bureau of Reclamation to this subject. Sedimentation has long been recognized as a problem, and active steps have been taken in dam construction, for example, to mitigate th evil. But the investigations are coordinat ing, for the first time, all scientific and tech nical resources, in a concerted attack o the problem.

Bureau engineers have kept a watchful ey on the loss of water storage in variou reservoirs. In some cases, they found th loss was growing at an alarming rate. Ele phant Butte Reservoir, for example, in Nev Mexico, has lost 16 percent of its capacit in 25 years; Guernsey Reservoir on th North Platte River has lost 21 percent i 12 years; and Cucharas Reservoir in Colo rado has lost 35 percent in 26 years.

One way to visualize the size of this loss i to picture the sediment deposited in Ele phant Butte Reservoir each year bein loaded into freight cars to be hauled away It would take 400,000 cars, enough to mak a train 4,000 miles long. Stated in anothe way, it means that each year enough wate storage capacity is lost to irrigate betwee 5,000 and 7,000 acres of new land. Ou job, as we can see it, must include ways o minimizing such incidents.

In the meantime, what has been done Agencies such as the Soil Conservatio Service, Forest Service, and Bureau of Lan Management have worked on erosion con trol through maintenance of forests an other vegetal cover, by land managemen the use of good farming methods, and insta lation of small erosion-control structures Individual farmers, through their own init ative, have contributed much toward th prevention of erosion. Results have bee good, in some cases, although the campaig is too new for results to be conclusive.

The Bureau of Reclamation, recognizin

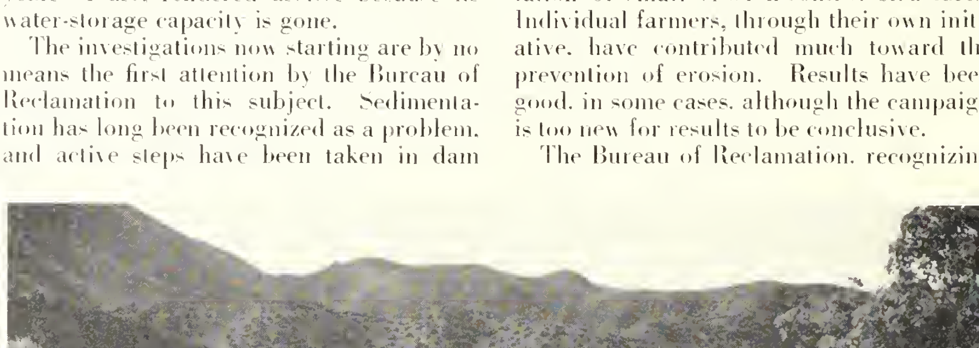


Photo by United States Forest Servic

Mono Debris Dam, Calif., built for catching sediment. Note the almost-filled reservoir.

that erosion is inevitable in certain respects, has in the past planned for it with the best means available. Portions of reservoir capacity have been reserved for "dead storage" for the accumulation of sediment. Only that storage capacity in excess of dead storage has been planned for use for irrigation, power, flood control, or other active purposes. The dead storage has usually been sufficiently large to store all the incoming sediment during the time that the cost of the project was being repaid by water and power users. But as mentioned earlier, where the sediment load is large, the dead storage will eventually be used up and the benefits from irrigation will be invaded in the years to come. Dead storage, Reclamation engineers believe, is satisfactory for relatively short-term economic evaluation of a particular project, but it is unsatisfactory in long-range utilization of the Nation's resources.

In certain areas where it has been recognized that sediment carried in canals would cause undue maintenance expenditures, elaborate works have been devised to remove most of the sediment before it enters the canal. An example is the desilting works for the All-American Canal in California.

Many plans have been investigated for removal of sediment from reservoirs to recover lost water-storage capacity. Except in isolated cases with peculiar local conditions, however, the cost of removal has been found to be far in excess of the benefits derived. Therefore it will be possible in only a very few cases to remove economically the sediment from reservoirs.

Until the present, planning oftentimes has been handicapped by lack of sufficient data. For example, preliminary plans for the Middle Rio Grande area have included proposals to construct dams on tributary streams to catch and store the sediment, thereby reducing the amount carried in the main stream.

Engineers felt that sediment-free water discharged from the reservoirs would tend to pick up some of the river bed material downstream and thus tend to deepen the river channel. As a result, the river could carry larger floods within its banks. Drainage would be improved in the valley and the ground water level would be lowered to the point where danger of waterlogging farm lands would be eliminated.

But several important questions remain to be answered. Engineers are unable to predict the depth of the scour of the river bed by the clear water, or the distance downstream that it will occur, or the effect that reduction in the natural variations of stream flow may have in reducing, ultimately, the channel capacities. They also want to know if the scoured material will merely be removed from one place only to be deposited at some other point in the channel. That would merely transfer the problem from one place to another. Also to be answered are questions as to whether the scouring might not be so deep as to endanger

Photo by Emil Eger, former Region III Engineering aide

SCIENCE AT WORK. *All-American Canal's busy silt-removing system.*

bridge foundations or other river structures.

So a full solution to the Middle Rio Grande sedimentation problem must rely upon full and exhaustive investigations. And that is true of many other rivers. The Bureau of Reclamation program is designed to study fundamental problems, and conditions existing in many specific areas, such as the Middle Rio Grande, in the West.

The investigations will follow several lines. Periodic surveys will be made of all reservoirs to determine the amount of sedimentation. From these, the Reclamation engineers will learn the rate of sedimentation which can be expected in reservoirs to be built in similar areas, and will have specific data on the actual water storage space left in existing reservoirs.

A crew, equipped with a supersonic echo-depth sounder developed by the Coast and Geodetic Survey for studies of ocean floors, will make these studies. A boat will travel across the reservoirs, receiving sound waves sent from the apparatus in the boat and bounced back by the reservoir bed. The time it takes for the sound to travel from the boat and back automatically records the depth of the water. Not only will this instrument measure the depth of the water—in most cases it will also measure the thickness of the sediment deposit, recording it continuously as the boat moves on its course. The "sounder" replaces the old, tedious, and oftentimes uncertain method of measuring depth by lowering a weight to the bottom and measuring the line on which the weight was suspended.

Laboratory investigations are to be started on a large scale. These are expected to supply some of the missing links in our knowledge of the fundamental laws of sedimentation. Specific problems will be tackled. For example, models of channels will be constructed. Observations will be made on various rates of sediment load and variations in water flow, the effects of different river developments on the scour, or deposition, in the stream channel downstream. These data will serve as a check on construction plans designed to meet the sedimentation problem.

These laboratory studies may eventually involve the use of models of an entire river system, reduced in scale to the size that can be accommodated at the Denver, Colo., Federal center. Such river models may have to be built outdoors because of their space, and will cover several acres. The "model study" method has been used successfully in designing dams, locks, and channels, but so far it has been used only sparingly for solution of sedimentation problems.

Some of the most experienced sedimentation specialists have been employed to pool their technical skills. Theirs is the arduous task of obtaining basic data, of sifting, coordinating, and interpreting these data, and of deriving practical solutions to many problems. It is not expected that all solutions will be forthcoming quickly or easily. Progress necessarily will be slow at times, for it is a new and challenging need. But efforts will be concerted. Duplication will be avoided, and coordination will be promoted, through a special subcommittee of the Federal Inter-Agency River Basin Committee. On this group are engineers from all interested Government agencies. Programs and activities of all can thereby be coordinated into a well-knit plan of action.

Water users, power consumers, and all beneficiaries of water resource development in the country, and especially in the West, will profit by this work.

Juggling Water at Grand Coulee Dam

by Luther E. Cliffe

Engineer, Columbia Basin Project, Region I, Boise, Idaho

Those circus stars who juggle knives, plates, and blazing torches simultaneously are mere novices compared with the engineers who juggled the mighty Columbia River during the construction of Grand Coulee Dam in Washington State.

"Juggling" best describes the way the Nation's second largest stream was diverted from its regular channel while man's largest concrete river barrier was being built.

The problem was the familiar one that must be met early in blocking any river. Diversion techniques vary widely from one project to another, depending upon site conditions and river characteristics. Because of these differences a method that solved the problem at one site may be completely useless at another.

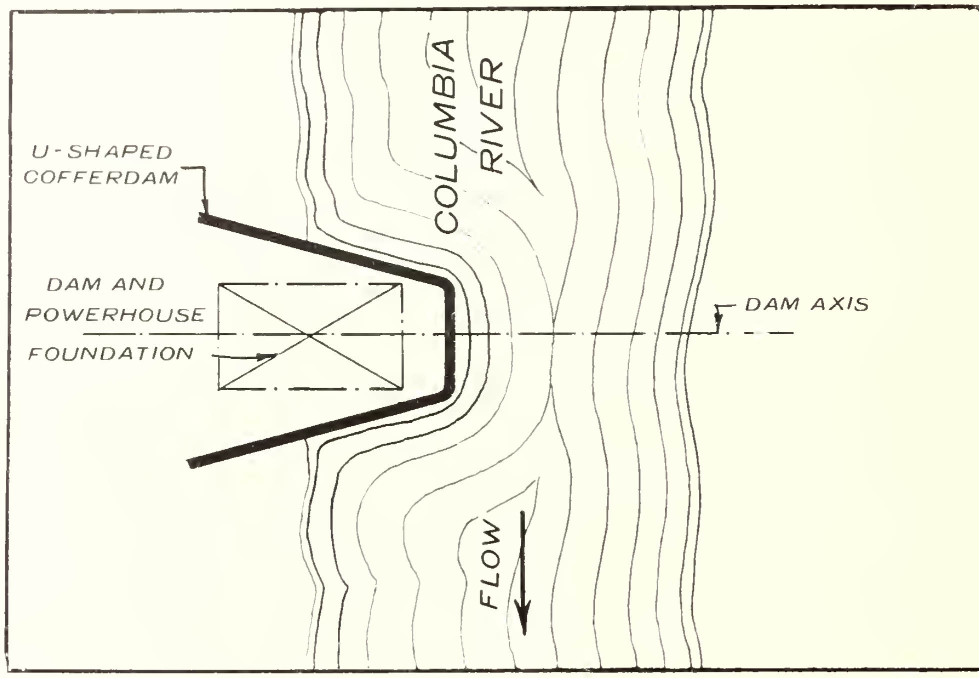
At Grand Coulee, the dam site was relatively wide (the completed dam being 4,173 feet long at its crest).

The Columbia River's dominating characteristic is its tremendous flow during flood season in early summer. The river follows a fairly predictable high-water pattern, although its peak flow varies greatly. It does not have the flash floods common to many western streams. This gentlemanly behavior is due to the fact that most of the Columbia's volume comes from melting snow and ice rather than from rapid run-off of rainfall, and the channel is so large that a small rise in water elevation accommodates a large increase in flow.

Don't think for a moment that such orderly conduct means that it was easy to control the river. The Columbia is a mighty stream, and the flow of water each season reaches a peak usually exceeding 300,000 cubic feet per second. In the 1946 season, for example, the peak exceeded 400,000 cubic feet per second. Because of the volume of water the engineers adopted an overflow-gravity-type spillway in the final design of the dam.

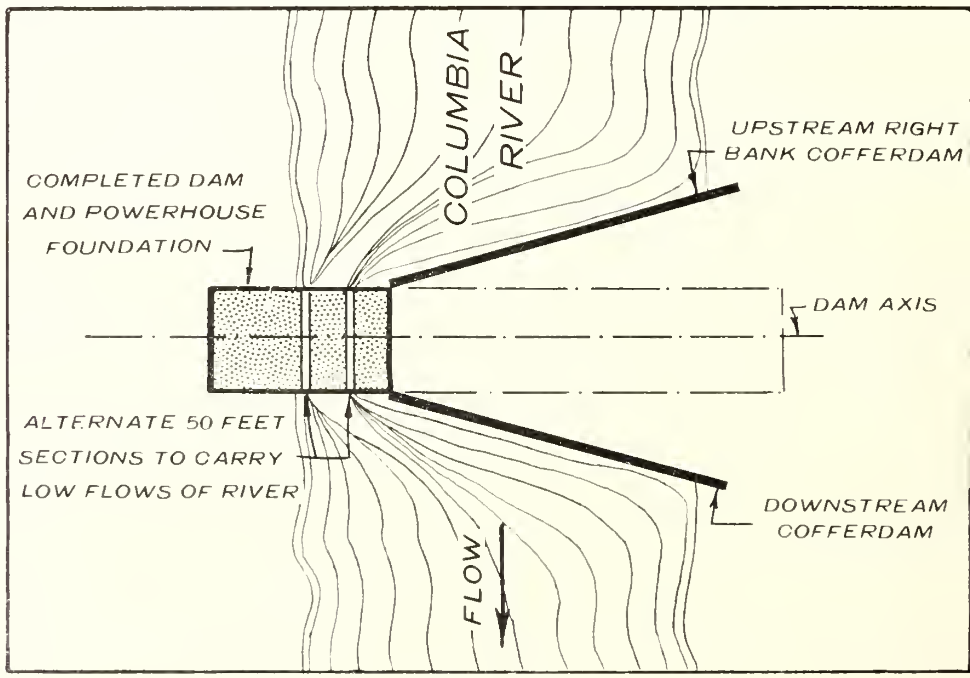
In studying the problem of diverting the river, engineers decided that there could be no adequate, permanent discharge outlets which could be utilized during construction. So they agreed that it was necessary to allow it to follow parts of its normal channel, diverting it from side to side, or allowing it to overflow the partially completed dam, always leaving enough of the structure above water to permit construction to proceed. And so we come to the "juggling" of the river.

The first phase of the diversion involved a cofferdam in the form of a large U, one leg upstream, on the left bank of the river, the other leg downstream, on the same bank of the river, with the bottom of the U extending slightly more than one-third of the way across the canyon. This U-shaped cofferdam consisted of a series of connected cells, each composed of interlocking steel sheet piling driven to bedrock, each cell filled with earth. The result was a steel-encased temporary earth dam which held the river to the center and right side of its normal channel. After pumping the water from behind the cofferdam, excavation started, the foundation rock was exposed and workers began placing concrete for the base of the left powerhouse and the left one-third of the dam.



PHASE NO. 1

Elbowing the river aside to give the builders a chance.



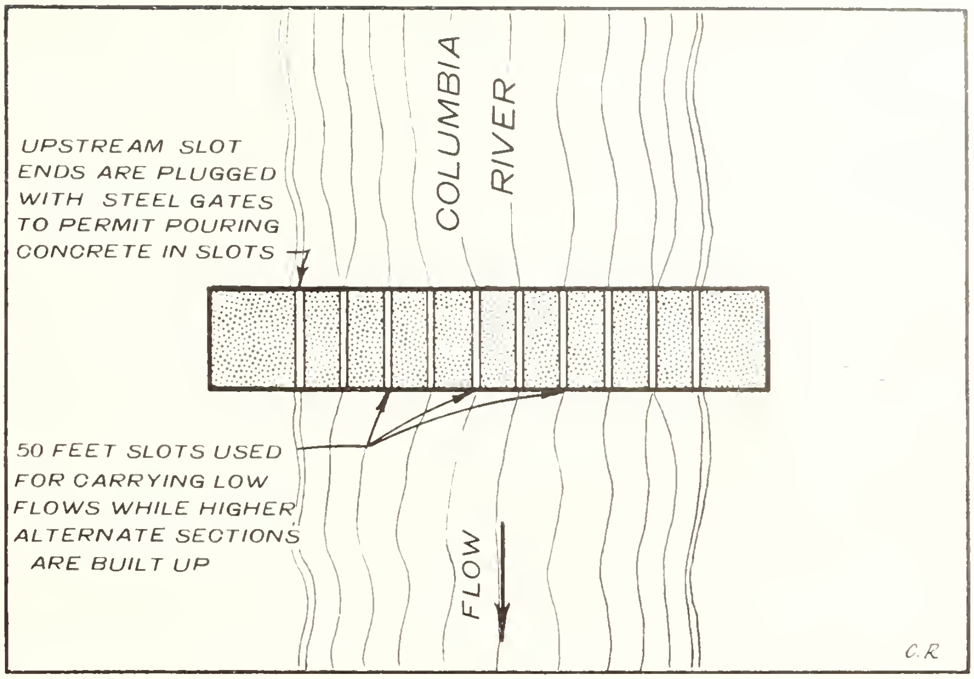
PHASE NO. 2

Pushing the river over to the other side while work goes on.

During this phase, most of the structure behind the left bank cofferdam was built to an elevation far above the usual high-water level of the river. The remainder consisted of alternate 50-foot sections, or blocks, which had an elevation of about normal low-water level. This was done with an eye to later phases of the diversion, when the river would be allowed to flow over this portion, the lower 50-foot-wide slots taking the flow during most of the year, and the flood passing over some of the higher alternate blocks as well. Also in this phase, a 100-foot section adjacent to the cofferdam was constructed to a higher elevation to form an anchor for other cofferdams to be built later.

The second phase of diversion required the removal of the first cofferdam and the construction of two more, one on the upstream side of the dam and one on the downstream side, each extending from the 100-foot anchor section across the river to the right bank. Constructing the upstream cofferdam accomplished the diversion, deflecting the river over the partially completed left end of the Grand Coulee Dam.

After the downstream cofferdam was constructed, it was possible to pump water out of the enclosed area and go ahead with excavation for and construction of the remaining two-thirds of the dam. Here again, that part nearest the abutment was constructed to an elevation well above high water, and the portion nearest the center of the old channel was built to a lower elevation, with alternate blocks carried somewhat higher than the intervening ones to give a series of 50-foot-wide slots. When this was accomplished, the cofferdams were removed.

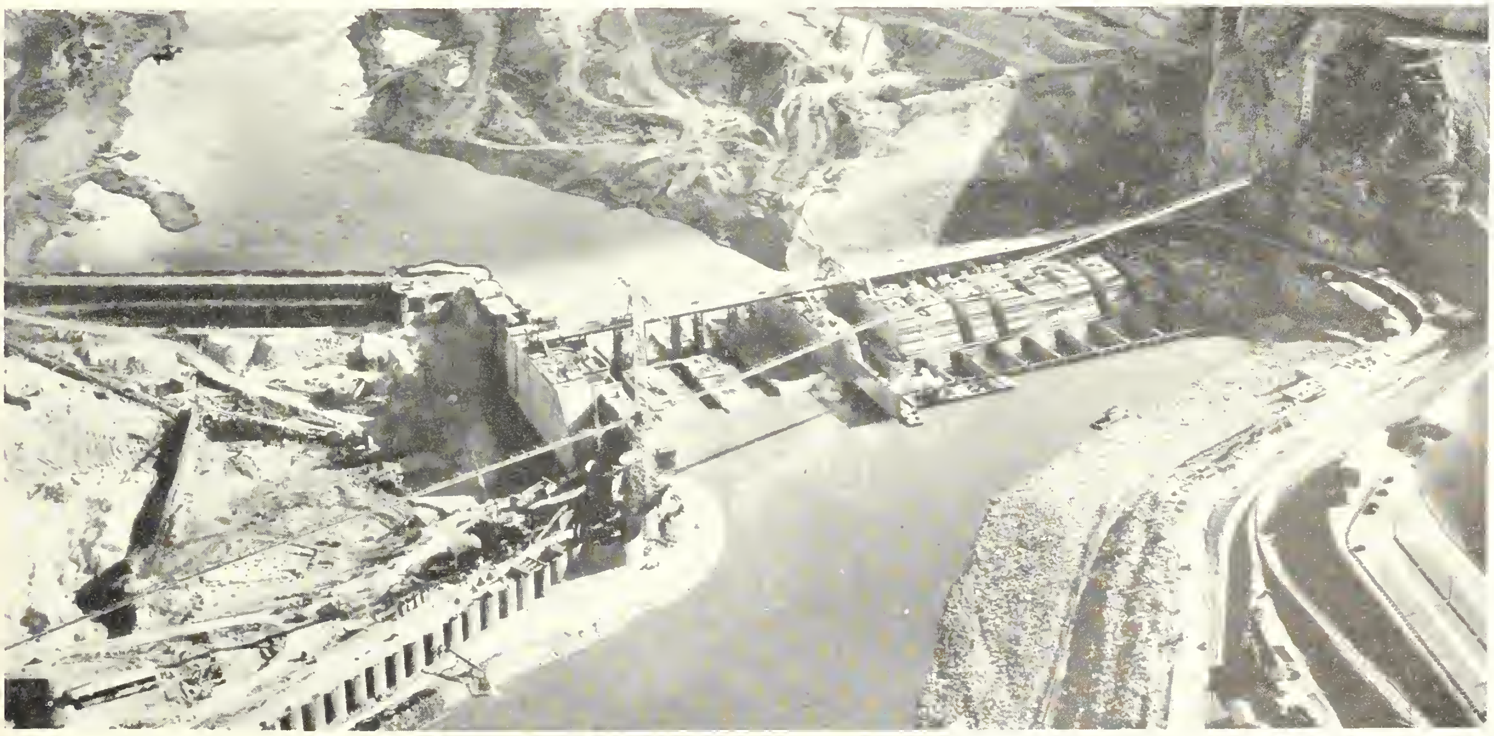


PHASE NO. 3

Juggling the river from slot to slot as the structure rises.

The third and final phase of river diversion resulted in the juggling act. No more expensive and hazardous cofferdam construction was necessary. Instead, large steel bulkheads, with rubber seals bearing on the upstream face of adjacent higher blocks, were used to plug the upstream ends of the 50-foot slots. A few lifts of concrete then could be placed. At the same time, the concrete also was being placed on the adjacent higher blocks. By shifting the bulkheads from one low block, or slot, to another, the river was juggled back and forth across the length of the spillway as the structure took shape.

There never was a period of waiting for the reservoir to fill after completing the construction of the Grand Coulee Dam. Since the river was shifted back and forth over partially completed sections of the dam, the reservoir was filling as the dam was being raised, and was nearly full when the last concrete was in place.



Photograph by K. S. Brown

HOW IT LOOKED FROM THE AIR as construction started on the east portion of Grand Coulee Dam.

PROSPERING AT PROVO

Irrigation-wise, John B. Stratton tells why he refused an offer of $150,000 for his Utah farm.

Photo by Paul E. Norine, Region IV

Stratton pruning the trees of his remunerative orchard.

by Barrow Lyons
Chief Information Officer

Few events could have affected the life of John B. Stratton and his family so profoundly as the provision of supplementary water on the Provo River project of the Bureau of Reclamation in Utah. His home is at Orem, Utah, a few miles outside of the city of Provo.

For three generations the Strattons farmed in this area of the West—always making a go of it, but not striking it rich. But the Provo project has assured a long season with ample water supply, and Mr. Stratton has been able to produce specialty crops of extremely high dollar value. At the age of 47 he has become affluent.

His story is worth starting at the beginning. James Stratton, grandfather of John B., was one of the early Mormon pioneers. He came directly from Liverpool, England, in 1850, a sailor by trade, and settled in Salt Lake City.

When the Mormons began to colonize the intermountain area, James Stratton took up a farm at Cedar Fort, Utah. Then Brigham Young sent him to the Moapa Valley, where he irrigated out of Muddy Creek and the Virgin River in what is now the State of Nevada. He went to Provo in 1867 and helped to build the first irrigation canal in the Orem area. Water was diverted by irrigation ditch from the mouth of Provo Canyon, named after a French beaver trapper by the name of Provost.

James Stratton's son, John H. Stratton, who was the father of John B., was born in Cedar Fort, Utah, in 1860. When he was 20 years old, he left Provo and homesteaded in what is now Orem.

John B. Stratton was born in 1899. When he was 17 years old, he rented a ranch from his father and purchased it 2 years later.

When John B. was only 11 years old, his father purchased 160 acres of irrigated land in Benjamin, Utah, for $1,000, which land is now under the Bureau's Strawberry Valley project not far from Provo. Shortly after the Bureau of Reclamation delivered water to the Strawberry Valley project, the father sold this land for $8,500.

John B. was able to combine starting a farm of his own with going to college. He entered Brigham Young University in 1918, the year in which he purchased 30 acres of land on time from his father. His father gave him 13 acres when he married in 1920, and shortly after he was graduated from college in 1922, he purchased from a local bank an additional 63 acres under the upper (Provo Reservoir) canal. It is this canal which the Bureau of Reclamation is enlarging and improving and which had enabled this Mormon community to change from grain and alfalfa to the much more highly profitable fruit specialties.

On the matter of farming, Mr. Stratton speaks for himself:

"I have raised every kind of crop that grows in this valley except celery. These crops include sugar beets, grain, hay, and all kinds of fruit: apples, apricots, prunes, plums, pears, tomatoes, dewberries, raspberries, strawberries, and cherries. In the operation over the years, we have found fruit much more profitable than field crops, so we have eliminated those. Field crops would grow just as well up here on the high bench, but the others are much more profitable. We are specializing in Bartlett pears, Bing and Lambert cherries, Chinese apricots, and Moor Park apricots.

"Several years ago we imported buds of an improved Hale peach from California. We grew them on our nursery stock which produced very sturdy trees. The production was twice as great as with the ordinary Hale peach."

Nineteen forty was the first year in which the Bureau of Reclamation delivered some water to the Provo River project. The following season its large canal was full throughout the year. Nineteen forty-tw[o] was an exceptionally good crop year for th[e] project.

"Our best year was 1 year ago in 1945," continued Mr. Stratton. "We sold $55,-483.74 worth of fruit. In 1943, we had [a] total freeze-out, the only one I have ev[er] experienced. That, of course, was the wor[st] year we ever had. During the years pr[e]ceding the war, we made from $3,000 t[o] $5,000 a year above all of our expense[s]. However, during those years, I put mo[st] of all we made back into the farm becaus[e] costs were low.

"Let me explain why the Bureau of Re[c]lamation has meant so much to us. Befor[e] the Provo River project came, we had vi[r]tually no storage capacity for late seaso[n] water. We ran the water onto the lan[d] from the ditches which our fathers ha[d] built. Ordinarily, during the spring, ther[e] is a high run-off period that comes towar[d] the end of May or the early part of Jun[e]. Then the streams gradually diminish and b[y] summer they are generally very low. Du[r]ing the low year of 1934, the entire amoun[t] of water available was barely enough f[or] two good irrigation applications.

"One summer, I had 10 acres in Italia[n] prunes. We had a drought and 2,000 bush[]els of prunes dropped on the ground becaus[e] we could not give the orchard one mor[e] irrigation. Assurance of a continuous wa[]ter supply throughout the summer wheneve[r] we needed it encouraged us to go into th[e] more profitable fruit crops, and I think th[e] Orem area eventually will give up field cro[p] farming."

"Of course, we had unusually high price[s] during the war period, but in the few year[s] during which the Bureau has been delive[r]ing water on this project, I believe I hav[e] made enough additional money from m[y] crops to pay off all of my portion of th[e] construction charges."

The Bureau has a contract with the Provo River Water Users' Association, under which the association pays for water delivered. This money will be applied to the construction charges.

A similar project, which already has experienced economic change because of storage water is the Bureau's Weber River (Echo) project, 75 miles north of Provo. Before this project was built, the annual gross crop returns on the area served had never amounted to more than $2,000,000. During the 1945 season, the gross crop returns were $13,700,000. Before the project was built, only 5 percent of the area was in diversified farming, most of it being in hay and grain. Now, only a small percentage is in hay and grain, the balance in more highly remunerative crops.

Mr. Stratton now owns 60 acres of fruit land. On this he has a two-story packing house with washing machines and all types of fruit graders. He has a cold-storage plant equipped with the new type of Freon automatically controlled refrigeration. There is another packing shed and there are tent cabins with a bathhouse for seasonal help. There is a 30- by 60-foot storage shed for box materials, a small tool house, and a barn with cement corral to conserve manure for use in fertilizing the land.

"I feed about 40 head of cattle in the winter," continued Mr. Stratton. "The profits from the cattle come from the fertilizer that is used on the orchards in spite of the fact that I buy all of my hay. We haul out and spread the manure just as soon as it is made and disk it in if possible, otherwise in the winter we spread it on the snow. It leeches out where you want it. You can increase yields just about double by using fertilizer.

"Out of one block of 6 acres of cherries this year, we produced 7,000 crates which brought a gross return of more than $17,000. Last year, on 5 acres of apricots, we packed 8,500 half-bushel baskets. That is about 825 bushels to the acre. Last year, they brought $3.76 a bushel, but this year they brought $3.30 a bushel. Figure it out for yourself. Last year, the apricots grossed almost $3,000 an acre."

The Strattons live in a nine-room house with an additional room in the basement. They heat the house with an air-conditioning coal furnace, have hot and cold water, showers, and electricity with which they cook. Equipment on the farm includes two spray pumps which cost $5,000, two caterpillar tractors, orchard disk and markers, three trucks and a touring car.

"A man who wanted to buy my farm, home, and all equipment, including the storage plant, offered me $150,000 this year," said Mr. Stratton. "Why should I sell it? I have had only one total crop failure in 25 years, and 2 years' partial failure due to frost. This farm enables me to enjoy life to the very fullest. I no longer have to do all the heavy work myself. I find time to fish and hunt, to go to shows and dances.

"Mrs. Stratton and I take two vacations every year. This summer we spent 2 weeks in Yellowstone, and last December we spent 8 or 10 days in California—long enough to appreciate home when we got back.

"We hunt deer, elk, pheasants, and ducks. Sometimes we go hunting for deer as far as 200 miles away, but most of our deer hunting is within a radius of 50 miles. We have killed elk near the ranch, but the State Game Commission moved that herd out of this area. The elk came down from the hills and ate the fruit buds off the trees. Pretty aggressive critters!"

The Strattons have five children living. The oldest is John D. Stratton, 25 years old, who has a 35-acre orchard across the highway from the paternal ranch. He is married, has purchased his ranch from his father and is doing well. Mar Jean, 12 years old, and Richard, 8 years old, are still going to school.

"We have always kept our children in school as long as they'd stay there," explained Mr. Stratton. "But the two girls, Ruby and Helen, decided to get married after 2 years of college. Their husbands were called to the service. They are now doing well with their husbands on fruit ranches which they are purchasing from me on a time basis."

Mr. Stratton has had an architect draft plans for a beautiful modern house which will be built as soon as materials become available. It will be on the high bench of Orem, looking up toward the mountains and far out over the fertile area upon which the Mormon pioneers established their home in the desert, almost 100 years ago, based entirely upon irrigation.

Another example of what can be done upon this land when sufficient water is applied was discovered in the case of E. W. Hoopes, who works in the plant of the Columbia Steel Co. near Provo. In 1945, from one-half an acre of raspberries, he received $1,700. He has a small place—three and a half acres—in raspberries, cherries, apricots, and peaches, and expects this plot to pay for his small home in 3 years.

The bench landowners above the project canal will also profit from the project. At present, the water supply from mountain streams is only partially available to them during the flood season, as the farms below have the water rights. The bench owners have purchased water in the project which is released to the lowland areas in exchange for the higher water being retained on the highlands.

Photo by Paul E. Norine, Region IV

Regular use of fertilizer is an important part of his horticultural plan.

Correction

Instead of the last two sentences in the fourth paragraph of the story India's Unfinished Business (p. 275, December issue) the following should have appeared "This province has 16,000,000 acres under irrigation."

RUTH F. SADLER, *Editor.*

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Approved Missouri River plan map.*—Color map of reservoir and dam sites in the basin construction program in Colorado, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

2. *Maps of seven States showing water resources development of the Missouri River Basin.*—Maps of Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming with locations (in color) of dams, reservoirs, canals, irrigable areas, and other works proposed as parts of a unified plan for the development of the water resources of the Missouri River Basin. (Also available from regional directors, Bureau of Reclamation, region VI, Billings, Mont., and region VII, Denver, Colo.)

3. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Table showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

4. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

5. *Fourth Report of Operations Under the Boulder Canyon Project Adjustment Act for Year Ended May 31, 1945*, published January 4, 1946. Fourth annual financial statement of the Commissioner of Reclamation transmitted to the Secretary of the Interior concerning operation, maintenance, and construction activities of the Boulder Canyon project during the year ended May 31, 1945. Ten cents a copy.

6. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals*, by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, seven-page mimeographed study with graphs.

Available from the Superintendent of Documents, Washington 25, D. C.

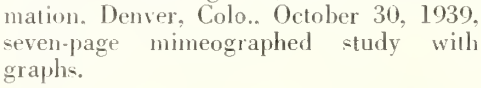
1. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

2. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest releases are:

Problem 14. Financial Aid for Settlers—25 cents.

Problem 23. Rural and Village Electrification—25 cents.

Problem 26. Recreational Development of Roosevelt Lake—75 cents.



Miscellaneous Publications

"Davis Dam Scheduled for 1949 Completion," in *Engineering News-Record*, August 22, 1946, page 84, illustrated. Major features of Davis Dam on the Colorado River—a $7,000,000 project whose construction was halted by the war, but now resumed—are a 3,900,000-cubic yard earth- and rock-fill dam, a by-pass channel to handle a maximum flow of 60,000 cubic feet per second during construction, and a power plant with an ultimate capacity of 225,000 kilovolt-amperes.

DDT and Other Insecticides and Repellents Developed for the Armed Forces, prepared by the Orlando, Fla., laboratory of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture. Miscellaneous Publication No. 606, 71 pages with illustrations, issued August 1946. Originally written and issued specifically for members of our armed forces and others concerned with the problems of controlling insects and insect-borne diseases affecting military personnel and civilians in occupied territory, this publication presents materials and methods of value for both military and civilian use under peacetime conditions.

Irrigation Requirements of California Crops, a cooperative report prepared by Arthur A. Young, irrigation engineer, Soil Conservation Service, United States Department of Agriculture, for the Division of Water Resources, Department of Public Works, State of California. Bulletin No. 51, 132 pages with bibliography, issued November 8, 1945. Comprehensive compilation of data that have been published or made available from public and private files, as well as unpublished findings resulting from cooperative research studies, pertaining to agricultural crops common to California.

"Mexico's New Soil and Water Conservation Program," by Phoebe O'N. Faris, in *Agriculture in the Americas*, November 1946, page 175, illustrated. Mexico, faced with serious diet deficiencies in many areas, is taking an important step toward returning badly eroded farms and grazing lands to productivity. (Agriculture in the Americas is issued monthly by the Office of Foreign Agricultural Relations, United States Department of Agriculture.)

Construction, issued by the Bureau of Labor Statistics, United States Department of Labor, September 1946, 73 pages (mimeographed). Statistical study of employment, volume, earnings and hours of work; prices of construction materials and machinery; rents and characteristics of rental housing and vacancy rates, and wage rates in the construction industry.

"Construction Legislation in Seventy-ninth Congress (second session)," in *The Constructor*, September 1946, page 45. Brief summaries of bills enacted and bills which failed to pass prepared for the layman.

"Colorado River Basin Development," in *The Constructor*, August 1946, page 41. The Bureau of Reclamation has submitted a preliminary report on development of the Colorado River Basin under existing government agencies to the Department of Agriculture, the Corp of Engineers, and the Federal Power Commission—members of the Federal Inter-Agency River Basin Committee—for their review.

The Magic Valley

By James A. Robertson, ***chief clerk, Valley Gravity project Region V***

EDITOR'S NOTE: The Magic Valley referred to in this article is not to be confused with the Magic Valley of South Central Idaho

The natives, and those who remain long enough to eat a pink grapefruit or peel a giant orange, call it "The Magic Valley." That the appellation has any connection with legerdemain would be denied by any of the chambers of commerce.

Geographers—those unromantic fellows so keenly versed in the science of the earth in its relation to human life—insist upon referring to this tropical tip of Texas, which points directly toward Latin America, as the Lower Rio Grande Valley. But to the fortunate souls who bask in its sun or spark in its moonbeams, filtered through sky-brushing palms, it is "Magic Valley."

Following my release from the Army in New Jersey, I reported for duty at McAllen, self-proclaimed capital of "Magic Valley," to assist in the administrative planning by the Bureau of Reclamation for construction of a gravity canal and a drainage system to serve 700,000 acres of fertile soil.

I arrived in "Magic Valley" last January by the way of Amarillo. From the subzero weather of Jersey to the subzero weather in Amarillo was merely one step to another. But from Amarillo to "Magic Valley"—a mammoth stride.

Approaching San Antonio, I lowered my car windows several inches. Down by the Alamo, in old San Antonio, I lowered the car windows as far as possible, and removed my topcoat. I haven't seen it since.

It is a long drive of more than 700 miles from Amarillo to "Magic Valley." A dull dreariness had crept over me between San Antonio and my destination. Suddenly, however, I got a whiff of orange blossoms and my eyes focused on dreamland.

To be in civilian clothes after 4 years in the service and without a War Department special travel order telling me where to go, how to go, and exactly what time to get there, was in itself inconceivable. But to jump from the icy fog and congested streets of the East to the clear, warm skies and scented air of one of the most beautiful valleys in the world was almost beyond human comprehension.

This was magic, yet I soon learned that "Magic Valley" had more tricks up its sleeve. Magicians produce birds and animals from a hat—"Magic Valley" produces cabbages and fruits of the earth in stupendous quantities at unbelievable seasons.

A local citizen—one of those conservative Texans noted for their understatements—warned me to be careful when I dug in the ground with my bare hands. He said the soil was so rich that my fingers were likely to sprout.

There is no denying that some of the land bears four complete crops and each crop represents a full year's production for farm land in northern climates. Here, in the dead of winter, the farmers and town gardeners gather lettuce, squash, tomatoes, oranges, grapefruit and lemons. Coats or other wraps are unnecessary, uncomfortable. There is no winter in "Magic Valley."

This is my first experience with citrus groves. Previously, I envisioned them to consist of trees with fruit hanging like apples or pears. That is not the way of it. Healthy trees resemble giant bushes, with clusters of grapefruit and others almost solid with oranges or lemons. Some of the better groves produce fruit that sells for as much as $1,700 an acre. This year the mature groves provided crops valued at as much as $4,000 an acre.

The production of winter vegetables, citrus crops, Brahma cattle and local farm industries in the four "Magic Valley" counties will amount to more than $125,000,000 this year. If that amount were distributed equally among the 75,000 agricultural population of "Magic Valley," there would be more than $1,600 for each man, woman and child.

Repayment Proposals

(Continued from page 31)

concerned principally with provision for the repayment in 40 years of the entire cost of the distribution system of the unit.

Under the contract draft, the annual payment of the construction charge for the distribution system may be based on either of two factors. One is a variable repayment charge governed by the annual returns to farmers from their irrigated crops. The other is a fixed annual charge based on the best estimate of the water users' long-time ability to pay. Either plan would schedule the repayment of the cost of the distribution system within 40 years.

During the contract negotiations the two repayment methods will be fully explained to the boards of directors of the irrigation districts so that the repayment method most suitable to local conditions may be adopted. In addition to annual payments to apply on the construction obligation, the water users will pay annually under this part of the contract the actual costs for operation and maintenance of the distribution system.

The estimated construction costs of the Frenchman-Cambridge unit, which will serve about 54,000 acres in the Republican River Valley of Nebraska and provide flood protection, have increased about 50 percent over the 1940 cost basis set forth in Senate Document 191 on which the Missouri Basin project was authorized by the Flood Control Act of 1944.

The directors of the Frenchman-Cambridge district in July agreed to increase the repayable obligation of the district in ratio to the increased cost. In other words the Frenchman-Cambridge district's obligation has been increased about 1½ million dollars. The repayment arrangements will be negotiated on that basis.

Because of changes in plans, on the Heart River unit (consisting of about 14,000 acres) in west central North Dakota, final estimates of the construction costs are being revised. Indications are that those costs will be considerably in excess of the estimates when the project was authorized, because of changes in plans and increased labor and material costs. The additional or increased obligation the Heart River unit will be expected to assume will be the subject of negotiations when the revised cost estimates of the unit are available.

The Secretary of the Interior has held that the water users' proportionate share of the increased construction costs of Reclamation projects shall be reflected in the repayable obligations to be assumed by water users. He also requires a repayment contract or other satisfactory evidence of the willingness of the water users to repay the reimbursable construction costs before construction of any feature of a project may begin. In the Frenchman-Cambridge case, a resolution of the district board was regarded as satisfactory evidence of the good faith of the water users to enter into a repayment contract, whereupon the Secretary authorized the award of a contract for the construction of Enders Dam. Construction of other features of the Frenchman-Cambridge unit will await execution of the contract. A similar procedure is anticipated on the Heart River unit in North Dakota provided the district water users adopt the same cooperative spirt as shown by the Nebraska district.

Straus Named to World Power Committee

Commissioner Michael W. Straus has been nominated chairman of a committee of five to work with the Commission Internationale in collaboration with the United States Committee of the World Power Conference.

Crops Jump in Gross Value

Crops in eastern Morgan County and western Summit County, in Utah, which in no previous year had produced an income of more than $2,000,000, in 1945 had a gross income of more than $13,700,000—an increase of almost 600 percent. The factor that caused the difference was the Bureau of Reclamation's Weber River irrigation project.

The project cost the Federal Government $2,725,885 to construct—or only one-fifth of the increase in crop values during the first year of operation. The water users in a period of a year will repay to the United States the project's cost.

Record for Hard Rock Drilling

The world's record for driving in granite or hard rock was made by three drilling crews at Rams Horn Tunnel-Colorado Big Thompson project when they drove a total of 80 feet in 24 hours. To make the record official, measurements were taken by Bureau of Reclamation engineers. The operation required 1,925 pounds of powder.

Weed Program Accelerated

The cooperative weed research program undertaken jointly by the Bureau of Reclamation and the Bureau of Plant Industry is now under way with work to start soon in research centers in Idaho and Arizona. A BPI plant physiologist has been working in the Denver Reclamation chemical laboratory. Details of the program yet to be worked out will be based on a recently executed memorandum of agreement between the two agencies. Widespread interest has been expressed in the preliminary edition of the manual of Weed Control on Irrigation Systems. Numerous suggestions for minor improvement in it have been received and the demand for copies including numerous requests from foreign countries is exceeding the supply.

The use of 2-4D on willows and other ditchbank weeds, and Benochlor for waterweeds, in addition to other improved weed control measures recommended by regional weed control specialists, is beginning to show reductions in operation and maintenance costs. The assignment of weed control specialists to each region has proved most satisfactory in developing a comprehensive weed control program covering irrigation systems and project farms.

Klamath Horses Take Trip to Europe

One hundred head of horses raised on the Liskey Bros. Swan Lake range on the Klamath project were recently shipped to Europe. The horses will be used to work in the fields of war-torn Holland, Belgium, Russia, and France. Many of the animals are from the original stock placed on the range by the Liskeys more than 30 years ago.

Straus to Visit Puerto Rico

On the invitation of Gov. Jesus T. Pinero of Puerto Rico, Commissioner Michael W. Straus is expected to visit Southwestern Puerto Rico to confer upon certain aspects of a multiple-purpose irrigation project. The visit is tentatively planned for the first week in February.

Density Current Data Sought

The demand for density current data collected at Lake Mead from 1935 to 1940 still continues. In view of the fact that analyses of these data, by scientists of various Federal agencies in Washington, was interrupted during World War II, plans are now under way to have the material printed and make it available to scientists throughout the world.

F. D. R. Memorial Under Study

A committee of five members of the Bureau's Washington office was recently appointed to study a proposal for proceeding with the plans for developing a structural memorial for the late Franklin D. Roosevelt. The proposed site of the memorial would be at Grand Coulee Dam overlooking Franklin D. Roosevelt Lake.

Bureau Experts In Demand

The latest requests for the loan of the services of Bureau experts in the fields of engineering and irrigation have come from the following countries and territories, through the Departments of State: Korea, Afghanistan, El Salvador, Egypt, and Puerto Rico, China, Costa Rica, Ecuador, Iran, Ceylon, and Hawaii.

Domestic Water From Irrigation Ditches

The Branch of Operation and Maintenance has begun a survey to determine the extent to which domestic water supplies are being drawn from irrigation ditches in all areas under its jurisdiction. The suitability of irrigation waters for drinking purposes, the need for additional studies, and other data on the purity of water supplies on irrigation projects will also be explored.

A Department-wide program concerning pollution of the western water supplies is under consideration by the Water Resources Committee, but no definite action has been taken thus far.

Pollution problems will be considered in the planning of future projects and, wherever it seems pertinent, the suitability of water for domestic and industrial uses will also be determined.

Columbia Basin Meeting Scheduled

Development of the Columbia River Basin will be the subject of a meeting of the Northwest States Development Association tentatively scheduled for March. The Association is comprised of Gov. Sam Ford, of Montana, chairman, and the governors of Idaho, Oregon, Washington, and Wyoming.

Renewable Natural Resources Conference

The Inter-American Conference on the Conservation of Renewable Natural Resources is scheduled for Yosemite National Park May 5–18. The Department of the Interior Committee on Scientific and Cultural Cooperation is preparing the program. The Bureau of Reclamation, Bureau of Land Management, National Park Service, and Fish and Wildlife Service are the Interior agencies primarily concerned with the conference.

U. S. GOVERNMENT PRINTING OFFICE 1947

Notes For Contractors

Contracts Over $10,000 Awarded by Branch of Design and Construction During December 1946

Spec. No.	Project	Date of award	Description of work or material	Contractor	Contract amount
1441	Fort Peck Power, Mont.-N. Dak. and Missouri Basin-power transmission lines unit, N. Dak.	Dec. 6	Schedules 2, 5, and 8, construction 115-kv. transmission lines, Glendive-Miles City, Fort Peck-Williston, and Williston-Garrison (aluminum conductors).	Morrison-Knudsen Co., Inc., Boise, Idaho.	$3,289,700.00
1456	Klamath-Tule Lake, Modoc unit, Calif.	Dec. 17	Schedules 1, 3, vertical-shaft pumps, pumping plant D.	Fairbanks, Morse & Co., Kansas City, Mo.	22,591.00
1466	Colorado-Big Thompson, Colo.	Dec. 19	Schedule 1, three 21,000-hp. vertical-shaft turbines, Estes power plant.	Allis-Chalmers Mfg. Co., Denver, Colo.	525,800.00
		...do...	Schedules 3 and 6, three 16,667-kv.-a., 1 9,000-kv.-a. generators, field tests; spare parts c, d, e, and h for each schedule, Estes and Mary's Lake power plants.	General Electric Co., Denver, Colo.	606,103.00
		...do...	Schedule 4, 1 11,300-hp. vertical shaft turbine, Mary's Lake power plant.	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	160,000.00
1481	Columbia Basin, Wash..	Dec. 10	4 833 kv.-a. transformers, 1 15,000-v. disconnecting switch, 3 15,000-v. disconnecting fuses, 6 lightning arresters, Pasco pumping plant.	Westinghouse Electric Corp., Denver, Colo.	18,769.95
1483	Boise-Payette, Idaho...	Dec. 11	Preparation concrete aggregates, Keener deposit...	Utah-Idaho Concrete Pipe Co., Nampa, Idaho.	29,200.00
1494	Colorado-Big Thompson, Colo.	Dec. 4	8 vertical-shaft pumping units, Colorado River improvements, Kremmling area.	Fairbanks, Morse & Co., Kansas City, Mo.	11,144.00
1496	Davis Dam, Ariz.-Nev..	...do..	Item 1, 5 stop-log guides, Davis power plant intake structure.	Willamette Iron & Steel Co., Portland, Oreg.	38,711.00
		Dec. 17	Item 3, 2 stop-log guides, Davis Dam outlet structure.	Valley Iron Works, Yakima, Wash.	43,800.00
1518	...do...	Dec. 21	Erecting 20 2-bedroom prefabricated houses, Davis Government camp.	W. S. Ford, Kingman, Ariz.	17,900.00
1535	Central Valley, Calif. ..	Dec. 30	Structural steel for S. P. Railroad bridge and farm bridges, Westley wasteway, Delta-Mendota Canal.	American Bridge Co., Denver, Colo.	17,117.00

Invitations for Bids for Construction and Supplies, in Amounts Over $10,000, Expected To Be Issued by Branch of Design and Construction During February 1947

Project	Description of work or material	Estimated date bids to be invited	Estimated bid opening date
Davis Dam, Ariz.-Nev	20-ton machine shop crane, Davis Dam and power plant	Feb. 4	Mar. 8
Provo River, Utah	5-foot, 9-inch by 8-foot, 0-inch fixed wheel gate frame and hoist, Salt Lake aqueduct, station 0+00 to 296+19.4.	...do...	Do.
Deschutes, Oreg	Earthwork, concrete structures, and steel pipe line, north unit, main canal, station 2994+00 to 3010+50.	Feb. 10	Mar. 18
Boulder Canyon, Ariz.-Nev	Motor control equipment for Boulder City supplemental water supply system	Feb. 15	Mar. 22
Buffalo Rapids-Second, Mont	Motor control equipment for Fallon & Fallon relift pumping plants	...do...	Do.
Colorado-Big Thompson, Colo.	50- and 70-ton cranes, Estes and Mary's Lake power plants	...do...	Do.
Do	50-ton, 25-ton, standard traveling cranes; 15-ton special traveling crane, Granby pumping plant.	...do...	Do.
Do	3 turbine governors, Estes power plant	...do...	Do.
Do	1 turbine governor, Mary's Lake power plant	do	Do.
Columbia Basin, Wash	Substation equipment and motor control equipment for Pasco relift pumping plants; transformers for R1, R2, R3 generating units, Grand Coulee.	...do...	Do.
Davis Dam, Ariz.-Nev	Transformers for Davis power plant	...do...	Mar. 22
Do	Copper cable, insulators, hardware, connectors for Davis switchyard	do	Do.
Do	Oil circuit breakers, disconnecting switches, Tuscon, Phoenix, Gila, Mesa, and U. S. B. R. Arizona-Edison substations.	...do...	Do.
Do	Main control board, Tucson substation	...do...	Do.
Do	Five turbine governors, Davis power plant	...do...	Do.
Do	100-ton low platform reversible full trailer with 50-ton jacks, 230-kv. Barker-Gene interconnection.	...do...	Do.
Hungry Horse, Mont	150,000-gallon water tank, Hungry Horse Government camp	...do...	Do.
Missouri Basin-Angostura Unit, S. Dak	7.74- by 7.74-foot fixed wheel-gate frames and anchorage, Angostura Dam	...do...	Do.
Parker Dam Power, Ariz.-Calif	Machine shop for Parker Government camp	...do...	Do.
Yakima-Roza, Wash	Construction Yakima pumping plants 13 and 14	...do...	Do.
Davis Dam, Ariz.-Nev	Double garage for Davis Government camp	...do...	Do.
Do	Garage and filling station for Davis Government camp	...do...	Do.
Do	20 permanent residences for Davis Government camp	...do...	Do.
Davis Dam, Calif.-Ariz	12 miles 34.5 kilovolt transmission lines, Yuma area improvements	Feb. 20	Mar. 27
Colorado-Big Thompson, Colo	Penstock air vent and structure drains, Estes penstock gate structure	Feb. 25	Apr. 1
Columbia Basin, Wash	19- by 17-foot radial gates and hoists, West Canal, bifurcation plant to Soap Lake siphon.	...do...	Do.
Do	13.8-kv. transmission line from Bonneville Power Administration 115-kv. transmission line to Pasco pumping plants.	...do...	Do.
Colorado-Big Thompson, Colo	Construction Olympus Dam, earthfill	Feb. 28	Apr. 4
Parker Dam Power, Calif.-Ariz	Main control board, Gila substation	...do...	Do.
Davis Dam, Ariz.-Nev	Power plant control and auxiliary power equipment	...do...	Do.

No. 3 Tule Lake Winner
FARM WINNER LIST
LUCKY VETS DRAW RICH FARMING LAND
First Number To Banks Man; Portlander 3d
Land at Tule Is Drawn by 85 Men, Girl
Oregon Daily Journal
VOL. XLV NO. 245
PORTLAND, OREGON
19, 1946 NORTHWEST EDITION 38 PAGES PRICE 5c
'GOOD TIMES' DEPEND ON WORK, SAYS TRUMAN
FARM WINNER LIST
HOMESTEAD DRAWING SPEEDY
E. M. Lindsay First Klamath Basin Winner
Herald and News
KLAMATH FALLS OREGON WEDNESDAY, DECEMBER 18, 1946
PRICE FIVE CENTS
By FRANK JENKINS
Wagner Indicted By Grand Jury
Policeman Accused Of Jail Beating
Suspense Rules As First Homestead Number Is Drawn
The Oregonian
PORTLAND, OREGON, THURSDAY, DECEMBER 19, 1946
PRICE FIVE CENTS
KLAMATH FARMS DRAWN
10 Children Lose Lives At Crossing
Polio Victim Who Survived Son's Birth Looks Forward to Rougghouse With Lad
Lucky Vets Win Title To Acrea
VETS WIN RICH SOIL
Banks Man First; Portlander No. 3
$2,000,0 Lottery
U. S. Gives Aw 86 California Farms to Veteran
Tule Lake Land Winners Tell Future Plans
Grand Jury Indictments
Job, Productio Brightens, S
By STERLING F. GREEN
Four S. F. Veterans Win Farms in Land Lottery
SEVERE TESTS STILL TO COME
Rigid Conditions Set on Occupancy
PLOTS ALREADY IN CULTIVATION
Tule Area Tracts Worth $15,000 Each
Road Conditions Unchanged Today
Flood Drop
Farley Purge
rike Fund Worker Aim

MARCH 1947

In This Issue:

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IRRIGATION IN THE PHILIPPINES

by Ambassador McNutt

●

YAKIMA-TIETON CELEBRATES

●

DITCHBANK PASTURING

THE *Reclamation* ERA

Reclamation ERA

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Credits

Art work by James D. Richardson, Georgie Petty, and Mary Edmondson, Bureau of Reclamation, Washington, D. C.

OUR FRONT COVER

All the world loves beauty

Young Moses Lopez, with a smile that matches the brightness of the chrysanthemums, is a descendant of the Spanish people who practiced irrigation in the Lower Rio Grande Valley hundreds of years ago. Here he obligingly poses in Francis J. Warnock's shipping shed. Warnock's Bureau of Reclamation farm in the Lower Rio Grande Valley produces $100,000 worth of these football season flowers annually. (See p. 58).

Illustration Credits

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71	Army Air Corps.

Unless otherwise noted, the above are Bureau of Reclamation employees.

Speaking of Credits . . .

The unusually fine drawing of the Hungry Horse Dam which appeared on page 37 of the February ERA was the work of John MacGilchrist of the Branch of Design and Construction in Denver. He is well known for his drawings of the Yangtze George project in China, which received national attention last winter.

Irrigation in the Philippines

by THE HONORABLE PAUL V. McNUTT

American Ambassador to the Republic of the Philippines

The Philippines is currently engaged in a Nation-wide food production campaign. In this campaign, irrigation will play a high priority role as this administration recognizes the vital part which this type of agriculture plays in any program of food production, especially of rice (the staple food of four-fifths of the country's 18 million inhabitants).

During enemy occupation, when the price of rice reached prohibitive heights, the hungry citizens of Manila would stealthily run after passing rice trucks, disregarding the armed convoys, and puncture the rice sacks. After the trucks had passed, leaving a trail of fallen grains, they would sweep them up with brooms, and hurriedly rush home with the precious particles of food (mixed with the dirt from the street). Philippine officials and farmers exclaimed then, "If we only had more irrigation systems!"

They are still saying that very thing.

On the food production program, at the top of the list, is the construction of new irrigation projects, as well as the repair and improvement of existing irrigation systems.

About 2 million hectares, or 4,940,000 acres (1 hectare=2.47 acres) are devoted to rice cultivation in the Philippines. Of this, about 30 percent, or approximately 1,482,000 acres, is devoted to irrigation. One-fifth of the irrigated area, or about 296,400 acres, is served by Government-owned irrigation systems, the rest being covered by private systems owned by individual farmers or by communal irrigators.

During the war, irrigation canals, structures and protective dykes were damaged. Field administration buildings owned by the National Government irrigation systems were destroyed, along with valuable equipment for irrigation investigations, construction and operation, which caused the suspension of any construction during that period. Invaluable plans and other records of several Government irrigation projects, most notable of which was the 49,400-acre (20,000-hectare) Pampanga River irrigation project in Nueva Ecija Province, have been lost by burning.

The power to grant appropriation of water for irrigation, as well as for all other public waters, is vested in the Secretary of Public Works and Communications, who decides all water rights applications, adjudications, or controversies, upon the recommendation of the five-man irrigation council appointed by the President of the Philippines.

The administration of National Government irrigation systems, including the levying of irrigation fees, is legally under the President and directly under the Director of Public Works of the Department of Public Works and Communications. Irrigation systems within the Friar Lands Estates, which were purchased by the Government from the Spanish friars, are administered by the Bureau of Lands under the Department of Agriculture and Commerce; these systems embrace about 74,100 acres (30,000 hectares), mostly planted to rice and partly to sugar in the Provinces of Cavite, Laguna, Rizal, and Bulacan. Private irrigation systems are owned and operated by the owners of irrigated lands, except those few systems administered by unique organizations called the "zanjeros" (ditch owners), which have existed since the Spanish regime. In a "zanjero" irrigation system, the "zanjeros" operate and maintain the irrigation system, although they do not own the irrigated lands. For irrigation services, the "zanjeros" are allowed by the landowners to cultivate and appropriate the produce of part, usually one half, of the irrigated land while the landowners are served water free for the other half; or the landowners cultivate all the land and turn over one-half of the produce to the "zanjeros." The "zanjero" irrigation systems exist principally in the Province of Ilocos Norte; the landowners there agitate constantly for the abolition of the "zanjero" practice.

Acknowledgment

I am deeply indebted for assistance in the preparation of this article to Mr. Isaias Fernando, Director of the Bureau of Public Works of the Philippine Government. Director Fernando has kindly furnished me with all the facts and background concerning irrigation in the Philippines, bringing to this task the interest and knowledge which is his as a pioneer in the field. A great deal of what has been done in Philippine irrigation is the result of his work. This article could not have been prepared without his assistance and cooperation.

PAUL V. McNUTT

The Bureau of Public Works is responsible for the investigation, preparation of plans, construction, and operation of Government irrigation projects. The Government proceeds with the construction of an irrigation project, once determined as advisable, unless the owners of one-half of the irrigable land or three-fourths of the owners of such land under the project file their objection against such construction within 90 days following due public notice.

All Philippine Government irrigation systems are of the gravity type, with water diverted directly from rivers by means of low overflow dams, without any supplemental supply from storage reservoirs. Typical diversion works consist of a weir connected to a long apron, with the crest of the weir usually less than 3 meters above the downstream floor. Steel sheet pile cut-off walls are provided on the upstream toe of the dam and at the downstream end of the apron; adjoining the apron downstream are several rows of staggered concrete blocks. Scouring sluiceways are provided at the end of the dam adjoining the main canal headworks. Carrying capacities of canals and structures are computed on the basis, generally, of one and one-half second-liters per hectare (0.021 cubic foot per second per acre) of irrigable area. All canals are of ordinary earth. No concrete-lined irrigation canals have been constructed so far. All structures, however, from the main canal headworks to the smallest turn-out are of concrete, mostly reinforced.

Irrigation was practiced in the Philippines long before the arrival of the Spaniards. Centuries ago the colossal task of converting an estimated area of 61,750 acres (25,000 hectares) of mountain sides into highly productive rice terraces—incidentally, one of the wonders of the country—was accomplished through the ingenuity and persistent labor of generation after generation of non-Christian tribes in northern Luzon. During the Spanish regime, another notable achievement in irrigation development was the construction of irrigation works, involving study and labor of about a century, to serve the vast land holdings of the friars in the Provinces of

Laguna, Cavite, Bulacan, and Rizal, embracing a total area of about 74,100 acres (30,000 hectares).

The policy of constructing irrigation systems by the Philippine Government was started in 1907 when it appropriated a reimbursable sum of 250,000 pesos for the investigation and construction of irrigation projects. In 1908 further legislation provided for a permanent annual reimbursable sum of 750,000 pesos for irrigation construction. The first major project built by the Government was the San Miguel irrigation system in Tarlac Province for the irrigation of 14,620 acres (6,000 hectares) of rice and sugar lands of the Tabacalera, a private corporation, at a fixed annual irrigation fee of 29,000 pesos. The funds for irrigation construction were withdrawn by the Government during the 4 years of the first World War due to retrenchment. The construction program was resumed in 1918 and it received substantial encouragement in 1922 when proceeds from the sale of a 20-million-peso bond issue was authorized for irrigation construction.

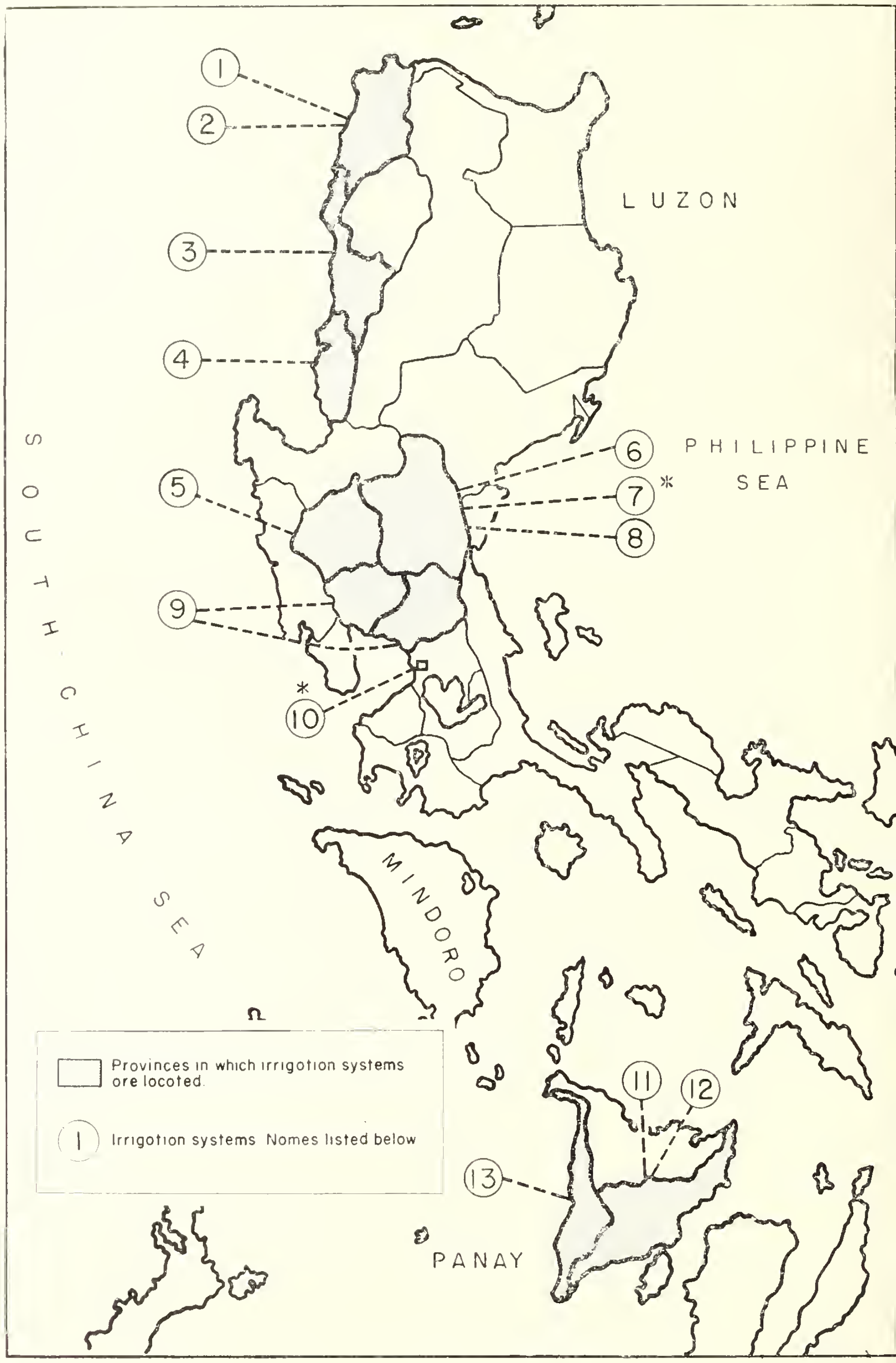
The 20-million-peso bond issue was originally intended to be the anchorage of a revolving fund for the widespread and continuous construction of irrigation systems in the Philippines. Each irrigation system constructed with money derived from this fund was supposed to be able to redeem the cost of construction at the end of 20 or 40 years through revenue from irrigation charges.

These charges, varying with the cost of construction, consisted of (*a*) the cost of operation and maintenance of the systems; (*b*) an amortization charge estimated to pay off the capital invested in construction at the end of the period specified in the irrigation notice published before the actual construction of any system, and (*c*) a contingency charge to take care of unforeseen major repairs. The annual irrigation charge varied in the different systems from 9 pesos to as high as 22 pesos per hectare of irrigated area.

The system of amortization was adopted with the object of turning over the ownership and operation of the system to the landowners at the end of the 20- or 40-year period, as the case might be, after the money invested in the construction of the system had been fully recovered by the Government and made available for use in the construction of other irrigation projects. This policy was carried for several years, and resulted in the construction of 11 irrigation systems. During the enemy occupation two small systems, the Rizal system at Nueva Ecija, and the Hanagdung system at Quezon, were constructed of semipermanent materials. (See map above.)

At first, the collection of irrigation charges was very satisfactory, and the Government laid out a scheme for a wide irrigation coverage of Philippine agricultural lands. For various causes, the collection of irrigation charges dropped perceptibly in

PHILIPPINE IRRIGATION SYSTEMS



1. Dingras Irrigation System (2,591 acres), Ilocos Norte Province.
2. Laog-Vintar Irrigation System (5,134 acres), Ilocos Norte Province.
3. Tagudin Irrigation System (3,211 acres), Ilocos Sur Province.
4. Amburayan River Irrigation System (9,139 acres), La Union Province.
5. O'Donnell River Irrigation System (8,225 acres), Tarlac Province.
6. Penaranda River Irrigation System (42,904 acres), Nueva Ecija Province.
7. Rizal Irrigation System (2,170 acres), Nueva Ecija Province.
8. Talavera River Irrigation System (22,526 acres), Nueva Ecija Province.
9. Angat River Irrigation System (64,097 acres), Bulacan and Pampanga Provinces.
10. Hanagdung River Irrigation System (667 acres), Quezon City.
11. Santa Barbara Irrigation System (11,161 acres), Iloilo Province.
12. Agaman River Irrigation System (13,091 acres), Iloilo Province.
13. Sibalom-San Jose Irrigation System (10,868 acres), Antique Province.

*Constructed of semipermanent materials during the enemy occupation.

Preparing the ground for planting rice.

1929 and has since continued to do so. Delinquencies in the payment of irrigation fees and the consequent court actions for collection mounted, resulting in a series of amendments to the original Irrigation Act of 1912.

The most important amendment, in effect, abandoned prospective ownership of the systems by the landowners, and changed the amortization charges to uniform flat assessment fees; the annual payments by the landowners being pruned to a maximum of 12 pesos per hectare in 1929, then to 6 pesos per hectare in 1935, the ownership of the systems being retained permanently in the Government. In spite of these relief acts of the Government, collection of the reduced rate continued to be unsatisfactory.

In 1936, the administration of Government irrigation systems was placed in the hands of the President, who was authorized to fix the irrigation charges and to prescribe the manner of payment. The construction of Government irrigation systems was side-tracked in 1932 by diverting the balance of over 4 million pesos realized from the original bond issue to other public works projects, but in 1935 an equal amount was appropriated for irrigation.

Before the war, with common labor available at a daily wage of one peso or less, the 6-peso fee was barely sufficient for the operation and maintenance of the systems, not to mention the annuity required to amortize the cost of construction.

With ditchtenders and other laborers in the irrigation systems today getting twice the prewar wage or higher, it is no longer possible to operate these systems satisfactorily with funds derived solely from irrigation charges at the prewar rate.

On July 22, 1946, because of the high cost of operation and maintenance of the systems, President Roxas fixed the annual irrigation fee on Government owned systems at 12 pesos per hectare.

Land ownership within the Government irrigation systems is generally in small holdings, the average for all the systems being 7.2 acres (2.9 hectares). Land holdings are particularly small in those systems located in the thickly populated Ilocos Provinces, namely: the Laoag-Vintar, the Dingras, the Amburayan River and the Tagudin irrigation systems, where the average farmer owns only 1.5 acres or six-tenths of a hectare. In Central Luzon, the average holding ranges from 13.8 acres (5.6 hectares) in the Angat River system to 22.2 acres (9 hectares) in the Talavera River system. The O'Donnell River irrigation system in Tarlac Province has an exceptionally high average—64.2 acres or 26 hectares per landowner. In the systems located in Panay Island, the averages are 5.93 acres (2.4 hectares) for the Sibalom-San Jose, 8.15 acres (3.3 hectares) for the Aganan River, and 16.55 acres (6.7 hectares) for the Santa Barbara irrigation systems.

The systems are built in accordance with the irrigation law chiefly to assure the rice crop during the regular growing season, which in most places starts with seedbed preparation in May or June and ends with the harvest in December and January. The short-season variety is harvested as early as October.

In some systems, where rice is also planted during the dry season when the water supply can irrigate only a fraction of the irrigable area, the system is divided into zones, one zone at a time being given water during the dry season of the year. In most systems, however, rice is not grown during the dry season, especially in central Luzon where the largest Government irrigation systems are located.

One of the main reasons for this practice is the farmers' persistent adherence to their old practice of growing only one "successful long crop" in one year, followed by an allegedly much-needed rest for them and for the soil during the remainder of the year. In many other places, however, the "rest" consists in planting crops other than rice, principally mongo, tobacco, corn, tubers and vegetables.

The average production within the systems is from 45 to 50 "cavanes" of "palay" (palay is unmilled rice; one cavan of palay weighs 97 pounds) per hectare, although production of over $65\frac{1}{2}$ bushels per acre (100 cavanes per hectare) had been reported from a few places previous to the war. In 1945, the highest rate reported was about $61\frac{3}{4}$ bushels per acre (94.5 cavanes per hectare).

It is conservatively estimated that in one regular irrigation season alone, that is, not counting the production during the dry season, one hectare of land within the Government systems yields an average of 20 cavanes (or 32 bushels) of palay in excess

Teaming up in rice planting season.

of that harvested from the same area of unirrigated land adjoining the systems.

Before the war, with the low price of rice, the 6 pesos paid by the landowners as irrigation fee to the Government represented the equivalent of over 2 cavanes of palay, or 10 percent of the average difference in production between irrigated and unirrigated lands.

Today it takes only 1 cavane of palay, or 5 percent of the excess production attributable to the irrigation service, to cover the new 12-peso irrigation fee.

The success or failure of farms within Philippine irrigation systems is dependent upon many factors other than the proper supply of water. Farm difficulties being experienced at present may be considered either as being inherent, or as an aftermath of the war.

Considerable damage to crops due to rats and insect pests is reported annually from almost every system, resulting not only in direct loss to the farmers themselves but also in the noncollection by the Government of irrigation fees from the areas so affected. It is sometimes difficult to convince some farmers to pay proper attention to seed selection, weeding, and use of fertilizers. Incidentally, Filipino farmers maintain that weeds in rice fields are kept down by continuous submergence of the field.

The effect of indiscriminate slaughter of farm animals during the enemy occupation is now greatly felt in every area. Unsatisfactory conditions of peace and order since the end of the war, coupled with deep-rooted conflicts between landlord and tenant, have brought about farm difficulties more serious than those caused by purely scientific problems still unsolved. Planting in some places has been unduly delayed or entirely discouraged.

Transplanting the rice from seed bed to the fields.

Absentee landlords have increased in number. The administration of irrigation systems has become more complex with the passage of the new tenancy law which provides among other things, that wherever the 70–30 crop sharing ration (70 percent of the harvest to the tenants and 30 percent to the landowner) is enforced, the payment of irrigation fees is charged against the tenants.

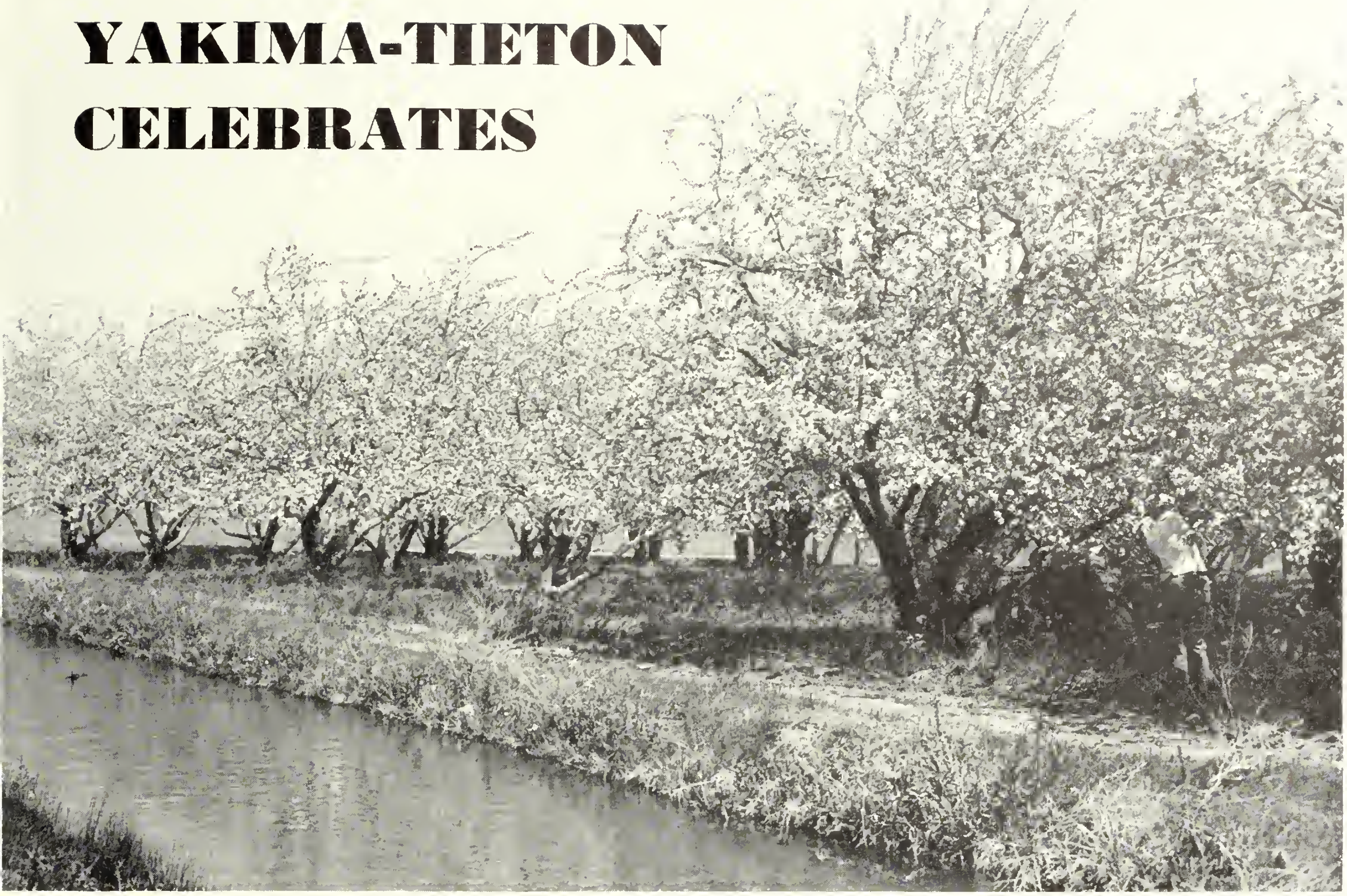
Public interest in irrigation construction, which may be said to have gained momentum steadily since 1908, began to wane in 1929, reaching its lowest ebb during the depression years of the early thirties. It started to pick up again in 1938 when, for the first time in Philippine legislative history, a few members of Congress assigned their shares of public works entirely to irrigation projects in their respective districts, instead of splitting them into the usual insignificant amounts for barri (district) roads or schoolhouses.

After the liberation of the Philippines, a substantial amount was included in the emergency public works appropriation for "reopening" the Philippine Government irrigation systems. Then in July 1946, supplementing his many pronouncements in

(*Continued on page 54*)

Typical of Philippine rice culture are these terraced paddies in the province of Camarines Sur.

YAKIMA-TIETON CELEBRATES



When reclamation farmers finish paying the construction costs of an entire irrigation system, they and the Nation have reason for pride

In May 1910 water started flowing from a new canal across the slopes of the Tieton bench in the Yakima Valley of Washington. It coursed along newly dug laterals and ditches and soaked into the land. Crews of workers planted young trees, and seeded for crops, expectantly awaiting the day of harvest. The new Tieton division of the Yakima Valley project, long the hope of early settlers, at last was in operation. It was one of the first projects of the rather new Federal agency, the Reclamation Service, now the Bureau of Reclamation, which had been established under the Reclamation Act of 1902.

Thirty-seven years passed. On St. Valentine's Day in 1947, survivors of the first water users, and the many who came after them, gathered at the thriving city of Yakima to the south for a very special celebration. This also was something new, for it was in observance of the complete repayment by the Tieton district farmers of the $3,580,000 which was spent to build the irrigation system which now serves 25,000 acres of highly profitable agricultural land. Tieton is the first irrigation district to complete the repayment of construction costs to the Reclamation fund.

The celebration at Yakima on February 14 was significant not only for this very praiseworthy accomplishment of paying off all charges. It also symbolized the investment value of reclamation. Since 1910 the Nation has been richer by $157,000,000 from Tieton-produced crops. This represents 45 times the cost of constructing the irrigation works. The products of Tieton's orchards are known the world around, and yet many other crops are grown.

Dignitaries gathered to mark the observance. Secretary of the Interior J. A. Krug, Governor Mon C. Walgren of Washington, Senators Harry Cain and Warren Magnuson, and Congressmen Hal Holmes and Walt Horan were among the principal visitors invited to attend. The Tieton farmers, led by Clifford Kail, chirman of the Yakima-Tieton irrigation district, were the centers of attraction both at the banquet and at a mass meeting which followed.

Tieton is one of the three main divisions of the Yakima project now completed and operation. A fourth, the Roza division, is under construction. The 1,300 farms on the Tieton division average about 24 acres to a farm. During 1946, the average return on Tieton lands was $751 per acre, a right fair profit on land which once, before irrigation, could be had at $1.25 an acre.

Repayment of the water users' contract gives the Tieton ranchers the right to operate and maintain the irrigation works. The Bureau of Reclamation will turn over these functions as soon as necessary contractual procedures are completed.

The achievement of Tieton ranchers culminated hopes of the first settlers in Yakima Valley. As early as 1890 irrigation was under way in the area, but the full development of the land and water resources was not planned until the Reclamation Act of 1902 paved the way for the Federal Government to assist the settlers in irrigation developments. Surveys in 1905 were followed by approval of the irrigation plan for the Tieton division in 1906.

Construction was a difficult proposition. The Tieton Canyon could be reached only by pack train, and private contractors shied from the construction proposals which were

Tieton district farmers VOTE their way out of debt.

advertised and readvertised. As a result, the bulk of the irrigation system was constructed by Government forces. Water was first furnished in 1910, but since storage was not available that summer, the supply was shut off in August. The following year, however, regular water deliveries were made for the entire season. With availability of water, Tieton land prices rose sky high, prices reaching $500 an acre. The price leveled off afterward, partly through operation of antispeculation regulations.

New settlers flocked to Yakima from every State of the Union. Not many of the newcomers were farmers. They included doctors, lawyers, druggists, hardwaremen, school teachers, and professional men of all types. Despite the lack of farm experience, a surprisingly large number were successful, building their own roads, schools and churches, and irrigating their land to a point of high productivity.

Apples, peaches, pears, prunes, small fruit such as berries, cherries, grapes, and plums are the principal crops. Hops, sugar beets, cereals, hay, and forage are also grown.

The construction costs of the Tieton division ranged from $93 to $100 per acre. And they have been met, to place Tieton division at the head of the list of irrigation districts meeting their reclamation obligations in full, and on time.

Yakima Superintendent Ball displays "pride of Tieton's eye" for new District Board members Fred C. Beisner, Clifford Kail (President), and H. B. Praetorius.

Irrigation in the Philippines

(*Continued from page 52*)

favor of irrigation. President Roxas wrote a Congressman relative to the latter's query about a proposed irrigation project in his Province. ". . . I also realize that the construction of irrigation facilities will increase the rice harvest and thus contribute to the economic progress of the Province. I am giving top priority to Government projects designed for agricultural development, a priority even above that usually assigned to road-building projects."

In connection with the food production campaign, the Secretary of Public Works and Communications has directed that at least one engineer in every engineering district devote his time exclusively to irrigation activities.

The Public Works Appropriation Act passed by the last Philippine Congress set aside 18,000,000 pesos for the irrigation activities of the Government.

It is indeed safe to say that the Philippines is now irrigation-minded and it is expected that this attitude will stay. Many Philippine landowners and farmers are clamoring for irrigation during the dry season, urging the construction of storage reservoirs.

The Philippines is looking forward to the day when the construction of multiple-purpose projects—irrigation combined with hydroelectric power and flood control—will be a reality.

EDITOR'S NOTE: Photographs used in the foregoing article were taken by members of the United States Agricultural Mission during their survey of the Philippines last year. The Department of Agriculture plans to release the Mission's report next month.

Nueces River Basin Plan Abandoned

Secretary of the Interior J. A. Krug recently approved the Bureau of Reclamation's recommendation against seeking congressional authorization for Reclamation development of the Nueces River Basin and adjacent Baffins Bay coastal area in Texas.

In his recommendation Acting Commissioner Warne of the Bureau of Reclamation cited the high costs under present construction schedules and the farmers' inability to repay their proportionate share of these costs. Compared with 1940 prices the development would cost 64 percent additional under present costs, or $81,500,000 now as compared with the former estimate of $49,559,000.

Another objection raised by Acting Commissioner Warne was the fact that it appears impossible to develop hydroelectric power to absorb part of the cost.

This finding was based on the fact that the proposed dams in the Nueces development were too low and the water yield inadequate to provide for the generation of hydroelectric power.

DITCHBANK PASTURING

by Robert B. Balcom, ***Agronomist, Branch of Operation and Maintenance***

Every irrigation district has a ditchbank weed problem. The many methods which have been devised to combat ditchbank weeds show that they create operation difficulties and maintenance costs and are considered one of the major obstacles to the efficient operation of the distribution system. All of the methods tried and numerous studies made have centered around finding more economic methods of solving this problem.

It is gratifying, therefore, to report that now some projects are solving their weed problems in a way which not only gets rid of weeds economically and prevents future weed problems, but also creates additional wealth for the project farmers. It is not a complicated formula involving large annual expenditures for costly materials and equipment, but a simple, practical, inexpensive method which can be easily followed by nearly all irrigation districts.

This method is the pasturing of ditchbanks with livestock. To obtain a full realization of the over-all problem which ditchbank weeds create, you have to consider the numerous costs and losses involved.

When the average project farmer thinks of ditchbank weeds, he realizes the danger of their spreading to his irrigated fields. Perhaps not as many weed patches are started by this means as was formerly thought, but the seeds of certain plants—both annuals and perennials—may be carried considerable distances by water. Weed seeds originating from plants growing on ditchbanks, and accumulating in the bottoms of the channel while the water is out, may be washed into fields with the next run of water. In channels having comparatively smooth bottoms, seeds may also be rolled along the bottom by the water currents.

Winds may carry the seeds of noxious weeds, particularly light seeds with parachute attachments like the Canada and sow thistles, from ditches to cultivated land. Even comparatively heavy seeds are driven over frozen ground, packed snow and ice by winter winds. Both domestic and wild animals scatter weed seeds because many of them pass through the digestive tract unharmed. Seeds with barbs and hooks and those which become mucilagenous when wet are carried on feathers, hair, and clothing. Perennial weeds do not respect property lines and may spread from a ditchbank to adjacent fields by their creeping lateral roots.

Weed Damages Mount

When the irrigation district official thinks of ditchbank weeds, he considers the operation problems and maintenance costs which they create. Trees, willows, and woody shrubs use thousands of gallons of water which may be badly needed for crops. Such woody plants prevent the maintenance of roads and proper inspection of the ditches and if not completely controlled must be removed periodically to make channel cleaning possible. Tall annual weeds grow out or fall over into the water and must be removed so they do not obstruct the flow of water or collect silt. Weed growths also cause unsightly appearance of ditches and cannot help but reduce community pride.

Some projects have proved the economy of pasturing ditchbanks for weed control. In any event the possibility should not be ignored or even passed over lightly by projects which have not given the practice a thorough trial.

When noxious weeds, so costly to eradicate on crop land, and the numerous annual and biennial weeds which hinder efficient farming operations have been controlled on ditchbanks and further infestation prevented, one source of farm weeds has been eliminated. Pasturing will not kill noxious weeds, but it will keep perennial plants from spreading their roots so quickly. In some cases, pasturing will furnish weed-seed control and will keep the banks from being reinfested.

A program of noxious weed control with the new 2, 4-D formulations or other chemicals should be initiated in conjunction with the pasturing program. Poisonous weeds such as water hemlock and whorled milkweed should be eradicated before pasturing is started.

However, after the noxious and poisonous weeds are once eliminated it would be poor economy not to try to develop some means of preventing further infestations. If you do not, noxious weed control on ditches may become an annual maintenance problem. Pasturing eliminates competition from annual weeds and allows the grasses to spread. As these develop into a sod they not only furnish more herbage but reduce the chance of weed seeds coming in contact with the soil. If a weed seed does become lodged where it can germinate, the competition from the grasses and the livestock eating the tender shoots prevent the weed plants from becoming well-established and getting down to the business of causing trouble.

The wrong way! Salt cedars and willows are double threat to ditchbank and surrounding farm land.

The right way! Seeded with crested wheatgrass, this ditchbank offers opportunity for future pasturing.

Every irrigation district is interested in reducing its maintenance costs. Until the pasturing practice is well established and the native or seeded tame grasses have covered the ditch right-of-way, some mowing may be desirable. But once a pasturing program is well under way, you can almost forget about mowing, burning weeds, and grubbing willows. Willows can be eliminated by grazing, but if large, old growths are present they will be killed much sooner if they are first cut down. Livestock prefers the new tender regrowth.

The elimination of weeds and woody plants and prevention of further growths will conserve irrigation water which otherwise would have been lost through transpiration. The neat appearance of grazed ditchbanks stands out in sharp contrast to jungles of weeds prevalent on unpastured sections. Rodents which live on weed and tree roots do not frequent pastured ditches. Also, gophers and ground squirrels do not like to burrow on soil tamped down by livestock.

Perhaps one of the main reasons why ditchbank pasturing has met with such great favor among project farmers has been that the very means of reducing their operation and maintenance costs and weed prevention on crop land has given them additional income.

When weeds are mowed, burned, grubbed or treated with chemicals year after year, you only get the satisfaction of temporarily eliminating the weeds. But when livestock is put to pasture on weed banks, these otherwise waste areas are converted into a profitable supplementary pasture and the weeds are controlled and prevented at much less cost than other methods.

Enthusiastic reports have come from several sections of the irrigated West showing how farmers have been able to support more livestock by utilizing ditchbank pastures. Many have used these grazing areas for dry cows, calves, horses, colts, or several head of sheep. While pasturing with horses is not favored in some areas, all classes of livestock except hogs have been used. Hogs should not be permitted on ditchbanks because of their rooting habits. Horses like to swim and wade in the ditches, and their sharp hoofs may damage banks cut through light soils, or those unprotected by sod.

One important precaution must be taken. You have to control ditchbank grazing as efficiently as any other well-managed pasture. If overgrazed, bare areas and eventually new crops of weeds will result and the entire purpose of the practice will be defeated.

White top on this ditchbank offers a constant menace.

Fence them in—Stock guards save ditch riders' time.

In most areas you may have to fence the ditchbank for pasturing. The use of electric fence has greatly reduced these costs. Cattleguards, to save the ditchriders' time in opening and closing gates, are also desirable. Many farmers who have ditches with too small a right-of-way to pay to fence are still taking advantage of the ditch area by setting the fence back on their property for a short distance.

Another practice which is growing in popularity is the placing of semipermanent pastures adjacent to the irrigation ditches and drains passing through the farm unit. Many irrigation districts have found ditchbank pasturing so valuable in reducing their weed control costs that they have assisted the farmers and created more interest by furnishing all or part of the fencing and cattleguard materials.

A few reasons for not pasturing ditchbanks have been advanced by irrigation districts which have not given the practice a thorough trial. No doubt some of them have some foundation.

For example, in sections of a project where irrigation water is used for culinary purposes it is not difficult to realize the desirability of excluding animals from the ditches.

Claims have also been made that heavy animals tramp loose fills and unsodded stretches into the water section. However, projects which have established an extensive pasturing program state that the small amount of damage which may occur is greatly overbalanced by the good results and general lower costs.

As most of the bank damage is caused when animals go down to the water for a drink this may be partially overcome by digging a sloping ramp in the cut side of the ditch or in a section where the bank is sufficiently wide to accommodate such a ramp. The animals soon learn to use this more gradual slope.

Several projects have increased the forage value of ditchbank pastures by seeding tame grasses. Also, if livestock is withheld from grazing until these seedings have formed a good sod, damage to the banks is prevented or greatly reduced. In the few areas where pasturing is not feasible, low-growing tame grasses may be seeded to replace weed pests. Many projects are seeding new ditches as soon as they are constructed in order to take advantage of the seed bed thus formed and to establish a desirable cover before weed competition develops. This will help stabilize the banks and prevent erosion, and a good pasture rather than weeds will be available for the new project farmers.

The irrigated areas in the West are in general becoming more weed conscious. Irrigation officials, boards of directors, and project farmers realize more than ever before the necessity and desirability of controlling and preventing weed infestations. They have ample proof that ditchbank weeds may infest farm land, increase labor costs, impair the efficiency of canals, laterals and drains and cause numerous other operation problems and maintenance costs.

Occasionally uncontrollable losses occur on irrigation districts which makes it all the more important that everything possible be done to reduce the controllable losses to a minimum. For this reason project officials and farmers who have made a thorough study of ditchbank pasturing and have given it a comprehensive trial refuse to go back to more expensive and less profitable methods of ditchbank weed control.

Weed Warrior

An effective device for removing Russian thistle weeds from irrigation canals has been devised on the Roza division of the Yakima project.

It consists of two extension teeth which are attached to the bucket of a truck-mounted dragline and operated on the bank as a fork. When weeds "jam" in a canal, the pressure of the water on the face of the "jam" oftentimes packs the weeds so tightly that they can be walked on without difficulty. For working out the plan, Harry J. Whetmore, Bureau watermaster, and Ray R. Johnson, dragline operator, each won an award of honorable mention and $50 in cash under the Interior departmental suggestion system.

Each of the extension teeth was made from two pieces of steel, $^5/_8$ inch by $2\frac{1}{2}$ feet by 3 feet 1 inch in size. The two pieces of steel for each tooth were fitted over a dragline tooth so that they met at the point of the tooth and were welded together from the point to the end. The end of each tooth was pointed for about $2\frac{1}{2}$ inches. Holes were drilled and bolts inserted through the straps, the bucket teeth, and the bucket itself. Thus the extensions were held and strengthened by the regular bucket teeth. The teeth extend 24 inches beyond the bucket.

The device has been very practical on the Roza division in all respects except that each time it was connected to the bucket, the bolts holding the bucket teeth had to be cut off. While excavating rock, the bolt threads became so damaged that the nuts could not be unscrewed.

It was therefore suggested that the teeth be made from 4- by 4- by $^3/_4$-inch angles about 3 feet long and pointed at the end for about 8 inches. These teeth could be bolted in the corners of the bucket where the bolts would not be damaged while digging weeds. The extensions could be readily attached or removed. It is believed the three $^3/_4$-inch bolts spaced at about 5 inches and of suitable length to pass through the angle and the bucket would give ample strength to the device.

Boulder Sets Power Mark

Boulder Dam and power plant which reached its tenth anniversary of commercial power generation, holds the record as a power producer among reclamation projects. By December of 1936, 3 months after the initial unit went into operation, it had produced more than 118 million kilowatt-hours of energy and by the end of 1946 had produced a grand total of 37,251,362,000 kilowatt-hours. That amount would have been adequate to provide all the energy used by the city of Chicago for a period of almost 7 years.

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Money-Making 'Mums

On the Bureau's Rio Grande project, chrysanthemums bring $100,000 a year to the Warnock family

by Lloyd E. Mulligan, *Region V, Amarillo, Tex.*

'Mum is the word on the 135-acre irrigation farm of Mr. and Mrs. Francis J. Warnock at Ysleta, Tex., in the lower end of the Bureau's Rio Grande project.

'Mum—as if you didn't know—is the florist's name for chrysanthemum—the flower so extraordinarily popular with female football fans.

A horticulturist since high school days when he specialized in growing sweet peas and similar small species of flowers, Warnock later switched to chrysanthemums exclusively because of their increasing popularity and attractive commercial possibilities. His specialization in the elegance of the rainbow's flower pot began 20 years ago, and has expanded annually to meet increased demands from florists throughout the Nation.

Warnock is assisted by his wife in the planting, cultivation, marketing and continual effort to increase the pulchritude of the elegant 'mums and the women they adorn. They now devote 16 acres of their fertile irrigation farm to production of 'mums and receive $100,000 annually for their effort. The Warnock-'mum combination is an exceptional illustration of what the Bureau's reclamation program can mean to western farmers.

From the time the rooted divisions of cuttings are planted in early April until the crop is harvested and shipped in the fall, the Warnocks and their small army of floriculturists and common laborers are as busy as bees. The Warnocks use a rooted division for plantings, in contrast with most growers, who prefer rooted cuttings. The roots are started in the three hot houses. Each of the two largest buildings spreads over eight acres. A 2-acre structure is maintained for experimental purposes.

When the rooted divisions begin to grow they are transplanted to open fields and irrigation is applied. As the flowers begin to bud, wooden stakes are driven into the soil to help support the stems. Skilled workmen tour the plants daily to clip off numerous small buds, thereby allowing all of the nourishment to flow to a single bud, thus producing the one large, elegant blossom that goes to market.

As the flowers approach the blooming stage, cloth houses are constructed to shelter them from wind and the wilting, color-destroying rays of the sun. The houses also provide some protection from insects, which seem to receive special bulletins about the progress of the growth of the 'mum crop. The Warnocks, however, keep their eyes peeled for the first sign of insect armies and meet them on the field of battle with modern apparatus and bug-bumping insecticides. When the grasshoppers arrive, the Warnocks call upon their turkey division to gobble up every hopper in sight.

The hot houses, consisting of wooden frames of two-by-fours, covered on tops and sides with white cotton sacking, allow the Warnocks to control the blooming dates of the 'mums to correspond with market demands.

The flowers are irrigated once a week during the summer. However, the period is extended to every 15 days with the coming of fall.

Harvest-time begins in October. Floral workers use a sharp knife for cutting the stem in a downward, slanting stroke, which prevents breakage in the stem and allows for better water storage in the flower.

The cut flowers then are taken into the packing house and placed in water-filled metal containers, where they remain until packed for shipment. 'Mums are so heavy that they have to be protected from themselves while in transit. They are placed in large cardboard boxes and lie on layers of wadded paper, which form a cushion. Wooden wedges are inserted in the shipping boxes to support each layer of flowers and distribute the weight evenly, thus preventing shifting or crushing. Six dozen large 'mums, or eight dozen small ones, are packed in each box. In order to insure moisture, ice is placed in each box prior to shipment by railway express. Under normal conditions, the 'mums remain fresh in transit from 4 to 10 days without additional refrigeration.

Frost and high winds generate the most anxiety for the Warnocks, and of the two natural dangers, frost is the worse. A fairly healthy breath of frozen air kills a 'mum "deader than a doornail." Smudge pots have been used, but with little success.

Chrysanthemum culture isn't the pretty picture the uninitiated believe it to be, the Warnocks avow. In a strong wind, the cloth-covered houses have a tendency to take off across the country like sail boats in a regatta. 'Mum growing is a year-round proposition and requires year-round attention.

After the crop is cut and shipped, the residue plants are chopped off with a hoe. The roots lie dormant in the ground until the following spring, when they begin to root. Then it is 'mum planting time again.

Thousands of week-end visitors are not unusual at blossom-time on the Warnock 'mum farm. The desert flower-pot's blooming brilliancy is a sight for eyes weary of parched earth.

"I always tell the visitors about the wonders of irrigation," said Warnock. "Anybody desiring to see the results of reclamation should come down to El Paso and 12 miles on out to Ysleta. We're mighty happy to have company, and it pleases us greatly to know that many persons come back year after year to view the beauty of our work."

Warnock's irrigation supply flows from Elephant Butte Reservoir in New Mexico. The 155,000-acre Rio Grande project was constructed by the Bureau of Reclamation in the rich alluvial bottom land along the Rio Grande, where Spanish and Indian settlement and irrigation date back hundreds of years. The untreated water feeds the Warnock's flowers and helps them produce more abundantly than would be possible with water from an average municipal system. Moreover, it is much less costly.

Warnock estimates his original cost for readying his 16 acres to produce chrysanthemums totaled $4,000 an acre. However, after the initial investment, land preparation costs were no longer a problem. Warnock believes his is the most extensive commercial production of chrysanthemums in the Southwest, and the only one in the world on a Reclamation project. The firm's slogan, "Best in the Southwest," is well known among national florists. The Warnocks welcome inquiries about their farm. They're not at all mum about their 'mums.

Packed with the greatest of care, "Fragile" is the watchword.

Cabins of cloth prolong the blooming season and assure a steadier market.

AGRICULTURAL GOALS FOR 1947

1947 CROP AND LIVESTOCK PRODU

COMMODITIES BY PLANTED ACRES

State	Corn	Wheat	Hay	Oats	Cotton	Barley	Sorghums for grain	Seeds—Legumes and grass	Flaxsee
Arizona	41,000	30,000	290,000	28,000	160,000	160,000	57,000	44,000	25,00
California	70,000	800,000	1,900,000	550,000	390,000	1,800,000	130,000	43,000	160,00
Colorado	850,000	1,850,000	1,100,000	250,000		800,000	300,000	70,000	...
Idaho		1,300,000	985,000	191,000		285,000	...	70,000	...
Montana	250,000	3,900,000	1,360,000	400,000		900,000	...	130,000	214,00
Nebraska	7,960,000	4,200,000	1,200,000	2,600,000	...	700,000	125,000	258,000	2,00
Nevada	...	20,000	180,000	12,000		24,000	...	...	...
New Mexico	150,000	400,000	190,000	40,000	130,000	40,000	250,000	32,000	...
North Dakota	1,400,000	9,500,000	850,000	2,240,000	...	2,700,000	1,000	75,000	2,050,00
Oregon	42,000	1,000,000	850,000	400,000	...	250,000	...	53,000	1,00
South Dakota	3,900,000	3,450,000	700,000	3,000,000	...	1,800,000	100,000	105,000	500,00
Texas	4,200,000	6,000,000	1,500,000	1,875,000	8,460,000	312,000	4,450,000	92,000	120,00
Utah	30,000	300,000	525,000	48,000	...	159,000	...	42,100	...
Washington	32,000	2,750,000	915,000	270,000		130,000	...	6,100	1,00
Wyoming	100,000	275,000	585,000	145,000		140,000	...	103,000	2,00
Total, all Western States	19,025,000	35,775,000	13,130,000	12,049,000	9,140,000	10,200,000	5,413,000	1,123,200	3,075,00
Production total for the United States	91,550,000	70,700,000	61,110,000	44,669,000	23,100,000	13,084,000	7,500,000	6,515,000	5,000,00
Percent of National totals raised in Western States	20.8	50.6	21.5	27.0	39.6	78.2	72.2	17.2	61.

WHEN the Secretary of Agriculture announced the 1947 agricultural acreage goals, what did it mean to the reclamationists of the West?

During the war years crop production on the operating Federal reclamation projects followed the requested annual shifts in crops planted very closely. A review of the 1945 crops grown on reclamation projects shows that reclamation farmers produced much-needed food, forage, seed and livestock to meet critical shortages. An analysis of the 1947 goals indicates that the important crops grown on reclamation projects are still needed on a sustained or a stepped-up production basis.

The Secretary of Agriculture has set high goals for the farmers of the United States. According to his announcement, the final farm production goals for 1947 call for a total planted acreage in the United States of 356,893,000 acres to meet the food and fiber requirements of the Nation. This is substantially higher than the 345,111,000 acres planted in 1946, and the prewar average of 341,605,000 planted acres.

These final goals take into consideration the record output of 1946 crops, the need for increased plantings of flaxseed, and recommendations made by State councils of the United States Department of Agriculture.

Final goals have also been set for livestock and livestock products.

In connection with the 1947 schedule calling for top production, Secretary Anderson has said:

> The production job farmers face next year is fourfold. We must produce to meet the needs of strong domestic demand and to supply some of the foods and other farm products still badly needed in war-devastated areas. Added to these is the job of starting to build up reserves of certain commodities, and the compelling need to work again toward a sounder program of proper land use and soil conservation.

The cultivated acreage on reclamation projects will total only 1.26 percent of the national acreage and according to preliminary reports of 1946 acreages, about 3.62 percent of the acreage in the Western States.

The table at the bottom of this page shows what the Department of Agriculture is calling for in crop production in the Western States, so that reclamation farmers can scrutinize these agricultural goals. They can then form some idea as to how the crops which they are growing fit into the total agricultural picture for the West and the country as a whole.

Compared with 1946 figures, the 1947 goals fluctuate. Much more cotton, flax, dry beans, soybeans, barley, and grain sorghums are called for. But farmers are asked to cut down on corn, oats, dry peas, peanuts, potatoes, and truck crops. Substantial shifts from certain war-emphasized crops are requested in some areas, while in others suggested changes in crop goals will necessitate a fuller use of the land.

The sugar beet acreage called for, or 1,069,000 acres, is 15 percent greater than that planted in 1946. A price of $14.50 per ton of beets has been guaranteed, which is $1 per ton more than the 1946 price.

FEDERAL RECLAMATION PROJECTS

Commodity	1945 acreage in cultivation	Percent of total United States acreage in 1945
Wheat	271,723	0.4
Rye	15,481	.8
Dry beans	157,255	10.0
Corn	55,564	.05
Oats	144,576	.3
Barley	326,715	3.2
Cotton	166,709	.9
Sugar beets	180,803	25.2
Potatoes (all)	265,841	9.4
Sweetpotatoes	849	.1
Truck crops (all)	181,816	4.7
Alfalfa hay	1,126,646	7.6
Total acreage	4,195,732	1.2

Continuing large requirements for linseed oil have brought about a boost in the support price of flaxseed to $6 a bushel, U. S. No. 1, Minneapolis basis.

When you compare the crops actually grown on Federal reclamation projects with the total grown by the Nation's farmers in 1945 (a record-breaking crop year), you can see that the specific crops do not constitute any sizable portion of the total planted acreages throughout the Nation.

(*Continued on page 63*)

ON GOALS BY WESTERN STATES

					LIVESTOCK						
atoes	Rye	Dry beans	Sugar beets	Dry peas	Chickens	Turkeys	Sheep and lambs	Cows (dairy)	Cows (beef)	Hogs	Bees (colonies)
4,600	...	18,000			760,000	100,000	524,000	50,000	464,000	4,000	69,000
1,700	10,000	377,000	180,000		21,200,000	3,700,000	1,855,000	830,000	546,000	61,000	470,000
5,200	60,000	350,000	200,000	30,000	5,600,000	900,000	1,500,000	211,000	550,000	48,000	79,000
5,300	6,000	150,000	95,000		3,800,000	300,000	1,050,000	220,000	146,000	33,000	170,000
9,100	30,000	30,000	88,000	28,000	4,200,000	300,000	2,160,000	140,000	680,000	32,000	56,000
8,400	300,000	70,000	80,000		28,000,000	1,450,000	200,000	550,000	902,000	531,000	64,000
3,000			500		390,000	50,000	550,000	18,000	193,000	4,000	14,000
4,900	5,000	270,000	500		1,320,000	60,000	1,500,000	61,000	652,000	9,000	19,000
5,900	400,000	1,000	18,000	10,000	10,000,000	1,200,000	630,000	465,000	319,000	144,000	25,000
5,400	38,000	1,000	22,000	22,000	4,500,000	2,100,000	729,000	231,000	326,000	25,000	72,000
0,200	400,000		10,000		14,500,000	500,000	1,140,000	401,000	573,000	375,000	20,000
5,500	20,000	4,000	1,500		35,260,000	4,400,000	9,575,000	1,320,000	2,700,000	198,000	292,000
6,100	8,000	7,000	50,000		2,670,000	1,850,000	1,930,000	110,000	135,000	12,000	55,000
8,600	16,000	4,000	17,000	235,000	8,240,000	1,500,000	325,000	335,000	137,000	26,000	70,000
5,000	10.000	80,000	55,000		1,600,000	200,000	2,450,000	65,000	442,000	12,000	44,000
8,900	1,303,000	1,362,000	817,500	325,000	142,040,000	18,610,000	26,118,000	5,007,000	8,765,000	1,514,000	1,519,000
9,800	2,374,000	2,150,000	1,069,000	478,000	677,110,000	40,666,000	35,299,000	24,418,000	14,861,000	9,162,000	6,151,000
30.7	54.9	63.3	76.5	68.0	21.0	45.8	74.0	20.5	59.0	16.5	24.7

Investment Insurance

How irrigation played the major role in providing a profitable and record-breaking harvest in the Southwest

by John P. Woodward,

Chief, Project Activities, Region V, Amarillo, Tex.

Irrigation paid off to the tune of $43,000,000 on four region V Bureau of Reclamation projects in 1946. This was the gross income of crops, livestock, and livestock products produced on 184,608 irrigated acres on the Bureau's Rio Grande project in New Mexico and Texas, the Carlsbad project in southeastern New Mexico, the Tucumcari project in east central New Mexico, and the Altus project in Oklahoma.

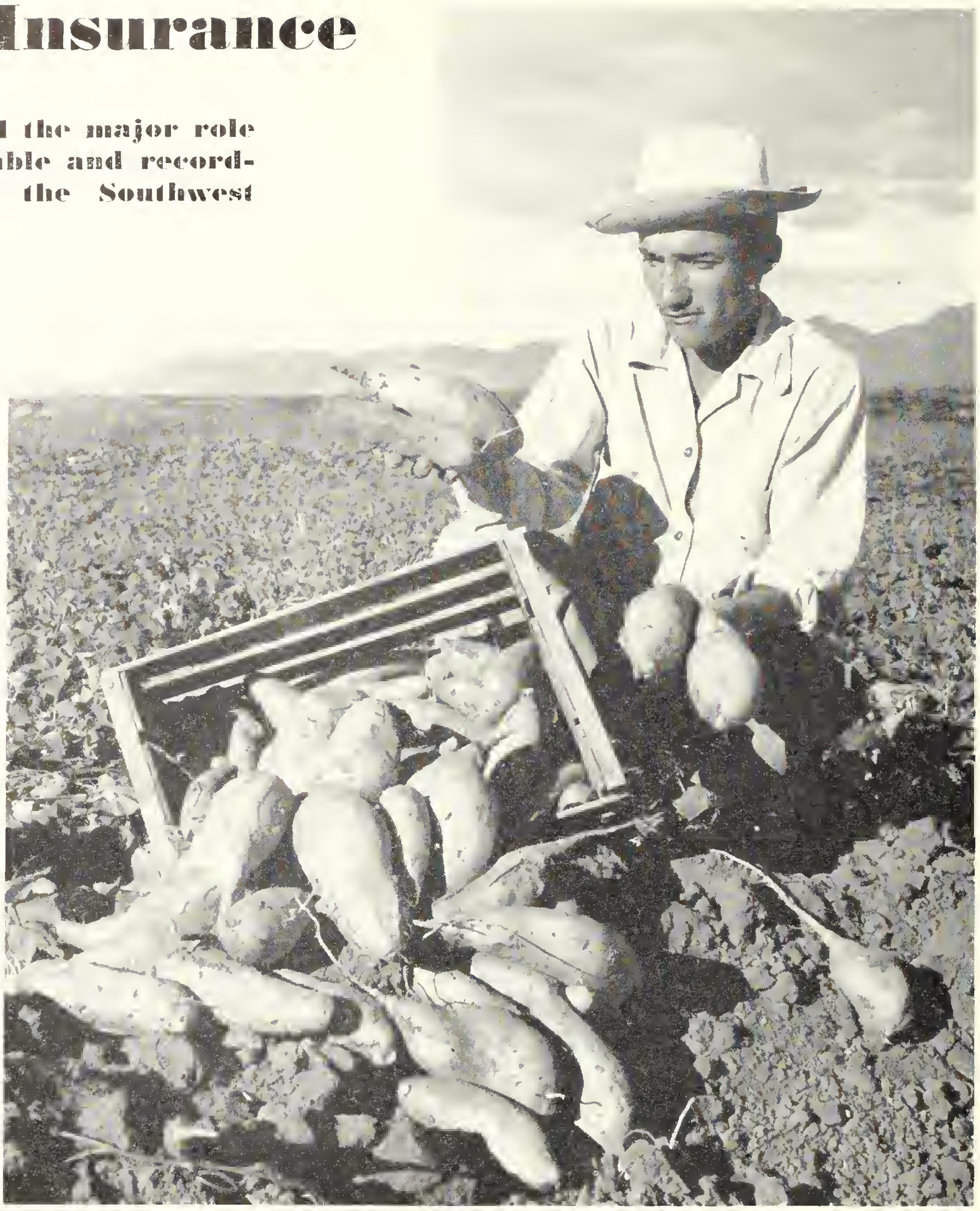
Dollars Roll In

The multimillions rolled into irrigation farmers' coffers in a year when many parts of the Southwest were experiencing some of the worst drought conditions and water shortages within the past decade. Rainfall was below normal for most of the summer months and continued hot weather lowered water supplies to a critical point. But with irrigation water available the hot, dry weather was ideal for early harvesting of cotton. As irrigation farmers were able to unload their cotton when market prices were high, income from this crop soared to record figures.

King cotton ruled the Rio Grande project in 1946 when values of the fleecy staple in the Messila and El Paso Valleys below Elephant Butte Dam, completed in 1916 by the Bureau, reached an all-time record of $31,353,471, an increase of $14,500,00 over the 1945 income.

Total value of all crops grown on this project was $38,771,051, also an all-time mark. The income from the 156,567 irrigated acres in cultivation averaged $247.47 per acre. Sales of livestock and livestock products increased gross returns to $40,656,528. Crop values for the banner year were about double the gross construction cost of the entire project to date.

At Carlsbad, N. Mex., another Bureau of Reclamation project reported a near-record year with 1946 crops valued at $1,984,380, an average of $99.95 per irrigated acre. These figures are all the more impressive when it is realized they were achieved in a year of drought which resulted in water shortages in the water shed and on the project, described as "the worst in history." Values in the 20,000 acres irrigated in the Carlsbad district were surpassed only by the $1,988,546 report of 1919 and the record $2,239,908 income of 1924.



Sweet potatoes mean sweet revenue.

At Carlsbad, cotton also was the major product, accounting for $1,177,815 of the total revenue. The 8,535 acres planted to cotton produced 6,263 bales valued at $939,540 and 2,647 tons of seed worth $238,275.

Bureau of Reclamation projects at Tucumcari and Altus entered the production stage for the first time in 1946. At Tucumcari, 2,526 irrigated acres in the Arch Hurley conservancy district produced crops valued at $216,108.51, an average of $85.53 per acre. By the end of 1947 the Bureau is scheduled to have completed at Tucumcari construction of facilities for the irrigation of 25,000 acres with about 6,000 acres actually receiving water for 1947 crops. The project contains 45,000 irrigable acres.

While irrigated acreage was small at Altus in 1946, the comparison between returns from irrigated and nonirrigated acres was significant. The value of crops raised on 451 irrigated acres averaged $130.72 compared to a $22.09 average on surrounding nonirrigated farms. Water for the project is stored behind Altus Dam, completed by the Bureau early in 1946. Ultimately about 53,000 acres will receive water. Facilities for the irrigation of approximately 20,000 acres are scheduled to be constructed in 1947, with from 8,000 to 10,000 acres actually receiving water during the growing season.

After scattered hail storms in May, weather conditions in the Rio Grande project area were ideal for growing, and permitted rapid and uninterrupted cotton picking during harvest. This enabled most of the gins to close in mid-January while ordinarily the crop is not completely ginned before the latter part of February.

Market prices were higher for all general crops, particularly cotton and alfalfa which were grown on 90 percent of the cultivated Rio Grande area. The average price for Acala cotton was $172.50, compared to

$117 a bale in 1945. Alfalfa at $27.42 a ton was considerably higher than the previous year's average of $18.95. Long staple cotton brought $250 a bale in 1946 and $215 a bale in 1945. Seed averaged $84 a ton compared to $60 for Acala and $63 for long staple seed in 1945.

The Rio Grande project produced 152.282 bales of cotton in 1946, an increase of 34.735 bales over the previous year. Production of long staple, once a substantial part of the total, has declined. Long staple production was only 935 bales. The remainder was Acala, which averaged 1.45 bales to the acre on 104.048 acres. Value of Acala cotton seed and lint combined averaged $289.74 per acre.

Alfalfa was second to cotton in value in the Rio Grande project area. This feed crop averaged 4.4 tons an acre from 35.739 acres. Total income from alfalfa was $4.309.668, an average of $120.59 per acre. Other hay planted on 434 acres was valued at $25.253.

The 7,635 acres devoted to vegetable and truck crops grossed $1.500.715 for a per acre average of $196.55.

The cereal group was produced on 3.501 acres from which a $201,383 crop was harvested. Seed crops on 2,577 acres were valued at $410.481. Fruits and nuts proved the least profitable crops when 4.500 acres grossed $295.615 for an average of $65.70 per acre.

A specialty crop of flowers topped the Rio Grande project area in per acre revenue. Flowers on 22 acres had a value of $58.850, or $2.675 per acre. Nursery stock on 59 acres was valued at $29.068, a per acre average of $492.67.

Through good years and bad, irrigated land will produce dependable crops, but it is in years of extreme drought that the true worth of irrigation becomes outstandingly apparent.

King cotton caused the smile.

Agricultural Goals for 1947

(Continued from page 61)

The table (p. 61) shows the area in cultivation in 1945, including lands which were receiving water under Warren Act contracts. Although the percentage of the 1945 national cropped acreage is small, it is evident that the products grown were those for which there was great demand during the war years, and in most instances are those for which the Department of Agriculture is calling for higher production in 1947.

In reviewing the 1947 outlook for crop production on Federal Reclamation projects, Commissioner Straus has expressed the hope that the farming programs on these irrigated areas will be carefully planned and that soil building practices will be used where intensive cultivation of wartime crops may have depleted the soil fertility.

Number One Jobs in the

Predevelopment Paves the Way

by H. P. Singleton,

Superintendent, Irrigation Branch Experiment Station, Prosser, Wash.

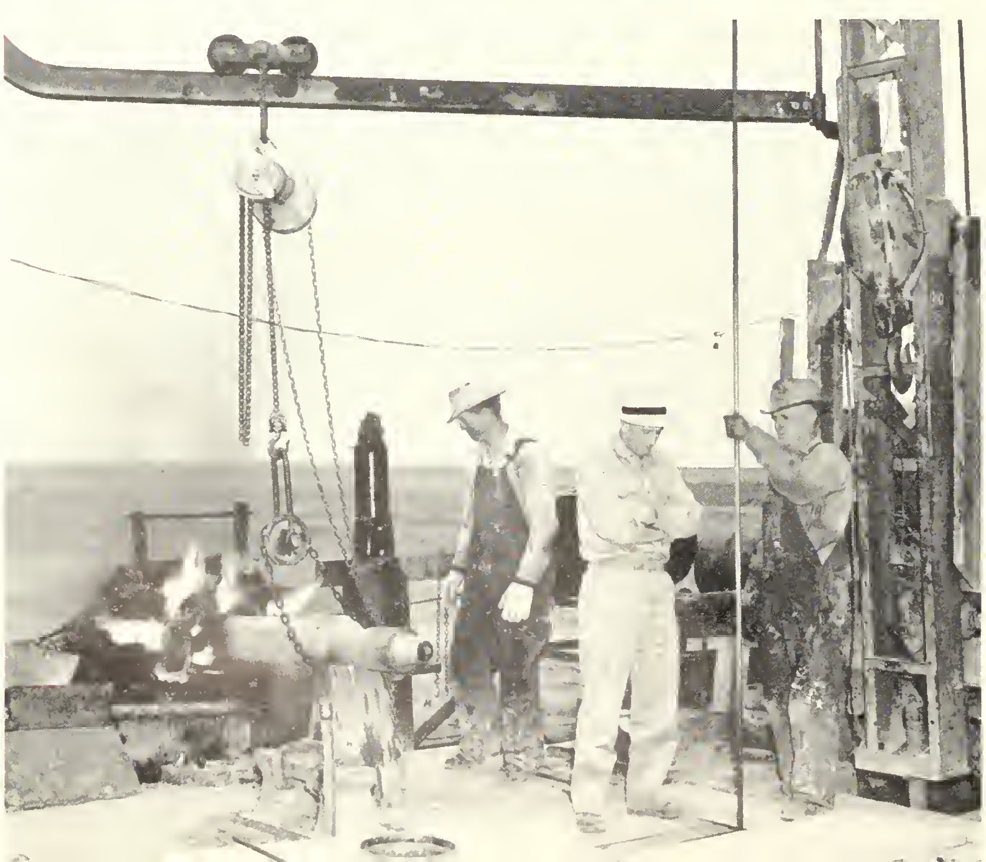
Tests and surveys remove some of the risk for future farmers—well dril

Successful crops make a successful farmer. All other factors being even, anyone starting operations on new land, in a new territory, usually either has to guess right the first time, or spend several years experimenting, until he learns by experience what crops are most profitable.

Farmers entering reclaimed lands in the Columbia River Basin will know in advance what kinds and varieties of crops are most likely to succeed. Through the cooperation of the Bureau of Reclamation, the Department of Agriculture, and Washington State agricultural agencies, this information will be gathered on two farms in the area. One of 48 acres in the southerly part of the irrigation project is known as the Pasco farm. The other, of 81 acres, near the center of the project, is known as the Moses Lake farm. On these two tracts, exploratory work will be carried out in all kinds of crops that might possibly be grown. This will be in addition to the more customary type of studies on irrigation and fertility requirements, control of insects and diseases, control of salinity, use of crop rotation and crop utilization.

Started before actual irrigation development in the basin, this is a new type of program, in that it will attempt to solve in advance many of the problems that would otherwise occur as new farm families settle on the lands. The advantage in putting irrigated farms on an immediate paying basis is obvious. It is significant, too, because irrigated areas in the State of Washington, while only 20 percent of total cropped acreage, bring in a gross revenue to farmers greater than the remaining 80 percent. Since development of the Columbia Basin project will about triple the irrigated lands in the State, the economic gain in putting the new acreage to profitable use immediately is easily seen.

Drilling a water-supply well on the Bureau's No. 1 "guinea pig" farm at Moses Lake.



To bring water to the predevelopment farms, wells will be used until water from the irrigation works becomes available. The facilities on the farms will be constructed by the Bureau of Reclamation with the assistance of the Extension Service of the Department of Agriculture and the various departments of the Washington agricultural experiment stations in planning. The Bureau of Reclamation will then operate the units and a part of each unit will be set aside for the experimental programs of the other agencies. In this way, the units will serve as demonstration farms for the settlers while permitting investigations in the field.

It is planned to continue the experimental farms in operation through the first few years after settlers arrive, to help them during their adjustment period. As new areas are scheduled for irrigation, other predevelopment farms will be established.

The concern of agencies responsible for making recommendations to farmers on irrigated lands is also manifested by other actions taken in the basin area. The Washington agricultural experiment stations have available two of the main types of soils in the Columbia Basin at the Irrigation Branch Experiment Station at Prosser, Wash. These are the "Sagemoor" and the "Ritzville" types. Research on the Sagemoor type began when the station was established in 1919. Recently the board of regents of the State College of Washington authorized the purchase of a half section of soil of the Ritzville type.

Columbia Basin Project

background.

Development on this land which lies in the Roza project of the Bureau of Reclamation was started in 1946. Cooperative work is being conducted by the Agriculture Department's Bureau of Plant Industry, Soils and Agricultural Engineering, through its Division of Soils, Fertilizers and Irrigation.

At Hermiston, Oreg., is the Umatilla field station of the Bureau of Plant Industry. The soil on this station is of the Ephrata series, one of the lightest soil types among those irrigated in the Columbia Basin. This facility also will be used in the studies.

Additional research assistance has been provided on the staff of both the Prosser and Umatilla stations. In addition to these Department of Agriculture technicians, the Washington State agricultural staff has given special attention to the problem. The entire work is being coordinated by the superintendent of the irrigation branch experiment station.

It is hoped thereby that the program will give opportunity to carry the results of the findings to all the new areas to be irrigated before the water is delivered to the land.

C B Job Year Ahead of Schedule

Excavation of the southern section of the gigantic main canal of the Columbia Basin project in eastern Washington is nearing completion almost a year ahead of schedule.

Although the contractor for the 6.6 miles of canal, Morrison-Knudsen Co. of Boise, Idaho, was allowed 750 calendar days, a goal of 300 days has been set to finish this job.

The Monighan Digs In

With giant strides, the walking dragline continues its history-making tour at the Columbia Basin project

The biggest piece of earth-moving equipment ever seen in the Pacific Northwest, a million-pound walking dragline, started work October 11, 1946, on the biggest construction job ever undertaken in the Pacific Northwest, the Columbia Basin project irrigation system.

Built in 1939 by the Bucyrus-Monighan Co., the dragline (a 9 W) has a factory rating of about 9 cubic yards when using a 170-foot boom. However, its owners, J. A. Terteling & Sons, Inc., Boise, Idaho, have attached Paul Bunyan buckets with which it will handle 15 yards of rock or 20 yards of common dirt at a scoop. In a 24-hour shift, the Monighan will move 9,000 yards of rock or from 12,000 to 13,000 yards of earth. The eastern Washington rock is estimated to weigh 2.1 tons per yard.

Equipped with a 630-horsepower Diesel engine, the Monighan has moved many millions of cubic yards of material on Bureau of Reclamation jobs and other contracts. It arrived on the Columbia Basin project from the Tucumcari, N. Mex., project. Prior to that it was on river-channel work in the Mesabi iron fields in Minnesota. Earlier, it was used for changing a river channel in South Carolina.

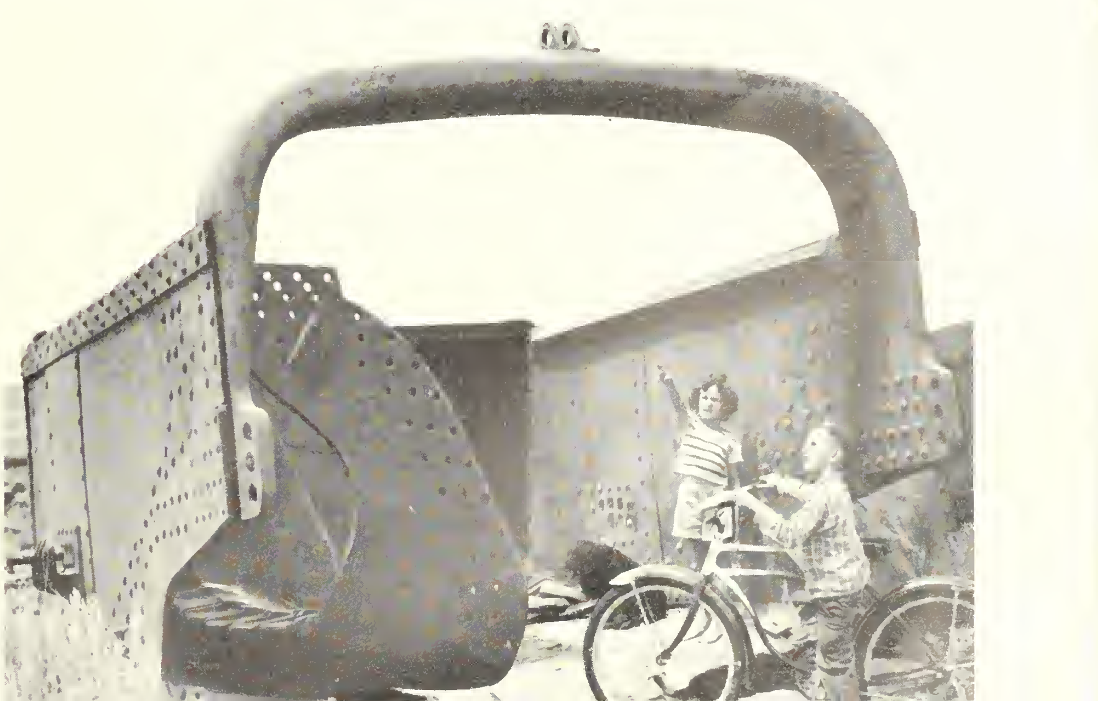
On the Columbia Basin project, the Monighan will handle virtually all excavation for the northern portion of the river-size Main Canal, which leads from the South Dam at Coulee City, Wash. Its way will be prepared by a blasting crew which will use 2,000,000 pounds of dynamite to break the tough, flint-like lava that characterizes the famed coulee area of eastern Washington.

Although walking draglines are not new to the construction field, their higher initial costs and their unusual size generally have restricted their use to the larger jobs. The Monighan on the Columbia Basin project has a circular base 30 feet in diameter on which it rests while excavating. In moving, it uses its two feet, which operate on an eccentric cam, moving inside an oval track frame.

As the two feet are lowered simultaneously, and pressed against the ground, the Monighan is lifted from its base and slides forward. The feet then are lifted, moved forward, and again lowered for the next step. The 9 W's shoes are 36½ feet long and 6½ feet wide. It takes a 7½-foot step and travels about 1 mile in 7 hours.

On the main canal job, the Monighan is scheduled to handle about 300,000 cubic yards of common and nearly 2,000,000 cubic yards of rock. Approximately 100,000 yards of the common excavation will be under a subcontract with the Bair-Crick Co., holders of the South Dam contract for the Grand Coulee Equalizing Reservoir, which will store water for the million-acre project.

Boy, that's only part of it!



FUTURE HOMESTEADERS

Three who won farms in the Tule Lake Division of the Klamath Project in California-Oregon during the recent drawing at Klamath Falls

by John A. Leveritt, *Region III, Boulder City, Nev.*

Vernon Elwood McVey
He flew under the deadline

"I'm looking for some land." It was Thursday evening, September 12, 1946. Vernon Elwood McVey, ex-Army Air Force pilot, had been looking over the Yuma Mesa division of the Gila project. Unexpectedly he met and thus greeted his former agronomy professor, Ian A. Briggs (now a Bureau of Reclamation official) at the San Carlos hotel in Yuma, Ariz.

"Too bad," said Briggs. "You are just a little late—applications have to be in on the Tule Lake division lands of the Klamath project in Oregon by 2 p. m. this Sunday—September 15." He went on to explain the lost opportunity.

McVey wasn't going to let the opportunity slip by. He started figuring time and distance. The next morning he began a series of hurried automobile trips over the State of Arizona. First to the Phoenix Bureau of Land Management office for an application blank, where he learned the cost per acre to be repaid over a period of 40 years without interest. Only $88.35 an acre for some of the richest land in the country. He laughed at the calendar—Friday the 13th!

Not superstitious, he phoned Klamath, Oreg., and was assured that, although there were thousands of applications, he would have just as good a chance as anyone else—IF he made the deadline.

From Phoenix, he drove to his dad's farm near Parker, Ariz. His father, Marshall F. McVey, caught his son's enthusiasm, but urged him to take a short rest. Saturday morning McVey completed the application, took it to town to be notarized.

Time was growing short. McVey enlisted the aid of his friend, Marion Beaver, a former Navy pilot, owner of an Army surplus airplane. These arrangements seemed to eat up the remaining time. Finally they took off by airplane to Klamath Falls, Oreg., and breathlessly submitted the all-important application blank with a few minutes to spare.

"After I had the application in, I realized that my chances were pretty slim. I had spent about $200 on the gamble." Not a bad investment, considering what he won.

Shortly after the war began, Vernon was drafted. He was accepted for flying training in November 1942 and was commissioned in October 1943 and assigned to the Army Air Field at Del Rio, Tex. There he met his pretty wife, Virginia, the daughter of a Texas rancher. They were married in Florida in January of 1944.

William E. Macy
He nearly gave up

"If I had been there I would probably have given up," says William Elsworth Macy, a young veteran of Lakeside, Calif. His name was drawn last.

At the beginning of the drawing there were 1,305 names of applicants who had been judged qualified. With 85 names gone that left Bill with 1,220-to-1 odds.

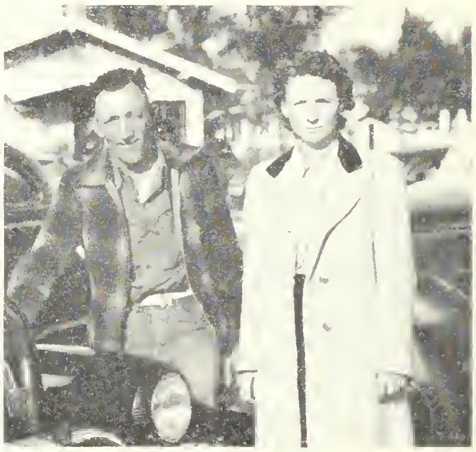
Bill has another claim to distinction among the winners—every member of his family is a veteran, including his mother.

His father, Elmer H. Macy, a retired police officer of San Diego, Calif., now farming near Lakeside, was in the Army during World War I. Bill's brother, Paul R. Macy, 22, is a first lieutenant in the Air Forces and is now stationed in Austria.

Bill was drafted into the Army in February 1943 and was assigned to a mobile communications squadron later attached to the Ninth Air Force in Europe.

His mother, Mrs. Jane Macy, was a member of the Women's Army Corps.

Bill is 23 and was born in Los Angeles May 12, 1923. He got his experience in irrigation farming which made him eligible to apply for a homestead on the family's farm in Moorpark, Calif.



Walter Max Hulse
He was from Missouri

"That is the best land I ever saw. Even beats that good Missouri River bottom-land all hollow," declared Walter Max Hulse, of La Habra, Calif., one of the 86 veterans whose names were drawn to make a homestead entry on this first Bureau project to open for veteran entry since the end of the war.

Walter, a man of the soil nearly all his life, gained his impression of the quality of the Tule Lake land when he inspected it several months ago. He had been to Grants Pass, Oreg., to look over some land for purchase. En route home, he stopped by the project and decided not to buy any land until he tried to get a farm through homestead entry.

"Even if money was no object, you could not buy better land. I would rather have it than developed land which I have seen priced at more than $500 an acre," he said.

"My plans are not definite for the first year's operation," he said. "I am going to follow the advice of the county agent. All I am sure of is that there will be plenty of work for the first few years. But these calluses did not get here by just sitting around thinking."

Walter was born near Springfield, Mo., February 10, 1911. When he was 11 years old his father died and the three boys ran the farm.

In 1935 he went to southern California where he gained his irrigation farming experience on farms and citrus groves. He was drafted into the Army in November of 1942, after 2 years in a defense plant which manufactured heavy duty lathes and aircraft parts. In the Army he served with the Air Transport Command and was discharged January 27, 1944.

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Approved Missouri River plan map.*—Color map of reservoir and dam sites in the basin construction program in Colorado, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

2. *Maps of seven States showing water resources development of the Missouri River Basin.*—Maps of Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming with locations in color of dams, reservoirs, canals, irrigable areas, and other works proposed as parts of a unified plan for the development of the water resources of the Missouri River Basin. (Also available from regional directors, Bureau of Reclamation, region VI, Billings, Mont., and region VII, Denver, Colo.)

3. *Landownership Survey on Federal Reclamation Projects.*—Available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

4. *The Colorado River.*—Comprehensive departmental report on development of water resources of Colorado River Basin for review prior to submission to the Congress. Limited number of copies available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

5. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals,* by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, seven-page mimeographed study with graphs.

Available from the Superintendent of Documents, Washington 25, D. C.

1. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

2. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest releases are:

Problem 14. Financial Aid for Settlers—25 cents.

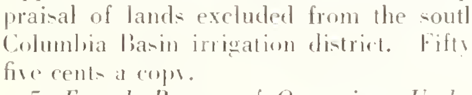
Problem 23. Rural and Village Electrification—25 cents.

Problem 26. Recreational Development of Roosevelt Lake—75 cents.

3. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Table showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

4. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

5. *Fourth Report of Operations Under the Boulder Canyon Project Adjustment Act for Year Ended May 31, 1945,* published January 4, 1946. Fourth annual financial statement of the Commissioner of Reclamation transmitted to the Secretary of the Interior concerning operation, maintenance, and construction activities of the Boulder Canyon project during the year ended May 31, 1945. Ten cents a copy.



Miscellaneous Publications

Agricultural Research in South Dakota, fifty-eighth annual report of the South Dakota Agricultural Experiment Station, by I. B. Johnson, director, July 1, 1944, to June 30, 1945. Report contains data on the progress of the research projects conducted by the station's scientists, brief summary of the activities of the substations, and condensed financial statement of the research funds used. For information write to the South Dakota Agricultural Experiment Station, South Dakota State College of Agriculture and Mechanic Arts, Brookings, S. Dak., 47 pages with illustrations.

Veterans' Training Course Turns Out Journeymen Craftsmen, by J. L. Bateman, Los Angeles Department of Water and Power, in *Electrical World,* July 20, 1946, page 60—illustrated. Nine apprentice training schools train 331 veteran enrollees to be future linemen, cable splicers, servicemen and conduit men in utility training program.

Building the Atomic Bomb Plant, in *The Constructor,* July 1946, page 95—illustrated. The story of the construction of the atomic bomb plant at Oak Ridge, Ky., a record-breaking job by general contractors.

Shooting Concrete into Walls Cuts Lumber Use and Labor Costs, in *Engineering News-Record,* July 11, 1946, page 100—illustrated. To overcome the current lumber shortage a west coast contractor builds walls with gunite shot against a single outside form, which method speeds construction and cuts costs.

Your Government's Records in the National Archives, by W. Brooks Phillips under the supervision of Philip M. Hamer, Records Control Officer, National Archives, 1946, 81 pages with index (National Archives Publication No. 46–18). A condensed description of the vast store of records in the National Archives and the pattern of their arrangement. Copies free of charge upon request of the Archivist, National Archives, Washington, D. C.

A Housing Project for Davis Dam, in *Construction Methods,* July 1946, page 91—illustrated. The Utah Construction Co. builds housing facilities for construction and office personnel as the first step in building for the Bureau of Reclamation the earth and rockfill Davis Dam across the Colorado River in Arizona.

What About International Standards for Building Dimensions?, in *Industrial Standardization,* July 1946, page 160—illustrated. An international housing shortage brings to the United Nations Standards Coordinating Committee suggestions for international standards as aids in bringing about speedier progress in building. Industrial Standardization is published monthly by the American Standards Association, 70 East Forty-fifth Street, New York, N. Y.

Bibliography of Agriculture, publications of the United States Department of Agriculture, State agricultural experiment stations, State agricultural extension services, and books and pamphlets from other sources listed by the departmental library, 162 pages (mimeographed) with author and subject indexes. August 1946, volume 9, No. 2.

Agriculture in Oregon, prepared by the Oregon State Department of Agriculture. Brief answers to the questions of civilians and servicemen concerning Oregon agriculture and the State, 20 pages with illustrations, issued in 1946. Write to the Oregon State Department of Agriculture, Salem, Oreg.

Looking Forward in Oklahoma Agriculture, published by the Division of Agriculture, Oklahoma Agricultural and Mechanical College, June 1946. Experiment Station Bulletin No. B 299. 92 pages with illustrations. An inventory of Oklahoma's agricultural resources; an analysis of major aspects of the State's farm industry and rural life with suggestions for future development. For information write to the Division of Agriculture, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

Report on the Columbia River Power System (fiscal year 1945), prepared by the Bonneville Power Administration, Department of the Interior, June 30, 1945. 35 pages with illustrations. Report shows the results of operation of the Bonneville Power Administration from July 1, 1938, to June 30, 1945, and includes certified financial statements for the Columbia River power system. Write to the Bonneville Power Administration, Portland, Oreg.

"Sprinkler Irrigation," by Gustav H. Bliesner, assistant extension engineer, Agricultural Extension Service, Institute of Agricultural Sciences, State College of Washington, Pullman, Wash., Extension Bulletin No. 336, *Washington Irrigation Series*, March 1946. 20 pages. Illustrated. A graphic explanation of the advantages of the sprinkler irrigation method. For copies write E. V. Ellington, director, College of Washington Extension Service, Pullman, Wash.

Mineralogical and Physical Composition of the Sands of the Oregon Coast from Coos Bay to the Mouth of the Columbia River, prepared by Dr. W. H. Twenhofel, Head of the Department of Geology, University of Wisconsin for the Department of Geology and Mineral Industries, State of Oregon, 1946. Bulletin No. 30. 66 pages with illustrations. Bulletin gives the results of painstaking field and laboratory studies of the sands of the northern two-thirds of the Oregon coastal area. 35 cents a copy from the Department of Geology and Mineral Industries, State of Oregon, Portland, Oreg.

Soil—A Foundation of Health, by Arnold P. Yerkes, supervisor, Farm Practice Research, International Harvester Co., 1946. 12-page pamphlet. The relation of soil to *your* health and the health of the nation. Obtained on request from Consumer Relations Department, International Harvester Co., Chicago, Ill.

Statement of the Federal Power Commission to the Seventy-Ninth Congress. (Fiscal year ended June 30, 1944.) 31 pages. Report on new applications for preliminary permits and licenses, and renewal of licenses, for power and transmission-line projects, and proceeds derived from licenses issued. Copies of the statement obtainable from the Federal Power Commission, Washington, D. C.

"Use of Aerial Photos in Controlled Mapping," by Pliny Gale, chief engineer, Jack Amman Photogrammetric Engineers, in a bulletin of the Agricultural and Mechanical College of Texas reporting a *Postwar Planning Conference for Controlled Surveying and Mapping*. (Page 36.) Report of the *Conference*—sponsored by School of Engineering, Agricultural and Mechanical College of Texas; College of Engineering, University of Texas and General Land Office, State of Texas and held in Austin, Tex., November 14–15, 1944—published in Bulletin No. 86, School of Engineering, Texas Engineering Experiment Station, College Station, Tex. Write to the School of Engineering, Agricultural and Mechanical College of Texas, College Station, Tex.

Cash Receipts from Farming by States and Commodities, Calendar Years 1924–44, compiled by Gertrude A. Gronbech and Selma F. Goldsmith, Bureau of Agricultural Economics, Department of Agriculture, January 1946. 183 pages (mimeographed). The cash receipts from farm marketings include cash receipts from sales only, as calculated on a calendar-year basis. Write to the Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

Ninth Biennial Report of the State (Oregon) Reclamation Commission—June 1, 1942–June 30, 1944. Report of the State Reclamation Commission, State of Oregon, made by Governor Earl Snell to the Forty-third Legislative Assembly, regular session, 1945. 21 pages (mimeographed). Write to the State Reclamation Commission, State of Oregon, Salem, Oreg.

Dynamic Factors Affecting Turbine Foundation Design, by Dr. Sergius Vesselowsky, research department, the Detroit Edison Co., Detroit, Mich., at present with the Library of Congress, Washington, D. C., in *Electrical World*, August 3, 1946, page 60—illustrated. The author summarizes the practical considerations involved in the design of foundations for large turbo generators.

Summary of Industrial Electric Power in the United States (1939–46), a report prepared by the Division of Finance and Statistics, Federal Power Commission, 1946. 78 pages with illustrations. Report presents data on supply and use of electric energy by manufacturing, including Government manufacturing, and extracting industries for the years 1944–46, with text tables showing data for 1939–46. Fifty cents a copy from the Federal Power Commission, Washington, D. C.

"Precipitation Seasons in the United States," by Stephen S. Visher, in *The Geographical Review*, January 1947, page 106, illustrated. A graphic study of the four parts of the United States which have well marked seasonal contrasts in total precipitation. (The Geographical Review is published quarterly by the American Geographical Society, New York, N. Y.)

"The Birth of Mechanized Construction," by C. S. Hill, in *Engineering News-Record*, December 12, 1946, page 102. Illustrated. Mr. Hill, associate editor (retired) of the Engineering News-Record, traces the unprecedented progress made in the development of the construction machine and in the coordination of the operation of various types of such machines on a construction job.

"Prospectus on Atomic Power," by Prof. J. B. Condliffe, University of California, and others, a project of the Carnegie Endowment Committee on Atomic Energy, in *Electrical West*, November 1946, page 55, illustrated. A study by an eminent group of California scientists presenting a summary which suggests early arrival of electric power generating plants deriving their energy from nuclear fission.

Foreign Entries

Navigation on the Columbia River, in *Engineering*, London, England, June 21, 1946, page 590. Article emphasizes that the navigation of the Columbia River is of interest to Great Britain, since by the Oregon County Treaty of 1846, British subjects have the right to navigate the river to its mouth. The Columbia rises in British Columbia and the first 465 miles of its length lie in Canadian territory. Engineering is published at 35 and 36, Bedford Street, Strand, London, W. C. 2, England.

C. S. I. R.—1945, published by the Council for Scientific and Industrial Research, Commonwealth of Australia, 1945, 98 pages with illustrations. Annual report of the Council for Scientific and Industrial Research giving technical details of progress in the fields of plant industry, entomology, animal health and nutrition, soils, irrigation settlements, forest products, food preservation, fisheries, national standards, radiophysics, aeronautics, industrial chemistry, dairy products, lubricants and bearings, mining, and in scientific research and post-war reconstruction.

PAINTING FOR PROTECTION

by Graydon E. Burnett

Engineer, Branch of Design and Construction, Denver

The word paint is usually associated with making the old homestead white or the barn red. To Bureau engineers, paint means much more than just the opportunity to harness the colors of the rainbow. It is the commodity that protects millions of tons of iron and steel against the corrosive ravages of Mother Nature.

Eleven years ago the research headquarters of the Bureau in Denver established the paint laboratory for the primary purpose of ascertaining the best available coating for submerged metalwork. Through the years the scope of paint research has been widened to include paints and protective coatings for all types of construction, and for all sorts of exposure conditions. Penstocks, outlet pipes, gates, trashracks, and a seemingly unending array of miscellaneous metal work are given the ultimate in paint protection because of the research in the paint laboratory. This research is also an important factor in production time.

The laboratory investigations include everything from ordinary house paints to hot-applied, coal-tar enamels; from cold water paints to complex synthetic plastic coatings. The selection of the proper paint for a particular service has become an exacting problem, and one which requires precision testing equipment and specialized technicians for proper operation and interpretation of results. For example, paint is a feeding ground for molds, but adding the proper amount of germicides and fungicides during the manufacturing process forestalls damage to painted surfaces.

One of the more interesting pieces of equipment in the laboratory is the weatherometer. A sample of paint is applied to a square of metal which, after drying, is placed in the weatherometer. The sample is then subjected to successive water sprays and the glare of bright sunlamps. Thus, by making up a bit of rain or sunlight, the technician accurately determines the ability of the paint to stand up under destructive elements.

Other laboratory procedures and equipment include salt spray boxes which are in continuous operation as a means of evaluating the relative effectiveness and durability of proprietary paints which claim to be the ideal protective agents for metal work exposed to corrosive waters; apparatus to study the moisture resistance of protective coatings; a gage, called a reflectometer, which enables precise measurements of color, gloss, and hiding power of paints; and a thickness gage which accurately measures coating thickness to one-thousandth of an inch.

PAINT MEETS THE WEATHERMAN *in this tub known as the weatherometer.*

In addition to tests on finished dry coatings, the properties of liquid paint are of great importance as they influence stability, ease of application, drying time, and physiological effects.

Today the laboratory is searching for equipment to set up a small scale paint formulation plant where paint products can be developed which will be hand-tailored to suit any particular requirement. Accurate composition data will be available for incorporation in material specifications, and less reliance will have to be placed on purely physical tests to insure proper quality.

An important concern of the laboratory is the painting operation. Notwithstanding

(Continued on page 72)

ONLY THE BEST *in paint for Grand Coulee Dam.*

Generators and Turbines on Order

Contracts totaling more than a million and one-third dollars were awarded during January for power equipment on the Colorado-Big Thompson project. The contracts call for three turbines and three generators for the Estes Park plant, and a turbine and generator for the Marys Lake plant.

The Estes Park plant will be located on the south bank of the Big Thompson River, about a half mile below the village of Estes Park, while the Marys Lake plant will be built two miles southwest of the Estes plant.

The plants are part of the Bureau's Colorado-Big Thompson project designed to divert Colorado River water from the western slope of the Rocky Mountains to provide a supplemental water supply for approximately 615,000 acres of inadequately watered land on the eastern slope. The ultimate total capacity of the project's power plants will be 175,000 kilowatts.

Recreational Surveys Planned

The Gunnison-Arkansas and Blue River-South Platte projects will be the latest locations for recreational surveys by the National Park Service as a result of a recently executed memorandum of understanding between the Bureau of Reclamation and the National Park Service. The estimated cost of $6,000 for the work will be transferred from the Bureau to the Park Service. This sum will be prorated between the Colorado River development fund and the Reclamation fund.

Parker Plant Gets Transformers

The power bottleneck at Parker Dam will be alleviated immediately through the loan of two 40,000 kilovolt-ampere transformers from the Corps of Engineers. These have been made available by Manhattan district engineer, Col. K. D. Nichols. The transformers at present are located at Oak Ridge, Tenn., and will be used at Parker pending completion of the new transformer bank.

Missouri Basin Investigations Get Cooperation

The Bureau of Reclamation, Bureau of Agricultural Economics, and the Montana State Agricultural Experiment Station are conducting a joint survey to determine economic conditions in connection with the entire Missouri Basin investigations under way. Under a separate agreement the Bureau of Reclamation and the Montana Agricultural Experiment Station will conduct a survey of piped and gravity irrigation methods.

Krug Announces Roza Openings

Secretary of the Interior J. A. Krug on February 14 at the Yakima-Tieton celebration (see p. 53 this issue) announced the opening to homestead entry of 1,722 acres of public lands on the Roza division of the Yakima project. There will be 28 units in the tract averaging 61 acres each. Public notices were sent to those who have indicated an interest in the opening. All applications must be filed with Superintendent D. E. Ball, Bureau of Reclamation, Yakima, Wash., by April 1, 1947.

Aid for Soldier Settlers

A Federal-State cooperative program is being set up to provide settler assistance to successful applicants on the Heart Mountain division of the Shoshone project in Wyoming. Buildings formerly used by war evacuees at the WRA center will be made available for conversion into living quarters by the new settlers. Agricultural assistance will be provided through arrangements with the Wyoming State Extension Service.

The Veterans' Bureau has notified the Bureau of Reclamation of its desire to provide vocational agricultural training for veteran settlers, and steps have already been taken to get this program under way on the Shoshone project.

Emergency Relief for Big Thompson

Assistant Secretary of the Interior Davidson recently approved a draft of a contract with the Northern Colorado Water Conservancy District providing for the construction of a temporary structure to carry water from the Alva B. Adams tunnel. This step was taken in order to meet the urgent needs of the lands in the Big Thompson Valley. The cost of the structure will be paid for by the Northern Colorado Water Conservancy District. The agreement covers the period beginning with the availability of water in 1947, and terminating as soon as the project has advanced far enough to permit delivery of water under the existing repayment contract between the United States and the district. The temporary contract will not amend or modify in any way the already existing repayment contract.

Testing Station Planned Near Imperial Dam

A permanent engineering station will be established near Imperial Dam by the Engineer Board of the United States Army, under the terms of a memorandum of agreement between the Interior Department and the War Department. The particular site chosen for the station contains all facilities required for testing equipment under conditions such as may be met anywhere in the world—controlled flow of water for testing floating and fixed bridges, swamps and desert. Lands in the same area were used for testing purposes during the war. The land where the station will be located was reserved for possible irrigation development but will now be released to the War Department.

Record Set at Anderson Ranch Dam

A new record for earth-placing was established at Anderson Ranch Dam recently, which ultimately will be the world's highest earth-fill structure of its kind. Over a 30-day period 377,000 cubic yards of material was placed in the dam which is located on the South Fork of the Boise River. This material is equal to a solid structure 500 feet long, 500 feet wide, and 40 feet high.

Provo OK's Increased Cost

A supplemental repayment contract which was approved by the Provo River Water Users Association early in December of 1946 was signed recently by Assistant Secretary Davidson. This contract represents the first offer by a water users association or an irrigation district to increase project costs which arose during the war years. Under the terms of the new contract the Association has agreed to an increased repayment obligation for construction of the Deer Creek division of the Provo River project from $7,600,000 to $11,400,000. (See February ERA, p. 44 for the story of Provo's prosperity.)

Bureau Engineers Loaned to Foreign Governments

Recognition among engineers of foreign countries of the Bureau's outstanding engineering achievements has been evidenced in requests that the Department of State is receiving from foreign governments for the loan of Bureau engineers and technicians.

(Continued on page 71)

Surveying From a Desk

by J. P. Smith,

Photogrammetrist, Branch of Design and Construction, Denver, Colo.

Through aerial photography only is it possible to survey this Colorado River region.

It was less than a century ago that such intrepid adventurers as John C. Fremont and Maj. John Wesley Powell took their surveying parties into the wilderness of the West where members of the parties suffered catastrophic privation, hunger, exposure, illness, and death.

Today, a survey can be made from a desk in a warm, comfortable office. This new science is known as photogrammetry—the art of obtaining surveys from photographs. Such surveys are obtained from the interpretation and treatment of aerial photographs. Through the use of photogrammetric processes, topographic maps for engineering purposes are compiled to any desired scale with contour intervals as small as 1 foot. Maps prepared by this method are being more and more widely used in Bureau of Reclamation work.

The work of photogrammetrists has proven to be an invaluable aid in geologic studies. The geologist uses a mosaic of aerial photographs as a base map, along with stereoscopic studies of paired prints, for preliminary investigations.

The study of landforms, drainage patterns, and distribution of vegetation, yields valuable clues to geologic conditions in proposed dam site and reservoir areas. Faults, landslides, location of bedrock outcrops, sequence of rock strata and other geologic conditions important to the engineer can be readily investigated by the use of photogrammetric processes allied with geologic principles. In addition, the nature of the problems and the areas of most profitable study can be outlined for subsequent field investigations.

A wealth of information is obtained by photogrammetric processes which might otherwise be neglected because of the large areas involved, the time element, and the high cost of ground surveying.

Working at a desk from photographs the Bureau photogrammetrist prepares a detailed survey of projects under investigation such as the site for a dam, a reservoir, a power plant, or the routes of tunnels, canals and laterals. Photogrammetry is also used for related engineering studies such as determination of reservoir capacities, location of power transmission lines and roads, and classification of land.

The tremendous advances made in aerial photography and the interpretation of aerial photographs during the war have resulted in wider use of photogrammetry. The aerial photographer flies over a predetermined flight line using a special camera equipped with an auxiliary instrument known as the intervalometer; by means of a motor, the intervalometer operates the camera automatically, winding the film, setting the shutter, and tripping it at regular time intervals. Most aerial photographs are taken between 11 a. m. and 2 p. m. because at this time of day any shadows which might obliterate ground detail are reduced to a minimum.

An additional field of photogrammetry, which shows great promise, is the location of material deposits for construction purposes. The investigations made in this new field of application are now adequate to assure that the preliminary location of construction materials deposits by this method is a practical engineering operation.

The steadily increasing use today of photogrammetry in engineering and geologic fields is a logical development since this science provides many advantages over the arduous ground-surveying methods in (1) a saving in time of months, and in some cases even years, (2) a more thorough survey, (3) greater over-all economy, and (4) availability of data not obtainable economically by other methods.

Bureau Engineers Loaned

(Continued from page 70)

Mr. Albert W. Newcomer, engineer from the Design and Construction Branch in Denver, has been loaned to the Government of Venezuela to assist in the investigations of water resources and in the planning of irrigation projects. He arrived in Caracas in October and is to spend 1 year advising on American techniques and "know-how" in irrigation planning and construction.

It is expected that another Bureau engineer will soon travel to El Salvador to assist that Government with problems concerning hydroelectric power development on the River Lempa. This detail, which is to take about 3 months is now under discussion with the Department of State.

Additional requests for the loan of Bureau experts have been received from the governments of Venezuela, which desires a construction engineer and a geologist to assist in the design and construction of a water supply system for the city of Caracas; Costa Rica, which desires an irrigation engineer to help in the planning of a large irrigation project; Ecuador, which desires an expert in river silting problems to assist in the control of the Guayaquil River; Ceylon, which desires a Bureau administrator to accept the post of deputy assistant director of irrigation of Ceylon for a period of 5 years; and from Afghanistan which desires several engineers to assist in the planning and construction of large irrigation undertakings.

The services of United States' technical personnel are made available through the Department of State under authority of Public Law 63, Seventy-sixth Congress, which permits Federal agencies to loan personnel on a reimbursable basis to certain foreign countries, for a limited time. The country desiring assistance places its request with the State Department through diplomatic channels, and the State Department requests the appropriate agency to make its personnel available if possible.

Recent Project Maps

Published by the Bureau of Reclamation

Panoramic Perspective of Boulder Dam Area. Map No. 47-3, supersedes No. 24550-A. Halftone. Size 7½ by 9⅜ inches, free.

Western half of the United States showing Reclamation projects and the 7 regions. Map No. 44-14, revised October 1945. Size 16 by 20 inches, free.

Orland project, California. Map No. 45-45 (supersedes No. 21880). Blue, green, and black. Size 8 by 10½ inches, price 10 cents.

Grand Valley project, Colorado. Map No. 45-40 (supersedes Nos. 23888 and 23888A). Green, brown, blue, and black. Size 16 by 26 inches, price 25 cents.

Klamath project, Oregon-California, Map No. 45-52 (supersedes Nos. 27450 and 27450A). Black, blue, green, and red. Size 16 by 20 inches, price 25 cents.

Motion Pictures

The Bureau of Reclamation distributes 16 mm. motion pictures relating to its activities. The films will be loaned the borrower willing to pay the express charges both ways. The list follows:

(Distributed from the Bureau of Reclamation Office, Washington 25, D. C.)

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Boulder Dam	4 reels (sound)
Reclamation in the Arid West	1 reel (sound)
Fundamentals of Irrigation	3 reels (sound)
Irrigated Pastures (Kodachrome)	2 reels (sound)
Fighting Weeds (Kodachrome)	3 reels (sound)
Measurement of Water (Kodachrome)	3 reels (sound)

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Letters to the Editor

MANILA, REPUBLIC OF THE PHILIPPINES
December 13, 1946.

DEAR EDITOR: We are glad you resumed publication of the RECLAMATION ERA this year, and we shall appreciate the privilege of again receiving copies thereof in the future as we find them very valuable and interesting.

Very truly yours,
AMBROSIO MAGSAYSAY,
Manager, Metropolitan Water District, 176 Arroceros, Manila.

WASHINGTON, D. C.,
December 12, 1946.

DEAR EDITOR: The article in your November issue, "It Works Both Ways," by Mr. William E. Corfitzen, has been read with much interest and deep appreciation.

The Bureau of Reclamation has played no small part in the training programs we have administered for nearly 2,500 foreign technicians who represent 24 other countries. Mr. Corfitzen and his colleagues have been of splendid assistance in the successful operation of these programs for sharing American know-how, and we are grateful for his fine presentation of our work.

Sincerely,
ELLIOTT S. HANSON,
President, International Training Administration, Inc.

Painting for Protection

(Continued from page 69)

the care taken in the laboratory to choose the right paint for the right purpose, almost everything depends on the observance of good painting practices. In some cases a metal work must be subjected to sandblasting before the application of paint. It is sometimes necessary to apply primer coats. Very often paint is ineffectively applied because the surface was not properly cleaned, or the surface was damp at the time of painting, or the paint was improperly thinned.

An interesting sidelight to the Bureau painting problems is the fact that the irrigation farmer plays an important role in certain irrigated areas through his production of soybeans and flaxseed. The Department of Agriculture reports that three-fourths of the total soybean production in this country is crushed for oil. While, at the moment, soybean oil is being used in food production, paint manufacturers are planning extensive use of it when it is released for manufacturing purposes.

The next time you see a Bureau structure, remember the paint is not merely decorative but is the finest protective coating that constant research has made possible.

OUR BACK COVER

Friant-Kern Canal.

Construction on this "man-made river," begun late in 1945, is progressing. The first 75 miles of the 156-mile canal are now under way. The Friant-Kern Canal is one of the most important irrigation features of the Central Valley project and will supply water for thousands of rich but inadequately watered lands.

It will stretch from Friant Dam to Bakersfield, Calif., when completed.

U. S. GOVERNMENT PRINTING OFFICE 1947

Notes for Contractors

Contracts Awarded During January 1947

Spec. No.	Project	Date of award	Description of work	Contractor's name and address	Contract amount
1495	Shoshone, Wyo.	Jan. 16	Transformers for Heart Mountain and Garland	Standard Transformer Co., Warren, Ohio.	$55,170.45
1504	Boise-Payette, Idaho	Jan. 15	Transformers and switchgear	I-T-E Circuit Breaker Co., Philadelphia, Pa	21,289.00
1506	do	Jan. 8	12- by 13.38-foot fixed wheel gate	Consolidated Steel Corp., Los Angeles, Calif	19,575.00
1510	Altus, Okla	Jan. 2	Reconstruction of State Highway No. 9	Stebbins Construction Co., Tulsa, Okla	137,173.20
1511	Columbia Basin, Wash	Jan. 14	Transformers and registers for Grand Coulee	Westinghouse Electric Corp., Denver, Colo.	18,201.00
[1]1512	Boulder Canyon, Ariz.-Nev	Jan. 10	Construction of Coachella Canal, station 6406 to 6517	Otto Ashbach & Sons, St. Paul, Minn	697,724.00
1514	Central Valley, Calif	Jan. 21	Completion of installation of penstocks 1, 2, 5	Eichleay Engineering Corp., Pittsburg, Pa	418,800.00
[2]1519	Yakima-Roza, Wash	Jan. 14	Elec. equipment for areas 1-17	Railway & Industrial Engineering Co., Greensburg, Pa	10,370.56
1521	Boise-Payette, Idaho	Jan. 21	Elec. equipment for Black Canyon	General Electric Co., Denver, Colo	26,203.40
1523	Parker Dam, Ariz.-Calif	Jan. 9	16 jacking units for floating bulkhead	Pacific Coast Engineering Co., Alameda, Calif	12,700.00
1524	Davis Dam, Ariz.-Nev.	Jan. 6	Construction of Phoenix-Tucson No. 2 transmission line	J & J Const. Co., Oklahoma City, Okla	175,165.31
1540	Boise-Payette, Idaho	Jan. 24	Clearing part of Cascade Reservoir site	W. D. Zavalas, Oroville, Calif	318,700.00
1544	Columbia Basin, Wash	Jan. 17	Overhead traveling crane	Judson Pacific-Murphy Corp., San Francisco, Calif	19,471.00
1546	Gila, Ariz	Jan. 21	Construction of laterals from A and B canals	V. D. Case Co., Long Beach, Calif	496,873.00
1560	Columbia Basin, Wash	Jan. 16	11 stop logs for Grand Coulee	Lakeside Bridge & Steel Co., Milwaukee, Wis	29,800.00
1567	do	Jan. 29	Structural steel roof framing	Worden-Allen Co., Milwaukee, Wis	27,200.00
1582	Central Valley, Calif	Jan. 28	5—45,000-pound radial gate hoists	Valley Iron Works, Yakima, Wash	11,350.00
R2-5	Region II, Calif	Jan. 2	Moving buildings and constructing utilities	Paul H. Spencer Construction Co., Los Angeles, Calif	75,695.93

[1] Schedule 1. [2] Schedules 3 and 4.

Construction and Supplies for Which Bids Will Be Requested During March 1947

Project	Description of work or material	Estimated date bids to be invited [1]	Estimated bid opening date [1]
Boulder Canyon, Calif	Trashrack handling equipment, Imperial Dam	Mar. 4	Apr. 4
Central Valley, Calif	11.92 by 11.92 feet fixed-wheel gate No. 2, Friant Dam	do	Do.
Colorado-Big Thompson, Colo	25-ton crane, Horsetooth Reservoir	do	Do.
Davis Dam, Ariz.-Nev	125-ton gantry crane, Davis Dam and power plant	do	Do.
Rio Grande, N. Mex	Revisions to spillway and channel, Elephant Butte Dam	do	Do.
Central Valley, Calif	Circuit breakers in generator voltage bus, Keswick power plant	Mar. 3	Apr. 7
Boulder Canyon, Ariz.-Calif.-Nev	Power transformers, oil circuit breakers, disconnecting switches, current and potential transformers for Boulder City water supply and Boulder City substation.	Mar. 5	Apr. 9
Rio Grande, N. Mex.-Tex	Power transformers, oil circuit breakers, disconnecting switches, lightning arresters, and metering and relay equipment for Socorro substation and Elephant Butte power plant.	do	Do.
Ogden River, Utah	Earthwork, pipelines, and structures, laterals 13.4 and 17.4 and equalizing reservoirs 13 and 17, South Ogden distribution system.	Mar. 11	Apr. 15
Boise-Payette, Idaho	Generator cables for Anderson Ranch Dam power plant	Mar. 15	Apr. 18
Central Valley, Calif	100-ton gantry crane, Delta-Mendota pumping plant	do	Do.
Columbia Basin, Wash	Generator voltage bus structures for units R1, R2, and R3, Grand Coulee power plant	do	Do.
Do	Power cable feeders to Grand Coulee pumping plant	do	Do.
Do	6,900-volt switchgear addition to feed pumping plant, Grand Coulee	do	Do.
Do	Construction Pasco relift pumping plants	do	Do.
Do	100-ton trailer, Grand Coulee Dam	do	Do.
Davis Dam, Ariz.-Nev	20-ton truck-mounted crane, Davis Dam and power plant	do	Do.
Klamath-Tule Lake, Oreg.-Calif	Construction pumping plant G, Coppock Bay area extension	do	Do.
Klamath-Main, Oreg.-Calif	Construction Adams pumping plant	do	Do.
Missouri Basin-Kortes, Wyo	Main control board and station service auxiliary power boards and miscellaneous bus equipment	do	Do.
Missouri Basin-Angostura, S. Dak	7.74- by 7.71-foot fixed-wheel gate frame and anchorage, Angostura Dam canal outlet	do	Do.
Provo River-Deer Creek, Utah	Construction Jordan Narrows pumping plant	do	Do.
Rio Grande, N. Mex	Construction Elephant Butte-Socorro 115 kilovolts transmission line, 75 miles	do	Do.
Riverton, Wyo	Earthwork and structures, Wyoming Canal, stations 883 to 1606, and laterals W-17.96 to W-29.89 and sublaterals.	do	Do.
Yakima-Roza, Wash	Construction pumping plants, areas 13 and 14	do	Do.
Do	Construction 2.61 miles 13.2-kilovolt transmission line; 62.45 miles 31.5-kilovolt transmission line	do	Do.
Davis Dam, Ariz.-Nev	Air compressors and associated equipment, Davis power plant	do	Apr. 22
Columbia Basin, Wash	Canal lining and structures, main canal, stations 751 to 1101	Mar. 20	Apr. 24
Fort Peck Power, Mont.-N. Dak	Power transformers, oil circuit breakers, disconnecting switches, instrument transformers for Circle substation	Mar. 28	May 2
Missouri Basin-power transmission lines, Nebraska.	Power transformers, oil circuit breakers, disconnecting switches, instrument transformers for Gering, Northport, and Sidney substations.	do	May 2

[1] Subject to change.

FRIANT-KERN CANAL, Calif.
Bureau of Reclamation Photo

APRIL 1947

In This Issue:

BENOCLOR 3-C

by
W. Harold Hirst

What is happening at the WRA centers on reclamation land?

See:
THE BUREAU RECLAIMS ITS OWN

THE *Reclamation* ERA

Reclamation ERA

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The RECLAMATION ERA regrets to announce the death of David E. Ball (see page 54 of the March 1947 issue), Superintendent of the Yakima project, Region I. Mr. Olaf Lundgren has been appointed acting superintendent of the project.

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Credits

Art work by James D. Richardson, Georgie Petty, and Mary Edmondson, Bureau of Reclamation, Washington, D. C.

"It's a fine thing for the Bureau of Reclamation to build great dams, and canals, and large power plants," said former Reclamation Commissioner Page, "but we must see that they serve . . .

THE PEOPLE

END OF THE RAINBOW. *They had to cross an ocean and almost a continent before they found a home and happiness at Tucumcari.*

by Garford L. Wilkinson

Region V, Amarillo, Tex.

THIS is a story about the people—people who are building new homes, transforming native, mesquite-infested range lands into cultivated fields—and other people, in a long-ago settled area, whose fears of recurring droughts have been banished; whose fields will remain green even though the rains fail.

Henry Batterman, his wife, Martha, and their children, Ella Mae, 9, and Dean, 6, moved to the Tucumcari, N. Mex., reclamation project, now under construction, in February 1946. Batterman could cultivate only a part of his 120-acre farm last year, but the income from this initial effort nearly equaled the purchase price.

There were others on this new project who did as well as the Battermans in their first year of operations. Among these were World War II veterans, Leo E. White, and D. C. Atwood. But the Battermans' experiences are especially interesting. Motion pictures have been filmed around events less engaging than those woven into the lives of Henry and Martha.

The Battermans

Henry and Martha were born on neighboring farms in Germany. What might have become a childhood romance was interrupted when Martha Busing's parents came to America. Years later, after finishing trade school in 1928, Henry Batterman left for the United States in quest of freedom withheld from the German populace, even before Hitler's regime. When Henry's boat docked on the east coast, he went to Colorado. Martha's parents settled first in Kansas, moved on to Colorado, thence to Nebraska. Henry worked as a common laborer, later as a machinist, but the lure of the land was deep in his heart.

"I saw how American farmers used machinery to plant, cultivate, and harvest their crops, and I loved machinery," Batterman said, "but more than anything else, I wanted to be a farmer and enjoy the freedom of persons close to the soil."

In 1934, Batterman quit his job as a machinist in Colorado, and became a laborer on an irrigation farm in Nebraska. There, in Nebraska, he renewed his friendship with Martha Busing. In time, Henry and Martha were married. Batterman then became a tenant farmer on a place near Scotts-

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bluff. He worked hard and learned rapidly all of the intricacies of irrigation. Today. Henry and Martha and their children are enjoying the good life that comes to energetic irrigation farm families.

The Atwoods

D. C. Atwood was born and reared on an Oklahoma farm, where cotton was the cash crop. Year after year, Atwood, his wife, and the children planted cotton. Some years the yields were so poor, they scarcely "put a sack in the fields." Atwood figured he was lucky to grow a good crop and dispose of it profitably in 1 or 2 years out of 5. That is the type of farming that takes as much out of the people as it takes from the soil. Cotton to the back door—cotton to the front door. Tumble-down shacks, disease, poverty.

Atwood grew sick of body, tired of spirit, and he was restless. He was fighting a losing battle, and he knew it. But what can a man do when he's ill? It wasn't too far to Hot Springs, N. Mex. Perhaps the baths there would help some—maybe give a fellow time to rest and plan an escape from King Cotton!

On his way home, after a month's rest at Hot Springs, in 1944, Atwood passed through Tucumcari, N. Mex. Everybody was talking about the irrigation project being built there by the Bureau of Reclamation. Irrigation! What a contrast to the dreary, thousand-mile stretch of sand and cotton and cloudless skies where a man either cursed his ill-fortune; or prayed for rain.

The Oklahoma cotton farmer bought a tract of land in the project area, then headed his car down U. S. Highway 66; back to Oklahoma. He knew his family would welcome the news, and join in the dreams of life on a farm where water was available, the soil new and fertile. Atwood is a booster for the project's high, dry climate as well as its other attributes, present and potential. "I've gained 29 pounds since I moved out here," he said. "I can do a day's work for the first time in 20 years."

OUR FRONT COVER

"IT SUITS ME"

D. C. Atwood, a dry land farmer for 20 years, finally lost his health worrying about crop returns because of droughts. After recuperating in the South, through a lucky accident he came across the Bureau's new Tucumcari project in New Mexico. That was the land for him. No more sleepless nights waiting for rain. Today, while he is not making too lucrative a living, it is at least a healthy and certain one, thanks to irrigation.

Strangely, Atwood still is a cotton farmer. There's something about growing cotton that gets hold of a man and won't let go. His first irrigated crop at Tucumcari averaged 1½ bales per acre. He believes he will make 2 bales an acre when the new land works a bit better.

The Tucumcari area is questionable for profitable cotton culture. Agricultural specialists are not encouraging its production and will remain skeptical, pending the results of additional experiments. The average frost-free dates are from April 20 to October 20, but King Cotton's Kingdom lies far to the south and east.

There is no gin at Tucumcari or nearby, so Atwood had to truck his cotton to Oklahoma. This would have been unprofitable, except for the fact that on each return trip to Tucumcari he hauled his married son's household goods and farm machinery. The son, J. J. Atwood, is renting a farm in the project area. Father and son hope to buy more land, in time. Moreover, they'd like to see many of their former Oklahoma neighbors settle at Tucumcari and share in the new life opening for the Atwoods.

Scores of families have purchased places in the Tucumcari project area; all are making progress. Eventually, the project will be settled by hundreds of land-hungry families.

The Whites

Leo E. White, Wisconsin, born, reared in Texas, is another new farm-owning settler at Tucumcari. White comes from a long line of farmers. His father and grandfather moved from Wisconsin to Texas in 1916 to farm and regain his health. "Father's health improved," Leo recalls, "but he lost the seat of his pants growing cotton in the 'Lone Star' State."

White's urge to be a dairy farmer came during his high-school days. His vocational agriculture project involved a registered gilt and a cow. The gilt cost more than the cow. He lost money on the pig enterprise, but made good profits on the cow and its offspring.

After graduating from high school, White enrolled in an agricultural college. A boyhood friend, L. C. Strawn, another successful project farmer, wrote a glowing account of opportunities open to settlers at Tucumcari. White, accompanied by Strawn, inspected the range that some day, by the miracle of irrigation, would produce an abundance of beans, corn, tomatoes, carrots, peas, livestock feed, and permit diversified, live-at-home programs, including chickens, eggs, milk, cream, and butter, to support the major cash enterprises. White acted quickly. He purchased a site for his future dairy farm, then went away to war.

Leo E. White, vocational farmer, comes by it naturally. His grandfather and father before him were "men of the soil."

Returning to Tucumcari in 1946, White assembled a dairy herd, and today milks 25 cows with an electric machine. He keeps accurate, daily records. Any cow that fails to produce a profit is promptly sold. He believes he is getting more production, considering the grade herd, than any other dairyman in eastern New Mexico.

"When one of my cows gains one-tenth of a pound of milk, I feel like tipping my hat to her," White said. "A fellow can't succeed in the dairy business unless he enjoys it."

This project dairy farmer is building toward a pure-bred Guernsey herd, knowing it will be a slow process. The grade cows will work and build profits for their owner, who will eventually replace present animals with others having better blood lines and greater production possibilities.

The homes of Batterman, Atwood, White, and a majority of the other settlers on the project, are the homes of present-day pioneers. They were built to serve an immediate need. From hard work, water, and the soil will come better, more permanent homes later on. Pigs, cows, sows, and hens are supporting the major cash crops. Later on, truck gardens will also add to each family's food needs and bring additional income from the public market.

On another project in the Bureau's Region V, there are people who, for many years, have been farming the land on which they were born. Some years were good; some fair; some tragic. When the rains failed in July or August, potentially high yields either returned only their production cost, or crumpled completely in the sweltering wind.

The Walkers

Arnold Walker is farming the place in the 52,000-acre Lugert-Altus project, in Oklahoma, also under construction by the Bureau, that was homesteaded by his father and mother in 1904.

Arnold's father, P. W. Walker, was a "Master Farmer" in Oklahoma in 1927. He won the award over the State's finest managers and tillers of the soil, but Arnold remembers years when the Walker farm, like those around it in the semiarid region, failed to meet expenses. "I have seen our crops almost made," he said, "then we'd have a drought of several weeks and lose every stalk in the field."

In addition to farming the original 160-acre homestead, Arnold cultivates 80 acres in the project area owned by his sister.

The Lugert-Altus project lies farther east than any ever constructed by the Bureau. These lands have been in cultivation about 40 years. In dry years, farmers talked about an irrigation system. Today, their goal nears realization.

"I'd like the whole world to know," Arnold said, "that irrigation is the best thing that ever happened to me or my family since mother and dad were given a homestead here."

Reclamation project farmers "eat high on the hog" year in and year out. The Walkers are no exception.

In 1946, for example, the first year water was available to the Walker farms, the land produced almost 1 bale of cotton per acre, despite an unusually late spring. Dry land cotton yield was poor. Arnold believes his irrigated cotton will yield from $1\frac{1}{2}$ to 2 bales an acre in normal seasons.

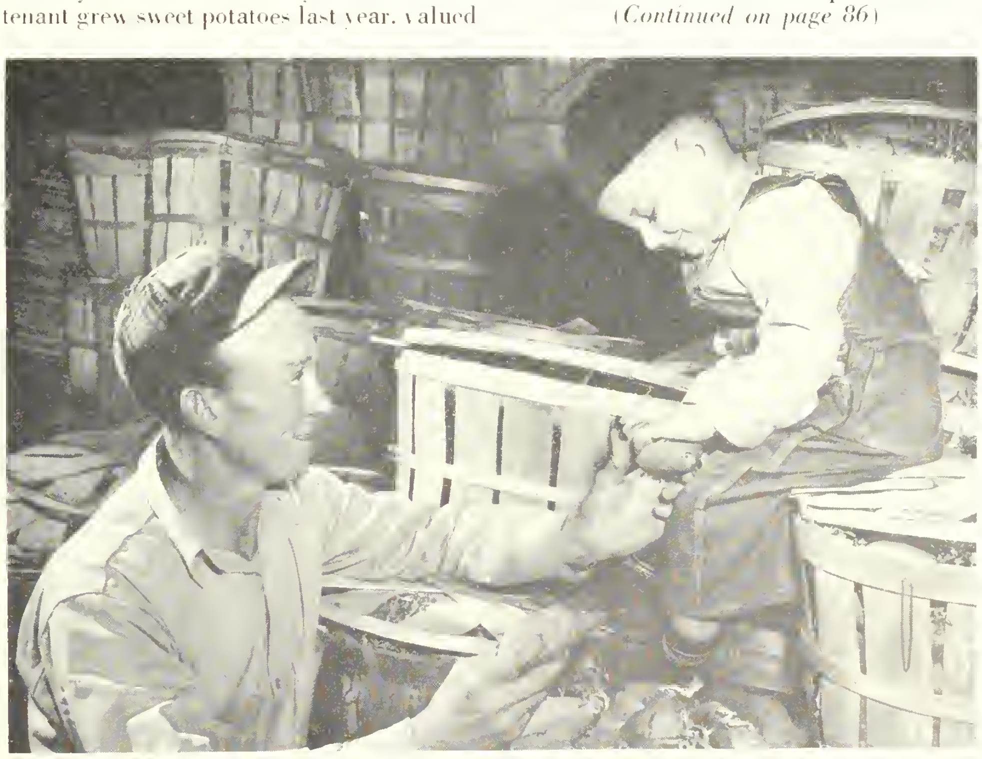
The Southalls

Peyton Southall is another Lugert-Altus project farmer who received an initial water delivery in 1946. The 38-year-old former tenant grew sweet potatoes last year, valued at $415 per acre, an amazing return for a first year crop.

Southall was born and reared on a dry land cotton farm near the project. His experience up to the time he married, and for years after, were not unusual in any particular. "I rented a place to farm and worked for wages around the community when I could spare time from my crops," he said. "I had to work out to make a go of it."

In the 1930's, during the Nation's great drought and dust storm era, Southall worked for a farmer who irrigated from a small diversion on the Altus municipal water line.

(*Continued on page 86*)



Peyton Southall and his small son, Stanley, inspect sweetpotato crop made possible by irrigation.

When you see this milky-white mixture running through canals, it is time for water weeds to beware. . . .

BENOCLOR 3-C

by W. Harold Hirst,

Weed Specialist, Region IV, Salt Lake City, Utah

A CHEMICAL developed by a naturalized Belgian scientist to destroy heavy moss which caused two boys to drown while swimming on his New Jersey estate may open a new era in the life of western irrigators now pestered by water weeds that choke canals and ditches.

Widespread trials in the summer of 1946 throughout the intermountain area by Bureau of Reclamation weed control specialists produced results which have raised hopes of obtaining better control for water weeds. The tests were made with the chemical specially treated to make it effective in running water. Not only did the experiments prove its effectiveness, it also indicated that control may be achieved with comparatively little time, effort, and equipment.

The chemical is Benoclor 3-C. While the tests last year did not answer all questions about how it may be used, it did show that Benoclor works rapidly. Furthermore, the cost was far less than the average cost of other methods.

Benoclor 3-C is the result of work by Herman Seydel, the Belgian scientist, who discovered a chlorinated hydrocarbon he named Benoclor 3, about 10 years ago. He found that this chemical kept his ponds free of the moss, his main objective. The Salt River project in 1943 was the first Bureau of Reclamation project to use Benoclor. However, this chemical is heavier than water, and early trials in the running water of irrigation ditches, produced poor results. By adding an emulsifier, chemists found the chemical would form a fairly stable emulsion and could be carried for some distance in the water. The resulting combination was named Benoclor 3-C.

A sister chemical "Cloroben" is used on city sewage disposal systems and for reducing bacteria in the water at bathing beaches.

So far, there has been no proof that Benoclor has had any ill effects on crop plants, and according to tests made by the Bureau of Animal Industry, Department of Agriculture, the quantities needed to kill weeds in the ditches are not sufficiently great to harm livestock.

Although the principal experiments on Bureau of Reclamation projects in 1946 were made in region IV, Benoclor 3-C has been tried in other regions with varying results. Weed control specialists now feel that it is past the experimental stage, although results are being watched carefully and continued testing is planned so that the most effective operations can be developed.

Benoclor 3-C destroys the chlorophyll of plants. On canals successfully treated weeds lose their color and take on a "cooked" appearance within an hour after treatment. Within a few hours after treatment the plants sink to the canal bottoms and offer little resistance to the flow of the water. Within 24 hours after treatment, the plants begin to disintegrate and start floating down the canal. However, they do not clog gages, turn-outs or laterals as do weeds removed by mechanical control methods.

Plants which were effectively controlled included sago pondweed (Potamogeton pectinatus), Richardson's pondweed (Potamogeton richardsonii), blanket moss or string moss (Algae), water buttercup (Ranunculus species) and water weed (Anacharis canadensis).

There were variations in the results obtained. In all, data on 30 canals were analyzed. The results were rated as follows:

Poor—3 weeks' partial control or less before regrowth started. Three canals.

Fair—3 to 6 weeks' control before regrowth started. Ten canals.

Good—6 to 10 weeks' control before regrowth started. Fourteen canals.

Very good—complete control for the season. Three canals.

Irrigation canal BEFORE . . . *and* AFTER *Benoclor 3–C.*

Different quantities of chemicals per volume of water were used and length of treatment was varied so that a complete test ould be made. Other factors which no oubt affected the results were density of egetation, silt and mineral content of water, velocity of water, weed species, and maurity of plants at time of treatment.

These quantities of Benoclor per cubic oot of water per second (c. f. s.) applied niformly over a period of 1 hour, gave the ollowing results:

2.3 gallons per c. f. s.—poor.
3.5 gallons per c. f. s. —fair.
4.3 gallons per c. f. s.—good.

The volume of flow was found to be a nore accurate means of determining the mount of chemical needed than the water urface width, used in earlier trials.

Application of the chemical for 1 hour vas sufficient for average conditions. The gures quoted above were for the initial aplication. However, in many tests "booster" pplications were made downsteam to mainain the original concentration. This aditional application was made if the Benclor "blanket" changed from its original nilky color to a "skim milk" blue. Usually his change in color came after the "blanket" ad run 1½ miles or for 3 hours, whichever vas the shorter.

The Bureau of Reclamation's Chemical aboratory at Denver, Colo., has recently eveloped a method for testing the concenration of the chemical in a canal to further mprove the effectiveness of "booster" pplications.

Actual cost records were kept on 27 anals with total length of 116 miles under reatment. The average cost per mile was 39.65. The average cost of other methods f control such as hand labor, dredges, disks, hains, and other mechanical devices, was stimated by managers of the canals at 96.91 per mile.

Equipment for applying the chemical onsisted of a one-horsepower air-cooled gasoline engine; a half-inch vacuum gear pump of 3-gallon capacity: a 60- to 80-pound pressure bypass hose, a "neoprene" high-pressure hose to the manifold: an adjustable manifold of quarter-inch pipe upon which nozzles could be placed at 2-foot intervals, and screened, fan-type brass nozzles with orifices of $^{20}/_{1000}$ and $^{40}/_{1000}$ inch. (See the June 1946 *Era*, p. 117, for illustration.)

It is recommended to canal managers who may try the chemical this summer that the treatments should start when plants are growing vigorously and have just begun to retard the water flow. Use 5 to 6 gallons of Benoclor 3–C to each cubic foot per second of water applied uniformly over a period of 1 hour. Apply the first treatment for at least 60 minutes, although if the water has high velocity, the treatment should continue for 75 minutes. Booster applications should be made after the "blanket" has traveled 1½ miles, or when the color begins to change. Apply booster treatments through the length of the "blanket" in sufficient quantity to raise the concentration of the chemical to that of the first application. About 25 percent of the original application will probably be needed for the "booster."

Users are urged to keep accurate records on the capacity of the canal before and after treatment, width of water surface at time of treatment, volume of water, type and density of vegetation, turbidity and velocity of water, quantity of chemical used, time taken for application, and location of "booster" applications. By keeping such records, and forwarding them to the nearest regional office of the Bureau of Reclamation, information will be obtained which will help to perfect the method.

Effectiveness of the treatments is reported by Mr. Glen Bunton, of the Logan Northern Irrigation Co., Logan, Utah, who said that after treatment, the flow of water rose from 65 to 75 c. f. s., and by the next day, water which had been flooding over had receded enough so that water flow could be increased to 93 c. f. s.—equal to the maximum flow at any time during the season.

Not fishing—scientifically removing weeds.

It pays to advertise at these rates.

In Unity There Is Power

How a group of farmers on the Minidoka Reclamation project in Idaho obtain electricity and distribute it at one of the lowest retail charges for current in the United States.

by Barrow Lyons,

Chief Information Officer, Washington, D. C.

MANY OF the houses have no chimneys—yet there is warmth within.

Hydroelectric power is the answer. It provides heat, light, and power which is distributed at a low cost and made available to farmers scattered over 44 square miles of south central Idaho. The distributing organization is called the Unity Light & Power Co.—a good name, not only because it happens to be the name of a neighborhood in the district, but because it typifies the operations of the company and the farmers who made this cooperative a success.

This is the story of Unity.

The present secretary-treasurer of the Unity Light & Power Co. is Grant A. Dunford. He is also a farmer on 40 acres of the Burley irrigation district on the Minidoka project in Idaho.

The Unity Light & Power Co. was organized in 1917 as a stock company, but was changed to a cooperative on May 20, 1921, mainly because cooperatives were not taxed. When the company was organized, stock was sold at $10 a share. Each participating farmer bought enough shares to pay for the cost of his transmission line to the Unity substation at the rate of $100 a quarter of a mile. The farmer has to install transformers, meters, and secondary wiring at his own expense. Thereafter, the company maintains the primary line, transformers, and meters.

Dunford doubles in books.

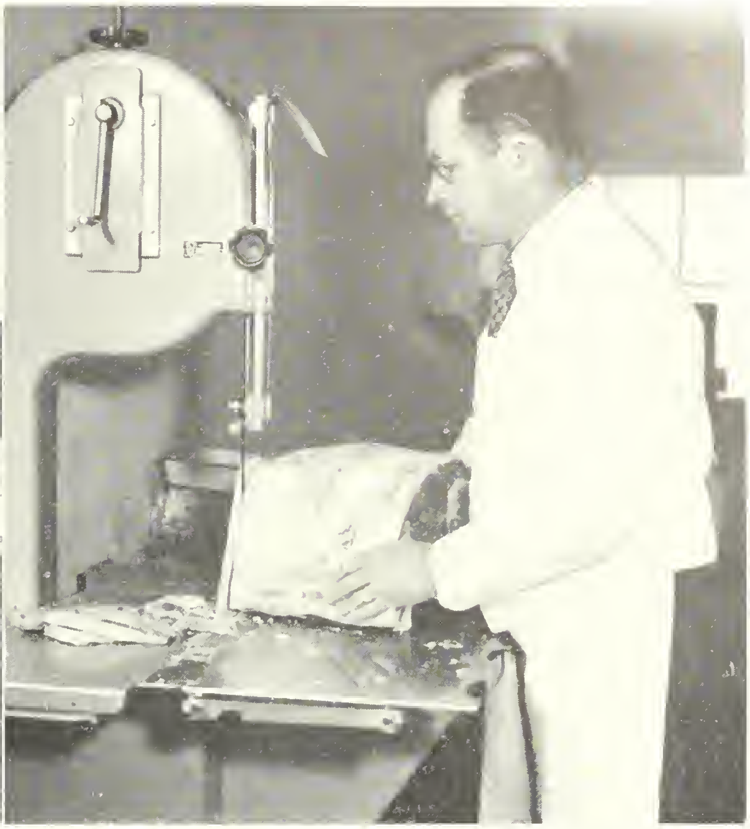
That was when the consumers were quite widely scattered. As the years have passed this initial amount has been equalized by refunds so that the investment of each is now around $150, and the cost of membership in the cooperative is fixed at that amount. One of the reasons for this change was to bring in as many outlying farmers as possible, and make it possible also for virtually everyone who wished to join the cooperative. Not everyone could afford the initial cost at $100 a quarter-mile.

There are now 375 members of the Unity cooperative. They own about 90 miles of transmission line serving approximately 44 square miles of irrigated farms—something like eight-and-a-half customers per square mile.

In 1945 the cost of electric energy to the cooperative averaged 1.064 cents per kilowatt-hour. The electricity was delivered to the customers at an average of 1.909 cents per kilowatt-hour.

For the fiscal year ended November 30, 1945, the receipts of the cooperative were $19,091.21. Energy cost was $13,153.14. Operating expenses, including salaries of a manager, an electrician, and fees to mem-

Small electric heaters for active small fry.



K. C. Merrill cuts choice steak with aid of Minidoka power.

bers of the board, amounted to $6,576.78. There was an operating deficit of $638.71, which was made up by other income of $1,266.19, such as interest on investments and sale of electrical equipment. This left a net income for the year of $627.48.

In 1944 there was a net deficit of $200.85. Mr. Dunford explained that the cooperative did not operate for profit, but to render a service to its members, so that a deficit was inconsequential, as long as it was made up another year. Generally there is a small profit. In 1943 it amounted to $1,154.64, in 1942 to $1,483.16, in 1941 to $940.35, and in 1940 to $728.17. Mr. Dunford looked back through his books to 1925—a period of 20 years. They showed, by a slightly different system of bookkeeping, that receipts had been $5,075.64 in that year, expenditures $4,253.31, indicating a net operating profit of $822.33. But uncollectible accounts amounting to $918.33 had been charged off, leaving a deficit of $96.

In 1925 the books showed total assets of $30,533.48. By 1944 these had increased to $73,902.79.

"We don't make a charge for depreciation," explained Mr. Dunford, "but we do keep our property in good shape, and charge the cost to maintenance; we do not consider this an actual depreciation of our property.

"The Bureau of Reclamation has just introduced a new rate structure. I have made a comparison with present rates, and I figure that under the new rate structure the cost to us will be about 40 percent less. I took our September bill to make the comparison. In September we bought 117,800 kilowatt-hours of energy at a new cost of $1,334.97. Figuring our demand charge under the new rates for 340 kilowatts at $306, and the cost of energy at $507, less a 3-percent discount of $82, I arrive at a total cost of $788.68, instead of the $1,334.97 charged under present rates.

"Even under the previous charges, I felt free to use as much electricity as I wanted. All of the members use current very freely—just about as we use water. We know that all of the profits are going back to ourselves, too. What is more, the profits to the Bureau of Reclamation are used to reduce the construction charges of the project. The Bureau is paying me about $50 a year for owning land around here."

A year ago Mr. Dunford wired his house for electric heating, insulated it, and put on storm windows to conserve heat. He figured that heating by current from the cooperative would cost him with thermostat control about $50 a year. Houses require heating on the Minidoka project from the middle of September until the end of May—sometimes into June. Electricity, Mr. Dunford estimated, would cost him a little over $6 a month during the heating season.

This compared with approximately $10 a month for oil, or $8 to $10 a month for coal with a lot more labor. At the request of his interviewer he looked up his bills for the past 2 years and compared them. Electric bills from August 1944, through July 1945, amounted to $74.92. For the next 12 months his bills totaled $101.40—a difference of $36.48 which might fairly be attributed to the added heating load.

That brought his house heating cost to an average of $3 a month, or an average of $4 a month for the 9 months during which he required heat. Under the new rates even this will be reduced. Mr. Dunford estimates the cost of energy to the members of the Unity Light & Power Co. to average about 1.185 cents per kilowatt-hour.

Unless the whole picture is given, however, this is slightly misleading, because membership includes some fairly sizable establishments, which receive energy somewhat below the average on account of quantity consumption. For instance, the Y-Dell ballroom in which large parties are held, and which uses current for electric sign displays, consumed 1,652 kilowatt-hours of current in September 1946, at a cost of $18.92. A creamery owned by Herman Stoker used 5,950 kilowatt-hours in the same month at a cost of $59.75.

Mr. Dunford picked out the bill of an average farmer who paid in the previous 12 months $58.03 for his current, an average of $4.84 per month. Current was used for lighting and general farm work, including operating pumps and shop equipment.

Asked for more specific information as to what equipment the average farmer on the project used, Mr. Dunford produced an inventory he had made following a slight argument with James Allen, a resident

Ninety miles of transmission lines.

farmer and shareholder, over the burning out of a transformer. The question arose as to who was at fault for the mishap. Mr. Allen maintained it was not his fault. The cooperative declared he had overloaded his No. 3 transformer. The inventory showed the following equipment on the Allen place:

Electric range	Refrigerator
Air heater	Mixer
Water heater	Grinder
Electric welder	Radio in house
Electric iron	Yard light
Washing machine	Spud cellar light
Radio in barn	Electric fence
Milking machine	House lights
Toaster	Chicken coop light

Altogether, the cooperative figured, Mr. Allen's load was the equivalent of some 14,937 watts, and although not all of the equipment would be in use at the same time, it was enough to burn out any No. 3 transformer. A No. 5 was installed, although it is not certain this will be adequate. Mr. Dunford said that Mr. Allen's bill for 12,-701 kilowatt-hours of current in the latest 12 months was $135.25—an average of $11.27 per month.

"When the Bureau of Reclamation built the Minidoka project it didn't think of using the power it generated, except for pumping purposes. When it was found that there was a surplus of current for the settlers, it applied the profits to reduction of the construction charges. When the construction charges are all paid out, the profits goes toward the operation and maintenance charges."

From April 1, 1926, to December 31, 1945, total of declaration of profits accruable to the Burley irrigation district totaled $1,719,880. These funds were applied as follows: $1,024,467 to the accounts of water users for the reduction of construction charges; $411,558 for increasing the capacity of the plant; $38,500 for the purchase of additional storage space in the Jackson Lake Reservoir; $93,932 to the accounts of water users for reducing operation and maintenance charges; $18,755 for an emergency transmission line to the Burley pumping station; and $132,648 unapplied but reserved for advance construction.

Current is sold to the towns and villages on the project, and they distribute it at a profit through their municipally owned systems.

In the fiscal year ended April 30, 1946, the city of Burley received from its municipal electric distributing system revenue of $184,678, and expended on that system $129,336, leaving a net profit of $55,342. In the last seven fiscal years its net profits amounted to $354,422, enabling it to make many civic improvements which would otherwise have been impossible. This has enabled the city to operate on a very low tax assessment.

The city of Rupert, also on the project, but considerably smaller, reports a profit from the operation of its electrical system of $229,720 during the twenty calendar years ended this year. It, too, has made many civic improvements on the basis of these revenues. In each instance the rates to customers are among the lowest in the Nation. Nearly half of the houses are heated by electricity. Many do not even have chimneys. The Minidoka project power rates have had a marked influence in bringing down the rates of private power companies in southern Idaho.

Towns in the area now have grown beyond the capacity of the Minidoka plant to supply current, and the problem of continuing to maintain rates as low as those in the past is one with which the Bureau is wrestling. In general, it has not been the policy of the Interior Department to encourage the payment of improvements by towns and cities out of surplus from the operation of electric distributing systms. The feeling is that citizens will profit more by the lowest possible electric rates—rates which will attract industry. Nevertheless, many municipalities prefer to use such surpluses for improvements or lowering the tax rate.

Electric welding cuts farm operating costs and labor.

International Engineering

EGYPT. It is understood that Mr. S. O. Harper, formerly chief engineer of the Bureau of Reclamation will serve on an international engineering board for the Egyptian Government. Other members of the board will include representatives from Sweden and Switzerland. The services of Mr. John L. Savage, Bureau consultant, were also sought but he was unable to accept the assignment due to previous commitments.

CHINA. The National Resources Commission of China, with which the Bureau of Reclamation has been dealing in connection with the Yangtze Gorge project, has been elevated to a ministry and is no longer part of the Ministry of Economic Affairs. The new office is directly answerable to the Executive Yuan.

VENEZUELA. Mr. Albert W. Newcomer, formerly of the Branch of Design and Construction, Denver, Colo., is now engaged in the investigations of the Tuay River Basin in Venezuela.

PORTUGAL. Mr. Fernando Vasco Costa, a professor from the University of Lisbon, Portugal, began studies of the Bureau of Reclamation's activities at Denver, Colo., during March. He is a State-Department-sponsored trainee.

The Farmers Take Over

With a salute to Yakima-Tieton farmers who paid the last installment on their debt to Uncle Sam, bureaucracy beats a retreat

It was February 14, 1947, St. Valentine's Day.

The place was Yakima, Wash. The occasion, the "Tieton pay-off party," according to the banners festooning the streets. Lining the sidewalks were people who had come from all over the Pacific Northwest to watch the proceedings.

Secretary of the Interior J. A. Krug, Gov. Mon C. Wallgren, Congressman Hal Holmes, Chamber of Commerce, State and reclamation officials, along with the prominent Yakima-Tieton farmers and families, rode in a 75-car caravan, paying their respects to the first water-users' district to completely pay off, on time, its obligation to the Government.

As the cavalcade reached the rural schools, over 800 children proudly waved their signs, "Welcome, Secretary Krug," and when the Secretary stopped at one of the buildings, struck up their small band, following the music with a lusty school yell which they adapted for the occasion.

Of all the sights he witnessed, among them the cold-storage plants for the famous "Delicious" apple grown at Tieton, the apple processing plants, and orchards, the children seemed to make the greatest impression on Secretary Krug.

Following his tour of the Tieton division, Secretary Krug spoke at a "farmers' banquet" remarking that, from his observation, the outstanding contribution of the Yakima-Tieton Reclamation project was the hundreds of school children who turned out to greet the visitors. He had heard a lot about the apples and other crops produced on the Tieton plateau, but to his mind the future citizens in the schools on the project were its most lasting claim to fame.

In his formal address later in the day, broadcast through the Pacific Northwest at Yakima, Wash., Mr. Krug took as his theme, "Bureaucracy beats a retreat." Receiving the final check from Clifford Kail, president of the Yakima-Tieton irrigation district, he said, "When this check has been deposited in the United States Treasury, the farmers of the Tieton division will have paid the last penny of their debt of more than 3½ million dollars—the amount spent by the Bureau of Reclamation 37 years ago in building the irrigation system that waters your lands.

"Nowadays a $15,000 check arriving at the Treasury's receiving window does not cause any eyebrows to lift, and an expenditure of $3,500,000 on a Federal project does not seem especially large," said Secretary Krug. "The significance of this occasion is

Secretary J. A. Krug and friends.

in what has been accomplished with that $3,500,000 investment.

"Some of you were here in 1910 when the Tieton area was a sagebrush desert about to receive its first water from the new canals. You have seen the Federal Government, through the conservation and use of the precious water resources here in the Yakima Valley, expand the national production, create $150,000,000 of new wealth, and provide homes for more than 1,000 families on 25,000 acres of land that formerly was not even good sheep pasture.

"Last year these Tieton lands produced crops of an average value of $750 per acre. Since they were first irrigated, each acre of this former desert has pumped new purchasing power of more than $6,000 into the arteries of our national commerce.

"Uncle Sam put his money into this venture under a wise law that was the keystone of the conservation program of Theodore Roosevelt—the reclamation law of 1902. This law has been supported by every administration since that time. It is not a partisan matter. Here on the Tieton division, Uncle Sam has now got his money back, dollar for dollar. In the meantime, the Treasury has sent its tax collectors to these former sagebrush mesas that now are dotted with apple and peach orchards. While I do not have the exact figures, it is clear that the Federal income taxes paid by farmers and businessmen who have earned their livelihood from these lands have greatly exceeded the cost of the entire irrigation project—a cost that has, in addition, separately been repaid in full by direct payments from water users."

Secretary Krug compared what has been done by irrigation in Yakima with what would have happened if in 1910 a barren island had been purchased by the United States for $3,500,000. Settled by our citizens, the Yakima-Tieton division has supported a thousand families in comfort and prosperity on farms, and even a greater number in the towns and villages that have grown up among them, he said, continuing with, "It does not stretch the imagination to compare an irrigation project with an island, since these projects are the only islands of intensive farming in vast unproductive expanses of the West which make up nearly half of all the land within the United States. They stand out in the sagebrush desert much as islands dot the sea."

"You men and women on the Tieton farms should be especially proud," said the Secretary. "This check for $15,000 is your final payment. Yours was one of the first irrigation districts established under the reclamation law and you have now carried out in full the contract made 37 years ago. This is the *first* final payment of all obligations by any irrigation district.

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It meant a lot to Tieton.

"You have changed the desert to verdant fields and orchards. Through the years, out of your earnings from the watered land, you have provided funds by your payments which the Department of the Interior has reinvested in other irrigation projects in the West. Several of these new islands of production which have been helped by the fulfillment of your contract are already the homes of new pioneer settlers. They, in turn, are beginning to repay their contractual obligations and will thus recreate and increase the reclamation fund for other new developments.

"I take pride in turning over this project to you—to your own elected officials, in order that it may continue to irrigate your farms under your direct control. Uncle Sam built the project. You have repaid his cost, and this irrigation system is now yours to operate and take care of. The Bureau of Reclamation will always stand ready to assist if you require help, but here is bureaucracy beating a retreat as planned. Here is the Federal Government, having extended a helping hand to its citizens, bidding them Godspeed, and withdrawing. Here is democracy creating vital projects which work for people, and then, when the task is done, leaving the people, strengthened and self-reliant, to carry on. That was Jefferson's way, expressed in his words, 'He governs best who governs least.'

"Reclamation has worked here in the Yakima Valley and it has worked in similar valleys through the West.

"Four million acres of irrigated land have produced 5 billion dollars in new American wealth. That partner of irrigation, hydroelectric power, created as a byproduct, serves industries, towns, cities, and farms with electric energy to improve living conditions for millions of people. The Congress wisely has authorized the expansion of the reclamation program so that it will reach twice the population now served. New irrigated lands and more power are to be made available in the years ahead in every State west of the ninety-seventh meridian.

"I agree with the western people who feel that true economy can best be achieved by completing these authorized projects speedily so that production will start paying back the Government's investment. Veterans are clamoring for a chance to clear the sagebrush and to farm these lands. They need living space now and a hungry world needs food. . . .

"In 1910, there were scoffers who said that the desert could not be beaten back and that the Tieton project would be a dismal failure. In 1947, the cynics who are the direct descendants of those same scoffers probably will contend that the new program for the Columbia River Basin will not pay out. They were doubtful that the power from Grand Coulee Dam would ever find a market. When the war came along and used this power, they said it would go begging when peace returned. But it hasn't; the tremendous demands being made on the Bonneville Power Administration which sells the power from Grand Coulee and Bonneville Dams conclusively proves that. The wartime peaks were surpassed in the fall of 1946, and now the demands are hitting new highs almost every week.

"What has been done through the construction of the great dams on the Columbia River toward the development of the Pacific Northwest, what you have done here in the Yakima Valley through the irrigation of the lands that were once desert, will be done again and again in communities yet to be established from the remotest creek at the Continental Divide to the mouth of the Columbia River at Astoria.

"The day will come when the final check of repayment will be delivered to the United States Treasury for all the developments on the Columbia River system. In that day and time, the Columbia River Basin will no longer be an area of undeveloped resources. It will have new millions in population. It will have great new factories and industries, and its agriculture, like the Yakima apple, will be famous throughout the world."

Adding significance to the occasion, Gov. Mon C. Wallgren proclaimed the week of February 10 as Reclamation Week for the State of Washington.

Director of the Branch of Operation and Maintenance, Goodrich W. Lineweaver, representing Reclamation Commissioner Michael W. Straus, presented the district with a certificate commemorating the event.

The formal transfer of the project took place March 1, 1947.

Name	Address

"Get Acquainted" Copies

If you have friends or associates who would be interested in the *Reclamation Era*, please list their names and addresses in the box to the left, clip and send it to the Commissioner, Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues so that they can get acquainted with your magazine.

Colorado-Big Thompson Project

Keeping Step With an Ever-Changing Economy, the World's Major Transmountain Water Diversion Faces a Future of Increased Benefits and Increased Costs

TEN YEARS AGO, Congress authorized the construction of the Colorado-Big Thompson project in the State of Colorado.

The main objective of this large scale multiple-purpose development is to combat crop losses due to irrigation shortages in northeastern Colorado. The Colorado-Big Thompson project has been authorized by Congress as an economically feasible engineering feat for transporting surplus water, which otherwise wastes away to the sea, from the upper reaches of the Colorado River on the western slope through the Continental Divide to the fertile, but inadequately irrigated, acres on the eastern slope of this great barrier.

When the Colorado-Big Thompson project is completed, it will collect and move this unused water far distances from the high country on the western slope of the Rocky Mountains under the Continental Divide via the Alva B. Adams tunnel to drop down the eastern slope toward the fertile area of northeastern Colorado, one center of which is Greeley, a town named for the renowned editor who urged the settlement of this area 80 years ago. It will insure and increase food production on 615,000 fertile acres now having a deficient water supply, and provide hydroelectric generating capacity of approximately 176,000 kilowatts in the process.

The major feature of this project was the drilling of a 13-mile irrigation tunnel—the longest of its kind in the world—through the Continental Divide—the backbone of the continent.

The story of how construction crews started simultaneously at the east and west portals of the tunnel and met each other in the middle, missing their calculations only by a fraction of an inch is engineering history, and a tribute to the soundness of the Bureau engineers' plans.

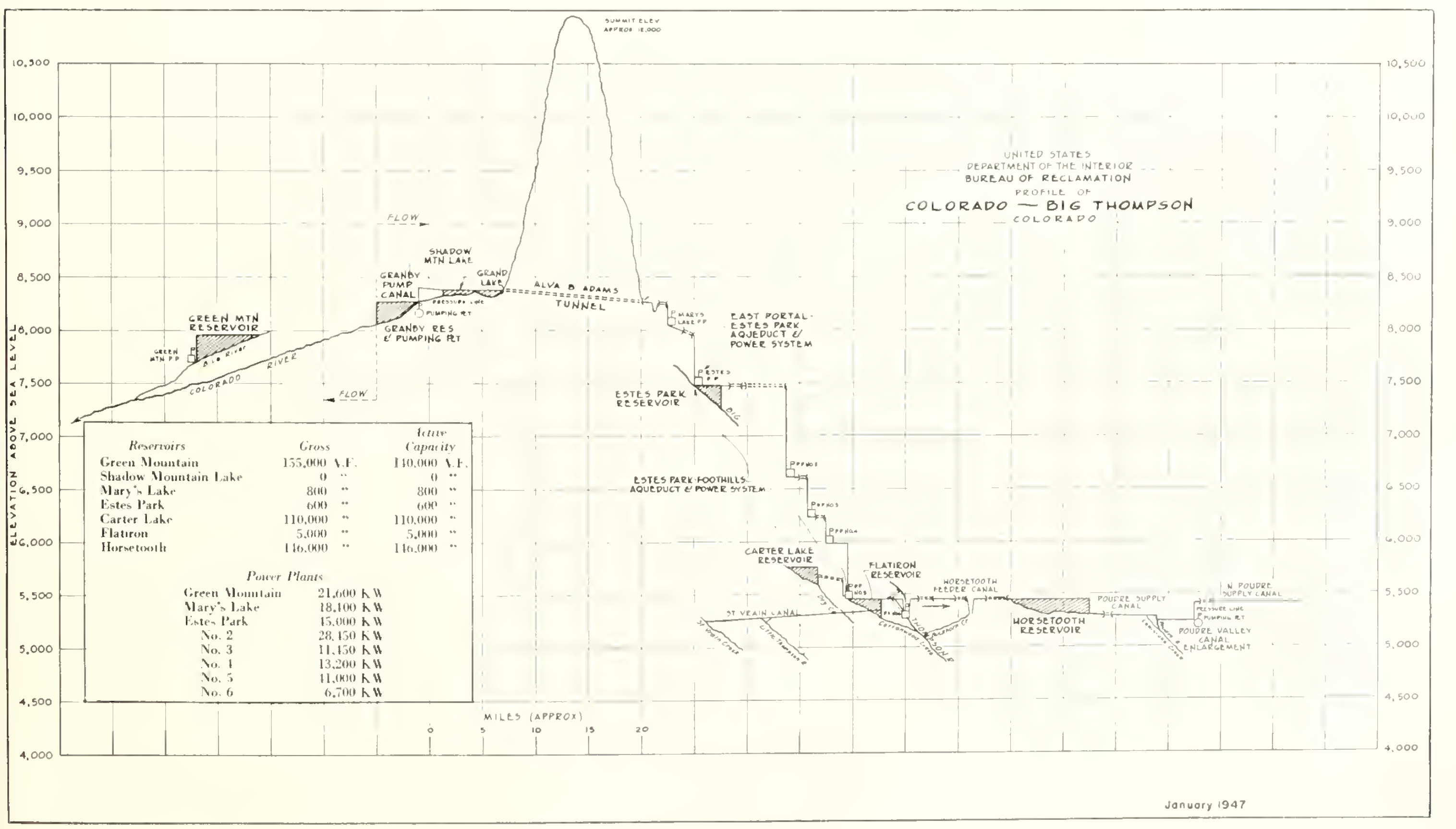
While the use of the waters for irrigation was the primary purpose of this feature, one of the most spectacular results to be achieved from the transportation of water through the Alva B. Adams tunnel is the creation of hydroelectric power. The profile drawing on this page shows the manner in which water rides through the tunnel, drops to holding reservoirs, and as it is released, generates hydroelectric power. Triple use of this water is made through irrigation, municipal water supply, and the power it guarantees for municipal, industrial, and rural electrification as well as to repay a large portion of the construction cost of the project.

Congress made initial appropriation for the Colorado-Big Thompson project in the Interior Department Appropriations Act of August 9, 1937 (50 Stat. 595), in accordance with the plan set forth in Senate Document No. 80, Seventy-fifth Congress. Finding of feasibility was approved by the President, December 21, 1937. The total expenditures on the project to June 30, 1946, were $26,387,750.

In 1937 only about $150,000 had been spent on preliminary investigations to pave the way for the actual construction, estimated at a cost of $43,000,000. As work progressed, improvements in preliminary plans were made to provide for the maximum development of a working partnership between irrigation and power.

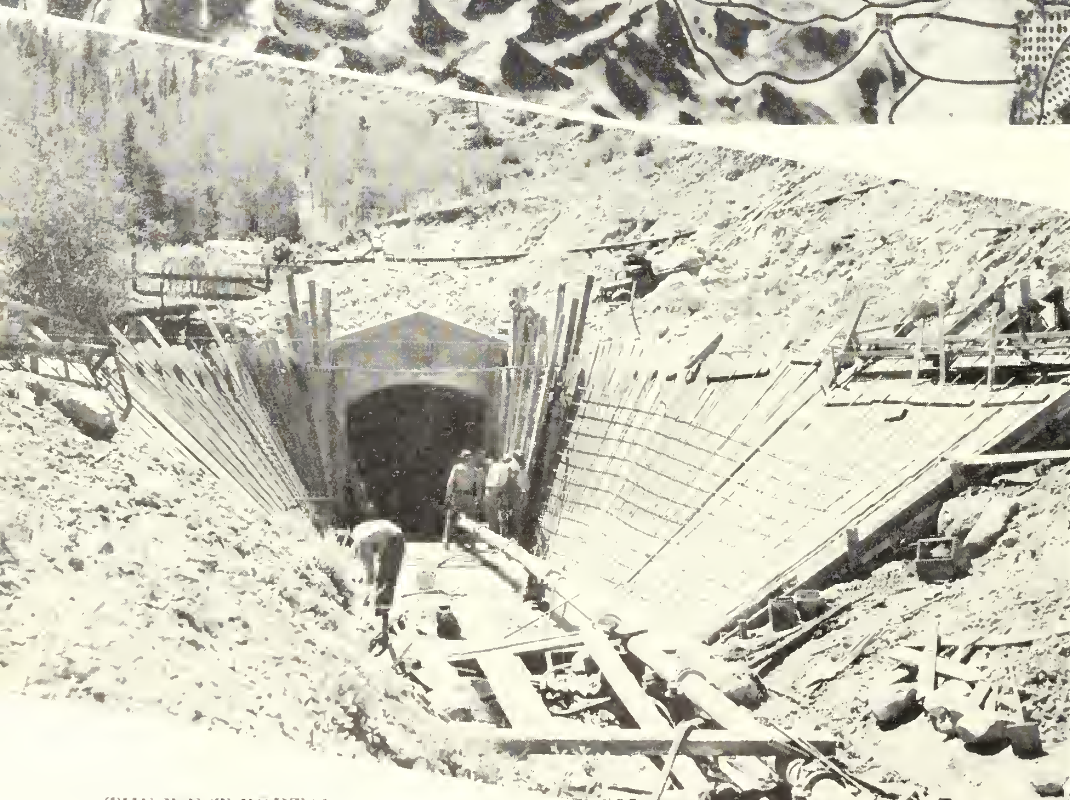
Since the project involved 19 separate but coordinated major engineering features, perfection of the preliminary plans involved

(*Continued on page 86*)



Reservoirs	*Gross*	*Active Capacity*
Green Mountain	155,000 A.F.	140,000 A.F.
Shadow Mountain Lake	0 "	0 "
Mary's Lake	800 "	800 "
Estes Park	600 "	600 "
Carter Lake	110,000 "	110,000 "
Flatiron	5,000 "	5,000 "
Horsetooth	146,000 "	146,000 "

Power Plants	
Green Mountain	21,600 KW
Mary's Lake	18,100 KW
Estes Park	15,000 KW
No. 2	28,450 KW
No. 3	11,450 KW
No. 4	13,200 KW
No. 5	11,000 KW
No. 6	6,700 KW



THE WEST PORTAL
OF THE ALVA B. ADAMS TUNNEL★

OPENING the way for full
Thompson project, the feature
panoramic perspective of this m
project, are the revised plans w
the water users and power cons
ducers and manuf

longest irrigation tunnel in the world—

★Originally called the Continental Divide tunnel
of the Stat

**›pment of the Colorado-Big
›hich are shown in the above
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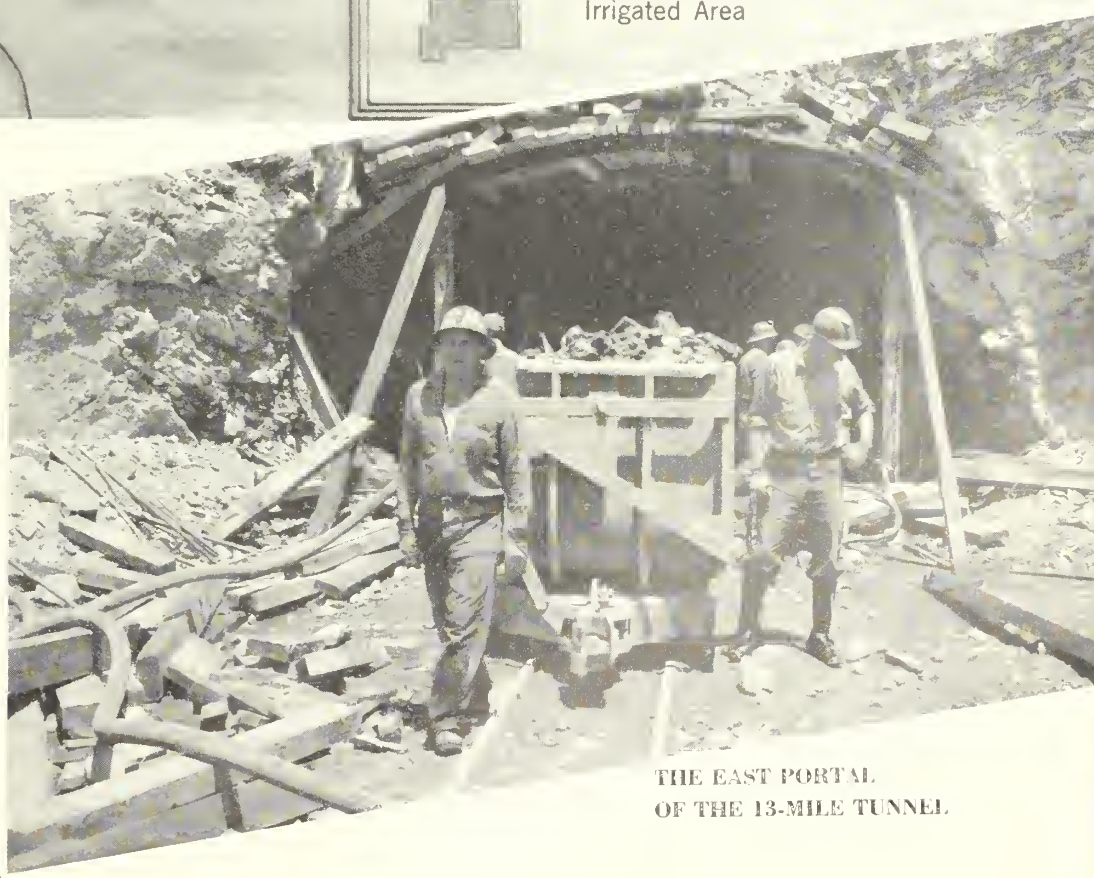
›nclude increased benefits to
› of the area, and to the pro-
›s of the Nation.**



THE EAST PORTAL
OF THE 13-MILE TUNNEL

›gh the backbone of the continent · · · · · · ·

› 1944 for the late Senator Alva B. Adams,
›do

Colorado - Thompson Project

(*Continued from page 83*)

considerable study and investigation. In so doing, and after viewing the actual results brought about by the progress of construction, engineers found ways of making the Colorado-Big Thompson safer, more economical in operation, and more valuable to the water users, power consumers, and the people of the United States for whose benefit it is being built. The estimated outlay for the project increased from $43,000,000 to $128,000,000 on the basis of 1946 prices, due to the increased costs of wartime construction plus the prospective additional expenditures involved in revising and perfecting the plans.

The increases in project costs are paralleled by an increase in permanent benefits from the project as well as a decrease in annual operating charges over the years to come.

The long-standing policy of the Bureau of Reclamation and the Department of the Interior has been that water users are expected to repay the reimbursable costs, allocated to irrigation, of constructing a project, within the bounds of their ability to repay. On the basis of increased costs and in consideration of increased benefits, allocation of charges must be made to the extent of the ability of the water users to repay the increased costs.

The House Appropriations Committee on the Interior appropriations bill not only has concurred in this policy of the Bureau and the Department, but insists that increased construction costs must be reflected in supplemental, or amendatory, repayment contracts.

In the case of the Colorado-Big Thompson project, the increase in cost between the 1937 and 1946 estimates represents an increase in the cost of the irrigation features from $24,000,000 to $70,000,000, and an increase in the cost of power features from $19,000,000 to $57,000,000. On the basis of current estimates, increased benefits amount to over 1 billion dollars, representing benefits accruing to the water users, power consumers, and residents of the area from power revenue, additional agriculture, and recreational facilities.

Although the present estimates call for the entire costs to be repaid by irrigation and power revenue as construction expenditures are made, an appropriate adjustment on a fair and equitable basis between power and irrigation will be effected.

The 11-year span between preconstruction estimates and the present status of man's greatest movement of water through mountains has been marked by a world convulsion of prices and costs incident to the economy of war and recovery. During that period the project has proceeded with mandatory changes in schedules and optional improvements in plans.

Many improvements have been made in the project plans without altering the basic concept that was initially authorized and undertaken.

Some of these changes were necessitated by adverse underground conditions not indicated by preliminary explorations. Others have been made in plan and design to obtain greater reliability in operation and thus more nearly eliminate prospects of service interruptions to both the irrigator and the power consumer. While there is no change in the project's yield of water, the delivery program results in marked benefits to the users. Other modifications were made to render project power firm to a greater degree and increase its value and the revenues to be received from its sale.

These changes in plan have been discussed with the Northern Colorado Conservancy District, the construction agency for the repayment of the irrigation costs, the congressional committees, and have been publicized as developed. Some of them are already reflected in completed features of the project or works now being built for all to see. Others are fully described in outstanding advertisements for bids or in the specifications for work on which contracts have already been made.

The value of the salable power output has been materially enhanced by greatly increasing the proportion of firm energy available from the system, thereby increasing the resulting revenues required to pay for the project.

The power transmission system has been expanded to meet the demand for public power by cities, towns, and rural communities in northern Colorado. Among these are several existing municipally-operated power systems and several large and well-established rural electrification projects. In so expanding the transmission systems, the policy of the Congress that power shall be furnished preferentially to cooperatives and public agencies has been followed.

Long after the Northern Colorado Water Conservancy District has made the final payment to the United States for the construction of the irrigation works in this development, the State of Colorado and the Nation will continue to benefit from an ever-increasing source of tax revenues made possible by the project. The board of directors which heads the district is empowered to levy taxes by collecting a general tax, with limitations, on all property in the district to pay for the indirect benefits accruing to the district by bringing in project water, and by a special assessment on lands receiving direct water.

Reclamation on the Mississippi

At the last meeting of the Mississippi Valley Association in St. Louis, Mo., a resolution was passed proposing that the Reclamation Laws be extended to the entire Mississippi Valley. This would permit investigations to determine the possibility of reclaiming millions of acres of flood-depleted lands around the Mississippi River.

The People

(*Continued from page 75*)

"Irrigation sure made a good impression on me, especially in those years when it didn't rain enough to wash the dust off a hen house."

Tenant-farmer, wage-earner Southall held fast to a dream of all solid men of the land: he wanted to have a place of his own—a place a man could call home, and mean it. Eventually, he accumulated sufficient cash to purchase a sandy land cotton farm. Looking across distant fields, he saw the Bureau's construction crews building the Lugert-Altus project. "Nobody will ever know how much I wanted one of those irrigation farms," Southall said.

As time approached for irrigating the first unit of the project, Southall decided to make one final effort to buy a place where he would have water to nourish his crops when they needed it. He was successful, and now owns 69 acres just across the main canal from the Oklahoma State Experiment Station. He also farms 45 acres of leased land adjoining his home place.

There are five children in the Southall household, ranging from Melvin, 16, down to Stanley, 3. They are a wholesome lot. Melvin, for instance, has won numerous State championships in connection with his 4-H Club work. Among these awards was first place in the State farm level contest, sponsored by the Soil Conservation Service. Another time, Melvin was tops in the State contest for dairy judging, but some one failed to enter him properly, and he was denied the trophy. Melvin graduated from high school this spring. He will begin studying agriculture at Oklahoma A. & M. next fall.

All of the Southall youngsters, including 3-year-old Stanley, who helps (?) harvest the potato crop, gather eggs and feed the cats and dogs, have a pride of ownership in the project home. The older children raise chickens and pigs as a basis of their 4-H club activities.

Southall will continue to cash crop cotton, although he has a weather eye set for other strong supporting undertakings. A dairy herd is planned after the alfalfa fields mature. The potato acreage will be increased, and more land devoted to growing row crop livestock feed, both for home consumption and sale. Truck farming also appeals to Southall, who will expand this phase of the farm program to help supply local markets.

Books might well be written about the people who, for many years, have made comfortable livings on western reclamation projects. But there are other stories, no less interesting, yet to be told about the new settlers in presently developing reclamation areas. Man's urge to till the soil and work with nature is as old as civilization, for, trite though it be, it still is true that our "civilization begins and ends with the plow."

Opportunity Knocks Again

Purple Heart Veterans of World War II won't talk about their wartime awards, but you can't stop them when they start explaining their plans for farming the reclamation lands they won.

by Robert L. Branam

Region VI, Billings, Mont.

IN THE GLASS CHURN were 212 capsules. Each capsule represented the hope of a World War II veteran for a reclamation-created farm on the Heart Mountain division of the Bureau of Reclamation's Shoshone project in northwestern Wyoming. The date was February 4, 1947—the day set for the Bureau's second postwar land opening.

Veterans from 18 States of the Union wanted to take advantage of this opportunity. Wyoming, of course, had the greatest representation, next came Montana, and there were others from Nebraska, Colorado, Kansas, Oklahoma, Idaho, Utah, California, North Dakota, Minnesota, Oregon, Arizona, Arkansas, Michigan, New Mexico, Tennessee, and Washington.

In keeping with the Bureau of Reclamation's policy to make irrigable farm units available to veterans of World War II, it was appropriate that the highest-rated 212 applicants for the 83 farm units, containing 7,720 acres of irrigable land, were veterans, that the ceremony for establishing priority of award was conducted in the American Legion Hall at Powell, Wyo., and that names were drawn by post commanders of the American Legion and Veterans of Foreign Wars.

Preparations for the Heart Mountain opening began many years ago. In fact, all things considered, its real beginning goes back to the time of that colorful westerner, William F. (Buffalo Bill) Cody. For it was then that actual irrigation development was started on what is now known as the Shoshone project.

A monumental contribution to the Heart Mountain opening occurred in 1910, when the Shoshone Dam (now called Buffalo Bill Dam) was completed. But even this was only one event in the continued progress of the Bureau of Reclamation to make water available to the arid and semiarid sections of the Western States.

With the passing of the February 4 milestone on the Heart Mountain division, the Bureau picked up speed in the task of putting more and more land under the beneficial effects of a stable supply of life-giving water.

HOLD EVERYTHING, I'LL BE THERE IN A MINUTE!
said Pete G. Milohov as he heard the postman's whistle.

The actual process of opening the 7,720 acres of irrigable land to public settlement began October 3, 1946, when Secretary of the Interior J. A. Krug made official announcement of the event. The 499 applications received prior to November 25, 1946, the end of the period of simultaneous filing, were graded by an examining board composed of Fred O. Arnold and Edgar Swallow, both Powell, Wyo., businessmen, and

The postman brings his notice to appear before the examining board for personal interview.

Milohor paying required water assessments, which completes his filing with the Bureau of Reclamation for a farm unit.

Checking their farm unit on the map, the Milohors are aided by Bureau officials Lloyd J. Klinger, left, and Alden S. Ingraham.

HOME WITH PAST AND FUTURE

Former internee camps—future veterans' homes.

RULERS OF ALL THEY SURVEY

Pete and the Missus look over the new property.

He's got what it takes. Through his own efforts in 1946 he was able to convert his profits into this valuable machinery.

All-American dog! Pete will take him along, of course.

L. J. Windle, superintendent of the Shoshone project. Top grades were given to 212 applicants.

Following the drawing in Powell, conducted to establish the order in which the 83 farm units were to be awarded, the applicants were called before the examining board for personal interviews to substantiate the claims made on their application forms as to capital assets, farming experience, character, and industry.

If he was able to complete the personal interview successfully, the applicant was allowed to pick out the farm unit he wanted most, in order of his priority. He then paid his water assessments and filed with the Bureau of Land Management for a homestead entry. As soon as his application was accepted by the Bureau of Land Management, he became a qualified homestead entryman.

To Ross Buchan of Powell, adjutant of the Hughes Pittinger Post No. 26, American Legion, fell the honor of selecting the first capsule from the glass churn. The capsule was opened and the folded slip of paper handed to A. J. Meyer, owner of station KPOW, Powell, a Mutual Network station. Over the air waves went the name of the winner of the No. 1 priority—Pete G. Milohov.

MILOHOV, 27, a homestead-born Purple Heart veteran, was working about his farm as usual on the momentous day. He first learned of his good fortune the night of the drawing when he read the *Billings Gazette*. The unassuming veteran tells that he and his wife, with the dubious assistance of their 6-month-old daughter Susan, scanned the list of priority standings. Checking off name after name they became increasingly disappointed. Then suddenly the name "Milohov" caught their eyes. It was part of the headline. There it was, so big they had not noticed it. Winner of first position for selection of a farm unit on the Heart Mountain division!

Milohov and his family spent the rest of the evening twirling the dial of their radio, reveling in the announcements of their good fortune, repeated and repeated in broadcasts from stations as far as the radio set could reach.

No stranger to homesteads, the prospective entryman helped his father, George Milohov, on a homestead in the Bull Mountains during his spare time while attending grade school at Pompeys Pillar, Mont. During his high-school days at the Huntley Project High School at Worden, Mont., he became more active on the homestead and was an enthusiastic member of the Huntley Project Chapter of the Future Farmers of America.

When the family moved to the Huntley project in 1938, his parents began operations on a 53-acre irrigated farm—acquainting Milohov with irrigation at an impressionable age.

Tragedy befell the family in 1939, when the father died. It was then up to Pete Milohov and his older brother Mike to assume the responsibility of operating their mother's farm.

In June 1944, Pete Milohov received "Greetings" from the president. He received his infantry training at Fort McClellan, Ala., and the following spring was sent to the Pacific theater. He first met the enemy in the campaign on Leyte. Practically noncommittal about his war experiences, Milohov tells that he was later sent to the island of Mindanao and shortly after meeting the Japanese, was wounded. He was taken to a hospital in the Philippines and later moved to the United States, being honorably discharged in October 1945. He holds, in addition to the Purple Heart, the Victory medal, Philippine Liberation medal, Asiatic-Pacific theater ribbon with two battle stars, and the Good Conduct medal.

As soon as he returned to the States, he stored the medals, donned work clothes, returned to the fields, and began preparing the soil for next year's crop. In the following spring he and his brother decided to expand their operations and rented approximately 200 acres from near-by neighbors.

The 1946 crop produced, in addition to always-needed experience, enough money to buy a complete line of farm equipment, which now will come in handy at his homestead on the Heart Mountain division.

Three days after the drawing, Milohov and his wife, Adele, traveled to Powell, where he completed his personal interview, selected his farm unit and filed with the Bureau of Land Management for homestead entry.

IN AN EFFORT to aid veterans in all ways possible, the Bureau of Reclamation is turning over the equivalent of two barracks buildings on the vacated Heart Mountain Relocation Center to veterans who want to use the material to construct homes and other farm buildings.

The Purple Heart veteran is already preparing for his move to the Heart Mountain division. His livestock is almost ready for the trip, and Milohov is making arrangements to buy more cattle for his new farm. In keeping with this trend, his two dogs, a female Springer Spaniel and a male Fox Terrier, recently became the parents of a curiously assorted litter. A couple look like their mother, one or two are definitely Spaniels, and the others take after their father, having a short-haired Terrier cast to their appearance.

Among other veterans whose names were drawn from the little glass churn in the Legion Hall at Powell was a hometown boy, Roy A. (Shorty) Myers. A native of Wyoming, Myers served in the South Pacific and for more than 1 year was listed as missing in action. Typically western, Myers is reluctant to show much concern about his experiences as a member of the fighting forces. However, he is eager—even anxious—to tell of his good fortune at the drawing and his many plans for the future.

ANOTHER homestead-born veteran on hand at the drawing was Huntington L. Downer, of Deaver, Wyo., whose father homesteaded in 1917 on the Frannie division of the Shoshone project. A member of the Navy air forces during the war, Downer was awarded two distinguished flying crosses and seven air medals.

Like Downer, Harry Thornton (Thorny) Ketchum is a native of the Shoshone project. Married and a father of a 6-month-old son, he is a third generation pioneer. The veteran of 30 months in the Pacific theater as a member of the Seabees was not discouraged even though 59 other names had been registered on the blackboard before his name was drawn. In fact he was pleased, for, knowing the Shoshone project like the palm of his hand, he knew that he would still have his choice of many desirable farm units on the Heart Mountain division.

During the ceremony that preceded the drawing, Kenneth F. Vernon, then assistant director of region VI, Bureau of Reclamation, reported that work was now under way to make additional homesteads available on the Heart Mountain division, beginning with the opening of 5,400 acres in 1947. As part of the Missouri Basin project, the Bureau of Reclamation plans to open many more farm units on what is known as Shoshone project extensions, he said.

In commenting on the opening of the Riverton project in central Wyoming, Mr. Vernon (appointed regional director on April 1, 1947) stated that approximately 10,000 acres will be opened for settlement in 1947 and approximately 50,000 acres in 1948 and 1949.

Mr. Vernon emphasized that the ultimate plan for the entire Missouri River Basin is the transformation of more than 5,000,000 acres of range and dry lands into 5,000,000 acres of the same kind of solid, steady, wealth-producing land contained in the operating divisions of Shoshone project.

The benefits resulting from utilization of the water resources in the Missouri River Basin will not only mean stabilized farm incomes for hundreds of thousands of people in the basin, he explained, but will result in a significant contribution to the economic wealth of the entire Nation.

Warne To Write Book on Irrigation

Assistant Commissioner William E. Warne has accepted an invitation to write a book on irrigation. The need for such a book was stressed in the invitation from the Science Editor of the Princeton University Press, Mr. Herbert S. Bailey, Jr. Former Commissioner Harry W. Bashore will review the manuscript which will be written in a popular style, designed to reach the general public. All plans are tentative, no publication date having been set yet.

The Bureau Reclaims Its Own

Free from the shadows of war, former war relocation centers have been given back to the Bureau of Reclamation, which is turning them into farms for veterans as quickly as possible.

by Carl J. Thye

Branch of Operation and Maintenance, Washington, D. C.

WHAT is happening at the three war relocation centers operated on Bureau of Reclamation lands?

At the Heart Mountain division of the Shoshone project in Wyoming, and the Tule Lake division of the Klamath project in Oregon-California, part of the land has already been turned over to veteran settlement activities, and on the Gooding division of the Minidoka project in Idaho, the Bureau is getting ready for the opening of the land to veterans of World War II.

Besides adding another item to its long list of public services rendered to the Nation in time of need, by making its lands available to the War Relocation Authority for providing shelter to evacuated Japanese during the war, the Bureau enhanced the value of some of the lands, and acquired considerable surplus property which is being made available to further Reclamation's veteran settlement program.

It will be remembered that, at the outbreak of World War II, the Justice Department apprehended and took into custody approximately 113,000 Japanese nationals and their American-born children. Of these about 39,000 were evacuated to centers on reclamation projects.

A total of 57,000 acres of Reclamation-withdrawn public land was turned over to WRA for camp-site and agricultural purposes. These included 1,100 camp-site acres, and 3,575 agricultural acres at Tule Lake; 1,294 camp-site acres and 1,843 agricultural acres at Heart Mountain, and 946 camp site and 784 agricultural acres at Minidoka. The remainder of the land was released to local ranchers for pasturing purposes.

Between April and July 1942, the evacuees began to arrive at the three relocation centers. At the peak of their capacity, Tule Lake sheltered more than 18,700; Heart Mountain almost 11,000, and Minidoka more than 9,000.

At first a memorandum of understanding between the Department of the Interior and the War Relocation Authority stipulated that the WRA would lease the land, pay for construction and land development, operation and maintenance of the irrigation systems, pay water rental charges, and make adjustments for lands which were made unfit for economic reclamation and productive cultivation as the result of the War Relocation Authority's activities. However, the Japanese internees made a definite contribution to the land development.

At both the Heart Mountain and Minidoka centers, they cleared and leveled the previously unfarmed land, constructed irrigation canals and other structures, including drainage ditches. At Heart Mountain, in order to get water to the land, it was necessary to repair the main canal from the Buffalo Bill Dam on the Shoshone project. At all the centers they improved the land and helped save crops by aiding in harvesting operations. WRA and the Bureau figured they came out even on the deal, so the original "memorandum of understanding" was canceled, and the mutual obligations were considered satisfied without exchange of funds.

With the lifting of west coast restrictions, the war relocation centers were closed by April 1946. The Bureau was free to reclaim its land, but was faced with the problem of using or disposing of the buildings, equipment, and supplies left on the centers.

The Bureau of Land Management, United States Department of the Interior, had been designated as the disposal agency to dispose of the land and buildings, and the War Assets Administration to dispose of the personnel property. Inasmuch as the land was under the jurisdiction of the Bureau of Reclamation, to aid in the veteran settlement program, Public Law 478, Seventy-ninth Congress, authorized the Bureau of Reclamation to acquire by transfer without exchange of funds, the lands, improvements, buildings, furnishings, and equipment which had been declared surplus at the three war relocation centers located on Reclamation lands. Under regulations of the Secretary of the Interior all of this property was made available to veteran settlers, nonprofit organizations and the Bureau, in connection with its construction, operation, and settlement programs.

As a result of this authority, there was constant activity in the centers last summer. Inventories were taken, buildings dismantled, renovated, or moved, supplies assembled, and the allocation of WRA property was begun.

The Bureau's policy is to use all the facil-

Only one of many necessities available to lucky vets.

Enough to keep 'em warm anywhere.

ities of the former WRA centers to advance the veteran settlement programs and to assist the existing communities in providing facilities needed to meet the increased demands of a growing population.

Three preference groups have been established to assure an equitable distribution. Group one includes the veterans who are or will be successful entrymen on public reclamation project land. Group two covers Bureau activities and its needs for providing necessary community facilities for settlers, construction workers, Government employees and others. Group three is made up of nonprofit organizations which can acquire property for uses beneficial to the development of the settlement program in the areas in which Reclamation projects are located.

Under this system 1,509 buildings have been set aside for veteran settlers, 1,300 for the Bureau, and 621 for nonprofit organizations.

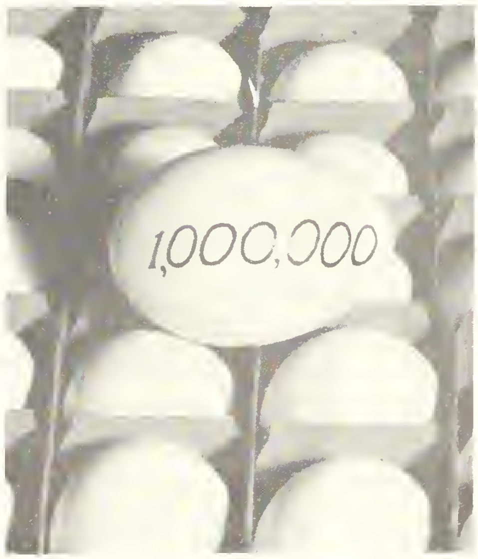
Veteran settlers are each entitled to two barrack buildings, 20 by 100 feet, which may be used for temporary housing or for building housing and farmstead facilities. The only charge to the veteran is that of removal to his land. Other materials to be made available to veteran settlers at no cost include heating stoves, beds, mattresses, blankets, hand tools, fertilizer and miscellaneous construction supplies of value to the settlers in developing homesteads.

Buildings taken over by the Bureau include those which are neded to conduct the activities of the Bureau on the project where the center is located or elsewhere. Among these are offices, shop buildings, and apartments for housing employees engaged in custodial maintenance of a center, and to expedite Bureau construction work directly related to present and future needs of the homestead program. Slaughterhouses, root cellars, refrigerated storage, and large warehouses will be utilized in connection with serving the needs of settlers and local farmers in the community and providing warehouses for the products they raise. The value of storage was apparent during the shortage of railroad cars in the summer of 1946, when all available space at the centers was used to store valuable crops which could not be shipped and would otherwise have spoiled in open storage. Apartment and dormitory buildings are being used to house custodial staffs and World War II veterans who are working on the projects or in nearby communities.

Group three—the nonprofit category—consists of State, county, or local government subdivisions or institutions, including local school districts, churches, public agencies, veteran posts, auxiliaries, Boy and Girl Scout troops, agricultural and other cooperatives, and organizations which would be concerned with the welfare of the settlers and their families and could contribute to the settlement program. School buildings

They were self-sufficient.

Millionth egg produced at Heart Mountain.



which used to welcome small Japanese children have in the past year accommodated neighborhood children, providing the critically needed additional classrooms for local grade and high schools.

Personal property allotted to the non-profit organizations consists of sewing machines, cots, mattresses, blankets, school supplies, and books.

In what condition were these centers after more than 3 years' operation under the WRA?

Heart Mountain, Wyo., is typical of the wartime operations at a war relocation center on a reclamation project. This war-born community, created as the result of the Japanese evacuation program, was at one time the third largest town in the State.

Heart Mountain was not a prisoner-of-war camp despite the fact that the community was barbed-wire enclosed and certain restrictions were imposed upon it. Actually, the community of drab, tar-papered, squat buildings made a definite contribution to the community, State, and Nation during the war. With nearby agricultural communities suffering from the manpower shortage, evacuee workers volunteered their services in harvesting important crops, particularly sugar beets. More than once were the harvests saved by these workers alone, thus saving farmers literally millions of dollars and contributing to the war effort in the production of food.

The community also gave more than 700 of its youth to the Army, the majority of them serving with the famous 100th Infantry Battalion and the equally honor-laden 442d Combat Team. These two fighting outfits were the most-decorated small units in the entire United States combat services. Purple Hearts won by these two units numbered in the thousands, while seven of the Nisei soldiers were recommended for Congressional Medals of Honor. Distinguished Service Crosses were won by the score, while Silver and Bronze Stars were counted by the hundreds.

Attempts were made to establish in Heart Mountain as nearly a "normal" community as possible under wartime restrictions.

The community was to a large degree self-governing, with a community council, elected by and from the residents, as the controlling body. The council was supplemented by block managers acting in an advisory capacity for the residents of the 20 blocks in the community.

The school system corresponded with other schools in Wyoming, following the same curriculum and expressing the same interests in sports and social activities as other students "outside the fence." Despite their smaller physical size, the Heart Mountain high school football team was defeated only once in 3 years of competition—then by a team averaging 40 pounds more per man. The residents of the center supported a weekly newspaper, *The Sentinel*, which topped all other Wyoming weeklies in circulation. (It was printed by The Cody Enterprise.)

Heart Mountain had its own hospital, staffed, except for a Caucasian medical officer and head nurse, by evacuee doctors, dentists, nurses, and nurses' aides. Under a trust agreement by which profits were returned to the evacuees themselves, several merchandise stores handled unrationed foods, while barber, beauty, radio repair, shoe repair, and dry-cleaning shops offered services.

Heart Mountain was nearly self-sustaining as far as food was concerned. Before the center was closed, approximately 1,800 acres of once barren, sage covered land were brought into production. Preliminary work of clearing the land was begun in January 1943, the evacuees having arrived too late in the year to start any farm work.

Most of the farm experts among the evacuees were unaccustomed to the short seasons and rigorous Wyoming conditions. Few of them had ever had any contact with irrigated farming; consequently, considerable supervision (under Glen Hartman, region VI, Operation and Maintenance economist) was necessary during the first year of operation.

Potatoes, in production, led the list of 98 varieties of vegetables grown by the evacuee farmers. Other crops included daikon, a Japanese root vegetable, turnips, Chinese cabbage, sweet corn, cabbage, dry and green beans, beets, cantaloupe, lettuce, green and dry onions, green peas, radishes, romaine, cucumbers, rutabagas, spinach, squash, tomatoes, Swiss chard, bell peppers—and probably for the first time to be grown in that part of Wyoming, broccoli, egg plant, celery, and watermelon.

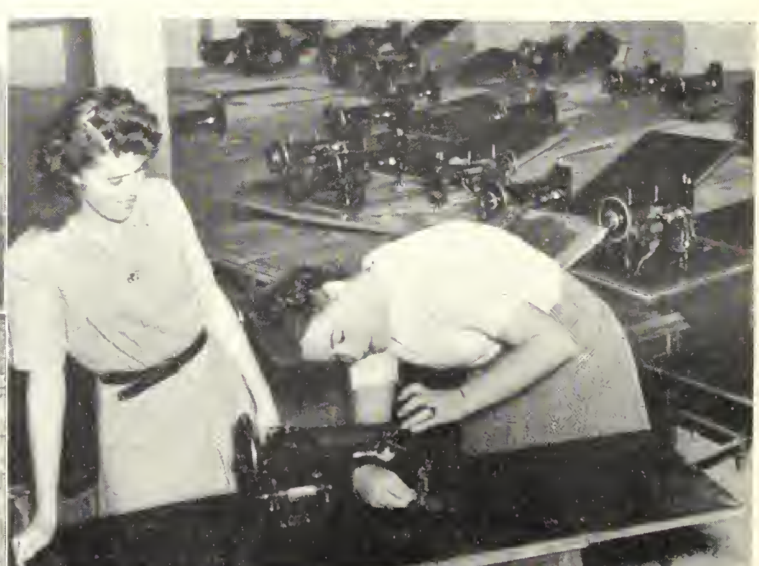
The first water brought to the Shoshone project for irrigation was the result of the evacuees' work. More than 200 of the farm crew workers lined the canal with bentonite, cleaned miles of canals and laterals before the first crops could be irrigated.

A starter-flock of chickens eventually provided all of the center's egg and poultry needs. Similarly, the hog farm, which started with 40 brood sows, supplied much of the meat consumed by the residents.

Social life was not unlike that found in other communities. Besides school activities, the residents participated in many church activities, the community supporting various Protestant denominations, one Catholic church, a Buddhist church, Seventh Day Adventist church, and the Salvation Army. Current events study groups, forums, Boy and Girl Scouts, the American Red Cross, USO, recreational programs for adults and children, and a score of other functions occupied the spare time of the residents. *(Continued on page 94)*

They beat the lumber shortage with their own mill.

Precious products available at the Hunt, Idaho, center.



RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Approved Missouri River plan map.*—Color map of reservoir and dam sites in the basin construction program in Colorado, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

2. *Landownership Survey on Federal Reclamation Projects.*—Available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

3. *The Colorado River.*—Comprehensive departmental report on development of water resources of Colorado River Basin for review prior to submission to the Congress. Limited number of copies available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

4. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals*, by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, seven-page mimeographed study with graphs.

Available from the Superintendent of Documents, Washington 25, D. C.

1. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

2. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest releases are:

Problem 14, Financial Aid for Settlers—25 cents.

Problem 23, Rural and Village Electrification—25 cents.

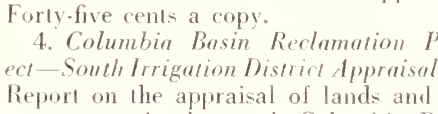
Problem 24, Agricultural Processing Industries—30 cents.

Problem 26, Recreational Development of Roosevelt Lake—75 cents.

3. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Table showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

4. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

5. *Fourth Report of Operations Under the Boulder Canyon Project Adjustment Act for Year Ended May 31, 1945*, published January 4, 1946. Fourth annual financial statement of the Commissioner of Reclamation transmitted to the Secretary of the Interior concerning operation, maintenance, and construction activities of the Boulder Canyon project during the year ended May 31, 1945. Ten cents a copy.



Miscellaneous Publications

"Columbia Basin," by F. J. Clifford, in *Pacific Road Builder* and *Engineering Review*, December 1946, page 4. Illustrated. A comprehensive study of the history of the Columbia Basin in Washington State, with special emphasis on the construction of Grand Coulee Dam and the development of the Bureau of Reclamation's Columbia Basin project.

Missouri River Basin, a progress report of the Department of the Interior agencies participating in the comprehensive plan of development of the basin, prepared by the Missouri Basin reports staff, Billings, Mont., December 1946, illustrated, 54 pages (mimeographed), issued quarterly. Write to the Missouri Basin Reports Staff, Billings, Mont.

"Davis Dam Completes Storage Regulation of Colorado River Below Boulder," by L. R. Douglass, Assistant Regional Director, region 3, Bureau of Reclamation in *Civil Engineering*, January 1947, page 14, illustrated. The story of initial construction on the Davis Dam project—the largest undertaking by the Bureau of Reclamation on the Colorado River since Boulder Dam.

"Coachella Canal Advancing Through the Sand," by C. S. Hale, construction engineer, Bureau of Reclamation, Yuma, Ariz., in *Western Construction News*, December 1946, page 73, illustrated. Excavation and lining of the 141-mile Coachella Canal—main branch of the All-American Canal System—which will irrigate 80,000 acres of rich farm land in the Imperial Valley in California.

"Rural Electrification and Electroagriculture," by M. M. Samuels, Fellow, American Institute of Electrical Engineers, in *Electrical Engineering*, January 1947, page 20. A comprehensive study of rural electrification—the art and business of bringing electric service to the rural area and to the individual consumer in that area, and electroagriculture—the art and business of using electric power for farming.

"Designed by Savage," by Murdoch J. McLeod, in *Federal Science Progress*, February 1947, page 26. Illustrated. John Lucian Savage, designer of the Nation's giant dams, plans the largest yet—for the Chinese. *Federal Science Progress* was published monthly by the Office of Technical Services, United States Department of Commerce.

"George Hebard Maxwell," by Bryce C. Browning, in *American Forests*, January 1947, page 32. Illustrated. A brief biography of the beloved conservationist who died on November 30, 1946, at the age of 86. (*American Forests* is a monthly publication of the American Forestry Association, Washington, D. C.)

"New Road into the Utah Wilderness," by Charles Kelly, in *The Desert Magazine*, February 1947, page 10. Illustrated. The story of Art Chaffin—farmer, prospector, boat builder—the promoter and builder of a new scenic highway through the little known red-rock desert wilderness of southern Utah.

"A Basis for Planning Farm Implement House Layouts," by G. L. Nelson and W. G. Kaiser, senior agricultural engineer and manager, respectively, farm bureau, Portland Cement Association, in *Agricultural Engineering*, January 1947, page 15. Illustrated. As a flood of tractors and other equipment becomes available, farm machinery storage has become a most urgent farm building need.

Letters To The Editor

BAYFIELD, COLO.,
February 1, 1947.

DEAR SIRS: Attached hereto is a subscription for 1 year for the RECLAMATION ERA from the Bayfield High School and their check in the sum of $1 payable to the Treasurer of the United States.

Sending you this subscription gives me more satisfaction than any of the previous ones because of the fact that the magazine will be available to all the students in the Bayfield High School as it will be a part of their library.

The superintendent, Mr. Aaron A. Baker, is sold on the importance of reclamation.

S. F. NEWMAN,
Reservoir Superintendent, Pine River Project.

WASHINGTON, D. C.,
January 16, 1947.

DEAR SIR: On the whole my comment on the RECLAMATION ERA is most favorable. I think it is a high-grade publication and should be very useful.

I would like to raise a question or two about the article "Homesteading—Then and Now" by Paul D. Olejar, which starts on page 10 of the January issue. If my memory serves me correctly, the mural by the late John Steuart Curry was based on the opening of the Oklahoma territory, April 22, 1889, and represented the "run" as it started along the Kansas border. The term "sooner" also developed at the time of the "run" into Oklahoma territory in 1889 when some of the settlers got into the land sooner than the others and sooner than the formal opening.

I think you will find this correct if you have time to investigate historical records or the story of the opening by Gittinger or statements in the encyclopedias. I will be pleased to have you advise if you find any evidence to the contrary.

Sincerely yours,
JOHN B. EWING.

Editors Note:

Reader Ewing is entirely right. John Steuart Curry's mural, entitled, "Land Rush," was based on the 1889 Oklahoma territory land opening. However, according to the "eye witness" account of the opening of the Cherokee Strip (also in Oklahoma) in 1893 (upon which the ERA's historical references were based), the illustration could well be adapted to either of the land rushes. "Sooners" were rife on both occasions. "Sooners" also were those who assumed that this use of the photographed mural would not be questioned.

No Disappearing Act

Several readers of the RECLAMATION ERA have wondered about James Robertson's overcoat. In his article, "The Magic Valley," appearing on page 47 of the February ERA, he stated, "Down by the Alamo, in old San Antonio, I lowered the car windows as far as possible, and removed my topcoat. I haven't seen it since."

No legerdemain was connected with this incident except that perculiar to printers, nor did Mr. Robertson imply dishonesty on the part of the people of San Antonio. The explanation is simple. The sentence should have read: "I haven't *worn* it since."

Motion Pictures

The Bureau of Reclamation distributes 16 mm. motion pictures relating to its activities. The films will be loaned the borrower willing to pay the express charges both ways. The list follows:

(Distributed from the Bureau of Reclamation Office, Washington 25, D. C.)

Boulder Dam	5 reels	(silent)
Boulder Dam	4 reels	(sound)
Reclamation in the Arid West	1 reel	(sound)
Fundamentals of Irrigation	3 reels	(sound)
Irrigated Pastures (Kodachrome)	2 reels	(sound)
Fighting Weeds (Kodachrome)	3 reels	(sound)
Measurement of Water (Kodachrome)	3 reels	(sound)

For Your Art Collection

Write to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C., for photographs suitable for display or framing which appear in this issue.* *This does not apply to photographs which carry outside credit lines.*

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4 by 5 inches (or smaller) single weight glossy	.25
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11 by 14 inches single weight glossy	1.25
11 by 14 inches double weight mat	1.50
16 by 20 inches double weight mat	2.50
20 by 24 inches double weight mat	3.00
24 by 30 inches double weight mat	5.00
24 by 36 inches double weight mat	6.00
30 by 40 inches double weight mat	8.00
	Per sq. ft.
Over 30 by 40 inches double weight mat	$0.85

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The Bureau Reclaims Its Own

(Continued from page 92)

Because of the scarcity of lumber during the war, the War Relocation Authority installed a saw mill, which was operated by the Heart Mountain evacuees.

The mill was located about 35 miles from the center along the east boundary of Yellowstone Park, at an elevation of approximately 9,000 feet. The land was leased from the State of Wyoming. Eleven buildings were erected of unfinished native lumber to house the equipment and the evacuees who operated the mill. These buildings have been transferred to the Powell, Wyo., Girl Scouts, who will use them for summer camping activities. The sawmill equipment may be allotted to the Indian Service and perhaps moved from the camp in the spring to a new location somewhere in Utah.

Before the Heart Mountain camp was transferred to the Bureau of Reclamation last year, the War Assets Administration had disposed of most movable items and major equipment except for some hand tools and miscellaneous supplies, a small amount of school supplies, and a store of fertilizer. Thus the major assets at the relocation center when the transfer was effected were the buildings and permanent fixtures.

Contracts are now being executed to transfer, without cost, the school supplies to Wyoming educational institutions.

The hand tools and fertilizer are still in the possession of the Bureau, but will be acquired, without cost, by settlers on the Heart Mountain division and Riverton project who take up homesteads during 1947 and 1948. Present plans call for an even division of all tools and fertilizer to the settlers on both projects.

In Tule Lake, hospital equipment will be available to furnish hospitals in the area. Proposed plans to be submitted for approval call for a 50-bed hospital at Alturas, Calif., a smaller unit at Tule Lake, and if need arises, sufficient equipment and medical supplies are available to establish medical centers in the nearby towns of Merrill and Malin, Oreg., all of which serve the growing homestead area.

Far from becoming "ghost towns," the former WRA centers teem with activity, and numerous governmental and civic groups have coordinated their work under the supervision of the Bureau to pave the way for the incoming settlers.

Crop Returns Reach Half Billion

Preliminary estimates of 1946 crop returns from lands irrigated partially or totally by Reclamation facilities already exceed half a billion dollars. These estimates cover crops produced on more than 4⅓ million acres in cultivation. During the year about 38,000 acres on nine projects received new water deliveries.

IRRIGATION IN SIAM

Modern irrigation methods made possible a contribution of over a million tons of rice to help combat world famine.

Kambhu prepares to report to his people on American irrigation.

IRRIGATION of rice fields in Siam is quite different from western United States irrigation, but the two have much in common. For contrast, there is the matter of rainfall—from 30 to 160 inches of rain a year in Siam; 3 to 20 inches on irrigated American lands. On the other hand, construction of impoundments and development of hydroelectric power are common problems which the Government of Siam wants to solve. Bureau of Reclamation works are being used as a model.

M. L. Xujati Kambhu, superintending engineer of the Royal Irrigation Department, Bankok, Siam, recently completed an inspection of various Reclamation projects. With his findings, he hopes to be able to tackle the engineering problems basic to Siam's production of food. For Siam's rice production is being counted on as one of the principal sources for combating world famine.

"Siam has given to the United Nations as a free contribution 156,000 tons of rice," Mr. Kambhu said. "From May 1946 to May 1947 she has taken upon herself the responsibility of providing the Rice Committee of the International Emergency Food Council with approximately 1,200,000 tons of rice for allocation purposes. This quantity represents practically 12 percent of the present-day world food shortage."

"Siam's ability to shoulder this responsibility is due in part to its modern system of irrigation," he said. Part of the crop is made possible by natural inundation of the central plain by the Choa Phye River. But climatic conditions are not dependable, and a dam is planned across the main river to stabilize and increase the crop yield through controls provided by a system of irrigation.

At present, Siam has no major impoundment dams, although 1,700,000 acres are irrigated by modern systems of ditches and diversions. Within the next 7 years it is planned to add 2,100,000 acres to irrigation.

Siam has heavy rainfall. This varies from 30 to 40 inches in the central portion to 100 to 160 inches in the western part. But the water supply is irregular—and rice cultivation requires 1,200 cubic feet a day per acre. Irrigation is needed to combat the prevalence of drought. Sixty-one of the last 114 years have been too dry for proper rice growth.

"I must say that all the works I have visited are of great interest to me," Mr. Kambhu said, "due to the fact that they have been carried on such a gigantic scale with great speed and yet are marvels of thoroughness, precision, and research. The main difference in irrigation works of the U. S. A. and Siam is that in the United States, hydroelectric power, flood control, and sometimes water communication, are amalgamated with irrigation, while in Siam only flood control and water communication have been combined with irrigation."

However, surveys are completed and a network of power generation to cover about three-fourths of Siam is planned. Some of the dams will be constructed in the near future.

"The average Siamese farm is 22 acres," Mr. Kambhu said. The average family consists of man, wife, and five children. A few farms are as large as 44 acres.

Aside from the heavy precipitation, the most interesting difference from the engineering standpoint is the flat terrain. The slope varies from 1 foot in a mile and a half to 1 foot in 30,000 feet—almost 6 miles. Soil varies from a few inches to about 2½ feet. Underlying this is a deep stratum of impervious blue clay. Although extremely hard to excavate, this clay makes exceptionally good lining for canals if left undisturbed. One of Mr. Kambhu's problems in the States was to find heavy earth-moving equipment that can handle this excavation.

Mr. Kambhu attended the Food and Agricultural Conference in Washington as a delegate from his country before starting his observation of irrigation works. He was accompanied by Ananta Chintakananda, secretary of the Siamese Legation. Visiting the Tennessee Valley Authority, he inspected the dams and works in that area, and later inspected rice fields in Louisiana and other works in Arkansas and Texas. On his Reclamation journey, Mr. Kambhu spent some time in the Denver office of the chief engineer before visiting irrigation works in the Southwest.

Kambhu, Chintakananda, and W. E. Corfitzen talk over world's highest dam.

NEWS ROUND-UP

Power and Irrigation—Partners

The Columbia Basin project was cited as a prime example of the fact that irrigation and power can work together as mutual helpmates in a recent speech by Operation and Maintenance Director Lineweaver at Ephrata, Wash. The speech followed the Yakima-Tieton celebration at which Secretary of the Interior, J. A. Krug, was the guest speaker, and Goodrich W. Lineweaver represented Commissioner Straus.

The Director said that the surplus waters of the mighty Columbia River could never have been diverted to the Columbia Basin project without the tremendous financial aid that power is giving to the repayment of the irrigation works. He said further, "The whole West can take a leaf out of the book being written here. The Bureau's program provides for the extension of the 'partnership' arrangement throughout the Columbia drainage basin and every other river basin in the West for comprehensive irrigation development."

He warned his audience against getting the wrong idea of development farms. "We are not planning to tell the settlers what to grow, or when, or how," he said. "We propose, together with these cooperating agencies (the Bureau of Plant Industry, Department of Agriculture, and the Extension Service), to make practical information available to the settlers in understandable terms. We are opposed to spoon-feeding settlers or to regimentation in any form, and our efforts are directed toward paving the way for the settler to succeed under his own steam."

In his talk he also referred to the Columbia Basin joint investigations which have been printed as individual studies and are now available to future settlers on the Columbia Basin project. (See p. 93.) He stressed the extensive research involved in the studies and expressed the hope that they would be read by all concerned, pointing out that these would go far toward assuring success and removing a great deal of the risk inevitably faced by future farmers who are not as fortunate in having available such comprehensive information as the Columbia Basin settlers.

Deschutes Slogan Winner

"Sagebrush to Clover" was Buzz Griffin's prize winning slogan describing the lands of the north unit of the Deschutes project in Oregon. The high-school freshman, son of Walter Griffin, one of the settlers on the the south county lands of the north unit, came up with this winning slogan as a result of his school's publicity contest at Culver to pick an appropriate name for the area. "Sagebrush to Clover," graphically describes the settlers program, namely the production of seed clover and alfalfa from formerly barren lands.

ARABIAN PRINCE VISITS AMERICAN KING OF POWER

"The desert, the dry weather, the unfertile soil, you have everything of ours here—but you have made it LIVE," said Prince Saud of Saudi Arabia (second from the right) on his recent visit to Boulder Dam. After completing a flying tour of the United States he said that the structure was the most impressive he had seen during his trip, "an incredible masterpiece of engineering which turned a vast desert into an Eden."

Veterans Get Priority for Columbia Basin Lands

Qualified veterans of World War II who now own Columbia Basin land, as well as qualified veterans who do not own land in the Columbia Basin area will be given A-1 priority for purchasing farms in this million-acre development. Secretary of the Interior J. A. Krug recently ruled that this preference is possible under the terms of the Columbia Basin Project Act and other authority. Others who will receive an equal priority in purchasing farms include nonveteran owners provided that they convey their lands to the United States in accordance with the terms of the Columbia Basin Act.

The Federal Government is now purchasing land in this project where construction of the irrigation works is well under way. The large blocks of land now being purchased will be divided into family-sized farms, assuring the best opportunity for the greatest number of people. The general policy of limiting water deliveries to ownership units not exceeding 160 acres of irrigable land will prevail. It is estimated at present that the average farm will be approximately 80 acres. The regional director's staff is now studying the specific application of this policy.

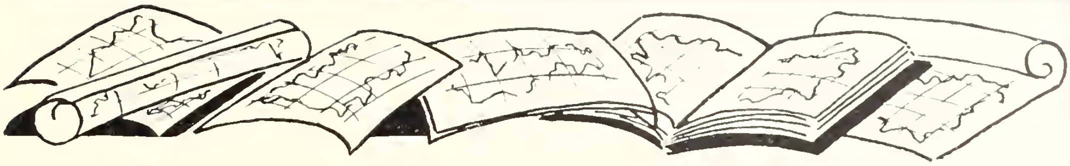
Orderly subdivision of the project lands can be speeded materially by release of entire tracts by landowners, who will still be assured of a farm after the lands have been divided. In this way they are given an incentive to sell their lands to the Government and through their cooperation bring about an earlier development of the area than would have been possible otherwise. Plans and studies which have been made of this vast project, known as "The Columbia Basin Joint Investigations," indicate that upon completion of the project, the total estimated population of the area will be increased to a third of a million people.

Topographic Maps Under Way

Commissioner Straus announced recently that topographic maps covering an area of more than 1,000 miles in the Feather and Yuba Basins in California are now in preparation. The work is being done under a joint agreement between the State of California and the Bureau. The maps will be used in making preliminary investigations, and later more detailed studies of irrigation works. Five counties, Nevada, Yuba, Butte, Sierra, and Plumas, are in the area to be mapped.

U. S. GOVERNMENT PRINTING OFFICE 1947

Reclamation's ATLAS



In ordering maps, please do not send postage stamps. Make check or money order payable to the Treasurer of the United States and address your order to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C. Please specify map number when ordering.

SMALL PROJECT MAPS

Showing Canals and Irrigable Areas

All-American Canal System, Calif., cld., 12½ x 17, #39-44—15 cents.

Belle Fourche, S. Dak., cld., 10 x 19, #23887—10 cents.

Boise, Idaho, cld., 11½ x 16, #42-3—15 cents.

Buffalo Rapids, Mont., cld., 11½ x 22, #40-48—15 cents.

Carlsbad, N. Mex., cld., 10 x 11, #23886—10 cents.

Central Valley, Calif., cld., 16 x 21½, #40-14—25 cents.

Columbia Basin, Wash., 10½ x 16, #39-84—10 cents.

Deschutes, Oreg., cld., 16 x 30, #43-1—25 cents.

Gila, Ariz., cld., 12 x 20, #39-93—15 cents.

Grand Valley, Colo., cld., 16 x 30, #45-40—25 cents.

Humboldt, Nev., cld., 10½ x 18, #40-54—15 cents.

Klamath, Ore.-Calif., cld., 16 x 20, #45-52—25 cents.

Kendrick, Wyo. cld., 10½ x 17, #24830—10 cents.

Lower Yellowstone, Mont.-N. Dak., cld., 10½ x 16, #46-30—15 cents.

Milk River, Mont., cld., 10½ x 24, #42-12—20 cents.

Minidoka, Idaho, cld., 8½ x 11, #23883—10 cents.

Minidoka-Gooding Division, Idaho, cld., 10 x 13, #23884—10 cents.

Newlands, Nev., cld., 10 x 13, #21444—10 cents.

North Platte, Nebr.-Wyo., cld., 10 x 20, #23510—10 cents.

Okanogan, Wash., cld., 8 x 10, #14424—5 cents.

Orland, Calif., cld., 8 x 10, #45-45—10 cents.

Owyhee, Idaho-Oreg., cld., 10 x 16, #23300—15 cents.

Rio Grande, N. Mex.-Tex., cld., 11 x 24, #19199—10 cents.

Riverton, Wyo., cld, 10½ x 17, #39-124—15 cents.

Shoshone, Wyo., cld., 10½ x 15½, #38-130—10 cents.

Shoshone—Garland Division, Wyo., cld., 10 x 15, #18988—10 cents.

Strawberry Valley, Utah, cld., 10 x 12, #46-16—15 cents.

Sun River, Mont., cld., 8 x 10, #27390—5 cents.

Tucumcari, N. Mex., cld., 10½ x 16½, #40-75—15 cents.

Umatilla, Ore., cld., 10 x 20, #21441—10 cents.

Uncompahgre, Colo., cld., 10 x 12, #23444—10 cents.

Vale, Oreg., cld., 10½ x 15½, #38-375—10 cents.

Yakima Basin, Wash., 10½ x 16½, #26376—10 cents.

Yakima-Sunnyside, Wash., cld., 12 x 23½, #40-77—15 cents.

Yuma, Ariz.-Calif., cld., 8 x 10, #2700—10 cents.

LARGE PROJECT MAPS

Showing Irrigation Canals and Laterals

All-American Canal System, Calif., cld., 22 x 30, #39-44A—25 cents.

Boise, Idaho, cld., 26 x 37, #41-25—25 cents.

Gila, Ariz., cld., 20 x 35, #39-93A—25 cents.

Minidoka, Idaho, cld., 17 x 22, #23883A—20 cents.

Minidoka-Gooding Division, Idaho, cld., 21 x 25½, #23884A—25 cents.

Newlands, Nev., cld., 21 x 27, #2144A—25 cents.

North Platte, Neb.-Wyo., cld., 23 x 44, #23600—25 cents.

Owyhee, Oreg.-Idaho, cld., 21 x 33, #23300A—25 cents.

Riverton, Wyo., cld., 22 x 36, #39-124A—25 cents.

Shoshone, Wyo., cld., 20 x 29½, #38-130A—25 cents.

Shoshone-Garland Division, Wyo., cld., 21 x 30, #18988A—25 cents.

Sun River, Mont., cld., 15 x 21, #27390A—10 cents.

Tucumcari, N. Mex., cld., 15½ x 25, #40-75A—25 cents.

Vale, Oreg., cld., 21 x 31½, #38-375A—25 cents.

Yakima-Kittitas Division, Wash., cld., 21 x 33, #24770A—25 cents.

Yuma, Ariz.-Calif., cld., 14 x 16, #23328—15 cents.

SPECIAL MAPS

Average Annual Precipitation in United States, cld., 10½ x 15, #44-1—free.

Boulder Canyon Project, vicinity of Boulder Dam, cld., 22 x 30, #40-40—25 cents.

Boulder Dam and Power Plant, 8 x 10½, #27400—free.

Boulder Dam and Vicinity, Ariz.-Calif.-Nev., 8 x 10½, #26170A—5 cents.

Panoramic Perspective of Boulder Dam Area, 8 x 10½, #47-3—free.

Same—larger scale, cld., 22 x 30, #38-408A—25 cents.

Truckee, Carson, Humboldt, and Walker River Basins, Nev.-Calif., cld., 18 x 24, #38-408—15 cents.

Utah Projects, Utah, 10½ x 14½, #46-10—15 cents.

Western half of the United States showing Federal Reclamation projects and seven regional boundaries, cld., 16 x 20, #47-1—free.

Uncle Sam Says

This is getting-ready time for my farmer nieces and nephews. Today's plowing and investment in money and labor may or may not pay off in rich crops. There's a big IF in every farm family's life. If the sun shines, if it doesn't rain too much, if we have a drought—if, if, if. However, there's one crop which has no "if" side. It's a crop of Savings Bonds, which grows steadily, rain or shine, wind or calm, year after year until it produces $4 for every $3. My city nieces and nephews can plant this crop, too, by joining and staying on the payroll savings plan or by arrangement with their bank.

U. S. Treasury Department

Editor's Note: The Inter-American Conference on the Conservation of Renewable Natural Resources, scheduled for Yosemite National Park May 5-18 has been indefinitely postponed. (See page 48, February Reclamation Era.)

Notes for Contractors

Contracts Awarded During February 1947

Specification No.	Project and State	Date of award	Description of work	Contractor's name and address	Contract amount
1469 [1]	Altus, Okla	Feb. 4	9 radial gates for Altus dam spillway.	Johnson Machine Works, Chariton, Iowa.	$16,250.00
1519 [2]	Yakima-Roza, Wash	Feb. 5	Electrical equipment for various pump areas.	Standard Transformer Co., Warren, Ohio.	86,911.00
1525	Minidoka, Idaho	Feb. 18	Electrical equipment for Burley and Rupert.	do	44,673.00
1531	Tucumcari, N. Mex	Feb. 14	Construction of laterals, Conchas Canal.	J. A. Terteling & Sons, Inc., Boise, Idaho.	875,759.75
1548 [3]	Fort Peck, Mont	Feb. 6	Electrical equipment for Fallon and Fallon relift.	Standard Transformer Co., Warren, Ohio.	17,878.00
1562 [1]	Central Valley, Calif	Feb. 19	Aluminum stairs, railings, and curbs.	Seattle Bronze Co., Seattle, Wash.	28,526.00
1571	do	Feb. 6	Structural steel cofferdam	American Bridge Co., Denver, Colo.	171,855.00
1575 [4]	do	Feb. 25	Electrical equipment for Ygnacio and Clayton plants.	Westinghouse Electrical Corp., Denver, Colo.	16,206.00
1589	Deschutes, Oreg	Feb. 3	Construction of laterals and sublaterals.	Adler Construction Co., Redmond, Oreg.	165,300.00
1592	Yakima-Roza, Wash	Feb. 27	do	C. T. Malcom & Co., Portland, Oreg.	47,138.75
1593	Hungry Horse, Mont	Feb. 6	Construction of exploration tunnels at dam site.	Benson, Douglass & Bissell, Coram, Mont.	16,928.00
1594	do	Feb. 10	Finishing floors and painting 50 houses.	Puget Sound Painters Inc., Seattle, Wash.	13,090.00
1596	Boise-Payette, Idaho	Feb. 14	15-ton traveling crane and lifting beam.	Judson Pacific-Murphy Corp., San Francisco, Calif.	11,719.00
1603	Colorado-Big Thompson, Colo.	Feb. 18	Construction of Brush-Sterling-Holyoke lines.	Utilities Construction Co., Nashville, Tenn.	458,011.00
1605 [5]	Boulder Canyon, Calif	Feb. 14	Radial gates and hoists	Pacific Coast Engineering Co., Alameda, Calif.	13,070.00
1612	Davis Dam, Ariz.-Nev	Feb. 28	Construction of warehouse building.	W. S. Ford, Kingman, Ariz	129,965.00
1613	Yakima-Roza, Wash	Feb. 7	2 turbine driven pumping units.	The James Leffel & Co., Springfield, Ohio.	32,497.00
1614	Columbia Basin, Wash	Feb. 13	132 main unit trashracks	Joshua Hendy Iron Works, Sunnyvale, Calif.	36,300.00
1616	Parker Dam Power, Ariz	Feb. 21	Fabricated structural steel	Emsco Derrick & Equipment Co., Los Angeles, Calif.	34,563.00
1617	Central Valley, Calif	Feb. 28	Construction of timber bridge and weir, Fresno River.	Munn & Perkins, Modesto, Calif.	30,650.00
1635	Davis Dam, Ariz.-Nev	Feb. 20	15 bulkhead gate frames	Schmitt Steel Co., Portland, Oreg.	18,350.00
67,500-A	Missouri Basin-Gering	Feb. 21	Bare aluminum stranded conductor.	Aluminum Co. of America, Washington, D. C.	193,937.97
67,500-D	do	Feb. 21	Poles for Gering-Sidney transmission line.	J. H. Baxter & Co., San Francisco, Calif.	124,827.35
E-33,060-A	Central Valley, Calif	Feb. 28	Conductor cable for Keswick and Shasta.	General Electric Co., Denver, Colo.	74,428.51

[1] Item 1. [2] Schedules 1 and 2. [3] Schedule 1. [4] Schedule 2. [5] Schedules 2, 3, and 4.

MAY
1947

Featuring:

●

A CENTURY OF IRRIGATION

by

Dr. John A. Widtsoe

●

WATER FORECAST

(*See;* "The Fortune Tellers," p. 113)

●

HOMES FOR VETERANS

THE *Reclamation* ERA

Reclamation ERA

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NEWS ROUND-UP

Kings River Report Goes to Congress

President Truman has sent to Congress the War Department's report on the division of costs between the irrigation and flood-control features of the Kings River project, California. At the same time the Bureau of the Budget authorized the release of the impounded construction funds previously made available to the War Department so that the work could go forward. Secretary of the Interior J. A. Krug concurred in Secretary of War Robert Patterson's recommendations after a series of conferences to adjust differences. The War Department has agreed that the project will be operated initially for flood control only. Its operation for irrigation is dependent upon the negotiation of repayment contracts by the Bureau of Reclamation.

Colorado-Big Thompson Contract

With the award of the 4-million-dollar-plus contract for the Granby pumping plant, the water supply for Colorado-Big Thompson water users became a step nearer realization. This pumping plant will be built between Granby and Grand Lake, Colo., and will lift water into Shadow Mountain and Grand lakes to the Alva B. Adams Tunnel for diversion to more than 600,000 acres of inadequately watered lands on the eastern slope of the Rocky Mountains.

Contracts were recently awarded for the Brush-Sterling 115,000-volt and the Sterling-Holyoke 69,000-volt lines on the Colorado-Big Thompson project. The successful bidder was the Utilities Construction Co. of Nashville, Tenn., and the money involved amounts to almost half a million dollars. The Brush-Sterling line will be approximately 37 miles long and will run from a tap near Brush, Colo., to Sterling, Colo. The Sterling-Holyoke line will be approximately 48 miles long, from the Sterling substation to a substation near Holyoke, Colo. Aluminum conductor wire will be used in both lines.

Conchas Canal Nearing Completion

Contract for constructing laterals and building a 3.3-mile section of the Conchas Canal, Tucumcari project, N. Mex., was recently awarded to J. A. Terteling & Sons of Boise, Idaho. This marks the next to the last section of the canal to be built. When this section is finished, the job will be approximately 80 percent complete.

The work proposed will extend the Conchas Canal to the Hudson Canal. It involves the excavation of more than a quarter million cubic yards of materials, provides for placement of nearly 5,600 cubic yards of concrete, the installation of 15,400 lineal feet of concrete pipe, more than 240 tons of reinforcement bars, and other metalwork. The project will provide irrigation facilities for approximately 45,000 acres of land now generally used for grazing and some dry farming, and will provide irrigated farms for about 560 families.

OUR FRONT COVER

Cherub and Cherry Blossoms

Little Nancy Lee Davison, surrounded by these beautiful blossoms, is our idea of the perfect spring portrait. The youngster, whose photo was taken as she stood on a canal bank in the Emmett Valley, is the daughter of Mr. and Mrs. Dave Davison, of Emmett, Idaho. She may not realize it now, but the 83,500-acre area where she is taking up a minimum of space will eventually receive supplemental water from the Cascade Dam, a feature of the Boise, Idaho, project. This structure as planned will be an earth- and rock-fill dam approximately 90 feet high and 700 feet long.

(This timely photo was taken by Stanley Rasmussen with the aid of Phil Merritt, Region 1, on April 7, 1947.)

Economy in Action

The Bureau of Reclamation has recently ordered a universal testing machine for its laboratories in Denver, Colo. The new machine will be used for testing items used in construction which have unusual or complicated shapes. Engineers have expressed the belief that as much as 25 percent in the cost of some materials can be saved through more accurate testing. The machine will be of the vertical hydraulic type and have a capacity of 5,000,000 pounds in compression, and 5,000,000 pounds in tenson. Its cost is slightly in excess of $400,000 and will be built by the Baldwin Locomotive Works of Eddystone, Pa. In the past the Bureau used a smaller machine, the property of the Bureau of Standards, for some of the necessary tests, but it has deteriorated since its installation in 1931 and has proved inadequate for making a great number of the tests the laboratories were called upon to perform.

Fourth Veteran Land Opening

Applications were closed on April 25 for 43 public land farms embracing 3,226 acres on the Gooding Division of the Minidoka project in Idaho. Qualified veterans whose applications are approved will be given an added incentive in the form of a "bonus," to make good on this project. Each entryman will be entitled to two former barracks buildings free of charge from the evacuated War Relocation Authority camp in the area. These can be converted into living quarters and farm buildings. In addition to the barracks buildings, the center offers free personal equipment, including small tools, toilet fixtures, tables, chairs, sewing machines, army blankets, and other necessities of life.

This brings the total acreage of reclamation lands to be awarded by the Bureau since the war to 20,193 or a total of 240 farms for veterans. At Gooding, this is not all raw land. Some of it has been farmed by Japanese internees during the war. Future land openings proposed by the Bureau as soon as funds become available and construction progresses sufficiently, include additional lands on the Klamath, Oreg., and Shoshone, Wyo., projects, and public land on Yuma and Gila, in southwestern Arizona, and the Riverton project, in central Wyoming. Information on the availability of public and acquired lands can be obtained from the Commissioner, Bureau of Reclamation, Washington 25, D. C.

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Anniversary Issue

One year ago, with the May 1946 issue, the Reclamation Era returned after a 4-year absence, voluntarily imposed upon itself as a wartime measure. No fanfare accompanied its revival. During the past year we have attempted to continue the high standards of editorial content, technical accuracy, and attractive format which distinguished former issues of this magazine since its inception in 1905. We have attempted to present useful and interesting information to persons concerned with the various aspects of the reclamation program, particularly the water users of the West. We have tried to include material which will be helpful in interpreting the policies and practices of the Bureau of Reclamation and assist the reclamation farmers in their important job of operating and maintaining their farms to their ultimate capacities. That we have succeeded to some extent is apparent by your many letters to us. However, we want to continue to improve this magazine, as reclamationists all over the world want to perfect their operations. Let us know your likes, your dislikes, your gripes, and your special interests. We will continue to be guided by your wishes—for this is your magazine, devoted to reclamationists here and abroad—and according to our mailing lists that includes a large audience, high school students, members of chambers of commerce, construction engineers, Congressmen, agricultural groups, sociologists, economists, and manufacturers. We want to hear from our audience—the boo's and the applause will help us adjust our performance to suit your needs.

—Ruth F. Sadler, *Editor.*

Single Copies of the *ERA Available*

For the benefit of our subscribers and others who would like to purchase individual copies of particular issues of the Reclamation Era, the following rates have been established:

	Cents
1 copy	15
6 to 9 copies	12
10 to 50 copies	10
50 or more copies	8

A limited number of back copies are available, except for the September 1946 issue.

Make out check or money order to the TREASURER OF THE UNITED STATES and send request to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. Please do not send stamps. For small orders, coins will be accepted.

Do You Plan To Move?

If so, please notify the *Reclamation Era* so that you may continue to receive your copy regularly.

Regional Director E. B. Debler, of Region VII, Denver, Colo., who retired April 30, was replaced by Assistant Director Avery A. Batson, who was designated acting regional director.

Letters to the Editor

Good Ideas From Engineers

2027 South Washington Street,
Denver 10, Colo.,
February 25, 1947.

Dear Editor: Membership of our local No. 128, which is affiliated with the American Federation of Labor, consists largely of technical personnel of the Denver Office of the Bureau of Reclamation. As employees of this agency we are interested in promoting a better understanding of the work which the Bureau of Reclamation is doing.

It has been noted on several occasions at our regular monthly meetings that the Reclamation Era has served very well as a medium for disseminating interesting yet factual information on activities of the Bureau.

Our organization is interested in sponsoring subscriptions to the Reclamation Era. These subscriptions are to be sent not to individuals but to (1) colleges and universities from which our members graduated and (2) union locals throughout the United States who are affiliated, as we are, with the International Federation of Technical Engineers, Architects, and Draftsmen's Unions.

At this time we do not know how many subscriptions this program may require. However, I have been directed by the executive committee to inquire as to rates for 50 1-year subscriptions as a starter. In notifying prospective recipients of the Era we will be happy to acknowledge any concessions made in subscription rates if you desire.

Very truly yours,

Lysle L. DeLong, *Secretary,*
Denver Association of Federal Engineers and Architects, Local No. 128.

¶Other organizations interested in reclamation, please copy!

Reclamation Era's subscription rate ($1 a year, special rate of 50 cents a year for members of water users associations) is already far below the price required for comparable publications. While this charge still exists, we hope similar plans can be worked out to boost the circulation of this magazine, which is published by and for reclamationists, and will grow or shrink according to the support you give it.—Ed.

Token From Texas

P. O. Box 447,
Ysleta, Tex., March 21, 1947.

Dear Mrs. Sadler: My husband and I wish to thank you for the very nice write-up we received in the March issue of Reclamation Era. It was a splendid article and we appreciate it very much.

Yours very truly,

Elma G. Warnock.
(Mrs. Francis J. Warnock).

¶Don't thank *us.* "Money-Making 'Mums' " (March 1947 Era) caught the eye of many readers who became new subscribers, and the favorable comments keep coming in. The Era is always on the look-out for interesting and useful articles like this on the experience of people on reclamation projects.—Ed.

Unofficial Ambassador

West Yellowstone, Mont.,
February 24, 1947.

Sir: In a district in Norway, Nordtrondelag (of 52 communities, if I am right), as in many others, sufficient power is in harness by now to light, heat and power the whole "works."

To a paper there (of the same name) I have sent a correspondence every year or so, by way of a "hello, folks," and this winter, too, when I have a quiet hour, I shall repeat. I have fancied that those parts might like to hear about power developments in the United States, a letter which would be the more welcome if accompanied by a cut or two. Could I have your permission to cut out, say, the "before and after" illustrations of the Black Canyon and Boulder Dam, appearing in the Reclamation Era, for reproduction in the mentioned district paper, of course giving source and credit?

Norway now looks forward to the day when she will be able to export power to Sweden, Denmark, and even England after her own needs are met, and is working at it as fast as her breath holds out. Without the waters around it, and running down it, that little country's fate would be sealed and laid away.

All my thanks for giving consideration to this peculiar request.

Respectfully,

H. T. Berg.

¶Request not peculiar, but typical. Era's photographs are gladly forwarded for reprinting—especially for such a worthy cause as helping to forge another link in the chain of international cooperation on matters pertaining to reclamation.—Ed.

For Your Art Collection

Write to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C., for photographs suitable for display or framing which appear in this issue. *This does not apply to photographs which carry outside credit lines.*

Contact Prints, single weight glossy paper, are available at the following prices *only if size of negative permits.* Most Bureau of Reclamation negatives are 8 by 10 inches.

	Selling price (each)
4 by 5 inches (or smaller)	$0.15
5 by 7 inches	.20
8 by 10 inches	.40
Enlargements:	
4 by 5 inches (or smaller) single weight glossy	.25
5 by 7 inches single weight glossy	.40
8 by 10 inches single weight glossy	.60
11 by 14 inches single weight glossy	1.25
11 by 14 inches double weight mat	1.50
16 by 20 inches double weight mat	2.50
20 by 24 inches double weight mat	3.00
24 by 30 inches double weight mat	5.00
24 by 36 inches double weight mat	6.00
30 by 40 inches double weight mat	8.00
	Per sq. ft.
Over 30 by 40 inches double weight mat	$0.85

Main Street, Salt Lake City, 1861.

Scene, the same—time, the present.

A CENTURY OF IRRIGATION

by Dr. John A. Widtsoe

THE ANCIENT ART OF IRRIGATION celebrates this year (1947) the hundredth anniversary of its modern birth in North America.

Irrigation was practiced on this continent in prehistoric days, as abundantly shown by the remains of ancient irrigation works. In later days, after Columbus, some native irrigation continued, and the Catholic padres, knowing irrigation from their Spanish days, set up irrigated missions, as in California, to assist them in their missionary activities. Up to 1847, however, all irrigation, except for an occasional ranch, was for primitive people, conforming to primitive needs.

The Mormon pioneers who entered the Great Salt Lake Valley in 1847, belonged to the civilization that Anglo-Saxon peoples had won for themselves through centuries of struggle. The gains of that civilization they must maintain. The stark desert must be subdued, but not at the price of civilized life and living. Somehow, they must hold on to the social, economic and spiritual possessions on the conquered desert as well as they had in humid regions. That was the challenge to the pioneers of 1847—to build communities of modern, civilized people under the ditch, comparable or superior to those in the rainfall regions from which they came. That accomplishment is in mind when we speak of modern irrigation.

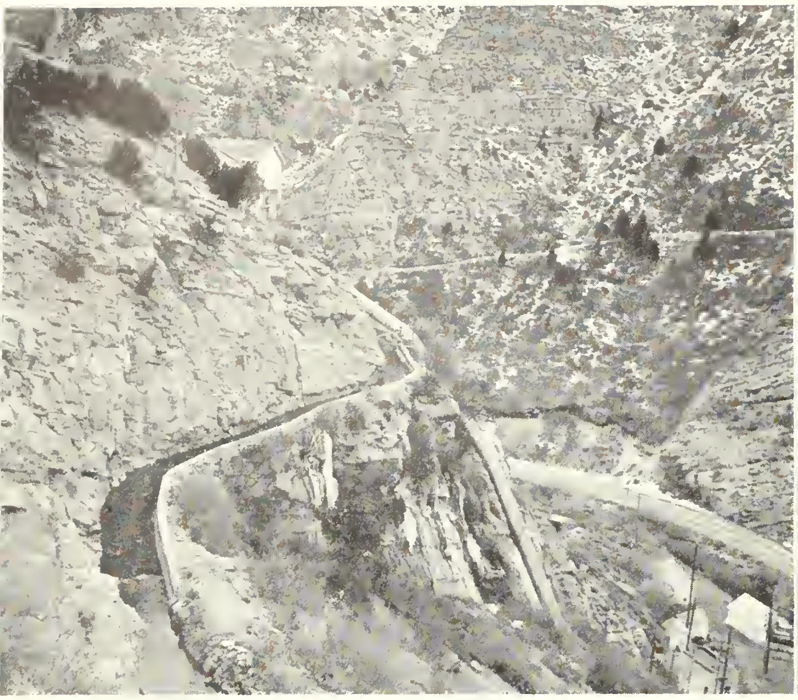
So, within a day of their arrival, they led water from City Creek to a patch of plowed ground, and planted a bushel of potatoes. The pioneers needed food. Would the desert yield it? That was their question. They did not realize that when they made that miniature ditch that day, they created an epoch-making event in the history of the United States, and for many a far-flung country. It was the infant beginning of the later mighty dams and canals that now make the western United States a fortress of strength in the union of commonwealths. That thrilling moment may well be celebrated by poet, painter, and sculptor.

Dr. John A. Widtsoe.

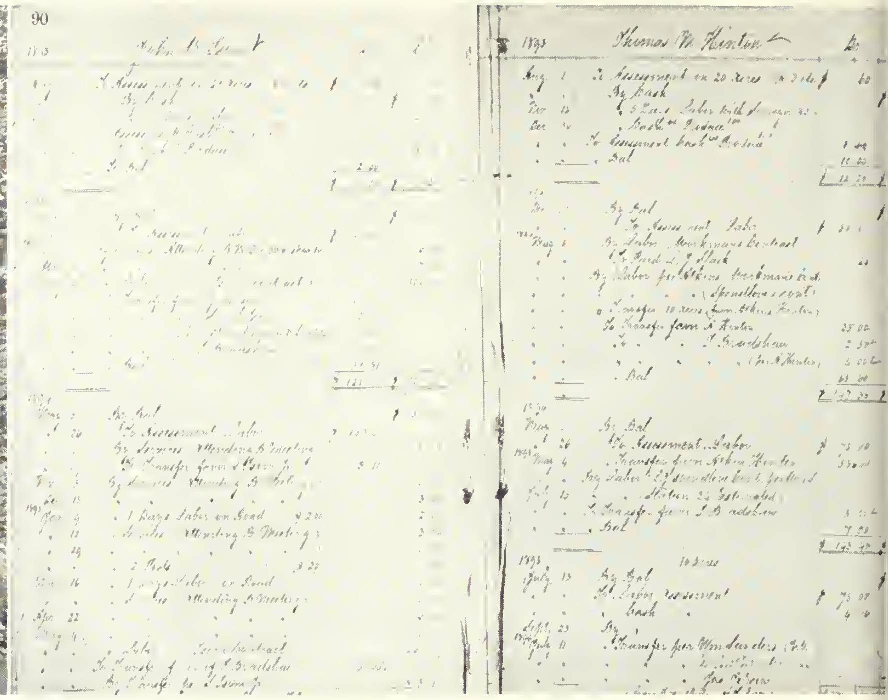
Soon, in good earnest, irrigation canals were projected and dug. There were few surveyors. Often the course of a canal was planned by sighting over a glass filled with water. Occasionally the results were disastrous as when the end of the canal was higher than the beginning.

There were no contractors to make bids for the work. The people, with limited tools, had to build the canals and the necessary structures themselves. That meant cooperation. Each man dug his own share of the canal, enough to irrigate the land assigned to him. Altogether, when the work was finished they looked with gratitude upon the desert-conquering, food-producing canals which they themselves had built. The common enterprise, successfully completed, made them as one. That was a step forward in the higher civilization.

After 18 years, about 1865, nearly 150,000 acres were under irrigation. 1,000 miles of canals had been dug, and nearly 65,000



Logan-Hyde Park-Smithfield Canal, carved out of solid limerock in 1861 and 1862, is still delivering water.



Balance sheet of Hurricane Canal Co., showing how labor at $2 a day was credited against assessments in return for water shares.

persons were living in fair comfort on the reclaimed land.

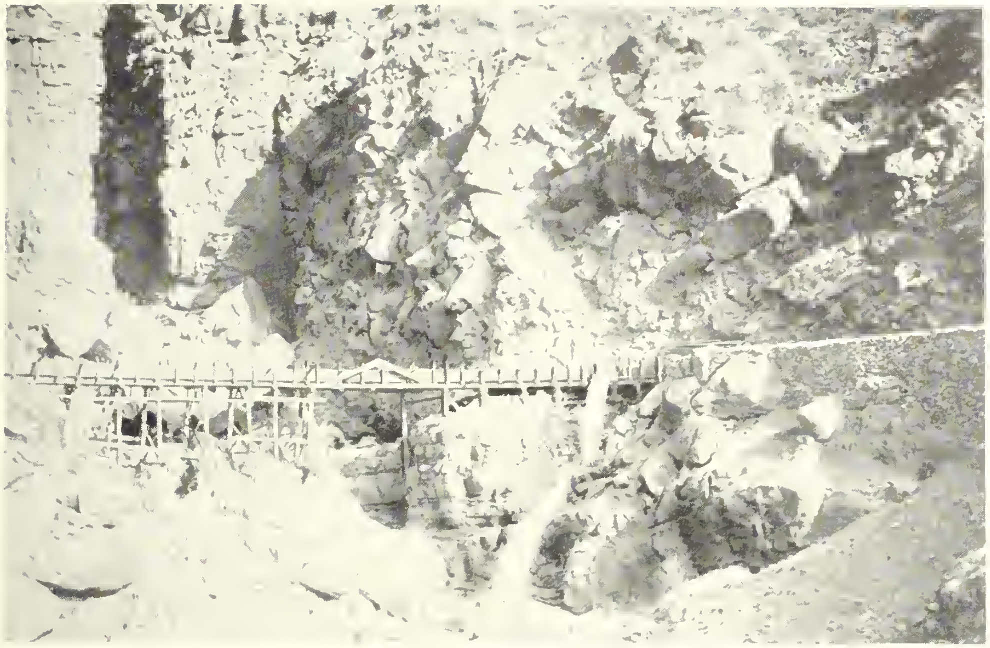
However, whenever water was diverted from the natural course of a stream, it was in violation of an ancient, well established common law. For centuries society had decreed that no person had the right to disturb the natural flow of a stream. That was the time-honored and respected law of riparian rights. Obedience to it would make irrigation practically impossible. The law of self-preservation is above all other laws. The pioneers, therefore, promptly abrogated the older law and set up the law of beneficial use instead. The waters of a stream belong to those who by legal means of appropriation divert or otherwise make economically beneficial use of them. This has become the legal basis upon which the reclamation of the arid and semiarid region of the United States has proceeded. Without this basic doctrine, there would have been no irrigation development.

Many farmers owned one canal and the water flowing through it. That raised a host of problems. How much water should be allotted to each acre of productive land? This made necessary a lawful distribution of the canal water among many users. This in turn required water masters, supervisors, or ditch riders. In the very nature of irrigation, every farmer fears a water shortage, and becomes an incipient water hog. Human problems followed the canal.

Then, too, questions arose when there were transfers of property. Did the water right go with the land, or was it a type of property, independent of use on certain lands? Whose duty was it to clean the canal? The problems involved in what is now termed "operation and maintenance" found their way into the laws of the terri-

Salt Lake City's Eagle Gate, 1861—note irrigation water lower left.

Present day view of same spot. Jordan and Salt Lake Canal now flows beneath street.



This wooden trestle, flume, and high rock masonry carry Hurricane Canal water across a deep wash.

Hurricane Canal emerging from one of nine tunnels in its 8-mile course.

tory. Before long a code of legal regulations was established, which formed the sound foundation of our present irrigation practices.

The pioneer irrigators paved the way to irrigation success by their cooperative labors, by shattering the law of riparian rights, and by setting up rules and regulations by which civilized communities could live happily under the ditch. In view of recent studies, it is remarkable how well, without knowledge of Italian and Spanish irrigation practices, these questions were answered by the pioneers.

It was nearly a quarter of a century (1870) before serious attention was given by other people to the irrigable West. In 1870, the Union Colony of Colorado, an irrigation project on a community scale, was founded under the influence of Horace Greeley. It drew heavily upon the experience of the Utah settlement. Other irrigation colonies followed. Irrigation was moving toward the highway. America was discovering the West. In 1878, John Wesley Powell gave the westward movement impetus by his report on the arid lands. From 1870 to 1880, the population of the Mountain States doubled; from 1880 to 1890 it almost doubled again. It has continued to increase ever since; and always on the basis of irrigated lands. The irrigation story of those years was not always that of success. Uninformed investors, and dishonest exploiters appeared and met failure. But, in the main there was constant progress.

Hurricane Bench, 1904, before irrigation.

Hurricane Bench as transformed by irrigation from Hurricane Canal.

In the decade 1890 to 1900, when the agricultural experiment stations got under way, there appeared the beginnings of the experimental study of the farmer's practice of irrigation. Irrigation engineers were on most of the western station staffs. The use of water had followed practical experience which might be misleading when factors of soil, crops, and climate were not considered. The United States Department of Agriculture set up an office of irrigation investigators to help the irrigation farmer. In 1901 the Utah station began an elaborate investigation of the relationships among water, crops, and soils. Out of these experimental efforts has come much new knowledge, laws of nature, of benefit to the farmer under the ditch. The notable personalities engaged in this work have made American history.

Then the Government of the United States undertook at last to champion the cause of irrigation. The Newlands Congressional Act of 1902 provided that irrigation works, beyond the easy reach of the ordinary cooperative methods, might be constructed with Federal funds, the investment to be repaid gradually, the first specified period being 10 years, by the farmers. As a result of this and supplementary acts, 54 projects have now been built, yielding water to more than 4,000,000 acres of land, and serving nearly 100,000 families. Under the direction of the Bureau of Reclamation, an empire, uniting the two seacoasts of America, has been built. Some of the works are wonders of the world, such as the pioneers did not dare to dream about.

At the beginning, this Government venture was almost wholly in the hands of engineers, who were instructed to look for suitable combinations of available water and land. Little or no attention was given to soil nature or quality. When the projects were completed, they were opened to all citizens, irrespective of fitness to farm under the ditch or anywhere else. As a result, minor financial and human disasters added to the store of experience, which led to a fuller consideration of the many factors that operate to make a successful irrigation enterprise.

It was early evident that if farmers beginning with raw land should repay construction costs in 10 years, only a few projects could be built. The period of repayment was, therefore, extended to 20 and then to 40 years. Nowadays people are thinking of a period of repayment, proportioned to the cost of construction, that may entail two generations of a family, and approximate a modest annual tax. Moreover, power, which has come to be an important element in the Nation's economic life, is now being given careful attention on many of the Government projects. Power revenues will aid greatly in repaying the Government for its investment in irrigation works.

We have learned much irrigation lore since the men of 1847 resolved to tame the desert, and diverted water through their tiny ditch from City Creek to plant a bushel of potatoes. We know now that irrigation and colonization go hand in hand: that the project must be adequate to enable the farmer to make repayment; that it is best to select settlers suitable for life under the ditch; to give the farmers help, chiefly by demanding from them no more than they can reasonably do; and to organize the people under the ditch as communities having, as a common cause of interest, the structures that supply them with water. And we have learned to bring other, perhaps lesser, forces into operation.

The progress of irrigation in a hundred years has been beyond our wildest dreams.

Now we look to the future. The engineer must harness the great quantities of unused water; he must also eliminate from canals and ditches the losses by seepage that destroy areas of fertile lands. The farmer must learn the law under which water enables plants to grow, and to reduce the waste that comes from superfluous irrigation. He must also plant suitable, intensive crops, the income from which will meet the overhead costs of irrigation structures, and labor in applying water on the farm.

Our irrigation problems are today as important as those that faced the pioneers 100 years ago—but we have more knowledge and techniques with which to solve them.

Dr. Widtsoe points to the Jordan and Salt Lake Canal, one of the earliest in Utah.

ABOUT THE AUTHOR

John A. Widtsoe, Ph. D., LL. D., is a member of the Council of the Twelve, Church of Jesus Christ of Latter Day Saints, and past president, Utah State Agricultural College, and the University of Utah. He performed a valuable service for the Bureau of Reclamation as Secretary and Vice-chairman of the 1923 Fact Finding Commission, which investigated the operations of the Reclamation Bureau (then the Reclamation Service) from the beginning, and reported the studies on April 10, 1924, in the document, Federal Reclamation by Irrigation. On the basis of this publication, the Congress passed, on December 5, 1924, an act designed to help settlers on Federal irrigation projects make repayments and to make future Federal irrigation development more secure. This act is commonly known as the Fact Finders' Act of 1924. He was appointed to this commission by Secretary Hubert Work of the United States Department of the Interior. Dr. Widtsoe is also the author of Dry Farming, The Principles of Irrigation Practice, Success on Irrigation Projects, and many other documents pertaining to irrigation.

CORRECTION—East should become West

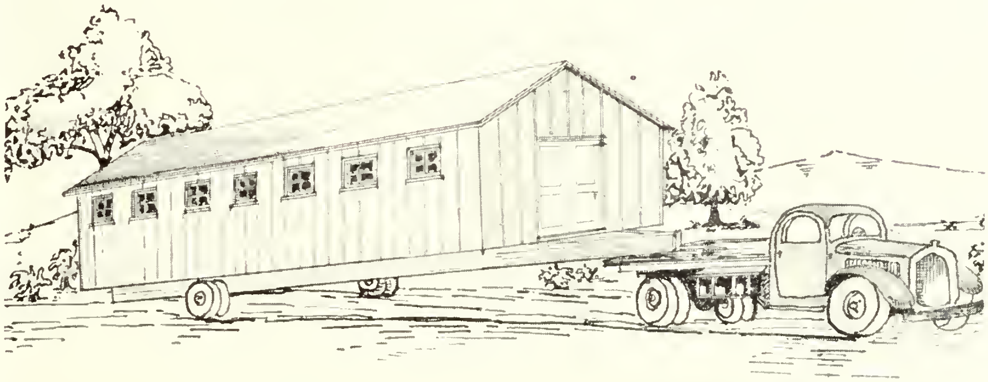
The illustrations of the East and West portals of the Alva B. Adams tunnel, appearing on the center spread of the April issue for the article, "Colorado-Big Thompson Project" were transposed. The photographer for the pictures appearing on page 87 was Arthur Fawcett, Region VI.

Homes For Veterans

Designs for living on a Reclamation farm, plus material and equipment, will add up to attractive and efficient homes for veterans of World War II and their families, who are now settling on Reclamation lands.

by Carl J. Thye

Branch of Operation and Maintenance, Washington, D. C.



Conversion convenient—if moved as is.

VETERANS! How would you like to have one of the homes shown on pages 104 and 105?

It won't be easy, but it is quite possible to build a tailor-made home to fit your needs out of the material and equipment made available to you under the Interior Department Appropriation Act for the fiscal year 1947 (Public Law 478, 79th Cong.). This act provides that certain properties such as land, buildings, equipment, and furnishings transferred from the War Assets Administration to the Bureau of Reclamation, be made available first to veterans who have been awarded farm units on public land opened for entry during 1946 and 1947.

You can live in these buildings temporarily, select your favorite architectural design, and although the result will depend primarily upon you and your own self-sufficiency, the Bureau of Reclamation will help you over the tougher hurdles.

Under the Bureau's plans, each settler will be given, free of charge, either two barrack-type buildings, or one barrack and the equivalent in small farm buildings, such as chicken houses, hog houses and other miscellaneous buildings, which can be moved bodily or in sections to the new farms—or entirely dismantled for moving. (See *The Bureau Reclaims Its Own* in the April ERA for the story behind these barracks.)

You will be wise if you have the buildings moved in sections suitable for the size house you need. To help you decide this vital question, the Bureau of Reclamation has prepared sketch plans showing one-, two-, and three-bedroom houses which can be constructed from these barrack buildings. Also, farm homestead lay-out sketch-plans have been prepared, and all of these will be made available to successful entrymen to help them make the most of the buildings presented to them. The sketches included with this article are typical of the suggested plans. You don't have to be an expert in designing and constructing buildings to follow these plans.

Particular attention has been given to the planning of the farm home so that it may be attractive and convenient to the business of farming. The home becomes the office of the farm business. In a farm home, usually the kitchen is considered the most important room in the house. It is literally the headquarters of the homemaker. Here all the meals are prepared and served, home-grown foods are prepared and canned, young children play here during the day, and in the evening it becomes a study hall for the older children.

In the winter, the cook stove furnishes much of the heat for the house and for heating water. An auxiliary work area to the kitchen is very important. This may be a part of the basement. Here wet laundry may be hung to dry in cold weather, farm products canned, milk separated, meats cut up, lard rendered.

Space for heating plant, fuel room, work shop, and a place to leave chore clothes before entering the house should be provided in this space. A basement should be a wish of all settlers as it becomes a most important part of the home, and can be constructed at minimum cost. It is important that the walls be made moisture proof, with enough window area to insure abundant light and ventilation. Stairs should lead to the yard as well as to the main floor of the house.

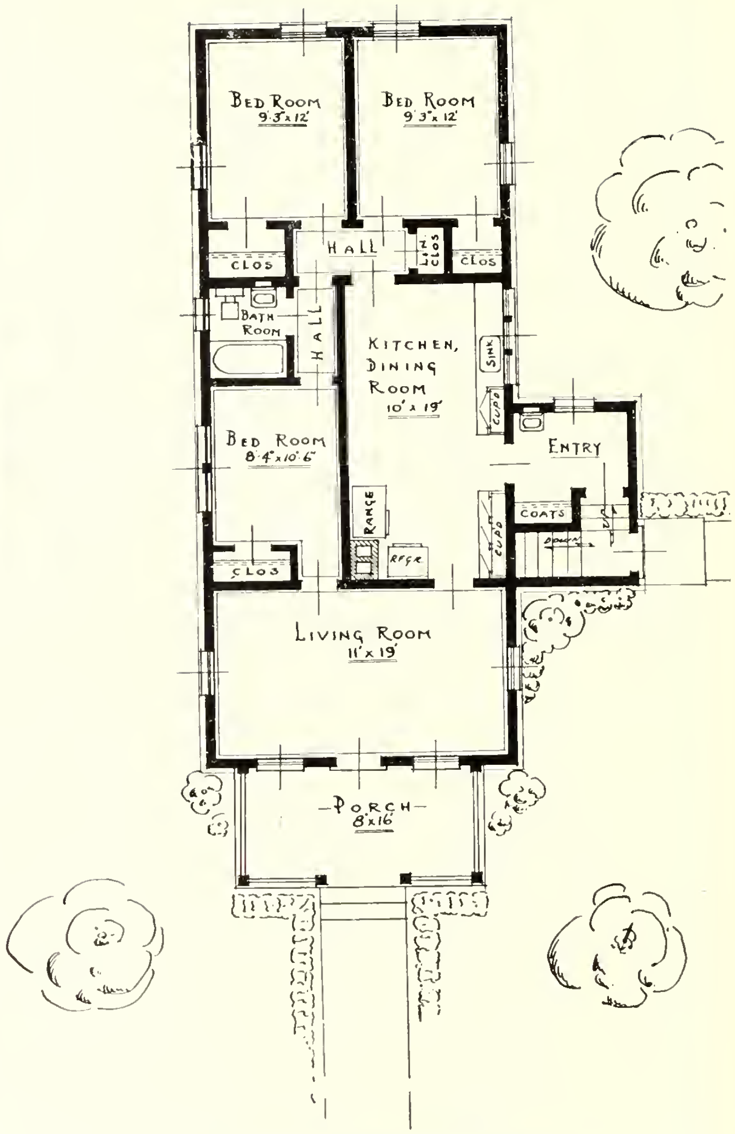
The living room is the center of leisure-time activity. Here the family reads, listens to the radio, entertains friends. House plants can be grown in the sunny windows.

The bedroom should be large enough to accommodate twin beds, or one double bed, and a child's crib. They should be on the side of the house to secure the best ventilation, and be as near the bathroom as possible.

The mode of life of new settlers will be characterized by a large degree of self-sufficiency; this especially is true in new land settlement areas. It is quite possible that most of the settlers will be young people and in many cases the brides may be city

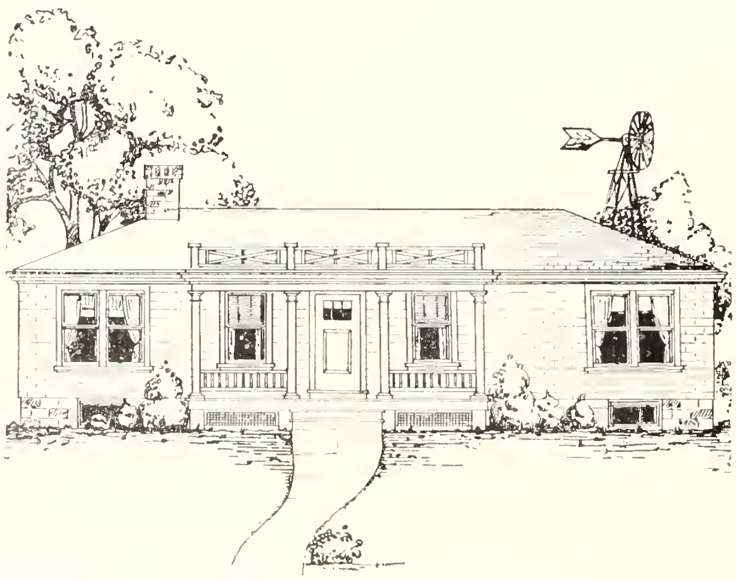
(*Continued on page 105*)

Build your own home from barracks like these.

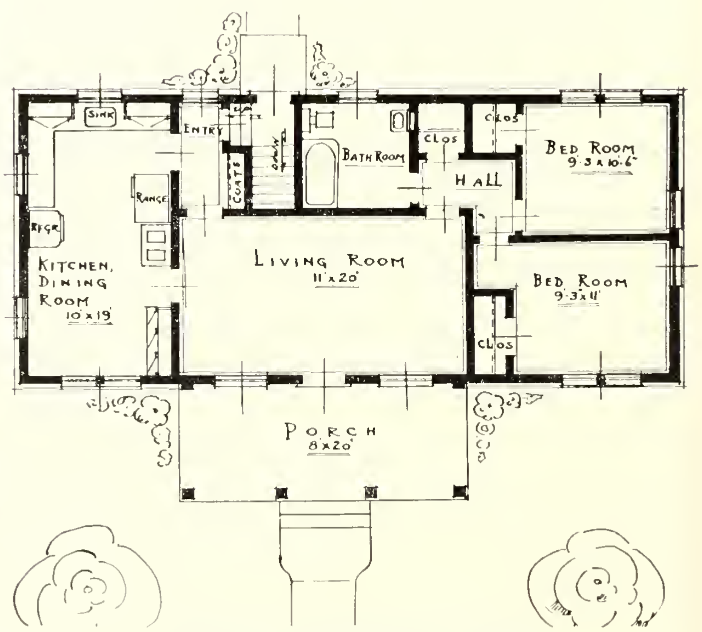


Floor plan—three-bedroom house.

Front elevation—three-bedroom house.

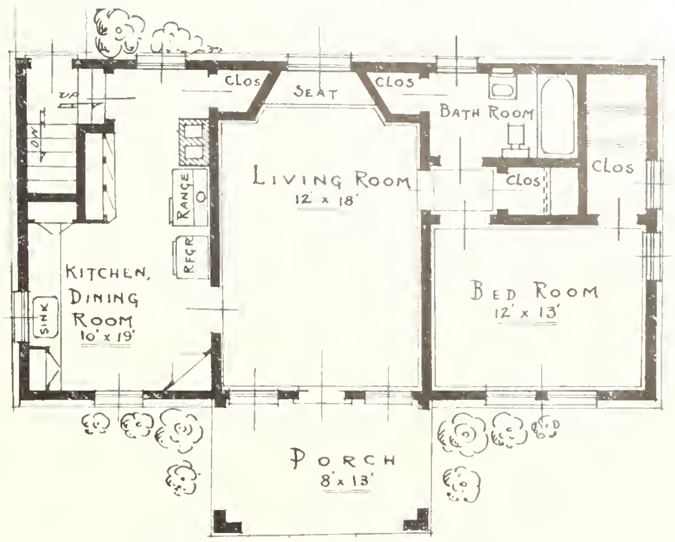


Front elevation—two-bedroom house.



Floor plan—two-bedroom house.

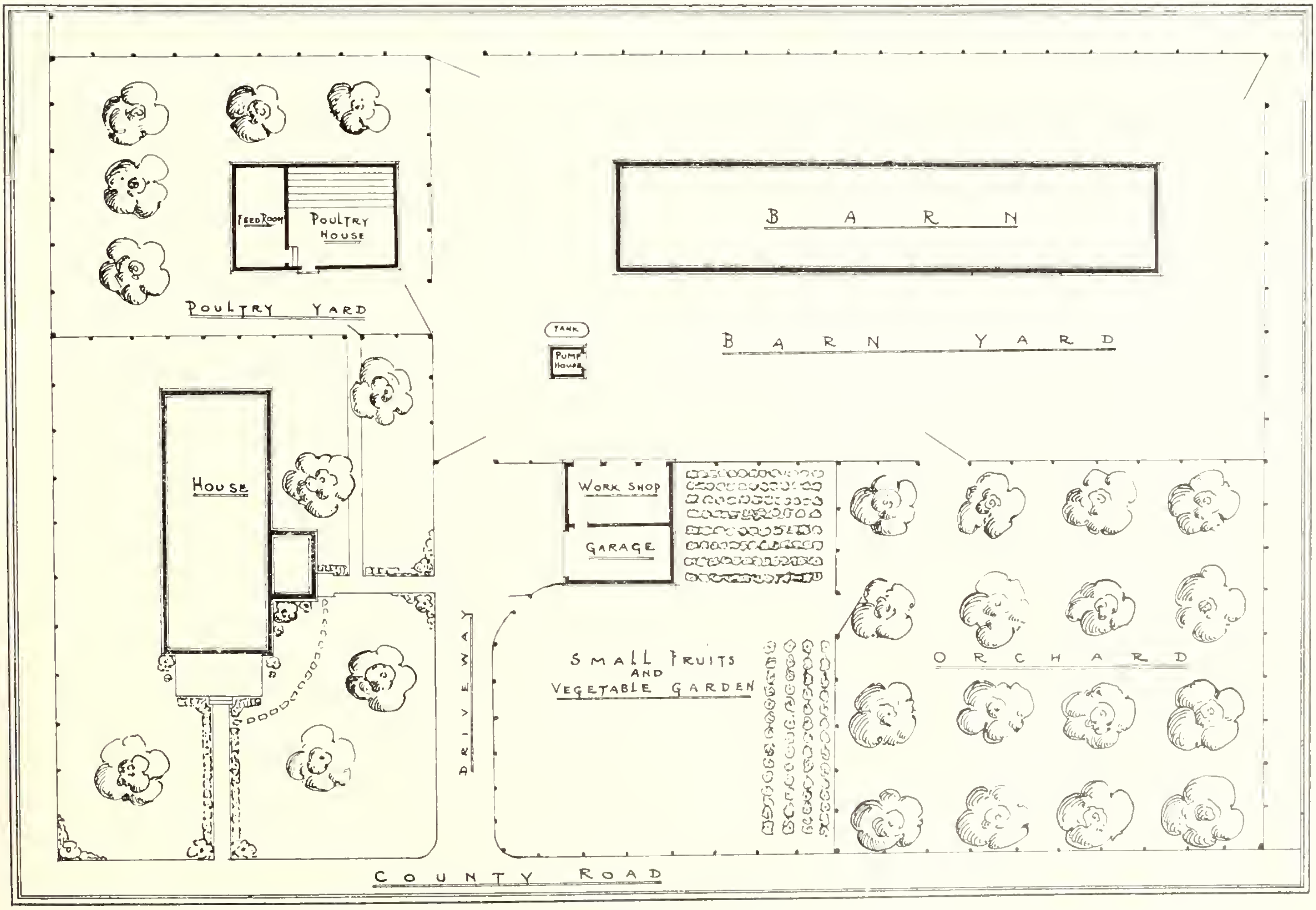
Front elevation—one-bedroom house.



Floor plan—one-bedroom house.

girls, coming to farms for the first time. It is essential that their new homes be made attractive so that they will learn to adopt the farm mode of living, and be happy to stay on these homesteads and help build a new community. It will be important for settlers to cooperate with their neighbors in order to make the maximum use of their labor resources. They will have to purchase materials and equipment to complete their farm structures, but the cost of farmstead buildings with certain accommodations can be held to a minimum, if the materials at hand are carefully selected and used in the proper place. Appreciable savings in cost of these materials and equipment can be realized through volume cooperative purchasing.

You are not the first entrymen on Reclamation farms, and there is plenty of help and advice available. Now, what will it be– blue or green shutters for that future home? The Bureau will not advise on that point. Leave it up to the Missus.



Homestead layout plan.

DATE SPREADER

A "gadgeteer" at work.

"Air conditioned" dates.

The Reagan's, of Phoenix, Ariz., invent a new gadget and reduce spoilage and harvesting costs in their date gardens.

by Ralph O. Baird,

Reclamation Economist, Phoenix Office of Project Planning, Region III, Phoenix, Ariz.

NECESSITY has mothered another invention. This time the event occurred at the M. F. Reagan residence at Forty-Eighth Street and East McDowell Road in Phoenix, Ariz., where Mr. Reagan and his son, Carl, have developed a gadget to reduce spoilage in their date garden.

Humidity, the bane of all date growers, has been causing rather severe losses in Phoenix gardens the past few years, and 78-year-old Mr. Reagan decided it was time he did something about it. After trying several models he has perfected a wire spreader which, when inserted in the fruiting frond, opens the bunch and permits the free circulation of air around the ripening dates.

This device consists of a wire ring 9 inches in diameter, on which two wires are attached. The four ends are bent around the ring equal distances apart and extend spoke-like 2 inches beyond the perimeter. The centers of the wires are joined about 10 inches above the ring to form a conical apex.

A hollow sheet metal cone with a handle in its fluted and turned-back base is used to insert the ring in the bunch of dates. The branches of the fruiting frond are then evenly distributed between the four spokes, and the entire gadget (it is still nameless) is kept in place by soft wire fasteners which are twisted around the stem of the fruiting frond.

Mr. Reagan used the gadget on all of his trees last year and he claims to have suffered almost no losses from fermentation spoilage, although the heavy rains that fell last September caused extensive damage to the crops of most Phoenix date gardens.

The open bunches also facilitate harvesting, and his pickers unanimously declared they could harvest almost twice as fast in Mr. Reagan's garden than they could where the Reagan spreaders were not used.

Neighboring date gardeners have encouraged Mr. Reagan to manufacture the appliance. He has made patent application and is now equipping his home workshop to turn out a quantity of the spreaders for other date growers. He hopes to have an ample supply of these spreaders available for sale in the very near future.

The Reagans are what might be called "gadgeteers." These activities provide an ample return for the rather extensive investments in metal and wood lathes, bench saw, joiner, jig-saw, drill press, and the many hand tools not found on the ordinary small ranch. They have made much of the mechanical equipment needed for their date garden and orange grove. Among the things constructed are an air compressor and its spraying and weed burning attachments.

NEW HORIZONS IN THE COLUMBIA RIVER BASIN

BY HU BLONK

Region I, Boise, Idaho

IN 1792 CAPT. ROBERT GRAY, standing on the rail of his ship off the coast now known as the Pacific, saw the mouth of a mighty river. Not finding it on such meagre maps as he possessed, he named it after his sturdy craft, the Columbia.

Some 12 years later, in 1804, Meriwether Lewis and William Clark, who had set out from St. Louis to chart a trail to the area now called the Pacific Northwest, looked for the first time upon the largest and most impressive stream of their entire journey. They knew it must be the Columbia. The end of the long trek and success was at hand.

In the more than 100 years since Captain Gray and Lewis and Clark set eyes on the giant river hundreds of thousands of other people—trappers and miners, missionaries and settlers, farmers and just plain tourists, have viewed the Columbia, each with a different emotion.

This spring, the Department of the Interior reported that it, too, had been watching the Columbia. What it saw and how it was inspired was reported to the public for the first time a few weeks ago in a voluminous, 600-page document. It was the most exciting bit of reading, from an economic standpoint, that the Northwest and the Nation had had for some time.

In simple terms, the report states that the Columbia, one of the biggest clear-water streams on the face of the earth, which had spent very little of its boundless energy in useful pursuits, should be put to work. And at least a million people would benefit.

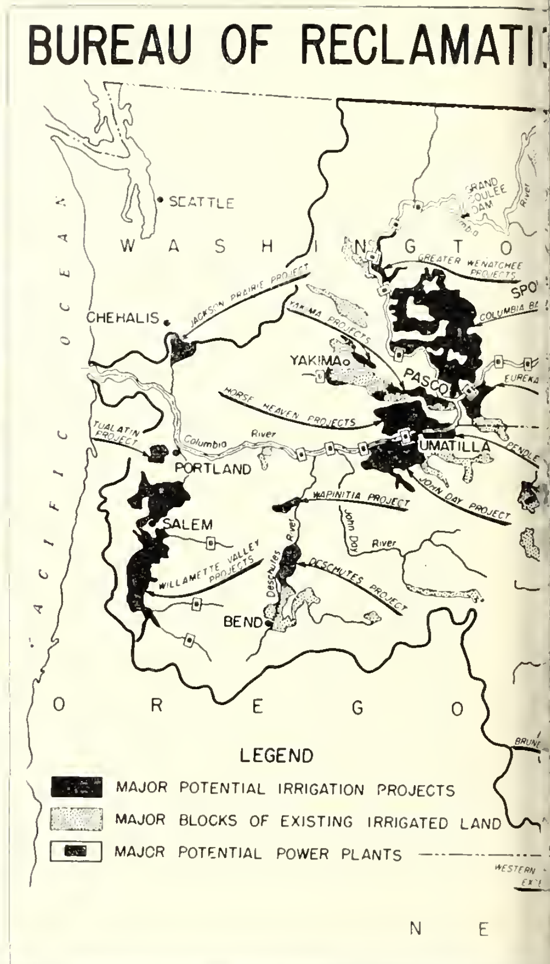
The document, technically called Project Planning Report No. 1–5.0–1, provides for the first time a comprehensive plan for the development of the land and water resources of the Nation's second largest river and all of its tributaries. It outlines vast potentialities in expansion of irrigation and hydroelectric power production, and describes benefits to be gained in navigation improvement, flood control, recreation, fish and wildlife conservation, and pollution abatement.

Prepared by the Bureau of Reclamation in cooperation with local, State, and other Federal agencies, the plan would double the existing irrigated area of the basin, and bring it new and enlarged communities with numerous opportunities for additional businesses, improved highways, greater investments in rural and business property, enlarged tax bases, and many other benefits that result from the transformation of sagebrush into fertile farm areas.

An extensive hydroelectric power development is described, which would increase the present installations of the basin by about five times. The Columbia, constituting the greatest concentration of potential hydroelectric power in the civilized world, would be made to drive 63 new power plants, to provide great volumes of energy for new industries, to lighten and increase the efficiency of farm work, and, in general, make life easier and more pleasant for people in urban and rural areas.

In detail, the plan calls for bringing under irrigation 3,840,000 acres of new land, now for the most part sun-baked and desolate, and providing supplemental water for 1,520,000 acres of irrigated land on which maximum crop production is not now attainable because of periodic shortages. About 10,600,000 kilowatts of installed power capacity are to be added. Flood

Western irrigation creates market for outside materials.



The plan will mean a lot to these future irrigation farmers.

Power like Idaho Falls City plant is part of the plan. Church of Latter Day Saints in the background.

protection is to be provided for nearly 1,500,000 acres of land, and drainage projects are to be built to improve the utility of more than half a million acres.

The report mentions, too, extending slack water navigation on the connected waterways in the lower basin—to Wenatchee on the Columbia, and to a point several miles upstream from Lewiston, Idaho, on the Snake. The Willamette also would be improved for navigation, and pollution in the stream materially reduced. A hundred and forty-two dams and reservoirs are to be created to control the river and its tributaries for the various purposes. Some of the projects are to be built by the War Department's corps of engineers; most of them by the Bureau of Reclamation.

Fourth in a series of reports on river basin developments, the Columbia resource plan quickly captured the imagination of the people of the Pacific Northwest, who long have looked upon the stream as the region's greatest asset, but who long have watched it flow, to a large extent uselessly, to the sea. Here was a program they could "sink their teeth into." No longer was it

OUTLINES VAST PLAN

Enroute to Western markets—products from all over.

In Idaho, irrigated acres produce up to 900 bushels of Spanish onions per acre.

Palatable peaches from the Yakima Roza area.

necessary for even the most enthusiastic of them to talk in vague generalities.

But charting the course for the full utilization of the river's riches for the benefit of the area and the Nation as a whole is not the only significant phase of the plan. The report's recommendation as to the ways and means of returning the cost of the Federal expenditure in the potential development, and certain existing projects totaling an estimated $5,939,765,000 at 1946 prices is highly important. It constitutes the key for opening the treasure chest to river resource development on a sound business basis.

Under the plan, every dollar allocated to irrigation and power is to be returned to the Federal Treasury. Even in the unlikely event that price levels as high as those of 1946 prevail throughout the very long construction period contemplated for fulfillment of the program, revenues from irrigation and power production would still exceed the reimbursable costs, totaling an estimated $5,043,222,000. Some 92 percent of these costs is to be repaid from net revenues from the sale of power alone. The remainder, $386,157,000, is to be repaid by irrigation farmers and domestic water users. The nonreimbursable costs would be those allocated to navigation, flood control, pollution abatement, and fish and wildlife conservation.

Taking a look at the development plan from a businessman's viewpoint, it is as sound as the American dollar. The annual costs are estimated at $291,276,000 and the annual benefits, $385,358,000. Under this ratio of benefits to costs—1.32 to 1.00—the benefits will exceed the costs by $94,082,000 annually. Is that good business, or isn't it? More than half of the monetary benefits would accrue from irrigation developments, nearly two-fifths from power.

The report presents an "all for one and one for all" theory for repayment of the costs incurred in the development of land and water resources in this 220,000-square-mile basin.

The financial plan calls for extending to the basin as a whole those principles of repayment, long recognized by the Congress, which provide for using power revenues to help repay costs of irrigation facilities that are beyond the ability of water users to repay in a specified time.

Many of the irrigation projects in the basin awaiting development have no opportunities for power production. Although needed as much as other projects fortunate in having power features, and capable of creating similar benefits in new homes, new farm and job opportunities, and crop production, many potential developments (and perhaps some existing projects) cannot reasonably be expected by themselves to return all the reimbursable costs within the maximum repayment period specified by law.

In contrast, the potential power developments on the Columbia and Snake Rivers and other tributaries will have repayment capacities in excess of their reimbursable costs. Several of these power projects will have no irrigation development immediately associated with them.

Clearly, revenues from such power developments could not only pay for the costs properly chargeable to power but could contribute to integrated agricultural and industrial development of the region by helping to make economically feasible many irrigation developments which otherwise cannot be constructed.

This can be accomplished under the basin-wide repayment plan. It would entail pooling the net revenues from designated Federal power plants and utilizing these pooled revenues to assist the repayment of worthy irrigation projects anywhere in the basin. Existing rates would not have to be raised nor would reductions be precluded.

The basin-wide repayment plant can be a sound framework for future expansion of the area for the benefit of the regional and national economy. With few irrigation developments remaining in any of the States on the basin which can stand on their own feet financially, including nearly all of those in the downstream States of Oregon and Washington, adoption of the plan is essential if agricultural stagnation in the future is to be avoided.

While the entire resource development program will take decades to accomplish, a start can be made immediately. This is a timely feature of the report. The plan suggests that work on projects under construction be expedited or begun on projects already authorized. These total 47 in number, and consist of projects authorized for construction by the Office of Indian Affairs of the United States Department of the Interior, the War Department, and the Bureau of Reclamation. Secondly, 14 projects are recommended for early authorization or reauthorization. The remaining 177 projects of the 238 listed in the plan would be undertaken later as needed.

Recommended for early authorization or reauthorization are the following:

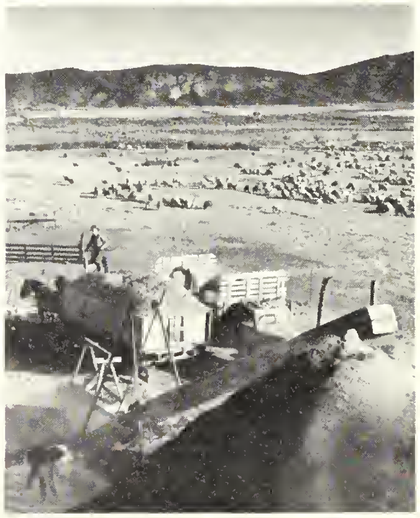
Idaho.—Payette Unit of the Mountain Home project, 230,000 acres and 165,000 kilowatts of power; Cambridge Bench, 2,360 acres; Hayden Lake Unit of the Rathdrum Prairie project, 1,000 acres; Council, 6,590 acres; Hornet Creek, 1,970 acres, and Mann Creek, 4,300 acres.

Montana.—Bitterroot Valley (without the Woodside Unit) 32,100 acres; Bitterroot Valley, Woodside Unit, 18,600 acres, and Missoula Valley project, 2,100 acres.

Oregon.—Canby, 1,675 acres; Bully Creek Unit of the Vale project, 5,000 acres; and Crooked River project, 18,500 acres.

Washington.—Kennewick Division of the Yakima project, 17,000 acres and 12,000 kilowatts of power.

OUR BACK COVER



THREE-WAY AGRICULTURE

Rich in fertilizer, food, and forage, this scene on the Boise project, Idaho, is typical of the areas irrigated by Bureau of Reclamation facilities. Here wagons are being loaded with chopped hay from the huge stock pile, preparatory to spreading it about the many pastures of the Carl Nicholson sheep camp.

Wyoming.—Upper Star Valley project, 15,500 acres.

The benefits from the resource development on the Columbia would be spread far and wide. Every section of the country would be affected.

Fifty thousand to seventy thousand new farms are to be created through the irrigation phase of the plan. These would provide, directly and indirectly, permanent jobs for approximately 100,000 wage earners in local enterprises other than farming. In established irrigation communities, two people are employed in the towns or near the developments, for every person on the farms. Thousands of other people throughout the Nation will be employed in providing goods and services for use by the increased population of the basin. One worker will probably be required in other parts of the United States for every two employed in the locality of the projects.

Thus the irrigation development alone will create a total of 250,000 to 350,000 employment opportunities, and the basis of support for a total population of one million persons throughout the country.

Major benefits will also be realized during the construction of the projects. Tens of thousands of jobs will be created both at the construction sites and at widespread points. United States Department of Labor figures show that for every five men employed on the project, eight are required in the production and assembly of hundreds of items which go into the construction of dams, power plants, canals, and other project works.

The key to unlock the riches of the Columbia was fashioned under the direction of the Bureau of Reclamation, but many local, State, and Federal groups participated. All agencies of the Department of the Interior involved in resource development collaborated. These were the Bureau of Mines, Fish and Wildlife Service, Geological Survey, Bureau of Land Management, National Park Service, Office of Indian Affairs, and the Bonneville Power Administration. Important contributions were also made by the Department of Agriculture, Corps of Engineers, and the Federal Power Commission.

The Governors of the States affected by the plan—Washington, Oregon, Idaho, Montana, Wyoming, Nevada, and Utah—now have the report. When they have commented on it, as they are privileged to do under Federal law, the document together with the remarks by the Governors and those of other Federal agencies, will be transmitted to the President and the Congress.

In the vastness of its Western undeveloped river basins, lie the untouched riches that America needs to move forward in the world economy. There, through the irrigation of parched lands, production of hydroelectric power from falling water, and the utilization of other resources, the country's horizons can be peacefully extended.

"W-DAY" At Tucumcari

The Noxious Weed Control Committee spearheaded the drive, and the Citizen Army routed the enemy—Bindweed

by D. D. SUGGS

Agricultural Engineering Aide, Tucumcari, N. Mex., Region V

FARMER-SOLDIERS OF THE AMERICAN REVOLUTION may have been instructed properly when told to hold their fire until they could see the whites of the enemies' eyes, but farmers on the Tucumcari, N. Mex., Reclamation project are firing away at the first biological manifestation of a noxious weed. They aren't taking any unnecessary chances of being surrounded and captured by the forces of "General Infestation."

Community cooperation at Tucumcari, nurtured by active participation in many patriotic endeavors during the last war, did not cease with the end of hostilities. It recently guided citizens in the project area to an early victory in an all-out home-front war on weeds.

Weeds were threatening to become a hazard with the delivery of water on the project, where 45,000 acres of raw land are being converted into irrigated farms. The initial unit of the project received its first water in the fall of 1945.

It is generally known that when water is applied to semiarid land, it creates conditions favorable to propagation of weeds as well as crop plants. Successful irrigation farmers know that eradication or control of noxious weeds is a "must" item on every good project.

Citizens of the Tucumcari project area were prompt in mustering combative measures. With complete cooperation of the Bureau and other Government, city, and State agencies, a weed-control program was launched in May of last year, and almost immediately proved its effectiveness.

Project investigation of this "boring from within" problem actually began in 1942. When these early Bureau-community cooperative planners for the war-to-come had completed preliminary plans, they retired from active weed-war duty until the construction program had advanced to the point when water would be available to the first part of the project.

W-day arrived in 1945. A Noxious Weed Control Committee was formed to study further details of the impending battle, and recommend and initiate eradication and control measures before the advent of irrigation could increase current infestation.

By spring, 1946, the strategy had been defined, the maneuvers planned. Reconnaissance reports singled out bindweed as the most dangerous "dictatorship" threatening the project area. It had begun infiltration tactics, and thus became the initial objective. Tucumcari city fathers made first contact with the enemy in and adjacent to the community. Bindweeds were sprayed at city expense with a one-tenth percent solution of the chemical 2,4-D (1 part chemical to 1,000 parts of water—also termed 1,000 parts per million). The thorough coverage of urban-infested areas is believed unique in the history of weed eradication campaigns.

The weed war was conducted in the city of Tucumcari and its adjacent area, because of the well-known fact that weed enemies building up a stronghold in any sector adjacent to peaceful weed-free agricultural land would, as well as creating havoc to gardens and lawns, soon be sending their forces out to conquer new territory. The city campaign contributed greatly to the ultimate success of the project venture.

City participation in the drive followed a conference of members of the Noxious Weed Control Committee, headed by Quay County Agent C. A. Grimes, and city and county officials including Mayor Virgil Montgomery, City Manager John Bender, Chamber of Commerce Secretary E. E. Rivers, and County Commissioner J. L. Jordon. Many businessmen and farmers also attended the initial parley.

A survey of bindweed in the city and project area had been completed under direction of W. H. Mercer, agricultural aide (see "Weeds—and Their Worthy Opponent," December 1946 ERA.—Ed.) and L. C. Brown, agricultural adviser for the Bureau of Reclamation.

It is an old military axiom that no war can be successful without complete support of the home folk. The weed-war's board of strategy did not overlook this phase of its campaign. To arouse the community generally to the peril and to acquaint the prospective servicemen and women with methods for eradicating and controlling weeds, the strategists arranged for a series of public demonstrations. The Bureau prepared a series of newspaper articles about weeds—the additional trouble and cost they create on irrigation projects. These articles, accompanied by photographs, were published in The Tucumcari Daily News and The Tucumcari American.

Otto Dillon, vocational agriculture instructor in the Tucumcari High School, went on the radio with announcements about the bindweed eradication demonstrations planned for the community.

Tucumcari Service Clubs sponsored showings of the Bureau's sound and color motion picture, Fighting Weeds. Following a series of exhibitions in the city, the film was taken into rural areas. It was shown six times for various classes at the high school and at a banquet in honor of Reclamation Commissioner Michael W. Straus. Weed-war plans were explained to Commissioner Straus and Regional Director Wesley R. Nelson. These officials joined in the campaign, speaking publicly about the harmful effects of weeds on irrigation projects, and commending the people in the area for their vigorous spirit in planning for the actual war.

The month of May was a merry one for weed killers. It was the time for demonstrations, and those in town and country were to be followed by day-to-day killing forays throughout the area.

The demonstrations attracted businessmen, farmers, farm women, farm boys and girls. The Tucumcari Garden Club sent a delegation to join forces in the front line attack. Members of the Future Farmers of America and 4–H Clubs were present and assisted in the drive.

During the demonstrations in May, Mercer, the Bureau's weed specialist, continued his talks to service clubs, luncheon clubs, and similar organizations in the community. He stressed the difficulties of farming in a weed-infested irrigation project, and rallied additional forces to combat the hazard before it could become more dangerous. Mercer also spoke at each demonstration. He answered questions about mixing the spray, quantities used, time required for killing, the occasional need for respraying, the effect of spray on farm crops, grasses and shrubs.

The community was aroused. Mrs. U. S. Devor, a member of a committee responsible for the beautification of the Tucumcari cemetery, and wife of a director of the conservancy district, reported a bindweed infestation in the cemetery. Within a few hours a spraying crew made an attack, and had the enemy under control in that sector.

K. T. Langley, local seed dealer, contributed the 70 percent compound of 2, 4–D in powder form for use in the demonstrations. Farm boys ran errands, and helped assemble the spray equipment and other materials needed for the campaign. Men and women in town and in the rural areas responded to calls for help in many divisions of the campaign. The undertaking became glamorized and had an atmosphere somewhat like that of an old-fashioned, Ozark Mountain husking bee or corn-in-the-tassel hoe-down. It was a serious job, but not without fun.

The demonstrations throughout the month of May and subsequent individual killing campaigns were not accomplished without difficulties. County Agent Grimes furnished his spray equipment, but many of the fittings needed repair parts which World War II had made scarce. Grimes and Bureau employees, FFA and 4–H Club boys worked in the Bureau' shop, making necessary parts. Spray nozzles were lent by the House Cooperative of House, N. Mex.

Home owners, although good soldiers, and eager to have weeds killed in their yards, were fearful of the damage that might be inflicted upon their flowers, trees, and shrubs. Rather than desert the cause, they volunteered to use hand sprays containing the weed-killing element, and personally protect their homes. One amateur gardener was made happy when told he could do his own spraying and guard against damage to his prized gooseberry crop.

Five weeks following the first spraying demonstrations a survey revealed an approximate 90 percent kill of the enemy. The best kills were found in areas sprayed soon after a shower, and in locations having sufficient moisture to promote vigorous growth. The least kills were in areas where the soil was extremely dry and hard.

The Tucumcari project weed-killing demonstrations and subsequent killing expeditions on project farms were but the beginning of a war that will be revived any time weeds imperil the area. The bindweeds are disarmed. Other weeds will be killed as they pop up in dangerous numbers. The people of Tucumcari and the project area are going to make the weeds keep the peace.

Plans for future weed control were made which were included a pure seed show held this past winter in Tucumcari. The show included a weed and weed-seed exhibit. Examination of crop seed for foreign elements, especially infiltrating weeds, and pure seed judging were demonstrated. Farmers were urged to plant only weed-free seed.

Future Farmers of America and 4–H Club boys had a big part in the show. They were taught how to identify weed seed prior to planting their project crops this spring. The Garden Club cooperated in plans for the show and the members will strive to keep weeds out of their gardens.

One Garden Club member, exemplifying the spirit of the whole community, said she is willing to sacrifice her flower bed for an entire year if necessary to help keep the weed-enemy from the reclamation project. The Tucumcari reclaration project's First Rout Army has made good!

County Agent Grimes leads the battle.

Citizens join the First Route Army.

The Fortune Tellers

West-Wide Forecasts of 1947 Water Supplies, Based on Work of the Western Snow Surveys

By Paul A. Ewing

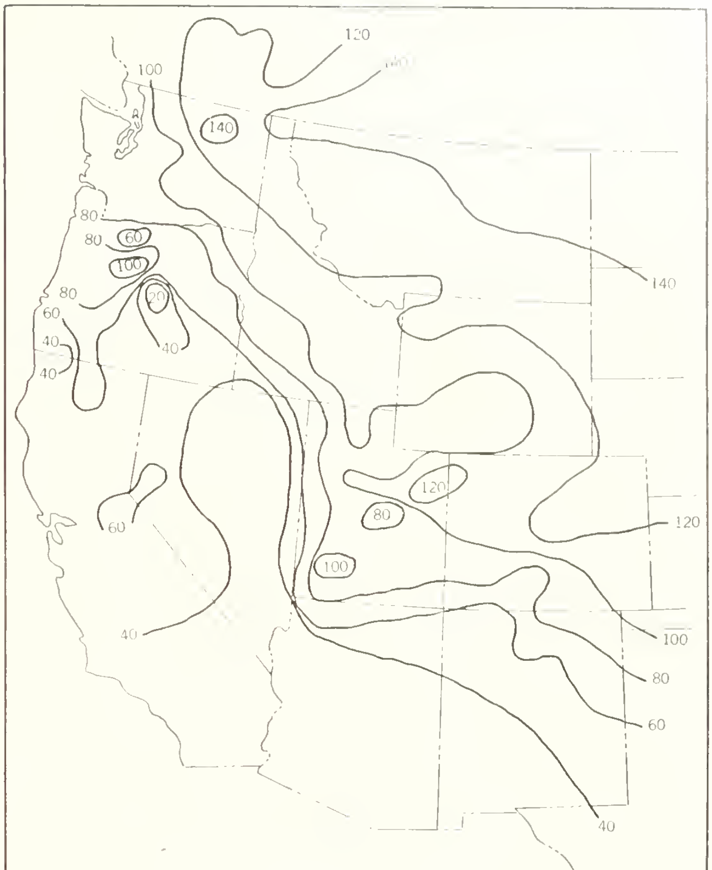
Senior Irrigation Economist, Soil Conservation Service,

and R. A. Work,

Senior Irrigation Engineer, Soil Conservation Service

WATER'S YOUR FORTUNE, *son—just in case you didn't know—and people who prophesy about western water supplies are therefore fortune-tellers. But water-supply forecasting is serious business, not to be done merely by gazing into the crystal ball. In fact, it's out of the realm of guesswork, and farmers can now be told pretty closely what water they will have for irrigation, well in advance of its actual need.*

To forecast summer water supplies a close knowledge of winter snow storage is necessary. How much snow is held in our high mountain fastnesses? How much water will it yield when melting? When will it melt? As western water supplies become scarcer and scarcer it is more and more important that these things be ascertained in order that the fullest possible use may be made of what water we have.



Prospective stream flow April-September 1947 in percent of 10-year average 1936-45.

UNDER THE TERMS of a recent agreement, the Bureau of Reclamation is cooperating to this end with the Division of Irrigation and Water Conservation, Soil Conservation Service. This agreement provides for establishing many new snow courses. More frequent measurements also will be made on some important courses now used in forecasting water supplies for project lands. The Soil Conservation Service has, for a dozen years, been the Federal coordinating agency in snow surveys. Previous to 1935 a multitude of agencies—Federal, State, and local—made snow surveys, but no consistent effort was made to systematize their methods and procedure or to broaden their objectives. Limited local needs were well served, perhaps, but wide coordination of results was not attempted.

The Division of Irrigation and Water Conservation undertook two principal jobs: to fill in the gaps, and to standardize equipment. In carrying out the first objective it conducts many snow surveys, adding them to the many more that are still made by the other pioneering organizations. The results of the latter surveys it collects, analyzes, and publishes, together with its own. All surveys are now carried out pretty much along identical lines and with standardized apparatus. The cooperating agencies include Soil Conservation Service field men, Forest Service and National Park Service rangers, irrigation district managers, Geological Survey stream gagers, power company patrolmen, Fish and Wildlife hunters, and Indian Service and Bureau of Reclamation employees. The snow surveys of the government of British Columbia are closely coordinated with the Columbia River work. Last winter nearly 2,300 separate snow surveys were made at 925 mountain locations by a force of almost 1,000 men from 170 cooperating agencies. Notwithstanding all this multitude of effort a high degree of harmonization has been attained; precise comparisons from survey to survey and from year to year are made possible, and the snow-water forecasts based on the measurements are increasingly accurate.

How the Surveys Are Made

The surveys comprise periodic visits to the carefully located snow courses, each of which is marked with a number of permanent stations (steel poles topped with official snow-course signs); and every set of measurements is taken each time at the exact spot where the preceding ones were made. The Federal sampler now in universal use consists of 30-inch lightweight metal tubes which, when screwed together, may be pushed down through the deepest snow. Thus a complete column, or sample, can be obtained by withdrawing the tube. The snow-filled tube is immediately weighed on a hand scale so calibrated as to give a reading of the inches of water in the measured snow. These weighings form the basis of forecasts of spring and summer run-off, which are issued in great detail a few days after the surveys, so that water-users are afforded a comprehensive outlook for all the principal watersheds and drainage basins throughout the West.

The work of visiting some of the more isolated snow courses, especially when climatic conditions may be severe, is often arduous in the extreme, involving long trips by skis or snowshoes. Recently the improvement of snow-transit machines has removed some of the hazards of this work, and further easing is expected as the use of these conveyances is extended. At present, however, many surveyors travel in pairs, and are protected against undue exposure by 185 shelter cabins, constructed or stocked by the Division of Irrigation and its cooperators, and scattered along some 20,000 miles of winter ski trails. Enough food and other emergency supplies are in one of these cabins to supply the needs of a snow survey party for several days.

The first reports of the surveys are those of January 1, and the last those of May 1, that being the latest date when the maximum accumulation of snow may be measured. April results, however, are usually not greatly modified by those obtained in May. In some of the States the final spring forecasts for the different water basins are made at local meetings participated in by anybody having pertinent information on the situation. For the whole Columbia Basin, the Columbia Basin Water Forecast Committee, composed of representatives of all States in that basin (and British Columbia), meets in Portland after the middle of April and draws up the general Columbia Basin forecast. A similar group representing the Colorado River Basin meets about the same time in Los Angeles.

Prospects for 1947

The following paragraphs summarize the water-supply prospects, State by State, as indicated by the April snow surveys. In general, the picture is similar to that shown a year ago, though perhaps less favorable. Severe shortages appear in prospect for the Southwest, including parts of California and Nevada, but with a progressive improvement from south to north. Rio Grande run-off will be deficient, as will that of southernmost tributaries of Colorado River. Columbia Basin will fare pretty well as will also the slopes east of the Rocky Mountains. The two charts accompanying this article further summarzie results of the April surveys.

Arizona

An acute shortage of water is imminent throughout the major irrigated areas. The winter snow-water crop was very short, record lows being recorded for most snow-survey courses. This shortage, coupled with general below-normal precipitation, will produce abnormally low run-off during the irrigation season. Reservoir storage is near an all-time low for April 1, being only 15 percent of total capacity (the 1936–45 average was 40 percent of capacity). Storage in Lake Mead (behind Boulder Dam) has declined to 59 percent of capacity from the 1936–45 average of 72 percent.

California

A general shortage is in prospect, the full natural April 1 to July 31 stream flow of snow-fed mountain streams being forecast by the California Cooperative Snow surveys, in comparison with the 1936–45 average, means from 28 percent for Kern River at Bakersfield to 68 percent for Sacramento River at Shasta Dam. Other principal Sierra streams show the following prospective run-offs: Kaweah River at Three Rivers, 41 percent; Kings at Piedra, 50; San Joaquin at Friant, 54; Merced at Exchequer, 51; Tuolumne at La Grange, 55; Stanislaus at Melones Dam, 60; Mokelumne at Mokelumne Hill, 61; American at Fairoaks, 51; Yuba at Smartsville, 54; Feather at Oroville, 53. The over-all picture may thus be said to promise about a 50 percent year. However, 24 reservoirs having a total capacity of 2,869,000 acre-feet of water, are holding 1,742,000 acre-feet, or 61 percent of capacity. The average storage in the 1936–45 period was slightly less than this amount, or 60 percent of total capacity. Three major reservoirs not included in the 24 were put in operation by 1944. They are: Narrows, capacity 45,000 acre-feet; Friant, 436,500, and Shasta, 3,714,000. On April 1 the total storage in the 27 reservoirs including these three was 71 percent of total capacity.

Colorado

Prospects vary widely, streams east of the Continental Divide promising run-off generally in excess of the 1936–45 average, while Rio Grande Basin streams will be in generally low supply (from 65 to 90 percent of average). Southern Colorado Basin streams will flow substantially below normal but those in the northern part of the basin will exceed the average. Forty-seven reservoirs have filled to 41 percent of total capacity, as compared with an average April 1 filling of 32 percent.

Idaho

The snow pack is progressively lighter from north to south, so that run-off substantially in excess of the 10-year average is in prospect for northern streams but some southern areas will have subnormal supplies. Kootenai and Clark Fork will experience heavy run-off, with some likelihood of floods. Mid-Idaho stream discharges will be about normal, with no severe floods in prospect and a water supply generally adequate for irrigation. In extreme southern and western areas the outlook is for irrigation shortages ranging from slight to severe, depending on weather conditions during the planting and growing seasons. Water stored in nine major reservoirs, including Jackson Lake, is 87 percent of capacity as compared with the 10-year average of 77 percent.

Montana

Run-off prospects are 15 to 20 percent better than a year ago, with reservoir storage also higher. Precipitation is above average, recent heavy storms having reversed the previously-developing dry trend. Stream flow is about normal for mountain streams, while severe floods have occurred in the eastern part of the State. Soil moisture conditions are good. Seventeen reservoirs west of the Continental Divide are 39 percent full, or slightly better than on April 1, 1946; 23 in Missouri drainage are at 74 percent of capacity (64 percent last year), and Fort Peck reservoir is 79 percent full (68 percent a year ago).

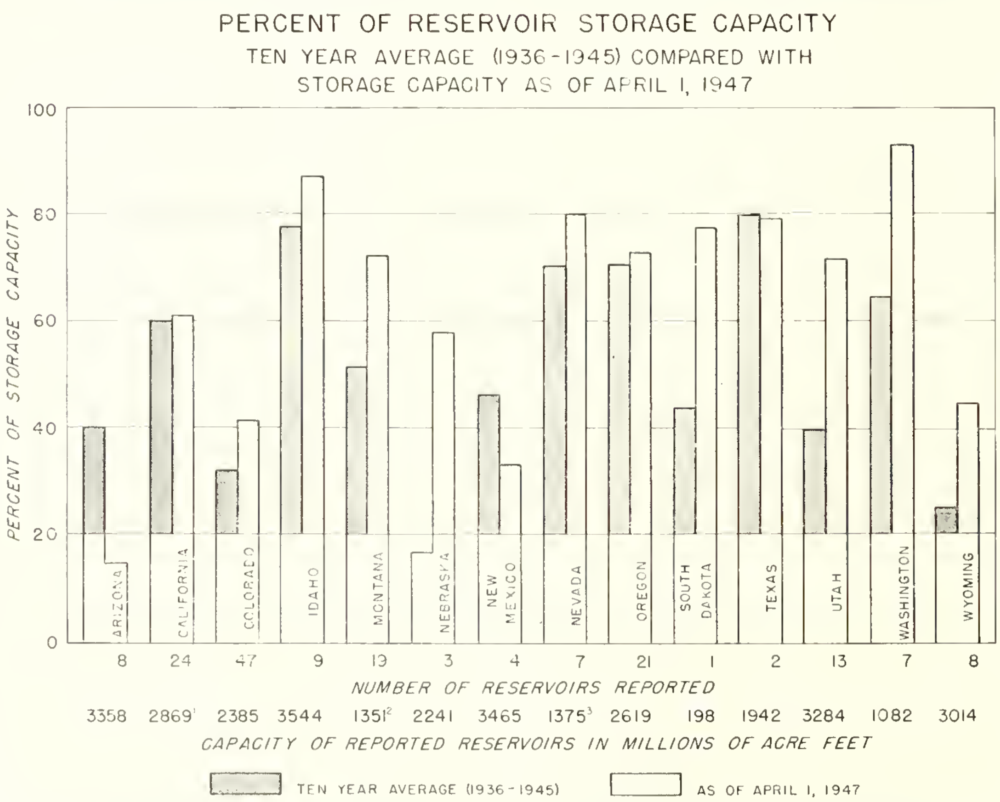
Nevada

The summer run-off available for irrigation will be short, with the general average ranging from 40 to 50 percent of the 1936–45 average. Soil moisture and ground-water conditions are fair, but the snow-water storage on the mountains is poor. Reservoir storage is very good, and total storage may reach 90 to 95 percent of reservoir capacity, thus helping to alleviate the shortage of natural stream flow.

New Mexico

Rio Grande drainage promises run-off substantially below the 1936–45 average, only Taos River showing a discharge in excess (125 percent) of normal. Other forecasts for the basin, in percent of normal are: Chama, 65; Embudo, 52. The main river, at Otowi Bridge, will flow 76 percent of normal. Discharge of Pecos River will be less than half (48 percent) of the 10-year average, while that of Canadian River, while better than Pecos, will be only 75 percent

(*Continued on page 116*)



Not all reservoirs in all States are reported, but enough are reported to give a reliable index of each State's storage supply. Most State averages for reported reservoirs are for full 10-year periods, but in a few cases reservoirs having shorter records are included.

[1] Does not include Narrows (Yuba River), Friant, or Shasta Reservoirs. April 1 storage in these three reservoirs combined is 3,287,000 acre-feet, which is 78 percent of their capacity.

[2] Does not include Fort Peck Reservoir (capacity 19,900,000 acre-feet). April 1 storage 14,980,000 acre-feet.

[3] Does not include Lake Mead (capacity 31,140,000 acre-feet). April 1 storage approximates 18,372,000 acre-feet.

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre feet) Active capacity	Mar. 31, 1946	Mar. 31, 1947
Region 1	Baker	Thief Valley	17, 400	17, 700	17, 400
	Bitterroot	Lake Coma	34, 700	9, 400	20, 400
	Boise	Anderson Ranch	464, 200	33, 025	97, 800
		Arrowrock	286, 600	262, 100	247, 800
		Deadwood	161, 900	108, 140	116, 900
		Deer Flat	169, 000	153, 760	158, 200
	Burnt River	Unity	24, 600	13, 500	24, 000
	Columbia Basin	F. D. Roosevelt	5, 220, 000	5, 110, 000	5, 108, 000
	Deschutes	Crane Prairie	50, 000	39, 700	41, 200
		Wickiup	187, 000	70, 600	97, 900
	Minidoka	American Falls	1, 700, 000	1, 370, 500	1, 618, 400
		Jackson Lake	847, 000	581, 500	577, 900
		Lake Walcott	95, 200	69, 300	69, 000
		Grassy Lake	15, 200	14, 300	12, 800
		Island Park	127, 300	128, 700	132, 400
	Okanogan	Conconully	13, 000	5, 000	6, 100
		Salmon Lake	10, 500	9, 500	9, 400
	Owyhee	Owyhee	715, 000	681, 600	593, 600
	Umatilla	Cold Springs	50, 000	48, 900	50, 000
		McKay	73, 800	62, 100	66, 300
	Vale	Agency Valley	60, 000	54, 600	51, 900
		Warm Springs	170, 000	141, 100	136, 500
	Yakima	Bumping Lake	33, 800	3, 200	34, 100
		Clear Creek	5, 300	5, 300	5, 300
		Cle Elum	435, 700	180, 700	413, 000
		Kachess	239, 000	201, 300	220, 800
		Keechelus	153, 000	94, 100	154, 600
		Tieton	197, 000	118, 400	171, 300
Region 2	Central Valley	Millerton Lake	503, 100	276, 700	337, 600
		Shasta	4, 389, 100	3, 214, 000	2, 758, 100
	Klamath	Clear Lake	437, 500	295, 200	226, 700
		Gerber	94, 300	51, 600	42, 500
		Upper Klamath Lake	524, 800	334, 400	345, 100
	Orland	East Park	17, 900	50, 900	31, 700
		Stony Gorge	50, 000	51, 000	39, 800
Region 3	Boulder	Lake Mead	27, 935, 000	17, 774, 000	16, 383, 000
	Parker	Havasu	688, 000	644, 800	649, 000
	Salt River	Bartlett	179, 500	1, 800	10, 300
		Horse Mesa	245, 100	224, 500	234, 200
		Horseshoe	67, 000	10, 020	13, 700
		Mormon Flat	57, 850	38, 700	40, 600
		Roosevelt	1, 398, 400	362, 200	80, 600
		Stewart Mountain	69, 800	19, 400	52, 200
Region 4	Fruit Growers	Fruit Growers	4, 500	3, 655	2, 100
	Humboldt	Rye Patch	179, 000	187, 700	185, 900
	Hyrum	Hyrum	15, 300	15, 500	11, 900
	Moon Lake	Moon Lake	35, 800	17, 860	9, 000
	Newlands	Lahontan	273, 600	249, 965	241, 600
		Lake Tahoe	732, 000	569, 000	518, 400
	Newton	Newton	5, 300	4, 900	4, 900
	Ogden River	Pine View	44, 200	13, 085	14, 855
	Pine River	Vallecito	126, 300	40, 800	60, 100
	Provo River	Deer Creek	146, 800	63, 400	73, 400
	Scofield	Scofield	65, 800		7, 600
	Strawberry Valley	Strawberry	270, 000	120, 700	115, 200
	Truckee River Storage	Boca	40, 900	12, 900	[1] 12, 000
	Uncompahgre	Taylor Park	106, 200	84, 500	70, 100
	Weber River	Echo	73, 900	55, 300	55, 300
Region 5	Altus	Altus	140, 000	11, 200	45, 500
	Carlsbad	Alamogordo	128, 300	31, 035	35, 600
		Avalon	6, 000	5, 345	3, 200
	Colorado River	Marshall Ford	810, 500	611, 100	497, 400
	Rio Grande	Caballo	345, 900	251, 020	266, 700
		Elephant Butte	1, 830, 300	1, 030, 900	513, 900
	Tucumcari	Conchas	300, 000	323, 340	264, 900
Region 6	Belle Fourche	Belle Fourche	177, 500	144, 800	154, 800
	Milk River	Fresno	127, 200	61, 600	136, 700
		Nelson	66, 800	28, 600	27, 000
		Sherburne Lakes	66, 100	24, 100	23, 400
	Riverton	Bull Lake	152, 000	48, 300	69, 500
		Pilot Butte	31, 500	18, 800	15, 100
	Shoshone	Buffalo Bill	456, 600	349, 800	291, 900
	Sun River	Gibson	105, 000	68, 900	58, 600
		Pishkun	32, 050	22, 800	17, 200
		Willow Creek	32, 400	11, 200	15, 300
Region 7	Colorado-Big Thompson	Green Mountain	146, 900	56, 400	64, 700
	Kendrick	Alcova	190, 500	37, 600	83, 700
		Seminoe	970, 000	543, 000	289, 200
	North Platte	Guernsey	41, 050	41, 900	31, 700
		Lake Alice	11, 000		5, 800
		Lake Minatare	57, 000	29, 000	20, 900
		Pathfinder	1, 040, 500	418, 700	472, 900

[1] Estimated.

RECLAMATION READING

Bureau Publications

New Folder

Electric Power from the Columbia Basin Reclamation Project.—A 12-page illustrated folder featuring a step-by-step description of the creation of the world's largest power plant at Grand Coulee Dam, and telling the story of the dam as a producer of power for war and peace. Copies available upon request to the district manager, Columbia Basin Project, Coulee Dam, Wash.

Miscellaneous Publications

"Our Oldest Public Utilities," by Harold F. Webb, in *National Safety News*, January 1947, page 22. Illustrated. Suggestions for a simple and practical safety program in the administration of water supply systems—oldest of all types of public utilities.

"The Industrial Future of China," by Dr. V. K. Wellington Koo, Chinese Ambassador to the United States, in *Industrial Standardization*, January 1947, page 4. Program of industrialization realized through imports of machinery is expected to open China's markets in an epic story of development similar to that of America's West.

Production of Electric Energy and Capacity of Generating Plants in the United States, 1945, prepared by the Federal Power Commission, 25 pages with illustrations. Publication presents information on the 1945 production and corresponding installed capacity of generating plants operated by electric utilities and other organizations producing electric energy for public use. Twenty-five cents a copy from the Federal Power Commission, Washington, D. C.

Bibliography of Agriculture, publications of the United States Department of Agriculture, State agricultural experiment stations, State agricultural extension services, and books and pamphlets from other sources listed by the Departmental library. 192 pages (mimeographed) with author and subject indexes—January 1947, vol. 10, No. 1. (Forty cents a copy from the Superintendent of Documents, Washington, D. C.)

"Operating Programs of the Bureau of Reclamation—Service for Water Users," by Alfred R. Golze, Assistant Director, Branch of Operation and Maintenance, Bureau of Reclamation, in the *Western States Reclamation Journal*, January 31, 1947, page 6. Illustrated.

Engineering Publications

Available from the Design and Construction Technical Library, Bureau of Reclamation, Customhouse, Denver, Colo.

Hydraulic Roughness Coefficients For Large Channels (Isthmian Canal Studies Memorandum 106) Panama Canal, Diablo Heights, C. Z., November 1946. The velocities of flow that may be produced in large channels, and the differences in water level that produce these velocities, are of prime importance in the selection, design, and operation of any trans-isthmian canal, particularly a sea-level type of canal. Estimates of these important factors are obtained from computations for which a roughness coefficient or factor must be chosen. This memorandum is divided into five parts, as follows: Part I—General; Part II—Open-channel flow formulas; Part III—Measurement of hydraulic roughness in Gaillard Cut; Part IV—Roughness data on large channels; and Part V—Recommended roughness values for Isthmian Canal Studies—1947.

Some Remarks About Seepage of Water From Canals on to Deep Soil, by George Hamel, Berlin. (Translated from Zeitschrift fur Angewandte Mathematik und Mechanik (1937), Vol. 18, p. 39). The problem of seepage from canals or channels in sandy soil, in which Darcy's law of permeability is valid, is solved in its entirety by means of simple theoretical functions.

Seepage from Canals, by Ing. Dr. R. Dachler (Translation, Bureau of Reclamation Library). This article establishes the connection between the quantity of water seeping through a unit length of canal, its cross-sectional shape, and the permeability of the material.

Determination of Run-off from Rainfall on Punjab Catchments, by Kanwar Sain and I. P. Kapila, *Proceedings of the Punjab Engineering Congress*, 1946. A study of the rainfall and run-off data of a number of catchments in the Punjab, India, with the object of determining the general suitability of empirical formulae for the prediction of run-off. The conclusion is that each stream is a law unto itself.

The Fortune Tellers

(Continued from Page 114)

of the average. Four major reservoirs are 33 percent full, as compared with a normal of 46 percent.

Oregon

Water supplies in many areas will be about comparable to 1944; 72 percent of irrigated lands will have good-to-fair supplies; these are served chiefly from reservoirs holding substantial carry-over from 1946. Most lands dependent upon unregulated stream flow will have supplies ranging from fair to deficient. Mountain snow cover is below average on 91 percent of all measured snow courses, and if precipitation during the run-off season is normal or less, stream flow below normal is certain for all streams except Hood River and Wallowa River. However, water-shed soils are wetter than average, thus favoring flow from the deficient snow pack. Crop land soil moisture is generally good, with fallow lands showing better than average. About three-fourths (73 percent) of the more important reservoirs are half-full or better; the general picture as regards storage is slightly better than the 10-year average—73 percent of total capacity as compared with 70 percent average.

Utah

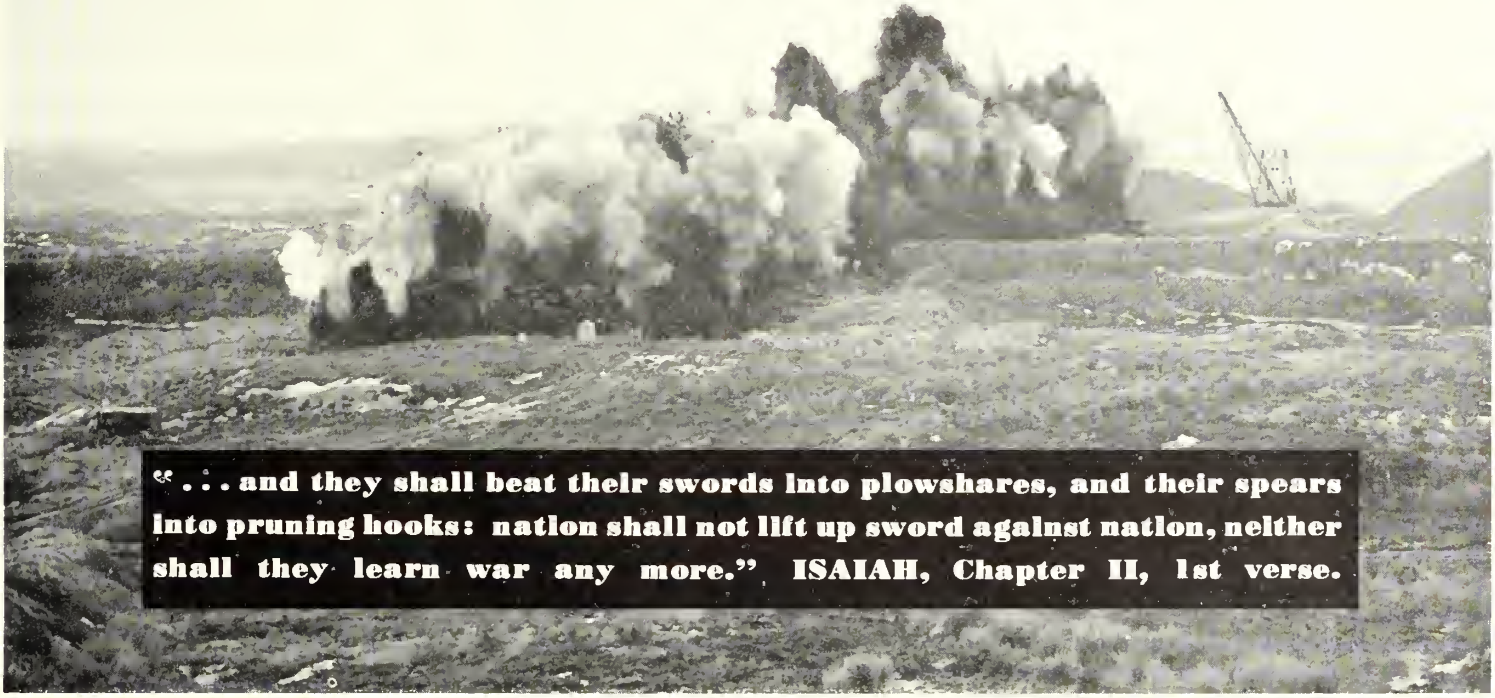
Most watersheds will yield satisfactory irrigation supplies. While total run-off, including flood waters, may be lower than normal, stream flow is expected to hold up through the late irrigation season. April–September run-off will range from 70 percent of the 1936–45 average for Price River (near Heiner) to 132 percent for Strawberry River (near Duchesne). Storage is at a high point, with the principal reservoirs showing storage totaling 72.4 percent of capacity. Utah Lake and Bear Lake are at the highest levels in many years. Storage users should, therefore, have adequate water with the possible exception of those on Price River, as the holdover in Scofield reservoir is very low.

Washington

Prospects are for supplies ranging generally from somewhat above to only slightly below normal. Storage generally exceeds the 1936–45 average, five principal reservoirs being 94 percent full as compared with the 10-year average of 65 percent.

(Continued on page 120)

Columbia Basin's Peacetime Arsenal



by E. R. Nicolai

Columbia Basin Project Office, Coulee Dam, Wash., Region I

SURPLUS WAR EQUIPMENT, ranging from fragile slide rules to massive power shovels, has been marshalled along a 140-mile front in eastern Washington to speed construction of the Bureau of Reclamation's largest development—the Columbia Basin irrigation project.

Probably no other area in the world has seen so much surplus equipment converted to peacetime use in so little time.

From the Grand Coulee Dam, on the north, down to Pasco, more than 100 miles to the south, equipment designed for winning wars is paving the way for delivery of irrigation water to the million-acre expanse. In saving millions of dollars for taxpayers, the Bureau also has helped contractors get an earlier start on the task of carving canals and foundations for dams from the stubborn basalt of the famed Big Bend region.

Quonset huts, purchased from the Army, have averted a critical housing situation at several contractors' camps. Surplus water tanks and large consignments of "invasion pipe" have been assembled to accelerate construction of necessary utilities. Trenches for the pipes were dug with an Army-type excavator, and the fittings, as well as the wrenches used to handle them, came from surplus stocks.

Bureau of Reclamation engineers and advance crews of construction forces ramble over the hills and down the coulees of eastern Washington's rugged countryside in surplus ambulances, jeeps, and weapon carriers. Surveys are made with one-time Army transits, and sites are marked with flags fashioned from Navy surplus bunting.

None of the great quantities of surplus equipment obtained for the Columbia Basin project is "surplus" after it reaches the Bureau. Many uses are found for virtually every item. Airplane hangars have been assembled at the Grand Coulee Dam to protect equipment and to service rolling stock. Odds and ends of steel from these hangars were used for various repair jobs.

Bomb shelters of "elephant" steel have been converted to equally placid tasks. Some of the steel forms a trash burner for the Bureau's sawmill at Coulee Dam. Other sections, covered with soil, protect war-surplus dynamite.

The conversion list is almost endless. "Bailey Bridges," built to carry troops and vehicles across European streams, now cross the river-size Main Canal of the project. Circus-size tents, designed originally as temporary hangars for aircraft, were thrown over the Grand Coulee Dam pumping plant last winter to protect workers and to keep cold air from freshly placed concrete.

This summer, when blistering winds push across the basin, workers will be cooled by refreshing drinks of water carried in insulated containers designed by the Army to transport milk to troops. And after completing their day's work in the basin, the engineers will write their reports in temporary offices containing surplus doors, windows, nails, roofing, flooring, electrical fixtures, and desks. They'll be using their war-surplus slide rules, triangles, and other office equipment in preparing field data.

Behind the acquisition and the highly effective use of the great quantity of war-surplus equipment on the Columbia Basin project is a ruddy-faced, jovial man—W. C. Rice, property management officer, who was drafted by District Manager F. A. Banks to "scout" for needed equipment and supplies. In his 25,000 miles of travel as a bargain hunter, Rice has journeyed by train, boat, automobile, and plane. His field has covered depots of the War Assets Administration, the Army, Navy, Treasury Depart-

Army bulldozers in a new role.

ment, and Department of Commerce. His itinerary, on a typical scouting trip might include Seattle, Tacoma, Fort Lewis, Portland, Pasco, San Francisco, or even Honolulu.

Looking from his office window in the shadow of man's largest concrete dam, Rice can point to a dozen pieces of war-surplus equipment at work at any time on any day. On the Feeder Canal for the irrigation system, near the dam's west abutment, war-surplus wagon drills are biting into the diamond-hard rock. The air-tool operators wear war-surplus safety goggles, their drills are served with war-surplus air hose, and lubricated with Navy grease. The holes are blasted with war-surplus 40 percent dynamite.

When the drillers' equipment is moved to a new location, it is pulled by a war-surplus truck equipped with a war-surplus derrick.

Down on the Columbia River below his office, Rice can point to other war-surplus materials used on an around-the-clock basis. A squatty sea mule pushes and pulls muck-laden barges. It is manned by a crew wearing self-inflating Navy life belts. The barge it handles is fashioned from a series of watertight cells designed for the Navy.

If a fire should start, Bureau workers will seize Army-surplus fire extinguishers to combat the blaze. If more assistance is needed, a highly mobile jeep, complete with gas masks, hose, and other apparatus, will speed to the scene. If someone is burned in the fire, he will be treated at the scene with one of the several hundred war-surplus first-aid kits.

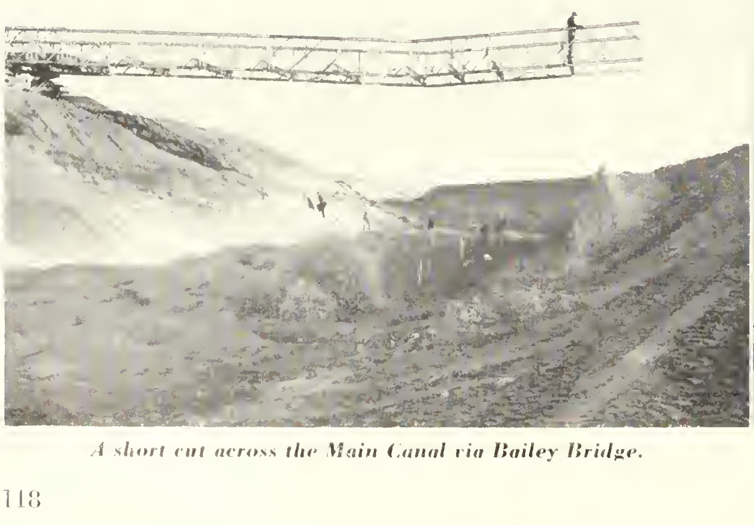
Use of war-surplus safety equipment has saved many lives on the Columbia Basin project, and likewise has prevented injuries. When two men recently fell from a barge and into the turbulent Columbia River they floated to safety because they wore Navy life belts. Other equipment pointing to greater safety includes small floodlights for illuminating work at night, goggles, life rafts, and mobile cranes for handling bulky objects which ordinarily would carry a high rate of strains and bruises.

Better upkeep of tools, with consequent lowering of injury rates, has resulted from the use of an annealing oven—another surplus item.

In his "little black book," which lists various bargains in war-surplus equipment he has obtained for the Columbia Basin project, Rice tallies off other items: 225 house trailers from the atomic bomb project at Hanford, Wash., and 283 prefabricated and demountable houses from Vancouver, Wash., for temporary housing at Coulee Dam; electrical cable for the Grand Coulee Dam power plant; tropical huts leased to contractors for their construction staffs; portable welding machines for repair and maintenance work at Coulee Dam and elsewhere in the basin; a 50-ton tank-recovery trailer for hauling transformers; and 575 treated ties for the Bureau's short-line railroad.

Despite the great quantity of surplus equipment he has purchased for the Bureau, Rice still adheres rigidly to a two-question formula: "Can we use it efficiently? Can we get enough use out of it to repay its cost?" If the answers to both questions are "yes," then Rice strikes a bargain.

"I had a give-away value the other day, but I turned it down," Rice commented. "The Army offered to sell me three weather-observation balloons for almost nothing. I simply couldn't see any useful application for them, so they were sold to the State penitentiary, but not for escape purposes. They were cut into strips and used for tarpaulins on the prison farm."



A short cut across the Main Canal via Bailey Bridge.

War-seasoned seamule now handles muck-laden barges.

Veteran, Wyoming

History repeats itself as land-hungry veterans of World War II follow the trails blazed by World War I builders of Veteran, Wyo.

By Vaughn Mechau, *Region VII, Denver, Colo.*

As much a part of war as the casualty lists, the suffering, and the insecurity, are the foxhole dreams of soldiers envisoning a place of their own in the country where the fruits of peace can be gratefully enjoyed.

After World War I, thousands of veterans with the help of the Bureau of Reclamation sought and found land where they could put down their roots on places of their own. Following the same cycle of war and peace, the soldier-sons of veterans of World War I now are impatiently laying out on paper their farm unit plans—just as they dreamed of them in the steaming jungles of Pacific islands, or as they huddled, bone-chilled, on some frozen European battlefield.

Now, and in the next few years, approximately 4,500 World War II veterans will have opportunities to settle on public land and 50,000 others on privately owned land on reclamation projects in the 17 Western States, and, through the "know how" earned in both war and peace, make their foxhole dreams come true.

Experiences of World War I saved lives and won battles in World War II. Experiences on irrigated land, learned the hard way by veterans of the first war, will be profitable for the returned soldiers of World War II.

The dreams of soldiers in 1918 materialized in 1921 when the first unit of the Goshen irrigation district, southwest of Torrington, Wyo., was opened to veterans. In that year 130 veterans of World War I enthusiastically discarded their olive drab for blue denim. Waters from the North Platte River meant the opposite of all the things war symbolized—life instead of death; construction in place of destruction.

So proud were the veterans of their new community that they petitioned the Union Pacific Railroad to change the name of the neighboring railhead to Veteran. Veteran was to be the shipping point for their produce—it was to be their village, their town, and in the future, their city.

Today Veteran stands, not as a shining modern city, but as a small community—an adequate school, a general store and post office, a grain elevator, lumber and feed store, and a few homes. For all its modesty, the town of Veteran is significant because it, too, was a battleground and marks a victory that will lead to future victories and to the successful development of towns and communities.

"Doc" Haas says livestock makes a successful farm.

In 1921, 130 returned soldiers successfully drew lots for units of the new irrigation district. Today, 19 of the original group are still on the land. In the intervening 26 years the former soldiers met and faced the multiple hazards of agriculture.

One of the first handicaps to the successful development of their dream community was the lack of agricultural experience among the settlers. At that time the Bureau of Reclamation did not have legal authority to set up even minimum qualifications for settlers. It was not until such authority was granted by what is commonly known as the "Fact Finders' Act" of December 5, 1924, that standards were set up to guarantee "reasonable assurance of success."

Many soldiers had no conception of the rugged life ahead of them, and were unsuited for the task they had selected for themselves. Those, too, whose minds speculated on selling their lands when necessary improvements were made, hampered the settlement.

Now, 26 years later, there are few of the original settlers left, but those who stuck it out are glad they did.

Today the original settlers are classified by their neighbors all the way from "comfortably well off," to "wealthy and influential." They have contributed to the welfare of their part of Wyoming and to the State as a whole. In the last election, two of the original veterans, Floyd Pease and Glen Hertzler, were elected county treasurer and county commissioner, respectively, of Goshen County. Walter W. Hudson, another original settler, retires this year as speaker of the Wyoming State House of Representatives.

It is from men like these that the veterans of World War II will receive guidance under the new settlement program of the Bureau of Reclamation.

George F. "Doc" Haas, another "original," points out: "Nothing succeeds like success. The best thing a young fellow can do on irrigated land is to follow the pattern and system of successful farmers. Too few of us knew much about irrigated farming when we started here. We had every kind of ex-soldier, from piano tuners to paper hangers.

"Too few of us remembered to forget that there are hours in the day and days in the week. We did not realize there was no let-up in work, season after season."

"Doc" Haas has come to the time in life when he is thinking about retiring—in an active sort of way. To his four grown sons

Evidence of a productive farm in the background

and four daughters, he is turning over the management of his now extensive farm.

"I am not going to to quit work—I am just going to take it a little easier," he said.

Although originally the unit was divided into farms averaging 70 acres, through the process of shaking down and working out profitable plans of operation, the individual farms now are considerably larger, averaging 120 acres.

Alert to the needs of young farmers settling on reclamation land, "Doc" Haas lists the following fundamentals for successful operations.

1. Farm background.
2. Long-range program.
3. Careful planning.
4. Balanced crops and livestock.
5. Utilizing the advice of county agents and agricultural agencies.
6. Vigilance and determination.

"Doc" Haas has the authority to speak. He and his wife moved onto their farm the first winter and underwent hardships as rigorous as most pioneers ever faced. For 6 weeks, that first bitter cold winter, Mrs. Haas never saw another soul besides her husband. A graduate of Kansas State College, Mr. Haas is a veterinarian and was farm-reared, but even these qualifications failed to make easy the hard work of farming. Neither he nor his wife have had a vacation in 10 years.

His rich irrigated acres produce potatoes, sugar beets, beans, alfalfa, corn for ensilage and livestock.

"You have got to have livestock to make a success of farming," he stoutly declares.

"You will find if you check every farm in this community that the ones having livestock are the successful ones. My Angus herd is fed from my land. They eat beet tops, beet pulp, and alfalfa. In return they give me fertilizer for the land and a cream check every month sufficient for running expenses of the farm. It took a long time to learn that livestock is vital to irrigated farms but you all see that those who follow that pattern, whether they are small or large operators, are successful," Haas said.

The veteran farmer warned against the evils of tenancy in newly created irrigated communities.

"Many of the boys put tenants on their places after they had become discouraged," Haas said, "and it not only hurt them but it hurt everyone else in the community as well. I have never known a tenant to have the same interest in a farm as the man who intends to make his farm his home. Equally detrimental is the large operator who mines the land for everything he can get out of it and seldom puts anything back in the soil," he added.

Haas urged the careful selection of examining boards for consideration of veterans for settlement projects. "They cannot put too much emphasis on farm experience," he declared.

"The examining board must consider that its action not only involves the lives of the applicants themselves, but has a definite bearing on the community, the State, and the Nation," said the veteran farmer. He ought to know about the life of a farming veteran.

He was there.

The Fortune Tellers

(*Continued from Page 116*)

Plenty of water in the main stem of Columbia River appears assured for generation of electric power; high river stages and some flood damage may, in fact, occur.

Wyoming

Prospects as regards both run-off and storage average better than normal. Run-off of five principal streams will be as follows: Shoshone, below reservoir, 133 percent of the 1936–45 average; Big Horn, at Riverton, 115; Popo Agie, at Riverton, 97; North Platte, at Saratoga, 97; Laramie, at Jelm, 123. Eight principal reservoirs are 45 percent full, as compared with the 10-year average of 25 percent.

British Columbia

Above-normal run-off is expected for all streams in the Kootenai-Columbia Basin, including Okanagan. North Thompson River at Barriere and Powell River on the coast should also flow above normal. Indications are that an early breakup is ahead, the flow of some streams being above normal. At all snow courses the ground is moist and not frozen beneath the snow cover.

Great Plains States

Storage in one South Dakota reservoir is 78 percent of capacity, as compared with an average of 44 percent. Three Nebraska reservoirs are 58 percent full; average 17 percent. One Oklahoma reservoir is 32 percent full. Two Texas reservoirs are 79 percent full; average 80 percent.

Detailed Forecast Available

Reports detailing the results upon which the foregoing summaries are based may be obtained by addressing the Division of Irrigation and Water Conservation, Soil Conservation Service, College Hill, Box D, Logan, Utah. Requests should identify the State or drainage basin about which information is desired.

The table on page 115 lists the reservoirs of the Bureau of Reclamation, their active storage capacities, and the amounts of water in storage on March 31, 1946, and on the same date this year. In the Pacific Northwest and in the northern Rocky Mountain region, the reservoirs are being filled sufficiently to assure enough irrigation water supply to mature crops this year. In the southwest, the six reservoirs of the Salt River Project in Arizona have about 220,000 acre-feet less storage than a year ago, and the lowest storage for March since 1940. The storage in Lake Mead is about 1,390,000 acre-feet less than a year ago, and lowest for March since 1938. On the Orland project in central California, the storage reserves are 30,000 acre-feet less than last year, and lowest for March since 1933. With its depleted reserves, the Carlsbad project has only about 4,000 acre-feet more storage than it had in March last year.

U. S. GOVERNMENT PRINTING OFFICE: 1947

NOTES FOR CONTRACTORS

Contracts Awarded During March 1947

Specification No.	Project and State	Award date	Description of work	Contractor's name and address	Contract amount
1551	Shoshone, Wyoming	Mar. 12	Main control board, distribution board and accessories	Control Corp., Minneapolis, Minn.	$51,402.00
1555	Missouri Basin and Colorado-Big Thompson.	Mar. 6	High pressure gate assemblies for Enders Dam and Estes power plant.	Willamette Iron & Steel Co., Portland, Oreg.	93,987.00
1570 [1]	Colorado-Big Thompson, Colorado.	Mar. 28	Construction of Marys Lake and Estes power plants and switchyards.	Peter Kiewit and Morrison-Knudsen, Omaha, Nebr.	2,176,708.00
1570 [2]	do	Mar. 3	Construction of Aspen Creek siphon Marys Lake Reservoir, Prospect Mountain conduit.	Horner and Switzer, Denver, Colo.	1,611,953.00
1575 [3]	Central Valley, California	Mar. 4	Electrical equipment for Ygnacio and Clayton Canal pumping plant.	Standard Transformer Co., Warren, Ohio	22,069.00
1576	Missouri Basin, Wyoming	Mar. 20	Three 13,333-kilovolt-ampere generators and accessories for Kortes.	Elliott Co., Jeanette, Pa.	501,711.00
1585 [3]	Colorado-Big Thompson, Colorado.	Mar. 17	Construction of Granby pumping plant	Granby Constructors, Colorado Springs, Colo.	1,139,998.00
1587	Denver, Colorado	Mar. 4	Testing machine with 5,000,000-pound capacity	Baldwin Locomotive Works, Eddystone, Pa.	339,775.00
1588	Yakima-Roza, Washington	Mar. 11	Construction of manifolds, discharge pipe lines and structures.	Schenmann & Johnson, Seattle, Wash.	773,131.00
1595	Central Valley, California	Mar. 3	One 30-ton 1,380-foot span cableway for Shasta Dam	Washington Iron Works, Seattle, Wash.	81,416.00
1611	Missouri Basin, Wyoming	Mar. 7	Three 108-inch steel penstocks and accessories for Kortes.	Darby Products of Steel Plate Corp., Kansas City, Kans.	78,856.00
1623	Yakima-Roza, Washington	Mar. 21	Construction of lateral distribution system, areas 15, 16, and 17.	J. A. Terteling & Sons, Inc., Boise, Idaho	224,153.00
1624	Central Valley, California	Mar. 4	Construction of Los Medanos wasteway extension	M. W. Brown, Redding, Calif.	11,849.50
1625	Missouri Basin, Montana	Mar. 24	Erecting 5 steel huts and constructing utilities, Miles City	Jayhawk Construction Co., Billings, Mont.	25,904.75
1627	Hungry Horse, Montana	Mar. 12	Construction of 12.47 kilovolt transmission line and distribution system.	Olson Construction Co., Salt Lake City, Utah	19,155.00
1628	Boulder Canyon, Arizona-Nevada.	Mar. 19	Construction of utilities for Boulder City	H. W. Polk, Las Vegas, Nev.	111,538.00
1629	Missouri Basin, Montana	Mar. 13	Erecting 5 steel huts and utilities at Hardin	Wm. J. Frates Construction Co., Billings, Mont.	28,468.30
1634	Fort Peck, Montana	Mar. 28	Electrical equipment for Wibaux substation	Standard Transformer Co., Warren, Ohio	11,200.35
1640 [4]	Davis Dam, Arizona-Nevada	Mar. 3	10 transformers and disconnecting switches	do	10,333.80
1650	Central Valley, California	Mar. 10	Test piling for Delta Mendota pumping plant	Underground Construction Co., Oakland, Calif.	19,201.00
1658	Boise-Anderson Ranch, Idaho	Mar. 11	2 radial gates and hoists for spillway	Valley Iron Works, Yakima, Wash.	18,200.00
1661 [5]	Central Valley, California	Mar. 11	11 20- by 17-foot radial gates	Berkeley Steel Construction Co., Inc., Berkeley, Calif.	26,620.00
1661 [6]	do	Mar. 11	11 radial gate hoists	Pacific Coast Engineering Co., Alameda, Calif.	29,700.00
R2-6	Region II, California	Mar. 17	Moving and converting buildings and constructing water system.	Paul Spencer Construction Co., Los Angeles, Calif.	13,624.70
7461-A-1	Davis Dam, Arizona-Nevada	Mar. 27	Reinforcement bars	Capitol Steel & Iron Co., Oklahoma City, Okla.	51,810.43
7478-A	do	Mar. 21	do	Sheffield Steel Corp., Kansas City, Mo.	93,242.16
G-38,213-A	Columbia Basin, Washington	Mar. 21	15,530 feet power cable	General Electric Co., Denver, Colo.	61,737.36
G-38,231-A	do	Mar. 5	1,000 tons reinforcement bars	Southwest Steel Rolling Mills, Los Angeles, Calif.	89,000.00
G-38,235-A	do	Mar. 5	do	do	91,000.00
G-38,237-A	do	Mar. 28	30,000 barrels portland cement	Lehigh Portland Cement Co., Chicago, Ill.	100,848.00
G-38,241-A	do	Mar. 6	Reinforcement bars	Sheffield Steel Corp., Kansas City, Mo.	56,180.73
G-38,247-A	do	Mar. 20	do	do	120,539.58
G-46,375-A	Colorado-Big Thompson, Colorado.	Mar. 27	33,100 barrels portland cement	Colorado Portland Cement Co., Denver, Colo.	93,060.65

[1] Schedules 1, 2, 3. [2] Schedules 4, 5. [3] Schedule 1. [4] Schedules 1, 2. [5] Item 1. [6] Item 2.

Construction and Supplies for Which Bids Will be Requested During May 1947

Estimated date bids to be invited	Estimated date bids to be opened	Project	Description of work or material
May 1	June 5	Central Valley, California	Construction Tracy pumping plant.
Do	do	do	20- by 17-foot radial gates and hoists, Delta-Mendota Canal, station L-185 to L-774.
Do	do	Colorado-Big Thompson, Colorado	Motor controls and switch gear for Granby pumping plant.
Do	do	Columbia Basin, Washington	Motor control equipment for Quincy pumping plant.
Do	do	do	Motors for Quincy pumping plant.
Do	do	do	Earthwork, concrete lining, and structures—Potholes East Canal, station 30+00 to station 376+30.
Do	do	do	Earthwork, concrete lining, and structures—West Canal, station 351+ to station 383+ and station 509+ to station 1229+19
Do	do	Davis Dam, Arizona	Control board for Phoenix substation.
May 5	June 9	Columbia Basin, Washington	Construction Soap Lake siphon—West Canal—station 383+.
Do	do	Yakima-Roza, Washington	Earthwork, pipelines, and structures—lateral distribution system—pump areas 2, 5, 6, and 7.
May 12	June 16	Boise-Payette, Idaho	Earthwork and structures—"C" Line West laterals 1.6 to 23.5.
May 15	June 19	Central Valley, California	Coupling capacitors with potential devices and carrier line traps for Keswick and Shasta switchyards.
Do	do	do	Earthwork, pipelines, and structures—laterals 4.8, 5.3, 5.9, and 6.0 and sublaterals—Contra Costa lateral system.
Do	do	Colorado-Big Thompson, Colorado	Materials for Loveland-Greeley 115-kilovolt transmission line (30 miles).
Do	do	do	Unit substation and pump boards for Granby pumping plant.
Do	do	Columbia Basin, Washington	Construction Burbank pumping plant.
Do	do	do	Oil and water storage tanks, Grand Coulee power plant
Do	do	do	23-foot pipe, Soap Lake siphon, West Canal.
Do	do	Davis Dam, Arizona	Bus structures and generator protective equipment for Davis power plant.
Do	do	do	Materials for Parker-Pilot Knob 161-kilovolt transmission line (125 miles).
Do	do	do	Materials for Prescott-Phoenix 230-kilovolt transmission line (75 miles).
Do	do	do	Materials for Tucson-Cochise 115-kilovolt transmission line (80 miles).
Do	do	do	Materials for Parker-Davis 230-kilovolt transmission line (80 miles).
Do	do	do	Materials for Davis-Prescott 230-kilovolt transmission line (140 miles).
Do	do	Missouri Basin, Angostura, South Dakota	54- by 72-inch outlet pipes, Angostura Dam.
Do	do	Missouri Basin, Kortes, Wyoming	3 96-inch ring follower gates, Kortes Dam and power plant.
Do	do	do	Drain lines, Kortes Dam and power plant.
Do	do	Provo River, Utah	Construction Jordan Narrows pumping plant.
May 20	June 24	Columbia Basin, Washington	Station auxiliary power boards a. c. and d. c. for Grand Coulee right power plant.
May 22	June 26	Deschutes, Oregon	Earthwork and structures—laterals M-57 to M-64-A and sublaterals.
May 27	July 1	Columbia Basin, Washington	Jet pumps, Grand Coulee right power plant.
May 29	July 3	Provo River-Deer Creek, Utah	Bypass with energy absorber, Jordan Narrows pumping plant.
May 30	do	Central Valley, California	Main and station service control boards for Tracy substation.
Do	do	do	Motor control and station service boards for Tracy pumping plant.
Do	do	Columbia Basin, Washington	Unit and main control boards for Grand Coulee right power plant.

THREE-WAY AGRICULTURE, Boise project, Idaho

Bureau of Reclamation Photo

JUNE
1947

Featuring:

•

FORTY-THREE YEARS on the Shoshone Project

•

BRAHMAN CATTLE

•

RECLAMATION and the Housing Shortage

THE *Reclamation* ERA

United States Department of the Interior
J. A. Krug, Secretary

BUREAU OF RECLAMATION OFFICES
Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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The Reclamation Era will continue to make its mailing facilities available for distribution of the Personnel and Project Directory. However, in order to comply with the President's program, the directory will be published semiannually, instead of quarterly, until further notice. We plan to be able to distribute the directory with the September 1947 issue.

Reclamation ERA

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Art work by Georgie Petty, and Mary Edmondson, Bureau of Reclamation, Washington, D. C.

Front cover photograph by Stanley Rasmussen, Region I. Back cover photograph by William E. Russell, Region III.

"Realistic Abundance"

Secretary Of Agriculture Clinton P. Anderson, speaking before the House Committee on Agriculture, April 21, 1947, made the following remarks which are printed here as a matter of interest to reclamationists:

"**As my contribution today** I want to outline what I believe to be the one practical policy for American agriculture—a policy of organized, sustained, and realistic abundance. I want to show you the opportunity we have now, at long last, to establish and maintain a balance between consumption and the sound capacity output of our agricultural plant. This is an opportunity not only to serve the general welfare but also, and not incidentally, to serve the best interests of United States farm people.

"**Now, how much food and fiber** do we need?

"I have looked at that question from a number of different angles, and the answer I get each time is that we need more than we have ever had. Look at it from the nutritionist's standpoint, and it's clear that many people need greater farm production in order to have adequate diets. Look at it from the standpoint of economics, and you see both potential markets and productive power which would, if brought together, mean profitable exchange and an expanding economy. * * *

Assuming that the buying of families with prewar incomes of $2,000 or more—the upper 40 percent of our income groups—represents what the people of the United States want, and applying their buying habits to the whole population, it is indicated:

"* * * that people want about 40 pounds more meat per capita than they were getting between 1937 and 1941; they want over 200 pounds apiece more milk, about 9 pounds more chicken, 23 or 24 pounds more fresh vegetables, around 17 pounds more processed vegetables, an additional 50 pounds of citrus fruit, and over 80 pounds more of other fruits. * * * I believe it is safe to assume that they would buy more products made from cotton, tobacco, and wool, although we do not have the precise measure for these products that compare with those I have just given for food.

"**Total up the wants of our people,** add in conservative amounts for exports, imports, and industrial uses, allow for good yields, and here's the picture: We would need more than 420 million acres for crops, orchards, rotation pasture, and fallow land. That is almost exactly what our production goals call for this year. It's around 10 million acres higher than the comparable figure for last year or for the 1937–41 average. It's the continuing acreage we would need if people of reasonable income could buy what they have shown they want.

"* * * Judging what the whole population wants by the actual food buying habits of persons in the upper 40 percent of our prewar income groups, our people would like to be able to buy a third more food than they had on the average in the five prewar years 1935–39. Last year our food consumption level was already 16 percent above prewar. So, as a result of increased consumer income and increased farm production, we have gone about half way toward suplying people's wants that were not being satisfied in the prewar years. * * *

"**What our studies and experience boil down to** is one simple fact: By supplying only the reasonable needs of our own people and reasonably expected export and industrial markets, we cannot only market as much agricultural production as we have now but can actually expand. We can do it profitably and with progressive improvement of our natural resources.

"Preliminary results of a current study in the Department of Agriculture show that of the crop land used to produce the civilian diet in the war years 1943 through 1945, about 80 percent was used in the production of livestock products; not more than 20 percent of the land that produced civilian food was devoted to crops for direct human consumption. The same study indicates that with present yields we would not have enough crop land to support our present population if all of us ate the same high-grade diet that our high-income families eat. * * * At average yields, it takes the product of only about two acres a person to produce the food for a low-income diet, while it takes 3 acres or more per person to supply the food for a liberal diet. It takes no imagination to see the possibility of eliminating the old problem of surpluses if we have the means to eat what we really want."

For carrying out a policy of organized, sustained and realistic abundance, Secretary Anderson outlined a broad program, in which the following was one of several major elements:

"The third broad program requirement is an over-all land program to make sure we conserve and improve our agricultural resources. Therein lies the hope for sustained and increasing abundance. * * *"

"Electric power helps to make farming easier and more profitable and farm living more satisfactory, and its extension to new areas is a great stimulant to business. Only half the farm population now has the benefits of this power, and the Rural Electrification Administration self-liquidating loans to cooperatives are in great demand."

Letters to the Editor

Housing and Mailing Problems

DENVER, COLO.,
April 20, 1947.

GENTLEMEN: I have recently moved from 3011 West Twenty-ninth Avenue, Denver 11, Colo., to 307 West Fourteenth Avenue, Denver 4, Colo.

I am sorry that my inability to find adequate housing has necessitated this change and will cause more, but I will appreciate your changing your records accordingly.

Very truly yours,

BERTHA S. PRATT.

We're sorry, too, mostly about the housing situation. Perhaps the story on page 132 will give reader Pratt some ideas.—Ed.

Family Stuff

522 BANKERS LIFE BUILDING,
LINCOLN, NEBR.,
April 21, 1947.

GENTLEMEN: Please send me, at once, 43 copies of the April number of the RECLAMATION ERA. I want these to distribute to the members of the Unicameral Legislature, and would like to do this before our water bills, now on general file, come up for discussion.

We are particularly interested in the transcontinental tunnel, with the accompanying article on the Colorado-Big Thompson project.

Personally, I am interested in the article on irrigation in Siam, and I read with more than common interest the one on irrigation in the Philippines. My young son had seen these installations and had been deeply impressed.

It is family stuff, of course, but this same boy had also served in the European Theater of War, and he has explained in great detail the conservation methods in use in France, Germany, and Austria. This was quite an education for him and for me.

Reclamation is my business but the RECLAMATION ERA is a family magazine at our house. It is read and discussed every month.

Sincerely,

MRS. MARCELLA ALLEN,
Secretary-Treasurer,
Nebraska Reclamation Association.

A Voice From Athens

The following letter was sent to the Commissioner of Reclamation and appears in these columns as an indication of the widespread interest in the problems of hydroelectric power, drainage, and irrigation.

10b NECTARIOU STR.,
Athens 8, GREECE,
March 30, 1947.

DEAR SIR: Having been selected for an overseas training under the auspices of U. N. R. R. A., I visited your country during the period of from June 1946 to February 1947.

My aims were to study your methods of work in hydraulic projects, and specifically for irrigation and drainage purposes.

I spent a great part of my stay in the U. S. A. with the Bureau of Reclamation, mostly at your offices in Denver, Colo., Boise, Idaho, Coulee Dam, Wash., Redding, Calif., Sacramento, Calif., Yuma, Ariz., and Boulder City, Nev.

It is my pleasant duty to express, both to you and the personnel of the U. S. B. R., my sincere thanks for the assistance given me.

The constant kind interest and help extended to me in my work, which enabled me to visit many of your excellent projects and get useful information, merit heartier thanks than I am able to express in this brief letter.

With the remembrance of your great and beautiful country, so advanced, free, and hospitable, forever fresh in my memory, I wish to thank you once again, and I remain, Dear Sir,

Yours sincerely,

PETER PETREAS,
Civil Engineer,
Ministry of Agriculture.

Get Acquainted

HASTINGS, NEBR.,
April 15, 1947.

DEAR EDITOR: I list names and addresses of friends whom I believe will be interested in receiving "get acquainted" copies of the RECLAMATION ERA.

If possible mail copies of the April 1947 number, which I think is one of your best issues as it contains much valuable information. The article, *The Farmers Take Over*, is noteworthy because it proves that reclamation projects when properly handled pay big dividends.

Yours truly,

A. J. GAUDREAULT, *Office Manager,*
City of Hastings,
Water and Light Department.

From Alberta, Canada

PROVINCIAL GOVERNMENT BUILDING,
LETHBRIDGE, ALBERTA,
April 2nd, 1947.

DEAR SIR: I was very pleased when found that you had again started to publish the ERA. It is a most interesting magazine especially for us interested in irrigation.

Yours truly,

C. S. CLENDENING,
District Manager,
Lethbridge Northern Irrigation District.

Everyone a Builder

This magazine is devoted to the reclamationists of the West. It is designed to bring profitable information and interesting facts to you. It can bring similar pleasure and profit to your friends, neighbors, or relatives who do not yet receive it. The price is nominal—$1 a year. If you live in the West and are a member of a water users association, the price is only 50 cents a year. You need allies in building prosperity for yourself and for your neighbors. Help build the circulation of the RECLAMATION ERA and add to the number of informed proponents of western water resource development.

OUR FRONT COVER

He Knew Them When. . .

Harry Smith, Sr., has lived on a reclamation farm almost since the Bureau came into being. Forty-three years ago he left his mining job in western Idaho for a job at the St. Louis World's Fair. On the train he met a young engineer who was very enthusiastic over the Minidoka tract near Twin Falls, Idaho, which he had just helped survey. Smith was so taken by the young man's enthusiasm he returned to Idaho and got himself a piece of land near the Snake River at Heyburn, Idaho, which he has farmed ever since. The young man on the train turned out to be Jack Savage, the world's foremost designing engineer, responsible for many world-renowned structures, among which are Grand Coulee, Hoover, and Shasta Dams.

2,4-D Weed Killer

The sensational weed-killing chemical known as 2,4-D can be used safely to clear weeds out of pastures, and cows can eat it with perfect safety, according to experiments conducted by the United States Department of Agriculture.

Cows and sheep who grazed in a pasture that had been given a spraying of double the concentration needed for weed control, developed no symptoms of any kind, and postmortem examination of some of them after slaughtering showed internal organs perfectly sound.

One cow received a special dose of about one-fifth of an ounce of 2,4-D daily. Blood samples showed its presence in her circulation, but it did not appear in her milk.

The one risk of trouble is the chance of poisonous impurities being present in commercial preparations of 2,4-D.

EDITOR'S NOTE.—The above item is reprinted from the Aminco Laboratory News, volume 4, No. 4, January 1947, published by the American Instrument Co., 8030–8050, Georgia Avenue, Silver Spring, Md., through the courtesy of the editor, Mr. Charles Schuettler. It is included in the RECLAMATION ERA as a matter of interest to farmers and to canal maintenance crews.

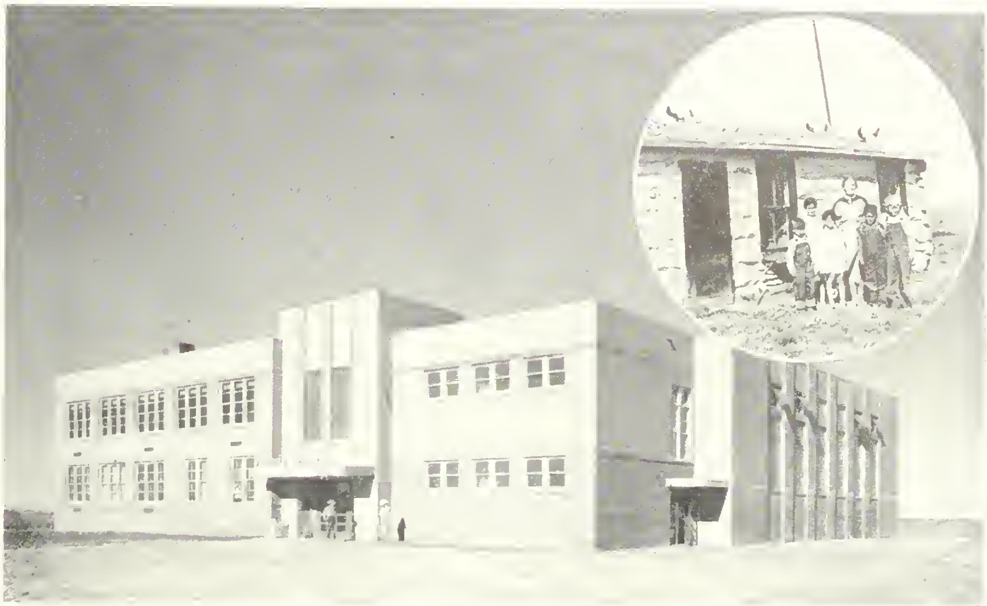
Education and Irrigation ~ PARTNERS in PROGRESS

"No more pencils, no more books, no more teachers . . ."

School may be over this month for many, but education and irrigation continue to march along together.

by Stanton J. Ware,

Reclamation Economist, Region VI, Billings, Mont.



Standard educational facilities are direct result of and benefit to irrigation. Note inset, preirrigation school.

TODAY, MORE THAN EVER BEFORE, the advantages of schooling are apparent in the every-day lives of farmers throughout the Nation.

The farm operator has to keep posted on new and improved methods of farm management and operations so that he can take advantage of his increased opportunities for making a profitable living.

The irrigation farmer is wide-awake to the challenge. In fact, he is leading the field in various programs for adult education and other community activities.

To prove this statement, here is the story of a typically successful irrigation community, once a dry land area, located in north-central Montana, the Greenfields Division of the Sun River Irrigation project.

Lagere Ereaux, according to the Fairfield Times, was the pioneer irrigator in the Sun River area. After 9 years of drought-caused crop failures between 1868 and 1877, long-enduring Ereaux dug a diversion ditch by hand and in 1877 applied the first water to his fields. The crops were a success, and he was able to obtain a contract to supply grain for use at the Fort Shaw army post.

With this example before them, other farmers irrigated individual tracts from that time. They had very little trouble in delivering water to the lower lands, but getting water to the higher bench lands presented serious difficulties. People began to make homestead entries as far back as 1910 under desert entry. Considerable homestead settlement of the bench was made but attempts to convey water to these lands met with failure until 1919, when the Bureau of Reclamation constructed canals through which the first water was actually brought to the Greenfields area. An adequate water supply for the entire irrigation season was insured when storage water was introduced in 1931.

During 1931, 87 irrigated homestead units were made available under the Bureau of Reclamation development program. More followed, the last prewar opening occurring in 1940 when 140 tracts were opened for settlement. As the settlements grew, so did the school system.

As late as 1925, eight schools, with but one teacher and only a few pupils each, were functioning there. Four of the schools had six or less students, while one of them enrolled only two children. In 1925 the number of Greenfield district farms was 304 with a farm population of 566 people. Ten years later, when organized irrigation had been established, with accompanying road improvements, increase in farm income and general betterment of living conditions, the number of farms had increased to 464 with a farm population of 1,008 persons.

By 1939, pressure had become so great that the Fairfield school district, located centrally within the project, was sending approximately 150 pupils by bus to 3 high schools situated beyond the project boundaries. It was then that a new $100,000 high school (see above) was built in Fairfield. It opened in the fall with 142 pupils and 7 teachers. By this time the community had grown to a prosperous, active group including 709 farms and 2,006 people (1940 figures). And in 1945, despite the heavy drain of war, the Greenfield's division included 840 farms with a population of 1,973.

Changes and improvements in the entire school system have kept pace with the rapid development of agriculture. By 1945, consolidation had brought together the pupils from smaller schools, and had made available more funds for improving the quality of instruction and the school buildings.

Busses were used to transport children to 2 schools of 45 and 185 pupils, while the Fairfield school had 253 in its elementary grades and 169 in its high school. Courses in home economics were offered and classes in agriculture were directed by a full-time Smith-Hughes instructor.

As the area grew in size and prosperity, farm families took an added interest in community affairs. The Sun River Project Fair became an event of note. Local irrigation farmers and their families helped to make the fair a success. Various contests and exhibits of agricultural products, livestock, and poultry were entered by those from the district and from other areas. The farm exhibits showed clearly that the farmers were putting into practice the ideas and methods learned at school. Farm youth, the pupils of the school year, demonstrated their fitness to take their places as successful farmers of the future.

The Greenfields Sire and Marketing Association, organized and directed by the farmers, owned in 1941 12 purebred dairy sires, a stallion, and 2 boars. The Sun River Electric Cooperative, formed in connection with the Rural Electrification Administration, aided in supplying electric power to numerous farms. Crop, dairy, and poultry inspection tours were commonly made by local farmers that they might benefit by learning through others' experience.

Ample evidence is to be seen by the progress of the Sun River project farmers that education and irrigation go hand-in-hand to produce better living and greater prosperity among those on and near an area under irrigation.

The irrigation farmer of today is a businessman who has developed more than horse sense in a machine age. He has ably demonstrated how to apply his learning to make a success in irrigation farming.

FORTY-THREE YEARS ON

by H. H. JOHNSON, *Superintendent, Operation and Maintenance, Region VI, Billings, Mont.*

FROM sagebrush flats inhabited only by antelope, prairie dogs, and rattlesnakes to a thriving agricultural community of 5,500 people in one generation, a community producing an annual crop revenue of around $3,000,000—that is the story of the Shoshone Reclamation project in northern Wyoming. It is a story that typifies the utilization through reclamation of the two great resources of the arid West—land and water.

The Shoshone project is an example of the present-day dual-purpose unit, which characterizes the extensive Missouri Basin development, incorporating irrigation and hydroelectric power. As now planned, water stored in the Buffalo Bill Reservoir will pass through two power plants. One, the Shoshone Power Plant, has been in operation for many years, supplying low-cost electric power at wholesale rates to many communities in the area. The other, the Heart Mountain Power Plant, is now under construction. After serving this purpose without loss, that water is then diverted for the irrigation of the lands of the project.

Ultimately the Shoshone Reclamation project will contain an area of approximately 160,000 acres. Three divisions of the project, Garland, Frannie, and Willwood, comprising about 72,000 acres, are completed. The Heart Mountain division of 38,000 acres, principally unentered public land, is now under construction.

It is on this division that the Bureau of Reclamation opened 83 farms for veteran settlement this February. Approximately 300 more farms will be available for entry within the next 3 years. The Oregon Basin division of about 50,000 acres remains for future development.

The agricultural potentialities of the Shoshone River valley were first explored by the early Mormon settlers in the last decade of the nineteenth century. They constructed irrigation works and successfully tilled a fertile area at the mouth of the river, near the towns of Lovell and Cowley. Here the broad Shoshone River valley facilitated easy diversion and simple development.

The greater project for the irrigation of thousands of acres was envisioned by the famous frontiersman—W. F. Cody. Colonel Cody, and his associate, Nate Salisbury, impressed by the great expanse of fertile land, extending from above the town that now bears Cody's name to the lower reaches of the Shoshone River valley, secured a permit for the development of an irrigation project to cover the entire region.

They proceeded first to establish the town of Cody and then constructed the Cody irrigation canal to serve an area in the immediate vicinity. The development was successful and, although not within the Shoshone Reclamation project as known today, was the pioneer unit of the area.

Realizing the need for greater resources to finance an undertaking of the magnitude envisioned in the larger project, Buffalo Bill and his associate relinquished their rights and these were later acquired by the then infant Reclamation Service.

The Shoshone Reclamation project was authorized by the Secretary of the Interior on February 10, 1904. Four months later actual work started on Shoshone Dam, a structure now known as Buffalo Bill Dam in honor of the pioneer who first realized the significant importance of irrigation to the community he had founded. Water was delivered to the first unit of the Garland division on June 1, 1908, and the Shoshone Reclamation project became an actual reality.

Buffalo Bill Dam, a concrete structure 328 feet high, creates a reservoir with a capacity sufficient to supply water to a depth of 2½ feet over each acre within the entire project. Located in the picturesque Shoshone Canyon, only a short distance above the Heart Mountain division, this dam had the distinction for many years of being the highest in the United States. In more recent times it has been dwarfed by such Bureau of Reclamation structures as Hoover, Grand Coulee, Shasta, and other dams.

The early history of the Shoshone project area is associated with Indian lore, stagecoach robberies, livestock feuds, and all the romantic features characterizing the old West.

Railroad service into the region was established during 1901 and 1902. Prior to that time travel was only by stagecoach. Garland, near the eastern extremity of the project, was at one time a thriving town on the stage route between the railroad points in southern Montana and the Big Horn Basin. Garland then offered all the comforts and recreational opportunities desired by the early-day traveller but today little remains of its glamour of the Gay Nineties.

The Launchberry Ranch on Eagle Nest Creek, near the center of the Heart Mountain division, was a major stop on the stage line between Red Lodge, Mont., and Cody, Wyo. Sam Launchberry, who resides on the home ranch established by his father, can still entrance the listener by relating stories associated with the stage-line station. Many years have elapsed since the stagecoach passed that way but the old Red Lodge-Cody trail is still in evidence across the Upper Ralston or Alkali Creek Flat.

THE SHOSHONE PROJECT

Ralston was originally considered and promoted as the principal project town. However, certain economic factors favored the then more central location at Powell, named after Maj. John Wesley Powell, an associate of Buffalo Bill, and the town site was established in 1908. For several years it remained only as a construction camp, with Cody and Garland serving the principal trading and recreational centers. The only mode of transportation, aside from the infrequent trains, was by team and wagon, and a trip from Powell to Cody was then a major undertaking. It is easy to recall how a handcar "borrowed" from the railroad company or the single automobile in the area improvised for service on rails, met with disaster in an attempt to dispute the right-of-way with the one train of the line.

Construction of canal systems with teams and fresnos (scrapers) in the early part of the century was a slow process, and the project necessarily was offered for settlement in relatively small blocks. The first land opening in 1908 comprised a small group of units surrounding Powell. The frontier was then rapidly moving westward and a free homestead was extremely popular.

At that time there were no restrictions as to character, experience, or capital. It was "first come first served" and the only requirement was a homestead right and enough capital to pay the transportation bill at "emigrant rates."

Many of the original homesteaders were "Easterners" lured to the West by the promise of free land and the romance associated with pioneering in the wide open spaces, where by the magic of irrigation the desert in the short period of a year or so could be made (according to the well-worn phrase) to "bloom like a rose."

These early settlers represented almost every vocation from bankers to yodelers, with a few experienced farmers. Many had but a vague comprehension of the trials and tribulations associated with the creation of productive farms from virgin soil. The fact that the cost of building the project had to be returned to the United States Government in a period of 10 years was not considered. What were a few hundred dollars a year compared with the revenue to be derived from bounteous crops which could be harvested from this new land?

For some the glamour was short lived. Difficulties attended the clearing and preparation of the land for water. There were a few years of low productivity before the virgin soil with its shallow zone of fertility could be made to yield abundantly.

Some with insufficient capital and equally insufficient farming "know-how" were forced to abandon their efforts.

On the other hand, many fine farms and comfortable homes on the Shoshone Reclamation project today bear tribute to the pioneers who had the fortitude and endeavor to remain in spite of poor crops, low prices, seepage and the many other vicissitudes of their pioneer era.

New settlers of today will find inspiration and courage in a visit with such men as Frank Kittle, George Kagi, Earl Murray, John Stutzman, Edgar Swallow, Pete Christinsen, and numerous others. They represent the pioneers of the Shoshone project, pioneers who are still in the saddle.

The selection of a farm during these early years of settlement was a major undertaking. No roads were provided to the farm units in order that they might be viewed from the luxury of an automobile seat. No experienced agriculturalist was provided to guide in the selection of the farm or to expound on the technique required to develop a selected site into a profitable farm in the shortest possible time.

Homeseekers were loaded into a spring wagon behind a team of mules and bumped over the sagebrush flats and coulees under the guidance of one Tom Johnson. Tom's principal qualification for the job at the time was that of being a "darned good mule-skinner." He did not know too much about irrigation but he was a pioneer and he knew his way around over the wide-open spaces. He also "knew his mules" and was sure to have his party aboard when they, the mules, decided to go home.

Little was done to assist the new settler. After the selection of his farm he completed his homestead entry, paid his filing fee, and was left more or less to shift for himself. He then proceeded to build his shack as best he could, clear the sagebrush, prepare the land for irrigation, plant, cultivate, and harvest his crop. Building materials were not provided; no agricultural specialist assisted him in planning his farm program. Engineers were of necessity too busy building new works to give aid in such a task as laying out a farm irrigation system.

Few sources of credit were available to the new settlers through the years of meager return. They had to do it the hard way. Those with sufficient stamina were in the majority. The fainthearted quickly went elsewhere and were replaced by the more hardy. The project now stands as a monument to the early twentieth-century pioneer.

Between 1909 and 1918 six additional units were opened on the Garland division. Each successive opening was accompanied

ABOVE: Homestead of John Dowling, 1912.

AT RIGHT: Dowling homestead thirty-five years later.

LEFT: Town of Powell, Wyo., showing main canal, 1909.

BELOW: City of Powell from same spot thirty-seven years later.

by new problems. In solving them, new techniques and needed experience rewarded the efforts of all concerned.

Between 1917 and 1920 the Frannie division, embracing lands principally in Big Horn County between Frannie and Cowley, was opened. Settler selection was then made by lottery and in the later openings the preference was given to World War I veterans.

Unusual difficulties accompanied the settlement and development of the Frannie division. For dogged determination to preserve their homes, in spite of adverse circumstances and without undue complaint, the pioneers of this division stand at the top of the list. New settlers on the Heart Mountain division who may at times experience discouragement can spend a few hours to great advantage visiting some of the early homesteaders on the Frannie division.

The Willwood division, proposed for settlement in several successive blocks between 1927 and 1938, was the first opening under the selective settlement act now in effect. The benefits derived through the process of controlled settlement are now evident. The development of this division occurred during the depression period when agriculture was generally unprofitable and the hunger for new farms practically nonexistent.

Although progress was somewhat slow, it has been steady and the major portion of the first settlers still continue to operate their original entries. While settlement of this division was about 20 years later than the Garland, the stage of development is now almost equal to that of the older unit.

The new settlers of the Heart Mountain division will reap the benefit of these past 43 years of progress in irrigation development. This has been a period of experience in all phases of the enterprise. The irrigation works embrace the most modern engineering skills in design and construction. The farm unit pattern has been developed by agriculturalists experienced in this particular field.

A qualified agriculturist has been employed on the project to assist settlers who desire help in the lay-out of farm irrigation systems and general farm planning. Financial aid in farm development will be available for successful applicants. In order that there may be no duplication of effort, the work of the several agencies, now engaged in the various fields of agricultural training and assistance on the project, will be coordinated in such a manner that the new settler may be assured of the best possible service from trained technicians in any particular field.

The facilities provided for the assistance of the present-day settlers are a far cry from those made available in the mule-team, walking-plow, claim-shack days of the early era. However, the early settler was imbued with a pride of accomplishment, a pioneering instinct which carried him through adversity. With his own hands, and with but little assistance, he wrought fine farms from sagebrush flats and his claim-shack grew into a modern farm home. The settler of today may avoid many of the discouragements of the earlier period, but he will need to preserve the pioneer spirit.

A brief inventory quickly reveals what has been accomplished through this development in the economy of the community, the State of Wyoming, and the Nation as a whole. The cost of the project to the United States, allocated to irrigation facilities, exclusive of the Heart Mountain division, is slightly over $7,500,000, the greater part of which eventually will be repaid. Since 1908, crops valued at $41,300,000 have been produced, which does not include the aditional revenue received from the sale of livestock and livestock products. The project now provides 650 farm homes with a rural population of about 2,000.

The town of Powell has grown from a few shacks in 1908 to a thriving city of 3,250 people and an assessed valuation in 1946 of $1\frac{1}{2}$ million dollars. This principal project city provides educational, recreational, and religious facilities equivalent to that of many midwestern cities of much greater population.

The assessed valuation of the project area in Park County has increased from slightly over $100,000 to more than $6,000,000. In addition the value of 15,000 acres of irrigated lands and improvements in Big Horn County must be added to the value of the project.

About 500 carloads of various commodities originating in almost every State in the Union were imported into the project during 1946, and over 800 carloads of agricultural produce were exported.

This has been the material accomplishment of the past 43 years on the Shoshone Reclamation project and it is only the beginning. Hundreds of satisfied farm families, comfortable farm homes, flourishing small business enterprises, all sustained by a secure water supply, fertile soil and inexpensive electrical energy supplied by project works, witness benefits that cannot be measured in dollars and cents, but all add up to a stabilized national economy.

WHO STARTED IT?

The State of Washington challenges the claim of the State of Utah to the title: "Cradle of American Irrigation"

by Robert W. Fisher, *News Editor, Walla Walla Union-Bulletin, Walla Walla, Wash.*

Any western community claiming that irrigation was used there first must reckon with the Walla Walla Valley in Washington because Dr. Marcus Whitman, missionary doctor, used irrigation successfully beginning in 1841, if not before, and continued it until he was killed in the Whitman massacre of 1847.

The location was some 6 miles west of the present city of Walla Walla at Waiilatpu, the Whitman mission established in 1836. The exact date is not known but it was between 1839 and 1841.

T. J. Farnham, who visited the mission in September 1839, mentioned only that "water from the Walla Walla (river) by capillary attraction was raised to the roots of vegetation," but in 1841 Joseph F. Drayton, member of the Charles Wilkes exploring expedition, stopped at the mission and told of the use of irrigation as follows:

"The Indians have learned the necessity of irrigating their crops, finding that Dr. Whitman's succeeded better than their own. They, therefore desired to take some of the water from his trenches instead of making new ones of their own, which he very naturally refused. They then dug trenches for themselves and stopped up the doctor's. This had well-nigh produced much difficulty but finally they were made to understand that there was enough water for both and they now use it with as much success as the missionaries."

The time must have been about July, for Drayton spoke of wheat nearly ripe and of a fine kitchen garden and of several kinds of fine melons.

Marvin M. Richardson in The Whitman Mission (1940) wrote:

"In one of his letters to the secretary of the American Board written in 1841 (Whitman) proposed to dig ditches around his fields which would serve both for irrigation and to prevent stock from passing." (Stock got into the cultivated fields quite often and did damage.)

Charles J. Bartholet, long-time Washington supervisor of hydraulics wrote in "Building a State" (1940):

"The first reclamation of arid lands in this State by irrigation probably occurred 100 years ago. Records of this department show that Dr. Marcus Whitman constructed a ditch in 1846 to divert water from Doan Creek for irrigation of lands in what became later the Whitman Mission Donation Land claim, located 6 miles west of the city of Walla Walla."

Thomas B. Hill, managing secretary of the Washington State Reclamation Association, Olympia, in a recent letter to me said the 1846 date mentioned by Bartholet "was arrived at by a witness in the adjudication of the water rights on the Walla Walla River and its tributaries. The witness had reason to believe that Dr. Whitman was irrigating before he was killed (1847) and (the witness) probably not knowing definitely when he (Whitman) diverted water from Doan Creek gave the date as near the end of his (Whitman's) labors there."

Dr. Marcus Whitman

This reproduction of the painting of Dr. Whitman by Ernest R. Norling, was made available to the Era through the courtesy of the Whitman College in Walla Walla, Wash., named in honor of the Doctor. As there were no pictures available of Marcus Whitman, the portrait, made in 1936, is based upon historical descriptions of the missionary, and is a composite of the prevailing characteristics of the Whitman family.

Editor's Note.—Although we are always glad to receive additional and interesting data concerning early irrigation practices, we refer our readers to Dr. John A. Widtsoe's article, *A Century of Irrigation*, in the May Era for a clarification of the issues involved in discussions of Utah's right to the title of "Cradle of American Irrigation." Also be sure to read the coming accounts of the Utah Centennial Celebration this summer.

A student of early irrigation sheds more light on the subject

by Clifford R. Koester, *Coulee Dam, Wash.*

Recently I have noticed printed statements to the effect that Walla Walla claims the honor of starting modern irrigation through the efforts of Marcus Whitman at Whitman Mission in 1840 or 1841.

Not wishing to detract from the luster of Dr. Whitman's achievements, I believe that a closer examination of the record will show that when the Whitman Mission was established in September 1836, at Waiilatpu, about 6 miles from the present city of Walla Walla, and some 25 miles from old Fort Walla Walla, irrigation was already being conducted from a stream at Fort Walla Walla by the Hudson's Bay Co.

Donald McKenzie, of the North West Fur Co., selected the site of Fort Nez Perces, later known as Fort Walla Walla, in July of 1818. In 1821, Hudson's Bay Co. and the North West Co. merged, with Dr. John McLoughlin the new chief in the Oregon country. While the activities of the Hudson's Bay Co. were of such a nature that encouragement of agricultural pursuits among the Indians would have been ruinous to their business, Gov. Sir George Simpson did entertain plans for making the posts self-supporting. It was to this end that irrigation was being applied at the Walla Walla post; not on a large scale, but nevertheless, a forerunner of Whitman's efforts. (This may be checked by consulting "A History of the Pacific Northwest," by George W. Fuller, p. 326.)

However, Dr. Whitman did a great deal of educational work among the Indians adjacent to the mission. At first, seeing how well his crops grew under this method, they appropriated the water from his ditches for their use. Upon being reprimanded for this, they became angry and caused quite a bit of difficulty by plugging Whitman's headworks and ditches. Later, seeing that there was enough water for everyone, they laid out their own system of ditches with the help of Dr. Whitman, and all were satisfied.

In searching out the history of irrigation in Washington State, as background material for compiling a history of the Columbia Basin project, I find the record often dim and devious, and I offer this for what it may be worth. Some are certain to dispute it because of the dimness.

After reading the article on the following page, you may be interested in next month's story of a well-known western college president's early days as a ditchrider.

Photo by Philip Merritt, Region 1

As an artist with deft, sure strokes of his brush transmits to his canvas a lovely picture, so Elma Hill Neal paints a realistic verbal picture with her pen in . . . . .

The Trials and Tribulations of a Ditchrider and His Wife

by Elma Hill Neal

One of the most sorely tried families in the western United States is that of the man who, provincially speaking, lives on a ditchbank, and whose business is that of distributing water over a designated area, tilled and tended by farmers who live under high tension at least 6 months out of the year.

The ditchrider is a peculiar person, a man set apart with an almost professional standing among his farmer constituents. He is trusted and defended, he is cussed and cajoled. The work involved is not difficult, it is seldom monotonous and is more often downright exciting.

From that stated hour when the watermaster orders the water turned in at the head of the canal for the first time in the spring, until the last rows of potatoes and beets are drinking their final drop before digging time in October and early November, the ditchrider has a varied job.

It runs the gamut, from slogging the tumble weeds and muck that ride the foamy crest of the first muddy water tumbling over the dry canal bed in the spring, to the delicate problem of human relationships between farmers in the boiling summer sun.

Twenty years ago, the ditchrider always rode a horse. Before the water season started, he engaged in a series of dickerings and tradings, which usually resulted in a fair bit of horseflesh, one that had plenty of life, but was not skittish, one that could plod away all summer, yet was willing to stand while his master regulated a headgate or plugged a gopher hole.

Following the horse era, on some projects, came that of the light cart, the seat padded with an old jumper or blazer. This afforded the ditchrider more comfort, but he was scorned by some of the older men who considered such luxury as effeminate.

Today on many systems, with broad well-made ditchbanks, jeeps are bounding along, turning abruptly down the steep inclines and jogging over boulders and through fields. They save time, if not wear and tear. Yet scattered throughout the West, one still finds the horse and the cart occasionally in use, although they are both fading gradually out of the picture as the age of mechanization seeps its way into all phases of agriculture.

One of the most crucial times of the water season is the start. After a long winter of freezing and thawing, the winding ditch with its banks, high fills, and sandy spots, is an uncertain affair. During the war years, it was hard to keep a repair crew on hand, and the ditchrider was constantly on the alert, driving to meet the water as it came down, following its surging spread, keeping a sharp lookout for the tiny gopher holes that sucked in the first cold snow water which, if not caught, would soon soften the bank and cause the entire side of the ditch to go out.

Often there were all-night vigils. With April weather just what April weather always is, they were no picnics. Buttoned to the chin in a heavy coat, weed hook and shovel always at hand, the ditchrider, with his eyes trained for closest observation, scanned the dark waters, his ear alert to the softest gurgle that would indicate a seepage. Always the water went through, the ditch soaked up its normal share, the morning came, and the ditchrider, tired to the bone, rode home to a hot breakfast and the hope of a little rest. An idle hope mostly, for from then on the canal was on his mind.

Daily, the ditchrider made his ride. Farmers' wives could set their clocks by the familiar figure moving down the canal. Scribbled notes were left at headgates and tacked on fence posts, ordering water for the day. Occasionally a farmer in irrigating boots hailed him and explained a special order. The South forty was dry. Couldn't seem to get the water over the hump, so wanted a little extra. Spuds were coming up. Peas were blooming.

The banks were green, with bright patches of blue lupine and Indian Paintbrush. The ditchrider spotted a dark object in the water. With his weed hook, he towed it to shore

Photo by Stanley Rasmussen, Region 1

Ditchrider George Deck, 77, 32 years with the Wilder Irrigation District, Boise Project, Idaho.

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Photo by Stanley Rasmussen, Region I

Cleaning the gates is a "must" in Deck's line.

and fished the malodorous mass onto the bank. Some farmer's fine ewe had cropped too close to the water's edge. Farther on, he dropped on his knees and bent low over the water to measure an orifice. Still farther on, the canal passed through the Vanderford corral. As he opened the gate, the Vanderford kids stopped their play and ran to meet him. For each he had a bantering remark. The spring air was balmy. The world seemed good.

Because youth and stability are a few of the requirements for a good ditchrider, he is generally in the process of rearing a family. Usually his modest little home is situated near his work. It is a poorly run project that does not afford its riders a reasonably modern house, and furnish them with paint and kalsomine to renovate it yearly.

A telephone is a necessity and babies are born and raised through high-school days in a room where a telephone is a constant source of annoyance, as well as a boon and a blessing. Most ditchriders and watchmen must make morning and evening reports to the watermaster. For possibly an hour, twice a day, the bells are jangling constantly. If the Christenson twins had a simultaneous spell of the colic, the frantic mother was made more frantic. If Wayne Grimmett's 4-year-old Joyce disappeared in the dusk of a lazy June afternoon, when the canal was rolling heavily on toward the thirsty alfalfa fields, the watermaster was informed by phone and made ready to have the water turned out at the nearest diversion point, perhaps to be soon called by the relieved father to say Joyce was found asleep in the clothes closet.

Ditchriders' children grow up with the fear of the big canal always with them. They know that it is swift and deep and whosoever slips in that racing current has little hope of scrambling up its slippery or concrete banks. Yet they seek the quiet waters in some nearby lateral and splash to their heart's content, and long before the accepted age, are swimming like schools of perch, almost as much in their element as when skipping along the dusty road toward home.

The ditchrider's job is his family's job. Each member is alert in his rambles for seeps and gopher holes, knowing a farmer's crop is at stake. There is no record of any modern Hans stopping a leak in a dike, but there are countless sons of ditchriders who go about the routine business of stopping a gopher hole with a shovel and a well-placed chunk of sod in a most unheroic manner. If that isn't possible, they spread an alarm that brings a repair crew.

The ditchrider's troubles are always especially his wife's troubles, and when the Fourth of July pops up on the calendar and the neighbors are planning a fishing trip, she must resign herself to prosaic duties, knowing that the days are getting hot and with the canal brimming full there is more chance than ever of a break, with less help at hand from farmers. It is almost impossible for holidays and Sundays to pass without trouble somewhere on the ride. It is then that she takes over and summons aid, tirelessly calling until she gets enough help.

Because in this northwest county, the seasons are short and a lot of production is crammed into a few months, a farmer's temper is often short. Squabbles over water are the ditchrider's dread. He must be qualified to measure water equitably, but more important, he must be cool-headed and able to make fair decisions quickly. He must know, too, where his authority

Photo by Stanley Rasmussen, Region I

Mrs. Deck is the home front trouble shooter.

stops, and the farmer's responsibility begins. Many a ditchrider has bit his lip in silence and gone about his business of delivering water, knowing that to give extra to one farmer, means taking extra from another. Many have spent sleepless nights after hard days, trying to figure out some way of settling a matter that seemed impossible of solution.

And so the short summer blends into fall. The water runs smoother and cleaner and clearer. A quiet stillness comes over the land. Asters grow down close to the water, and in the low place behind the fill, cattails grow tall and willowy, and a red-winged blackbird tilts atop a heavy brown spike. From his highway on the ditchbank the ditchrider looks out over the lush green of the potato fields waiting for a killing frost. From over the brow of the hill, comes the faint whirr of a thresher and a thin cloud of chaff blows lazily in the soft air. Stacks of alfalfa hay dot the horizon and give off a musty fragrance. Already the daily orders for water are dwindling. The water in the canal is getting lower. Soon the phones will silence. Soon the beet trucks will be rumbling down the highway. Soon the ditchrider will go out some morning and find a thin crust of ice on a pool of water left in a low place in the canal. Soon comes his rest.

About the Author

Elma Hill Neal says about herself: "I am by education a school teacher with the heart of a farmer.

"Those hours of courting that resulted in my marriage to Ed Neal, were spent mainly on a ditchbank, for water was short on Lost River that summer and had to be measured carefully and doled out sparingly. When the river bed showed dry gravel, we took off on a honeymoon that included all of the irrigation projects in the neighborhood of Yellowstone Park.

"Not including the 4 years spent at the University of Idaho where my husband polished off his education, we have lived in the 'water business' and its people are our people. For five years, I wrote a column in the weekly paper published at Aberdeen, where he was manager of the Aberdeen Springfield Canal Co. But my greatest pride lies in my family of three boys and a girl, with stair-step ages of 15, 16, 17, and 20."

Photo by Stanley Rasmussen, Region I

Partners, season after season.

BRAHMAN CATTLE

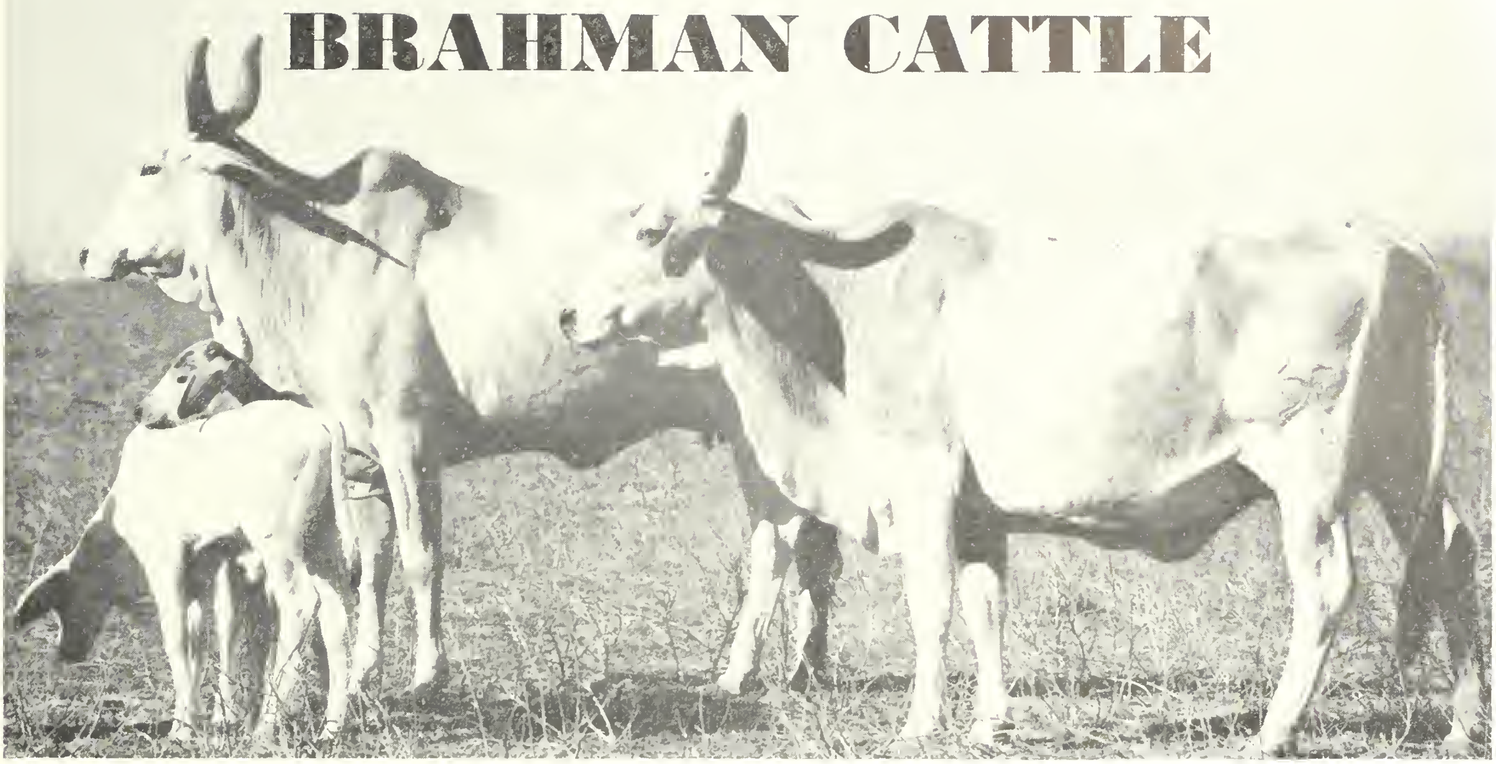


Photo by Charles A. Knell, Jr., Region V

As a good investment, ranchers of the Southwest recommend these descendents of the sacred white bulls of India

DOWN IN THE SEMITROPICAL Lower Rio Grande Valley of Texas, almost 1,800 miles from the Continental Divide in southwest Colorado where the Rio Grande begins its wandering course through New Mexico and Texas to finally spill in the Gulf, Brahman cattle sweat, shake off flies with a shimmy of their thick hides, multiply themselves, and add dollars for their owners with less bother than it takes to tell.

Brahman breeders and the ranchers, who range the descendants of individuals imported from their native India, take issue with the expression "as wild as a Brahman steer."

Brahman cattle may be "as wild as a Brahman steer," or as meek and lovable as a dowager's pet cat. It all depends upon the circumstances. On the range, where wolves and coyotes lurk to nab new-born calves, wildness and a vicious personality are assets. But in the feed lots, up close to the ranch house, in the show ring—wherever Brahmans are treated kindly, they are as affectionate as a Collie pup. Give a tame Brahman half a chance and he'll eat the shirt off your back, or wash your neck and ears with his moist tongue.

Brahmans, because of their agility and their refusal to be pushed around, are used in rodeos to thrill blood-thirsty spectators demanding action. Many cowboy rodeo performers have left their saddles empty in the old corral and prematurely joined their partners on the Range Beyond the Sky, because they zigged when they should have zagged near a Brahman steer.

There are many breeds and types of Brahman cattle. The term "Brahman cattle" is about as generic and broad as the word "horse." Each original breed derived its name from the district in India in which it was bred. Moreover, several distinctive breeds have been developed in the Lower Rio Grande Valley and the Texas Gulf Coastal Plains area by crossing the Brahmans with English breeds, including Herefords, Aberdeen Angus, and Shorthorns. The progeny of the first cross is often bred back to the purebred bull of European origin. The King Ranch in Texas has, by crossing Brahmans with Shorthorns, developed a strain that has achieved the status of a new breed known as Santa Gertrudis. By crossing Brahmans with Shorthorns, this breeding resulted in removing the Brahman humps. Earlier crosses were made with Brahmans and Herefords, and the offspring were called Bradfords.

The offspring of crossbred cattle have the vigor and vitality of the Brahman and the additional beefiness of the English breeds. They are sleek, short-haired, with loose, mellow hides. The hybrid animal is quick maturing and fattens rapidly. They are good feeders as well as excellent range beef stock.

The Brahman is believed to be the oldest of all breeds of cattle, and it is said that more than half of all the cattle in the world are either Brahman or possess some Brahman blood. White bulls of the breed are regarded as sacred by the Brahman caste of India, where they are associated with the Hindu divinity, Brahma. The cattle have endured the famines of India and other countries. Nature obviously fortified them with certain features to withstand heat and ward off insects and other pestilences which affect other breeds of cattle.

Contrary to the claims of any chamber of commerce, it does get hot along the Border and in the Lower Rio Grande Valley. But the hotter it gets, the better the Brahmans like it. Fact is, Brahmans nearly always rest in the sun. Mother range cows drop their calves in areas where they can observe the terrain from all directions and where they can keep their babies in the sun. Moreover, there are no better mothers in the animal kingdom. When mother cows go for water or feed, they summon other cows to stand guard by the babies. When attacked by a predatory animal, the mother Brahman spreads her legs over the calf and rips the attacking beast to shreds with her horns.

Beef Producers

Brahmans, produced primarily for beef, have a very high dressing percentage of meat, well covered, with evenly distributed fat. They are said to be preferred by many packers because their carcasses contain more marketable meat.

Other attributes of Brahman cattle include the early age they attain marketable status, the uniformity with which they de-

(*Continued on page 141*)

RECLAMATION and th

Photo by Stanley Rasmussen, Region I

This sheet iron form previously used in lining canals is now providing a substantial roof over her head for Mrs. I. D. Lionberger.

WHEN the Bureau of Reclamation is authorized to build a dam in a desert, a reclamation project in a wilderness, or opens land for veteran settlement, construction workers, irrigation farmers, and Bureau employees are faced with housing problems far exceeding those of the East. For when "the wide open spaces" of the West reveal no shelter for hundreds of miles, then reclamationists get busy.

If private facilities are not available, and local interests cannot or will not build dwellings where they are needed, then the Bureau tries to provide the most economical and habitable dwellings possible for its employees, who rent the quarters thus made available at fixed rates set by Interior Department policy.

The Bureau has always constructed permanent buildings, sewers, sidewalks and other utilities, for the maintenance staffs which will be permanently located at the construction site. Temporary buildings are erected with an eye toward moving them out again, and using what can be salvaged for another project. Nothing goes to waste if the supply people, engineers, and other Bureau of Reclamation employees can help it.

But the postwar housing crisis added to the Bureau's already complicated reclamation program. Shortages of materials, labor, and rising prices hit the Bureau as hard as any other agency in the country. Reclamation farmers on projects being constructed, or already built, found themselves faced with land—lots of land—but no houses for the returning veteran, his wife or family, for the children who had grown and wanted to set out on a farm of their own, for the people from the East, who recalled Horace Greeley's recommendation, or for those who, in the atomic age, were seeking solace in the soil.

Out of these emergencies came some solutions to the problem. Commissioner of Reclamation Michael W. Straus, speaking before the House Subcommittee on Appropriations this spring, mentioned one activity of the Bureau which helped solve the housing situation for many people in the reclamation area, especially veterans of World War II who are now homesteading on reclamation land, or employed by the Bureau. Mr. Straus said, "* * * the Bureau was specifically requested to use surplus Government war property to the limit. That policy was further implemented by the Congress in turning over to the Bureau certain abandoned Government-owned Japanese War Relocation Authority camps and a prisoner-of-war camp. We are getting full utility out of this otherwise lost property. Outside Denver there is an abandoned war-surplus Government-owned ammunition loading plant into which we are moving our engineering headquarters and testing laboratory. It is a fortunate arrangement that gets us needed space in otherwise wasted property and at the same time releases commercial space in crowded Denver."

Trailers proved the "number one remedy" in providing homes for workers at the

Here are a few examples of the house-hunting, house-building, salvaging, and converting program of people in the reclamation area.

The scarcity of building materials is working a hardship especially on new settlers in the reclamation area. On the Roza Division of the Yakima project in south central Washington the situation is particularly acute. Mrs. I. D. Lionberger and her husband ingeniously solved their difficulty by turning upside down and making into an annex a heavy 16-gauge sheet iron form used in concreting a canal for the new 72,000-acre area. The forms, 10 feet long and 9 feet high, are practically indestructible. They are also being used by other residents of the Roza as chicken houses, cow and feed sheds and as other farm buildings.

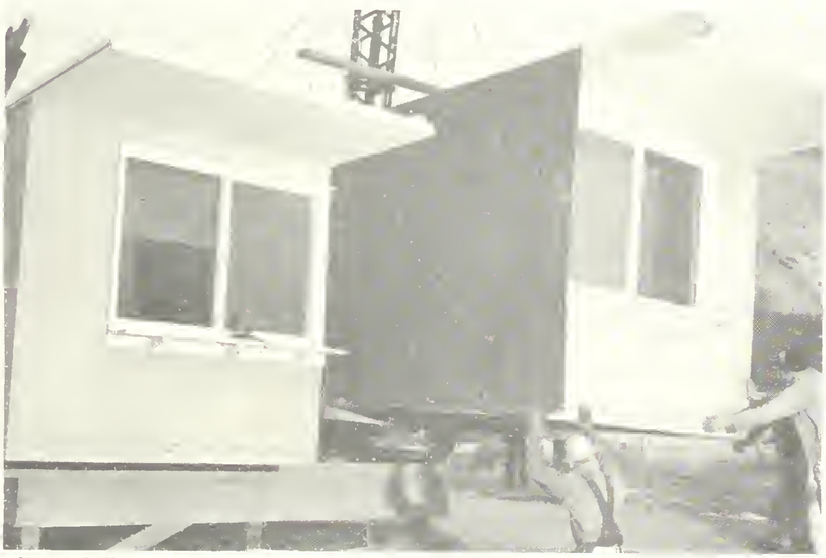
Trailers

The ubiquitous trailer seemed to be the most widely used and popular answer to

HOUSING SHORTAGE

Photo by Harry W. Myers, Region III
Camp Williston barracks from Boulder City now serve as homes for Davis Dam workers.

Photo by Ben G. Glaha, Region II
ision of the Central Valley project in California.



"Pre-fabs" from Hanford atomic plant will serve as homes for Columbia Basin workers.

the housing problem throughout the reclamation area.

On the Columbia Basin project in Region I, 247 trailer houses were obtained from the Federal Public Housing Authority camps in Kennewick and Pasco, Wash. Fifty were purchased, the remainder leased for the use of veterans and their families. The trailers were trucked to the Government town of Coulee Dam and parked in four camps, one for single men, three for families of Bureau personnel.

Trailers neatly arranged in "streets," with all the necessary facilities available, are used in Region II for Bureau of Reclamation employees at Tracy, Calif. (Delta-Mendota Canal), and Reedley, Calif. (Friant-Kern Canal). Transient agricultural laborers and construction workers live in trailers in Lindsey, Calif.

Region III's housing situation is far from being solved, but trailers furnished partial relief. At Davis Dam the contractor has set aside a special area where privately owned trailers can be parked and connected to all the necessary utilities. In addition, the contractor has 50 units available for rent to veterans only. These trailers were formerly in use at a Navy Depot.

Region IV purchased 23 house trailers. Eleven are in use in the Durango, Colo., area, 4 in the Grand Junction, Colo., area, 4 operating out of Spanish Fork, Utah, and 3 for drill crews at Morgan, Utah.

The Federal Public Housing Authority supplied trailer camps which are now the makeshift abodes of engineers stationed at the Vernal, Utah, field office. Surplus trailers formerly used to house war workers at west coast factories are now used by employees engaged in the program for development of the Missouri Basin project.

In Region VI at the present time 23 trailers are being used. Six are located near the site of Angostura Dam in South Dakota, 12 are housing Bureau employees at the Boysen unit in central Wyoming; 3 are housing field crews engaged on activities relating to the Lower Marias Unit, in northwest Montana; and 2 are being used as living quarters near the site of the proposed Yellowtail Dam, 35 miles south of Hardin, Mont. In addition, Bureau engineers at Region VI headquarters live in trailers.

Salvaged War Surplus Material

If there is an abandoned war surplus camp or building left unwanted, uninhabited and unclaimed in the reclamation area, it is there only because the Bureau hasn't found it yet and worked out some way of using it to beat the housing shortage. At Ephrata, Wash., project officials negotiated with the Army and later with the War Assets Administration, for several hundred buildings which were standing idle at the Ephrata Army Air Base. Some were used on the spot, and others were moved to locations where they were needed and converted to habitable dwellings.

Photo by Joe W. Buller, Region VI

Alexander Burg lives in a tent until he can start building his home at Heart Mountain.

Photo by Joe W. Buller, Region VI

Log cabin homes from the Benbow mines help to alleviate the shortage.

Resident Bureau engineers set up offices in the former headquarters building at the air base. Motor pool buildings, maintenance shops, and about one-half of the base's warehousing facilities were put to use by the Bureau. Hospital wards were converted into apartments for 150 families of Bureau employees. Fifty more apartments were made from former bachelor officer quarters. Two former civilian dormitories were occupied by single men.

The former aircraft shops building was utilized as a Bureau carpenter shop for prefabricating partitions, closets, and other items needed in making living quarters out of buildings never intended as such.

Air base buildings, once used by members of the Women's Army Corps, now house construction crews of a contractor at work on the project irrigation system. An adjacent group of buildings, including dormitories and a former Army mess hall, are being used by another contractor.

Houses which were once occupied by Army and civilian personnel at the Yuma Army Air Base have become the homes of Bureau employees on the Gila project in Arizona. Administrative offices have been established in the former headquarters of the air base on the Yuma Mesa where farms for homestead entry by veterans are being developed.

Twenty-one theater of operation type buildings from the Yucca Army Air Base have been purchased and are being dismantled and transported to Davis Dam. Out of these wartime structures will be erected 20 dwellings, 1 garage and fire station and 1 dormitory and guest house.

As work started on Davis Dam last spring, 10 barracks from the Army's former Camp Williston in Boulder City, Nev., were moved by the Utah Construction Co., down the Colorado River to provide housing for the men who are building Davis Dam. (See *Houses Over the Dam*, back cover, July 1946 ERA.)

From the Hanford atomic energy project, 23 small second-hand prefabricated dwellings went to Coulee Dam. One hundred fifty War Housing Project homes of the 2-, 3-, and 4-bedroom type from Vancouver, Wash., formerly used by war workers, were dismantled and trucked more than 300 miles to Coulee Dam under private contract, where they were reassembled by Government forces. An additional 110 "demountables" have recently been transferred from Vancouver to Coulee Dam to meet the needs of house-hungry veterans and other employees working on the project.

To alleviate the acute housing shortage in Boulder City, Nev., the Bureau of Reclamation in 1942 and early in 1943 constructed 100 portable houses. Many of the lots on which these "temporary" houses were built have been landscaped and are abloom with planted flowers and shrubs.

Fifty additional "temporaries" were acquired from Vancouver, Wash., and sent to Boulder City, Nev., to help solve the still critical housing shortage among Bureau of Reclamation employees in Region III headquarters.

War Relocation Centers

ERA readers are already familiar with the salvaging of buildings and surplus material from former War Relocation Authority centers. (See *The Bureau Reclaims Its Own*, April 1947 issue.) Veterans are already beginning to live on their farm units and to construct their farm buildings from salvaged materials.

At Newell, Calif., one-story barracks originally utilized by War Relocation Authority and Army personnel in the WRA camp at Newell, Calif., will be used to house transient agricultural workers. These barracks will be converted to small apartments on the spot and will not be moved. Others will be torn down and the lumber used for building homes and farm buildings in the area for homesteading veterans on the Tule Lake Division of the Klamath project in California-Oregon.

In Region I, barracks from the Hunt Relocation Center on the Minidoka project in Idaho are already being transported to farms in the area.

Living in a Grain Bin

How would you like to live in a grain bin? The people at Boysen, Wyo., and

Photo by Joe W. Buller, Region VI

Commodity Credit granaries in the first stage of conversion, Boysen, Wyo.

Photo by Greater North Dakota Association Photo (W. F. Sebens)

Joe Paulson's granary house after conversion is the envy of his neighbors.

Photo by Joe W. Butler, Region VI

Kingman twins play in front of their dormer-windowed, storm-doored quonset home.

Photo by Wm. S. Russell, Region III

Pass the ammunition—and build a house, says Navy veteran Walsh.

Terry, Mont., have no objections, and Joseph Paulson of the Lewis and Clark irrigation project in Williston, N. Dak., is the envy of his friends, because of his granary home.

Twelve Commodity Credit Corporation grain bins that helped, in their own way, toward winning the war, are now serving as houses and office buildings in Region VI.

In most cases a single bin is used to fill the desired purpose. However, additions were made to the houses at Boysen out of material salvaged from the WRA Center at Powell, Wyo.

The granaries, 14 feet wide, 24 feet long, and 10 feet high, were constructed in panels bolted together, making it possible to dismantle the structures with a minimum of effort. Each roof, with a 4-foot gable, was in one unit. In order to hold the great weight of the grain, the bins were reinforced on the inside with 2 by 6-, 2 by 8-, and 4 by 4-inch beams, which now serve as main braces for the house structures, making them consideraby stronger than most residences.

Mr. Joseph Paulson, a reclamation farmer on the Lewis and Clark irrigation project, started in the summer of 1946 to build his home, using a commodity credit granary as a basis for building operations. The granary is now the living room 14 by 24 feet, with an open brick fireplace and a large plate glass window. The east wing, housing the bedroom, bath and kitchen-dinette, was added from new material. Mr. Paulson, last January, figured that his grain-bin-home would cost about $3,750.

Buildings used during World War II to house Civilian Public Service assignees (commonly known as "conscientious objectors") are being used as resident buildings for Region VI employees engaged in activities on the Angostura Unit of the Missouri Basin project where construction is now under way. The original camp, located near the site of Deerfield Dam on the Bureau of Reclamation's Rapid Valley project in South Dakota, consisted of 6 temporary cabins, a permanent house, laboratory building, shop, storehouse and two garages. The buildings were dismantled during the early part of 1946 and moved to Hot Springs, S. Dak. Along with additional material salvaged from buildings at the vacated Heart Mountain Relocation Center in northwestern Wyoming, these were merged into a housing project, consisting of 18 two-bedroom, 2 three-bedroom, and 5 duplex resident structures, a concrete testing laboratory and an office building.

Mining Camps

Chromite mining camps where vital supplies were produced during World War II, are being used in Regions IV and VI to fill essential needs in the gigantic construction effort of developing the Colorado and the Missouri Basin projects.

Log cabins and frame buildings, constructed to withstand the rigorous climatic conditions prevailing in the higher altitudes of the Beartooth Mountains, originally used to house workers and administrative personnel engaged in taking chromite from the Benbow Mines near Dean, Mont., are being moved to Billings, Mont., where preference will be given to veterans of World War II employed by the Bureau.

Quonsets

Quonset Huts, named for Quonset Point, R. I., where they were first developed on a wide scale and manufactured for our fighting forces, reappear in many guises on several Bureau of Reclamation projects in the West.

Two hundred of these arched, steel-ribbed huts are being used for various purposes on the Columbia Basin project. The majority have been converted into family dwelling units and men's dormitories. Each of the dwelling units has a 16 by 20 living room, a combination kitchen and dinette, a utility room, two bedrooms, and bath. The Government camps at Coulee City and the Potholes dam site are Quonset villages.

Quonset huts obtained from the War Assets Administration by Region VI are 20 by 100 feet, and, where used for residences, have been divided into duplex apartments.

Photo by Norton T. Novitt, Region VII

At home in a former prisoner of war camp. Youngsters build miniature project while their dads work on Enders Dam.

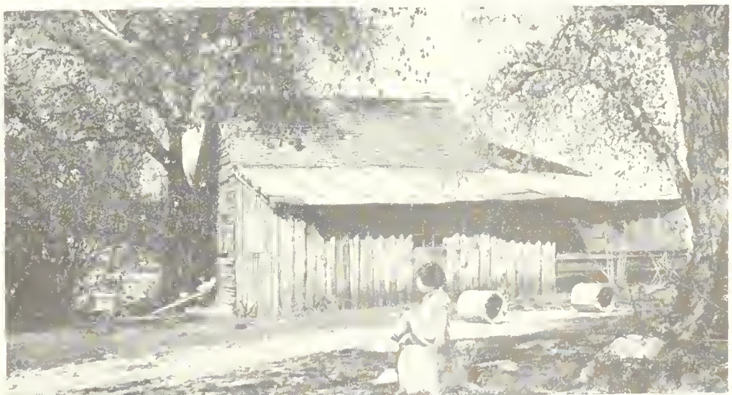


Photo by Paul E. Norine, Region IV

Home was once like this for the Gillman family. Today it's a chicken house.

Prisoner-of-War Camp

There are a few tell-tale signs at the Bureau's offices in Nebraska which reveal the source of their housing facilities. Floodlights remain on the roofs of some of the buildings, providing street lighting, and reminding the inhabitants that this was a former prisoner-of-war camp, which accommodated 3,000 German POW's. Here and there are reminiscent signboards, some being used by young boys constructing miniature reclamation projects with "spillways" labeled "Military Police." A wartime water tower looks on like a guardian sentinel, as prisoner-of-war barracks are dismantled, reconverted, and parts of the buildings are transported 80 miles from Indianola to Imperial, Nebr., for reassembly into housing, for workers building Enders Dam.

The District Engineer's Office of the Frenchman-Cambridge Unit of the Missouri Valley project, moved right into the area of the former POW camp. Previously, the engineers had been quartered in the Memorial Auditorium at McCook, Nebr. Some of the buildings were remodeled on the spot into apartments and office space for Bureau personnel. Others were dismantled for use as construction material. Former barracks were turned into two buildings to serve as quarters for the Soils Laboratory and the Survey Office.

A 20- by 30-foot section of a barracks building was moved and attached to the garage for office and storage space.

The people at Indianola are not at all depressed by their environment. This spring, employees of the district office could be seen marching en masse to their garden plots, and in April they enjoyed their first all-camp dance and entertainment at the recreation hall of the camp—formerly the POW theater building.

Photo by Paul E. Norine, Region IV

Down, but far from out is Mrs. Leroy Nielsen in her comfortable basement residence. The little Nielsens are Robert, Kathleen, and Carol. La Dean and daddy weren't home when this picture was taken.

Ammunition Cases

To Navy veteran Charles H. Walsh, of Logandale, Nev., goes a salute for his method of meeting the housing problem. He built a house of 50-caliber shell cases, on his 10 acres of land near the shores of Lake Mead at Overton, Nev. Mr. and Mrs. Walsh, their children, Susannah, age 5, and Donny, age 2, are now living in their new bungalow, made out of 500 empty ammunition boxes from the Las Vegas Army Air Field—where thousands of aerial gunners had been trained during the war. The house is modern in every respect. Electricity from Hoover Dam furnishes power for domestic needs, and as Walsh said, to a Bureau of Reclamation representative recently, "This is one way of meeting the housing problem. With a couple of coats of paint on the exterior it will serve our needs very well."

CCC Camps

Barracks once used by members of the Civilian Conservation Corps at Palisades, Colo., were converted into six apartment houses at a cost of about $1,200 each, for Region IV engineers and their families.

Area Engineer C. H. Jex, at Grand Junction, Colo., has this to say about the CCC apartments at Palisade: "This office is very proud of the apartments at Palisades and feel they serve a very good purpose in housing of engineer veterans. The families occupying them are very happy with the modern way they have been fixed up and the result is reflected in their work. Also, the nominal rent of $20 a month will enable the Bureau to liquidate the cost of conversion in 3 or 4 years."

Denver "Co-op"

In crowded Denver it appeared that the problem of locating office space had been solved when the Remington Arms plant outside the city limits was declared surplus by the Public Buildings Administration, which assigned part of the plant to the Bureau for use as a Federal center. Converting these factory-type structures into offices presented some difficulties, but the location of the buildings complicated the already critical problems of transportation and housing. To meet the situation a group of 100 employees banded together and purchased 160 acres of land close to the new offices. Some of the reclamation engineers made good use of their professional knowledge to plot home sites. Preliminary work is already well under way on the construction of streets, sidewalks, water and sewage systems, and many other features demanded by a modern community. This is not a temporary wartime or postwar emergency development. The employees have proudly given it a name, Glennon Heights, Inc., and expound the advantages of their cooperative plan which enables the employees to own their own homes, have a gorgeous view of the Rocky Mountains, grow fresh fruits and vegetables in their own gardens, and have space for their children to grow and play.

Another plan—a cooperative employee housing register—resulted in finding homes for approximately 50 Bureau families. Each employee, for 50 cents, could avail himself of the facilities made available, which included display and classified advertising in local and suburban newspapers, spot radio announcements, and a direct-mail campaign to all apartment-house owners and real-estate agencies.

A classic example of cheerfully putting up with abject living conditions until building materials and labor become available is that of the family of John W. Gillman of Orem, Utah, son of James W. Gillman, president of the Provo River Water Users Association. Mr. and Mrs. Gillman and their daughters, 10-year-old twins Karem and Karmen, and 2-year-old Audrey, moved into an ancient, unpainted frame shack in 1942 and lived there until they could start building a modern brick home a year ago. They moved in last fall and are happily looking forward to the 1947 irrigation season on their 40-acre irrigated farm and orchard on the Provo Reservoir Canal, fed by Deer Creek Reservoir. And what of their former "home"? It serves as a brooding house for baby chicks.

Cellar Dwellers

Project farmers in Utah, Nevada, and western Colorado, have for the most part managed during the scarcity of housing materials and labor by "doubling up." In Utah, however, a custom of comparatively long standing, engaged in by thrifty farmers, who believe in "pay as you go," have saved the day for many a family, both nonveteran and veteran. It is the practice of constructing a concrete basement, throwing a temporary roof over it, and living therein, until receipt of the next crop money with which to build the rest of the house. During the housing shortage, couples finding themselves unable to get either materials or labor after getting the basement "poured," lived in the basements as an absolute necessity, and sometimes in rebellion against high cost of materials.

A family quite typical of the "cellar dwellers" are the LeRoy Nielsens' who operate a small irrigated berry farm and orchard on the Provo River project. Situated a few miles north of Provo, on Highway 91, which leads to Salt Lake, their "home," since 1941, has been four basement rooms which they built in the spring of the year and moved into that fall. A spic and span housekeeper, petite Mrs. Nielsen has made the comparatively small quarters more than do for their balanced family of two boys, LaDean 13, Robert 9, and two girls, Carolyn 6 and Kathleen, 19 months. Now, that more building materials are availabe, Mr. Nielsen plans either to complete his home or move to one ready made.

PROGRESSIVE FARMERS MAINTAIN CLEAN FIELDS TO PRODUCE THE GREATEST QUANTITY AND THE BEST QUALITY AT THE LOWEST COST

by J. T. Maletic, *Soil Technologist*

Region VII, Denver, Colo.

WEEDS cost the American farmer an estimated average monetary loss of $450 a year. During the war, weed control was curtailed and the farmer's loss due to weeds increased. Shortages of labor, chemicals, and machinery added to the usual difficulties facing the farmer in controlling the spread of noxious weeds. Controls for preventing the dissemination of weeds in seeds and livestock feed were relaxed. The farmer, under pressure to produce record crops at record speed, could not always be too discreet about the quality of seed and livestock feed. As a result, noxious weeds kept spreading, and the farmer kept losing. Today the shortages and pressures are lessening and a campaign against weeds is on. Introduction of new chemicals, enactment of better State weed laws, a fuller realization of the weed menace, use of new machinery (especially in sugar-beet growing), and the increasing interest of farmers in weed control are resulting in a vigorous postwar fight against weeds.

The Bureau of Reclamation's sound movie, *Fighting Weeds*, will aid the farmer in planning his battle against weeds. This film covers many known practices of weed control that have been proved practical. As yet information covering the use of 2, 4–D is not included; however, as this chemical and other new methods take their place among other proven control practices, new footage will be added. The film is directed primarily to the irrigation farmer; however, it is also an excellent film for the dry-land farmer located on future project areas. Here is the story of weed identification, prevention and eradication as told by this film.

Identification

You have to know your weeds before you can know how to control and eradicate them properly. Weeds are classified according to length of life, as follows: Annuals, biennials, and perennials.

ANNUALS are plants which start from seed in the spring, summer, or early fall, and complete their entire life cycle in 1 year. They usualy have a small root system and produce an abundant crop of seeds, some of which retain their ability to germinate for several years. Common weeds in this group are Russian thistle and sunflower.

BIENNIALS are plants which complete their life cycle in 2 years. These plants produce only roots and leaves the first year but build up a large reserve food supply. The second year they produce flowers and seeds. Bardock, mullen, white, and yellow sweet clovers, and wild carrot belong to this group.

PERENNIALS are plants which live three or more years. They are subdivided into simple and creeping perennials. Simple perennials reproduce only by means of seeds. They generally have large tap roots such as curled dock and dandelion but may have fibrous roots, like Rugel's plantain. Creeping perennials reproduce by creeping rootstocks or underground stems, as well as seeds. Some of the most troublesome weeds belong to this group: for example, field bindweed, Canada thistle, white top, Russian knapweed, and leafy spurge. The film advises, "When in doubt about the type of weed, consult the county agent; and never initiate a control or eradication program until the weeds are properly identified."

Prevention

To start an effective program of preventing weed growth, get at the source of weed seeds. Some means by which weed seeds are spread, include:

1. Crop seed.
2. Wind.
3. Streams and irrigation distribution systems.
4. Domestic and wild animals.
5. Farm equipment, and other vehicles.
6. Screenings, forage, and other feeds for livestock.
7. Persons' clothing.
8. Moving livestock from weed-infested areas.

Once you know where the weeds come from, active steps can be taken to prevent weed seed dissemination. You can (1) plant only certified weed-free seed; (2) mow or burn weeds in the bud stage; (3) control perennial weeds; (4) establish grasses and other weed competing plants on ditch banks (just as you would prepare a pasture); (5) use cattle guards if ditchbanks are used for pasture; (6) increase ditchbank pasturing and reduce operations costs by removing willow and other weed growth; (7) avoid over-grazing ditchbank pastures; (8) clean weed seeds from clothing before leaving infested fields; (9) clean weed seeds from thrashing and other farm equipment before entering clean fields; (10) grind screenings finely before feeding, and (11) hold cattle in corrals several days before transferring them to clean areas.

Department of Agriculture photo

Man-size Russian knapweed in orchard.

Eradication

The best methods of controlling weeds will vary for different areas due to differences in soil texture, soil fertility, water table, climate, etc. Frequent cultivations known as "clean cultivation," or shoot-cutting at regular intervals, usually about every three weeks, is the most economical control for some weed patches. For some weeds, such as field bindweed, cultivation will have to be continued over a period of 2 or 3 years. The choice of the implement depends upon the size of the infested area but the cutting blades used should overlap sufficiently to prevent skipping any of the weed shoots. If the patches are too large, or whole fields are infested, and you find you cannot afford to cultivate them, plant a smother crop, or winter grain, and, keep the crop in good growing condition. If grain or other early maturing crop is planted, shootcutting should be practiced for the remainder of the growing season after harvesting the crop.

For small patches, where it is impracticable to use the cultivation method, chemicals may be employed. Sodium chlorate is the cheapest chemical to use in some instances, particularly noncultivated areas, but it must be remembered that it may sterilize the soil for several years. Caution must be exercised in using chlorate due to its highly inflammable nature. Make applications in the fall to take advantage of the winter rains. In general, sodium chlorate is applied at the rate of 5 to 7 pounds per square rod. For small patches of weeds, carbon bisulphide has been found to be very effective and, while it is more expensive, it does not sterilize the soil. It is recommended that a weed gun built for the purpose be used, and that 2 ounces of the chemical be injected into the soil at 18-inch intervals. It should be applied at a depth of from 4 to 6 inches depending on the type of soil and other factors.

Weeds spread like an epidemic disease. Like a disease, an ounce of prevention is worth a pound of cure. Weed surveys are showing that weeds are taking over more and more territory. The area of infested land is definitely increasing. To help farmers combine their weed-control efforts, many of the States have enacted weed laws that provide for the formation of weed districts. District organization assures a district-wide eradication program. Under district organization, weed control is conducted on farm land, roads, railroad right-of-ways, ditches, and other areas within the weed district. The method of financing weed control district programs varies with individual States.

The film, Fighting Weeds, *upon which this article is based, was produced by the Branch of Operation and Maintenance of the Bureau of Reclamation in cooperation with State Agricultural Experiment Stations and Federal agencies. Copies of film are available upon request to the Regional Directors, Bureau of Reclamation, at Boise, Idaho; Sacramento, Calif.; Boulder City, Nev.; Salt Lake City, Utah; Amarillo, Tex.; Billings Mont.; or Denver, Colo.*

Bindweed. . . .

reaching a railroad right-of-way.

White top spreading from roadside. . . .

and infesting a farm.

Single blade weed eradicator.

International Engineering

Australia—

Mr. Ian Langlands, Officer in Charge of the Building Materials Research Section of the Australian Council for Scientific and Industrial Research, recently completed arrangements while in the Denver office for having a student research member of his staff take a course in practical training in that office. Mr. Langlands, who has returned to Australia, will name the student in the near future who will receive several months training in the concrete research laboratory.

China—

Eight Chinese engineers recently reported to the Denver, Colo., office for assignment to the sections planning the important Yangtze Valley project. The men were made available by the Chinese Government, all being qualified graduate engineers with some experience. The Yangtze Gorge is the project for which internationally known Dr. John L. Savage, formerly the Bureau's Chief Designing Engineer, drew up the preliminary plans under the auspices of the State Department at the request of the Chinese Government.

Egypt—

Mr. S. O. Harper, former Chief Engineer of the Bureau of Reclamation, has recently returned from Egypt where he has been serving as a consultant to that government in connection with the proposed raising of the Aswan Dam on the Nile River. His services were obtained through the United States Department of State. In addition to this major assignment, he also advised the Egyptian Government on over-all resource development of the Nile.

Robert Brown Goes to China

Robert C. Brown, former Region V Bureau engineer on the San Luis Valley project in Colorado, has joined the program planning staff of UNRRA on the Yellow River project in China. His headquarters are in Shanghai, but he will work in the downstream area of the Yellow River, which will be diverted to relieve two million acres of land suffering from periodic floods.

The work is being done under the Ministry of Agriculture and Forestry in the Nationalist Government with UNRRA serving as a consultant. Brown is acting as a technical adviser and will engage a staff of Chinese engineers. He expects to remain abroad until September 1947.

He has been with the Bureau since 1938, having started as a transit man on the Vallecito Dam in Colorado. From there he went to San Luis Valley where he spent 5 years as an engineer. Prior to becoming associated with the Bureau, Brown spent 4 years with the New Mexico State Highway Department.

Retiring on the Run

or

90 Years Without Settling Down

by **Orin Cassmore,**

Sacramento, Calif., Region II

Doing stories on people retiring used to be easy. Each one was just like the one before it, with only the names changed. Clichés snapped into line with as little fuss as troops at a separation center—the Job Well Done, the Race Well Run, The Old Warhorse turned out to Graze in a Pleasant, Daisy-speckled Pasture.

Nowadays, it's not so easy to write about people retiring. We found that out when we started to interview Gilbert H. Hogue and Lewis E. Foster of Region II, who have been with the Bureau for 45 years (ever since it started, and before) and are now leaving after lending us several extra years of their time during the war.

Today's retiree is fast on his feet. Before you can write about him, you have to catch him—no small job, as we found on a visit to Gilbert Hogue's retirement party at Friant Dam.

After a fine speech by Assistant Regional Director Bob Calland, who had been pointing out the exceptional moral values that make up for the modest salaries in long careers of public service, Mr. Hogue rose to his lean height and said with simple dignity: "So long, slaves," reached for his overcoat, and was off to Mexico with his wife.

Lewis Foster, who'd shifted to Sacramento from his 1912–45 superintendency of the Carlsbad project to pinch-hit for us during the personnel shortage, looked like a better bet. We found him settled back in a comfortable armchair beside a glowing fire in a long and lovely room, one of several such in a rambling cement-block home with a patio full of citrus and exotics, a home straight out of a sunset treatise on "Western Living." This looked like the real stuff for an old-style retirement article. Except for one discordant note—sticking impudently into the lawn was a sign—"For Sale."

Despite his ease, Mr. Foster looked a little gloomy and restless. "Not that I'm not glad to see you, but when I heard you drive up, I thought you were somebody come to buy the house."

Mrs. Foster, filled with vitality and humor, and a disturbing charm which seems hardly proper in a person married shortly after the Spanish-American War, a lady whose eldest son is graying distinctively at the temples, added, "Yes, Lew is anxious to get going."

Get going where? And ***why?*** Southern California, they replied, where kinfolk live, where they ***may*** decide to retire for good on a few acres where Mr. Foster can experiment with citrus, or more probably, establish a base for the trips they've wanted to take for the past 40 years.

This restlessness was disappointing, for it once again ruled out that typical old retirement piece. But at least the Fosters would be there long enough for us to get ***some*** kind of a story. Since it was too late in the

Photo by J. E. Fluharty, Region II

Hogue is "given a ticket" before he starts for the open road.

day for prospective buyers and they couldn't get away until they ***had*** sold the house, the Fosters were able to relax for a while and brief us on 45 years with the Bureau of Reclamation.

Mostly, Mr. Foster wanted to talk about the many great guys he had known in the Bureau, and what ***they*** had done. "Yes, there was always the feeling that we had a great mission; and there always seemed to be great men to carry it out." He told of F. H. Newell, first Reclamation Commissioner, and his vision of what the Bureau could accomplish by helping the West prosper through a sturdy democratic economy of family sized farms; of Engineer Louis C. Hill, whose work made Salt River, Rio Grande, Carlsbad, Yuma, and other projects possible; of Chief Engineer F. E. Weymouth and the able men who followed them.

But we wanted ***Mr. Foster*** as the subject of the story, not only because his tour of duty more than covered the life-span of the Bureau of Reclamation and the Reclamation Service before it, but even more because he had been actively connected with one single project—the Carlsbad—almost all that time. He had been down where the work is, down where the big plans and high policies either pan out or peter out. So he began by telling us that he was born near Los Angeles, Calif., on the small, diversified farm (some fruit, some alfalfa, some Morgan horses and Hambletonians) that his father purchased shortly after he came out from Maine in 1875. In 1898, he went off to the Spanish-American War.

Out of the service, he joined the Hydrographic Branch of the Geological Survey, granddaddy of the Bureau of Reclamation, at Montrose, Colo. Transferring to the Reclamation Service, when it was set up in 1902, he worked as rodman, topographer, hydrographer, and instrument man on some of the first surveys, including those of the famous Gunnison Tunnel on Colorado's Uncompahgre project.

Early in 1907 he was appointed superintendent of irrigation for the Carlsbad and Hondo projects in New Mexico, and immediately married Claire Waltz of Berkeley, daughter of a minister who had homesteaded up in the Coeur d'Alene country back in the late Seventies—the girl he'd met and fallen in love with 9 years before.

"They only let me have 2 days off to get married," he stated, adding that this was an indication that the Government was very busy getting water on the land of the Carlsbad-Hondo projects. From Mr. Foster's remarks, we gathered that he had been appointed as superintendent of irrigation to see if he could figure out some way to get back the good money that had gone sailing after bad, down the Pecos River. Mr. Foster said, cautiously, "It might have been better, at the time, if we hadn't gone in there." That puts it mildly.

In the first place, said Mr. Foster, the water supply was meager and poor. There were 4 tons of solids—gypsum and salts—per acre-foot.

In the second place, much of the land was not good. About 3,000 to 4,000 of the project's 25,000 acres were (and are) marginal. Because of poor drainage, they were only suitable for farming during 2 years out of every 4.

In the third place, no one could predict when spring would come, and frost bit deep into the growing season.

In the fourth place, where in the world did the original settlers expect to sell the stuff they planned to raise?

"You can add to that," said Mr. Foster, "occasional rampages by the river (as late as 1940, a million-acre-feet went down a stream that normally carries but 250–300,000 a year). And a leaky reservoir. *And* inexperienced farmers. The Pecos Valley Investment Co. was composed of promoters from the rain belt, nonfarmers from the East. They all came tearing blithely West in 1888 looking for a good place to try out this irrigated farming idea that could make men rich overnight. Knowing nothing whatever about it, they picked a stretch of country that looked wonderful only because it was having one of its rare good water years. By 1893 they had McMillan and Avalon Dams built. By 1904, almost everyone and everything was busted, including Avalon Dam."

Mr. Foster then went on to explain how a call for help to the Federal Government was answered in 1904—principally, it seemed, because of Theodore Roosevelt's fanatic belief in the ability of his reclamation program to take any hurdle, no matter how high.

Everyone had to get busy fast, patching and planning and advising and educating, to meet one of the new Reclamation Service's first great tests, that of putting this exceedingly shaky project on its feet. The engineers rebuilt Avalon Dam and designed spillways for both dams (which the first builders had neglected to do) in order to ease the dangerous pressures that came with every flood. An intelligently planned drainage and distribution system was laid out after careful investigation had showed just what was wrong with the area. "Part of it was underlaid with gypsite deposited through the years until it formed an impervious hardpan which caused the affected area to fill up like a saucer after a few irrigation seasons," explained Mr. Foster.

Cooperation of the State Agricultural College was enlisted to set up demonstration farms and determine what crops were best suited for the project. It had raised wonderful peaches, but spring frosts too often took the fruit buds. Sugar beets had looked like a good crop, but careful study indicated that local pests made them another unsuitable investment. So cotton was pushed as the main crop, for it was hardy, pest-free here, and could be stored indefinitely or ride a thousand miles to market without loss. The demonstration plots worked out the most conservative rotation for the area—cotton, small grain, alfalfa, and cotton.

By 1914, the project's horizon had brightened. "If a farmer came in and did not buy so much land that his working capital and reserves were impaired, he could pretty well count on making a go of it," Foster stated. "One genuine evil, hard to conquer, had been high-pressure selling methods by the development companies, into whose hands fell much of the acreage the first settlers abandoned. Almost two sets of farmers had been plowed under since 1888, but it looked like the third would make it."

Well, they did. Project management kept learning more and more about the country and the land. Crop patterns, cultivation, and irrigation practices that would make best use of the gypsum soils and mineral water supply, were worked out. Cooperation with the college continued and expanded.

"There were always studies and experiments going on, covering what should be grown and how to grow it. The behavior of the land under irrigation was carefully checked, and the staff soon knew exactly how every acre would react. A system of shifting water rights around to make fullest use of land that could produce for a short while, then had to drain for a year or two, was worked out. With constant care and

Photo by J. E. Fluharty, Region II
Foster's hobby from now on.

watchfulness, Carlsbad became a stable productive project. We really had to work, but we finally got the project so it could pay off," said Mr. Foster. "Most of the credit for this goes to the fine group of intelligent, hard-working, cooperative farmers, who took the bad years with the good, learning something from each failure. The project is now, without a doubt, successful."

"At what cost?" we asked.

"Original work on the dams and canal systems cost the people of the United States $1,400,000, now practically all paid back," Foster replied proudly.

"A third dam, Alamogordo, an incredible 200 miles farther up the Pecos, proved necessary because the river's enormous silt load was choking the lower dams. This dam and some concrete canal lining will cost another $2,600,000. The water users started repayment on these final features last year with far better prospects of unbroken repayment than they had for repayment of half that amount 40 years ago.

"Operation and maintenance charges run around $2 to $2.50 per acre," he continued. "By the way, the project started out with a staff of a superintendent, a hydrographer, a chief clerk, and one or two other clerks, a watermaster, a foreman, and a few laborers, and remains just about the same."

Although Mr. Foster didn't say so, we know that in return for this outlay, a hopeless barren, once a failure, has been turned into a region that regularly produces crops worth $85–$100 an acre, with all that this means to the farmers, to the towns in the vicinity, to people far away who make the things these farmers buy. And the farmers buy plenty! They are ***very*** prosperous now, and have been moderately so for a good many years.

But Mr. Foster ***did*** say that this prosperity has been achieved on farms averaging less than 100 acres. "A 160-acre farm is enough for a ***real*** farmer; a man who likes to farm. Our people do well. Not just a meager, careful living—every winter, lots of them drive their good cars out to warmer places for a vacation. It's about all any sane man would want."

"All these years, how did events in the world outside, changing policies within the Bureau and the Department, affect the work at Carlsbad?" we queried.

"Well, within the Bureau, there was always a magnificent spirit—men that would stand by you 100 percent in spite of frequent hell, and high or low water. There were some bad times from administrative changes. Some were irritating, but amusing—like the infinite variety of questionnaires one Secretary sent out, including one demanding a full description of 'All types of steam vessels operating on the reservoirs under your control.' Some were not so funny," he said wryly.

The trend in the last few years has been good, in the main, Mr. Foster thinks. Particularly as the Bureau has recognized nationally what was obvious early in the history of the Calsbad project: that our work does not end when the dams are built, and the water comes down through the distribution systems.

"If projects are to pay out, if farmers aren't to be plowed under, there must be constant scientific and practical study of changing problems—water use, crop and cultivation and fertilization practices, shifts in consumer demand. This will be done with the full cooperation of research agencies and county agents. But each region needs its own staff to collect and adjust findings of these other agencies to the use of reclamation projects. And, above all, each project needs somebody who is passionately interested in reclamation from the farmer's point of view, not merely as an administrator and collector of water charges, to bring these findings right down to every acre on his project. Even after a project is on its own, it needs someone to do the same kind of a job," Mr. Foster stated.

The great lesson he learned at Carlsbad is that "Irrigated lands will always turn up with new problems—of soil, of water, of changing economic conditions. Reclamation is a job that never ends."

Were the Fosters sorry that the job was over, sorry to leave a place where they'd

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Brahman Cattle

(*Continued from page 131*)

velop for market, and their ability to forage on poor range.

Brahmans vary in color; some are white, others are silvery gray, steel gray, and dark gray. Dark hips and shoulders appear to predominate in the bulls. The eyes are mild—sleepy appearing, and the ears are broad, long, and pendulous. The neck is short, and it blends smoothly into a well-fleshed shoulder. The hump, which is directly above the shoulders, is large in bulls, but not so highly developed in cows. The ribs are well sprung and evenly fleshed, and the depth of the body compares favorably with the width. The hindquarters show an abundance of flesh, which extends down on the hind leg near the hock.

Stamina Unlimited

Some Brahman breeders and range men believe the hump stores energy for the animals' use when hard times come knockin' at the door, somewhat as the hump, which it is said, enables the camel to go days without water. Brahman owners say the hump grows and recedes in tempo with adequate or inadequate feed. It is a fact that Brahmans can and do travel farther for water and grass than any other type of cattle.

Brahmans have massive bodies, deep and thick. Their bone is large, but not coarse. The average cow, in good condition, will weigh from 1,000 to 1,200 pounds, and the bulls range from 1,700 to 1,900 pounds. Cows fed for the show rings weigh up to 1,700 pounds; whereas, the bulls often attain a weight above 2,200 pounds.

A surprising characteristic of the Brahman cattle is that they sweat. This phenomenon is observed principally on the neck and in the creases of the hide covering the shoulder vein and dewlap where the perspiration oozes through the skin. Another interesting feature about Brahmans is the fact that they never open their mouths and pant.

The first Brahmans, a bull and a cow, were brought to the United States in 1849, by James Bolton Davis of Fairfield County, S. C., while serving as ambassador to Turkey. The records of these cattle were lost during the War Between the States.

The second importation of Brahmans to this country was in 1854. Richard Barrow, a Louisiana plantation owner, had entertained and assisted a representative of the British Government, who had been sent to this country to study sugar cane and cotton production. The plantation owner refused payment for his assistance to the British official, but the British Government, not to be outdone in good neighboring, proceeded to ship four Brahman bulls from India to the Louisiana planter.

Word of the Brahman bulls and their offspring spread to Texas, and Lone Star State ranchers rode over to the Barrow plantation to check first-hand on the wild rumors about the strange critters. The Texans learned that Brahmans were large and energetic, and that they would graze greater distances from water, and feed over more acres than the famous Texas Longhorns, then being grown in the Gulf coastal area and in the Lower Rio Grande Valley. The Texans became the leading customers of Louisiana Brahman breeders, and they bought and sold and raised a great many in the seventies and eighties.

In 1855, J. M. Frost and Albert Montgomery of Fort Bend County, Tex., near Houston, purchased two Brahman bulls in India. These bulls were mated to cows carrying some of the blood of the four Louisiana plantation bulls, which strengthened the bloodlines of the breed on the American continent.

Some of the Louisiana Brahmans were driven to Texas in 1889, and J. D. Hudgins, of Hungerford, Tex., purchased a dozen of the top animals to begin a breeding herd that has become famous in this country. Today, Edgar H. Hudgins, of the J. D. Hudgins Estate, ranks among the foremost breeders and authorities of Brahman cattle. Mrs. S. C. Broder, secretary of the American Brahman Breeders Association, maintains offices at Hungerford. The association's office, however, will be moved soon to Houston, Tex. Numerous importations of Brahmans were made from India in the following years until now the breed is prominent throughout the South and several of the arid Western States where natural conditions make for hardship on men and beast alike. The Brahmans are inherently and physically fitted to withstand the southern and droughty elements.

The Cattleman's Choice

R. P. Guerra, McAllen, Tex., business leader and active proponent of the Bureau of Reclamation project that is designed to supply water to approximately 700,000 acres of the Rio Grande Valley's citrus groves and winter vegetable gardens, is one of the leading breeders of Brahmans along the United States-Mexican border. Mr. Guerra comes by his love of livestock through generations of cattlemen dating back to the time of the Conquistadores. The Guerras have been engaged in the livestock industry along the Lower Rio Grande since 1740. There they lived, worked, served in war, and prospered under the colors of five republics.

The Brahmans now being bred and ranged on the 32,000-acre Guerra ranch in the Rio Grande Valley are the result of an intensive search for a breed of cattle that would thrive best in the heat and among the Texas fever ticks, insects and ailments common to the Texas-Mexican border. The famed Texas Longhorns had been replaced by breeds that produced more beef, but which failed to prosper in the area.

The American Brahman Breeders Association claims that "Brahman Cattle Always Lead—Never Trail." Mr. Guerra relates interesting experiences in this country and in Old Mexico to prove that Brahmans, on the trail with any other breed of cattle, can outwalk and outlast all others. Brahmans have developed characteristics which enable them to preserve and perpetuate their life where most other cattle become prey to heat, drought, disease, and other pestilence.

Most of the 5,000 head of cattle on the 73,000-acre ranch of Elmer and Lloyd Bentsen, 40 miles northwest of McAllen, are Brahmans. The Bentsens prefer them to other breeds on the basis of profit, coupled with the ease with which they are produced in the arid region.

J. E. Pate and son, J. W. Pate, are among the numerous Lower Rio Grande Valley breeders and importe s of Brahman cattle. They irrigate their pastures at Hidalgo, Tex., just across the international bridge from Reynosa, Mexico, with waters from the Rio Grande, and the Pate cattle have to do less rustling for their feed than their kin, who range among the thorns of the brush in other areas of the Southwest. The Pates have special pride in the quiet behavior of their cattle, and treat them with unusual kindness.

Many Texas breeders now import choice animals from Brazil, where the Indo-Brazil crossbreds are quite common.

J. D. Hudgins, whose heifer calf, Queen Resoto Manso 153, was champion of the Houston Fat Stock Show in 1946 and repeated championship honors of the class at the 1947 exposition, says the Brahman crossbred cow is a much better mother than the average range cow. They have an unlimited amount of energy, and are great rustlers. They are usually in fine condition, and they give plenty of milk that contains a higher percent of butter fat than that of the British breeds and slightly higher than that of the Jersey. Butter fat in Brahman milk has been recorded as high as 7.7 percent, according to Mr. Hudgins.

Brahmans, in a comparatively short time, have become the choice of cattlemen in most sections of the country where heat and drought and many related troubles have routed other breeds. They are being boosted by the breeders and ranchers through an association that was organized less than 25 years ago. The association is incorporated under the laws of Texas, and sanctioned by the United States Department of Agriculture, for the purpose of registering worthy individuals of the Brahman breed. No record association has ever used more care to enter only worthy animals in the registry.

It is unfortunate that most Americans have been introduced to the Brahman cattle only in rodeos, where they react to such beastly treatment by becoming vicious. But the men, women and children who raise, feed and care for them know that they respond to kindliness with wistful trust. They have changed the old saying to: "as **mild** as a Brahman steer."

From California to Washington, D. C. Via The Central Valley Project

Marilyn Stewart in front of the Capitol, Sacramento, Calif.

For the best essay on "The Possibilities of the Central Valley Project" a California school girl has won a trip to Washington, D. C., and a week's sight-seeing in the Nation's capital.

She is 16-year-old Marilyn Stewart, talented and pretty senior in Sacramento "Hi" who is winner in a State-wide contest offered by the Daughters of the American Revolution. Her essay was selected by the D. A. R. as tops among thousands submitted in the contest, and she left in May, with her mother, Mrs. Robert Stewart, for her first journey to the East.

Little Miss Stewart, an exceptionally bright student and life member in the California Scholarship Federation, has written many essays, but, she says, this one was her most difficult. This was because a subject big and intricate enough to require a book to explain, had to be compressed into an article of less than 500 words.

News of her selection was conveyed to Miss Stewart by Miss Henriette L. Huntington, Regent of the Sacramento Chapter, Daughters of the American Revolution. Miss Huntington, whose grandfather's uncle, Samuel Huntington, signed the Declaration of Independence, is a Sacramento school teacher.

Miss Stewart's winning essay follows:

The Possibilities of the Central Valley Project

The purpose of the Central Valley project is to utilize California's water resources in such a way as to yield the greatest possible benefits for all of the people. However, this purpose cannot be realized unless the project is completely developed. The far-reaching ultimate program consists of irrigating arid lands and furnishing supplemental water to inadequately supplied farms, producing hydroelectric power, salinity, and flood control, navigation, and recreation. The cost, estimated by the Bureau of Reclamation, would be $99,730,000 annually, while the benefits would be $275,003,000 annually.

The great Sacramento-San Joaquin Basin is an extremely fertile region, but 2 million of its acres are in desperate need of supplemental water supplies. Also there are over 3 million barren acres that could be converted into highly productive farms if furnished with water. This irrigation would indeed be a great boon to farmers in this State and would bring in other pioneers to cultivate the new farmlands.

Under the ultimate plan, less than a quarter of the tremendous amount of hydroelectric power generated would be required for the project's pumping purposes. The greater amount of remaining power would be sold for commercial purposes, and thus new industries could be established using this cheap form of power. In view of the Nation's rapidly dwindling natural resources, hydroelectric power is becoming increasingly important to our country's future security and welfare.

Flood control, navigation, and salinity control are mutually dependent. Water that ordinarily wreaks havoc with the land would be stored in great reservoirs. Then it could be released to repel the very harmful encroachments of salt water from San Francisco Bay into the fertile Sacramento-San Joaquin Delta. This added water supply would also aid the proposed deep water channel project connecting the Sacramento River with Upper San Francisco Bay. Thus cheap river transportation would be provided, the towns along the channel would be further developed, and our State capitol, Sacramento, could become an important shipping center.

The Central Valley project would supply incidental recreational facilities by means of reservoirs, canals, and controlled stream flow. These reservoirs and canals would provide ideal places for boating, swimming, fishing, and picknicking and would furnish youth with recreational and outdoor life that could help prevent juvenile delinquency.

Innumerable benefits can be derived from the Central Valley project. California could support a greately increased population to develop the new farm lands and to establish industries using hydroelectrie power. As a result, agriculture, industry, and business would be stimulated throughout the whole state. There can be little doubt that the Central Valley project could provide the impetus for increased and lasting prosperity for all California.

Do You Plan To Move?

If so, please notify the *Reclamation Era* so that you may continue to receive your copy regularly.

Retiring on the Run

(Continued on page 140)

raised a family and made a host of friends, had been an important part of the community in every way?

"No, indeed," said Mrs. Foster. With a reminiscent smile, she added, "Those were priceless years, among the best people in the world. But now that they are ended, we want to grow a California garden."

"Maybe Mr. Foster hadn't wanted to be a reclamation man in the first place?" we asked.

"Well, to tell the truth," he said, brightening so much that you wouldn't be surprised to see him turning up as a junior at USC next fall, "I was going to study to be a doctor. . . ."

"No," Mrs. Foster laughed again, "Lew would have quit if he'd rather have been anything on earth except just exactly what he was, a superintendent of a reclamation project. He loved his job."

Those remarks seemed to me to sum up a remarkably well-spent life. We might add that four fine children were sent to college. The girls are now happily married, and the boys, now men, are good engineers, one working for the Denver, Colo., office of the Bureau. Mr. Lewis Foster played a big part in building the great West of today. He has every reason to sit back, to settle down, and take his ease in the evening.

It was evening when we left, and Lewis Foster peered into the street as he went to the door with us and said, "Sure wish somebody with more money than sense would come along. I'd like to ***get going.***"

Water Scarcity

The old captain had struggled all day in the hot sun trying to get his boat over a bar in the Missouri River. He cussed and he fumed when every try turned into failure. There just wasn't enough water to float the barge.

He was still trying at sundown when a grizzly old miner came down from his cabin on the high bank with an old pail to get his usual daily supply of water.

The captain watched him intently. The miner dipped his bucket in the water, as he had done every night for years, paying no heed to the visitor.

His pail full, he started back up the bank.

The captain could hold his rage no longer.

"Hey," he shouted at the top of his lungs, "You put that back."

NEWS ROUND-UP

Enders Dam Under Way

Construction on Enders Dam, the fourth unit in the Missouri Basin, and the first feature of this development in Nebraska got under way officially on May 29, when the dam site was dedicated. Mr. Harry D. Strunk, Chairman of the Republican River Valley Association and Bureau of Reclamation staff members from Region 7 were in charge of the celebration which lasted from May 29 through June 1.

A special train took thousands of visitors to the dam site. School bands from many areas in the Republican River Valley participated in the celebration which included a huge barbecue festival the first day and was marked by a series of pageants, parades, and special events.

Enders Dam, near the town of Enders, Nebr., will be one of two reclamation structures, the other being Medicine Creek Dam, north of Cambridge, Nebr. These two dams will be the main features of the Frenchman-Cambridge project which will provide irrigation water for more than 53,000 acres of land. Waters from the Enders Dam will join those of the Republican River and the Medicine Creek Dam to water lands from Enders, Nebr., in Chase County through Hayes, Hitchcock, Red Willow, and Furnas Counties to the Harlan County Reservoir about 3 miles below Orleans, Nebr. The land area of the project comprises a narrow strip 1 to 3 miles wide and 110 miles long in the valleys of Frenchman Creek and the Republican River.

Floods in the Republican River Valley in 1935 took a toll of more than 100 lives, and ways and means of combating this menace have been worked out by the Bureau of Reclamation and the Corps of Engineers.

The Enders Reservoir which the dam will create will cover approximately 3,200 acres, or about 5 square miles and will have a storage capacity of 74,000 acre-feet. This storage capacity is to be divided almost evenly between irrigation and flood control, with a small balance provided for silt deposits. The dam itself will be 112 feet high with the crest of the main structure approximately one-half mile long. An additional dike, approximately 1¼ miles long at the north end, will extend almost 2 miles from the Frenchman Creek to the outskirts of the town of Enders.

Workmen began on March 25 to remove about a million and one-third cubic yards of earth, an essential part of the construction program, which also includes the rerouting of Nebraska State Highway No. 61. It now passes across the Frenchman River upstream from the site of the dam and will be rerouted to cross the top of the dam.

According to the best estimates available, the following are among some of the materials that will be required for the Enders features of the Frenchman-Cambridge project: 200,000 tons of rock, 53,000 cubic yards of concrete, 4,600,000 pounds of steel, as well as piping, electrical equipment, ventilating systems, small buildings, and guard rails.

It has been estimated that these features of the project will require 3½ years to complete.

Warne Becomes Assistant Secretary of the Interior

William E. Warne.

William E. Warne, Assistant Commissioner of the Bureau of Reclamation, will take office as Assistant Secretary of the Interior on July 1, 1947. Long a top-ranking administrator in the Federal Service, as the Bureau's Assistant Commissioner, he directed what has been called the greatest planning and programming schedule for developing the land and water resources of the West ever undertaken.

A Reclamation veteran, he became recognized as a leader in the planning field for his work in connection with the Columbia Basin Joint Investigations. The objective of this study was to facilitate settlement of the million-acre Columbia Basin project in central Washington which is to provide irrigated farms for 17,000 families.

He also served as Assistant Chief of the Division of Power, Chief of Staff of the War Production Drive Headquarters. He is a graduate of the University of California, where he received his A. B. degree in 1927.

President Truman nominated Mr. Warne for the position on May 7, and the Senate confirmed the appointment on May 14. Mr. Warne succeeds Warner W. Gardner.

Survey of Class 5 Lands

The Commissioner has requested the Regional Directors to conduct an immediate survey of all lands designated as class 5, under the provisions of the Omnibus Bill of 1926, with a view to restoring them to a status in which they will be subject to construction charges, or recommending that the Secretary declare them class 6, or permanently unproductive, land.

Class 5 lands are lands which were previously subject to construction charges, but upon examination were found to be insufficiently productive to earn these charges and were thereafter placed in this category. All costs for class 5 lands were suspended until the Secretary of the Interior could determine their suitability for irrigation.

Under the Reclamation Act of 1939, the only lands to be placed in class 5 were irrigable lands suspended from the pay class pending completion of planned project works.

It's HOOVER Dam

(See Back Cover)

When Congress passed House Joint Resolution 140, and President Truman signed the measure on April 30, the name of the highest dam in the world was changed from Boulder Dam to Hoover Dam.

Mr. Hoover's name was given to the dam because he was the United States representative on and served as chairman of the Colorado River Compact Commission, which drafted an agreement between the States comprising the Colorado River Basin, and because he was President at the time the legislation which authorized construction became effective.

Hoover Dam, which is 726 feet high, spans the Black Canyon of the Colorado River between the States of Arizona and Nevada. The towering mass of concrete is 171 feet higher than the Washington Monument in the Nation's Capital; it has a base thickness of 660 feet—more than the length of two ordinary city blocks.

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Landownership Survey on Federal Reclamation Projects.*—Available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

2. *The Colorado River.*—Comprehensive departmental report on development of water resources of Colorado River Basin for review prior to submission to the Congress. Limited number of copies available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

3. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals*, by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, 7-page mimeographed study with graphs.

Available from the Superintendent of Documents, Washington 25, D. C.

1. *High-Pressure Reservoir Outlets*, by J. M. Gaylord and J. L. Savage—a report (1923) on Bureau installations compiled from correspondence, project histories, feature reports, technical papers, special reports prepared for this purpose, and from personal inspection of the installations described. Obtainable from the Superintendent of Documents.

2. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

3. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest release is: Standards and Levels of Living, studies by the Department of Agriculture for Problem 9—20 cents.

Problem 14, Financial Aid for Settlers—25 cents.

Problem 23, Rural and Village Electrification—25 cents.

Problem 24, Agricultural Processing Industries—30 cents.

Problem 26, Recreational Development of Roosevelt Lake—75 cents.

4. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Table showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

5. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

Miscellaneous Publications

Soil Properties Contributing to Citrus Chlorosis as Revealed by Seedling Tests, by W. T. McGeorge, agricultural chemist, Department of Agricultural Chemistry and Soils, Agricultural Experiment Station, College of Agriculture, University of Arizona, Tucson, Ariz.; 165 pages with illustrations. Technical Bulletin No. 112, September 1946. A study designed to determine the manner in which the alkaline-calcareous characteristic contributes to micro-nutrient element deficiency symptoms in Arizona soils.

The Electric Light and Power Wage Structure, by Joseph W. Bloch, economist, United States Bureau of Labor Statistics, in *Public Utilities Fortnightly*, January 30, 1947, page 143. Comprehensive survey of the types of employment of the nearly 200,000 workers in the privately owned industry, and an analysis of payments for the varied classes of service.

More and Better Forage on Irrigated Pastures, by Curtis R. Fuller, in *Western States Reclamation Journal*, February 28, 1947, page 10. Illustrated. Livestock operators on irrigated farms and ranches can make large contributions to the food producing effort by improving their management of pastures already in use and by establishing new ones.

Shall We Spend $2,000,000,000 More on the Colorado? by Edward Churchill, in the *Saturday Evening Post*, February 22, 1947, page 28. Illustrated. The author discusses the question as to whether the muddy, erratic Colorado River—even with projects vaster than Hoover Dam—could possibly provide jobs, crops, and baths for the millions of thirsty people who look to the river as their life line.

Frank Banks—Wilderness Fighter, by Don Eddy, in *This Week*, March 16, 1947, page 4. Illustrated. The dramatic story of a shy New Englander who for 40 years has battled blizzards, floods, and grizzlies to make the Western wastelands bloom. (Copies of *This Week*—syndicated weekly magazine supplement—are obtainable by writing to United Newspapers Magazine Corp., Publishers, 420 Lexington Ave., New York, N. Y.)

Engineering Publications

Available from the Design and Construction Technical Library, Bureau of Reclamation Customhouse, Denver, Colo.

1. *New Results in the Determination of Foundation Properties by the Dynamic Test Method*, by H. Lorenz.—Translation by the Bureau of Technical Library from VDI Zeitchr (1934), of article on apparatus and research of dynamic testing of soils and foundations. It was found that with a surface vibrator, it was possible to identify various strata and estimate their bearing power.

2. *Experimental Attempt to Solve the Problems of Failure in Nonmetallic Materials*, by M. Ros and A. Eichinger.—Translation of Report No. 28 of the Swiss Federal Materials Testing Institute by the Bureau Technical Library. The various failure theories are reviewed and from the interpretation of the test results obtained on different materials, the conclusion is reached that a general failure theory is not possible, since the structural composition differs among materials themselves.

3. *New Protection Against Airborne Diseases*—published by Lustra Corp. of America.—This booklet gives complete details of five new models of germicidal fixtures. There are many practical applications for farm use.

U. S. GOVERNMENT PRINTING OFFICE 1947

Notes for Contractors

Contracts Awarded During April 1947

Specification No.	Project	Date of award	Description of work or material	Contractor's name and address	Contract amount
1358	Mancos, Colorado	Apr. 17	Construction Jackson Gulch dam and inlet and outlet canals.	Vinnell Co., Inc., Alhambra, Calif.	$1,925,904.50
1585	Colorado-Big Thompson, Colorado.	Apr. 11	Schedule 2, construction Granby pump canal	do	591,358.75
1645	Davis Dam, Arizona-Nevada.	Apr. 16	One 325-ton gantry crane, one lifting beam	Star Iron & Steel Co., Tacoma, Wash	306,300.00
1666	Klamath-Tule Lake, California.	Apr. 18	Construction earthwork and structures, M Canal, Station 127+01 to 113+30, Modoc Unit.	George R. Stacy, Tule Lake, Calif.	120,341.00
1667	Central Valley, California	Apr. 16	Construction Shasta Dam to Summit City highway, and Shasta Dam left abutment parking area.	Harms Bros., Sacramento, Calif	814,273.50
1671	Missouri Basin, Hardin, Mont.	Apr. 21	Schedules 4 and 8, exploration tunnels, Yellowtail damsite	Jayhawk Construction Co., Billings, Mont	119,546.00
1672	Yakima-Roza, Washington	Apr. 11	Construction lateral distribution systems of pump areas 1 and 9.	Morrison-Knudsen Co., Inc., Boise, Idaho	135,029.00
1675	Central Valley, California	Apr. 2	Items 3 and 4, fabricated and standard pipe, pipe fittings, bolts, gaskets, for 96-inch river outlet gates, Shasta Dam.	Associated Piping & Engineering Co., Inc., Compton, Calif.	10,283.00
1683	Columbia Basin, Washington.	Apr. 25	7 vertical-shaft pumping units for 6 relift pumping plants, Pasco lateral system.	Food Machinery Corp., Peerless Pump Division, Los Angeles, Calif.	26,127.10
1687	Central Valley, California	do	Hollow metal doors for control bay and service bay units 2 and 5, for Shasta Power Plant.	M. Reuter & Sons, Portland, Oregon	12,375.00
1689	Columbia Basin, Washington.	do	Hollow metal doors for elevator towers and power plant; steel partitions with doors for left powerplant, Grand Coulee Dam.	do	34,928.00
1693	Central Valley, California	Apr. 16	Construction Contra Costa Canal, Stations 1993+11 to 2321+25, and Clayton and Ygnacio Canals.	Parish Bros., Benicia, Calif	1,072,147.50
1695	Boulder Canyon, California-Nevada-Arizona.	do	Aluminum railings, door frames, curbs and trim; metal partitions; steel doors and stairs; structural and architectural metalwork, for Boulder power plant.	Newman Bros., Inc., Cincinnati, Ohio	36,737.00
1703	Yakima-Roza, Washington	Apr. 15	Steel pipe and accessories for wasteway crossing, Wasteway No. 5, Stations 162+78 to 539+00, and for lateral distribution systems.	American Pipe & Construction Co., Portland, Oreg	11,050.00
1708	Central Valley, California	Apr. 18	Furnishing and installing sheet-metal ducts for ventilating system, Shasta power plant.	Fox Metal Products Corp., Ogden, Utah	19,666.00
RV-1	Rio Grande, New Mexico	Apr. 25	Reconstruction of Elephant Butte roads	Jones Bros., Albuquerque, N. Mex	47,643.00
2213	Columbia Basin, Washington.	Apr. 10	900,000 square feet of plywood	Rucker Bros. Lumber Co., Ephrata, Wash	111,132.00
7475-A	Davis Dam, Arizona-Nevada.	Apr. 18	Poles for 161-kilovolt line	J. H. Baxter & Co., San Francisco, Calif.	246,798.40
G-38,236-A	Columbia Basin, Washington.	Apr. 10	110,000 barrels portland cement	Spokane Portland Cement Co., Spokane, Wash	391,776.00
67,020-A	Missouri Basin-Enders Dam, Nebraska.	Apr. 23	1,710,481 pounds reinforcing bars	Capitol Steel & Iron Co., Oklahoma City, Okla	97,128.76

Construction and Supplies for Which Bids Will Be Requested During June 1947

Project	Description of work or material	Estimated date bids to be invited [1]	Estimated bid opening date [1]
Boise, Idaho	Butterfly valve for Anderson Ranch Dam and power plant	June 1	July 7
Central Valley, Calif	Pump discharge pipes for Tracy pumping plant	do	Do.
Do	Utilities for Tracy government camp	do	Do.
Do	Materials for Shasta-Tracy 230-kilovolt transmission line (88 miles)	do	Do.
Davis Dam, Nevada-Arizona	Control board for Phoenix substation	do	Do.
Do	Miscellaneous steel and cast iron pipe for Davis power plant	June 2	July 8
Boise-Payette, Idaho	Earthwork and structures, "C" Line West laterals 1.6 to 23.5	June 6	July 11
Central Valley, Calif	Butterfly valve for Tracy pumping plant	June 15	July 21
Colorado-Big Thompson, Colo	Siphon No. 1 for Horsetooth Feeder Canal	do	Do.
Do	Control and station service distribution boards for Estes power plant	do	Do.
Do	Unit substation and pump boards for Granby pumping plant	do	Do.
Do	Control and station service distribution boards and station service transformers for Marys Lake power plant	do	Do.
Do	Materials for Sterling-Sidney 115-kilovolt transmission line (40 miles)	do	Do.
Columbia Basin, Washington	Insulators for 230-kilovolt right switchyard, Grand Coulee power plant	do	Do.
Do	Conductors for generator circuits R-1, R 2, R 3, tie circuits 1 and 3, 230-kilovolt right switchyard, Grand Coulee power plant.	do	Do.
Davis Dam, Nevada-Arizona	Power transformers, oil circuit breakers, disconnecting switches for Parker power plant	do	Do.
Do	Crossarms, conductor and conductor hardware for the Tucson-Cochise transmission line	do	Do.
Do	Conductor and conductor hardware for the Parker-Davis transmission line	do	Do.
Parker Dam, Arizona	Oil circuit breakers, disconnecting switches, instrument transformers for Gila, Ariz.	do	Do.
Provo River, Utah	Siphon, penstock and discharge lines for Jordan Narrows pumping plant and siphons	do	Do.
Davis Dam, Nevada-Arizona	Air compressors and associated equipment for Davis power plant	June 17	July 22
Central Valley, California	Earthwork, pipelines, and structures for laterals 4.8, 5.3, 5.9, and 6.0 and sublaterals, Contra Costa lateral system	June 18	July 23
Klamath-Tule Lake, California	Pumping units for Coppeck Bay Area Extension	do	Do.
Yakima-Roza, Washington	Earthwork, pipelines, and structures for lateral distribution system, Pump Areas Nos. 9A, 10, and 12	do	Do.
Deschutes, Oregon	Earthwork and structures, North Unit Main Canal, Station 3010+50 to 3562+30	June 20	July 25
Klamath-Tule Lake, Oregon	Pumping plants G, H, J, K, L, and M, Coppeck Bay Area Extension, Modoc unit	do	Do.
Boise-Payette, Idaho	Willow Creek pumping units	June 25	July 30
Columbia Basin, Washington	Air compressors and associated equipment for Grand Coulee power plant	June 27	Aug. 1
Central Valley, California	Main and station service control boards for Tracy substation	June 30	Aug. 8
Do	Motor control and station service boards for Tracy pumping plant	do	Do.
Colorado-Big Thompson, Colorado	25- and 50-ton cranes for Granby pumping plant	do	Do.
Columbia Basin, Washington	Domestic water pumps, chlorinating equipment for Mason City	do	Do.
Do	Unit and main control boards for Grand Coulee right power plant	do	Do.
Davis Dam, Nevada-Arizona	Conductor and conductor hardware for the Davis-Prescott transmission line	do	Do.
Do	Conductor and conductor hardware for the Prescott-Phoenix transmission line	do	Do.

[1] Subject to change.

Reclamation's Forty-Fifth Anniversary

Forty-five years ago this month the Bureau of Reclamation was established. At the time the Reclamation Act was passed on June 17, 1902, during President Theodore Roosevelt's administration, the agency was known as the Reclamation Service. Today it is the largest single agency engaged in the development of western river resources.

HOOVER DAM—Arizona-Nevada
Bureau of Reclamation Photo

JULY
1947

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ly Experiences as a Ditchrider

by
Charles A. Lory

E Reclamation ERA

This Month's Cover Girl

UTAH'S QUEEN

Pictured above in her royal regalia is Miss Calleen Robinson, who was chosen queen of the Utah Centennial. She is a true descendant of the original Mormon pioneers, who first practiced irrigation in the State a century ago, being the granddaughter of a Provo River project farmer. The sequin embroidery on the skirt of her royal costume represents the covered wagons used by her ancestors. The *Era* is indebted to Utah Centennial Commission photographer (Stephen J. Moloney) for this photo.

On the cover, Utah's queen is shown turning a valve on the intake structure of the Jordan Narrows Siphons. The siphons and the Salt Lake Aqueduct, which will convey Deer Creek storage water to the lands of the Salt Lake Valley as well as provide a domestic water supply for the people in that area, are nearing completion 100 years after irrigation was first practiced in the same valley. The aqueduct will more than double Salt Lake City's domestic water supply. Cover photo was taken by Bureau of Reclamation's Photographer Paul E. Norine, Region IV.

Giving Credit Where It's Due

The excellent panoramic perspective drawing of the Colorado-Big Thompson project which appeared on pages 84–85 of the April *Era* was the work of Harry A. Grout, Region VII, Denver, Colo.

Reclamation ERA

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Letters to the Editor

Engineering News-Record on Record

The following letter to Assistant Commissioner of Reclamation Markwell is printed here with the permission of Mr. Cleary whose opinions are highly valued in the engineering field.

330 West 42nd Street,
New York 18, N. Y.
April 17, 1947.

Dear Mr. Markwell:

Had I not been informed that you were operating under a tight schedule when we were both in the Denver office last week, I would have endeavored to see you because I was eager to make a report on my inspection tour of regions III and V.

This note can hardly convey to you the spirit of enthusiasm with which I returned from my reconnaissance of reclamation projects. I am impressed with the scope and size of the undertakings themselves, but more importantly, perhaps, with the universally high caliber of the Bureau personnel. Nowhere have I come in contact with a group of men of such fine qualifications and devotion to the task in hand than I met on this recent trip.

Many attentions quite beyond the call of duty were extended to me and I made the most of every opportunity to acquire background and understanding of at least some elements of the present reclamation program. To supplement my field observations, I am now burrowing into reports and other literature with a view toward the preparation of copy for publication in *Engineering News-Record.*

The itinerary originally proposed by you was perfect. And the details handled by the field staff were beautifully coordinated. In this connection, may I tell you that Mr. Nelson and Mr. Moritz supplied very companionable and well informed guides in the persons of Jack Woodward of the Information Division staff in the Amarillo office, and Jack Shankland, an engineer assigned to the Construction Division at Boulder City. Thanks to both of these men the inspection was just as enjoyable as it was enlightening.

It is my intention to come to Washington at the end of the month so that I might have an opportunity of sitting in on some of the hearings related to the Arizona work and at that time I look forward to calling at your office to personally express my appreciation.

With kindest regards and best wishes, I am
Cordially yours,

Edward J. Cleary,
Executive Editor,
Engineering News-Record.

More on Benoclor

The Clorobex Corporation,
15 Exchange Place,
Jersey City 2, N. J.

Dear Editor:

The article "Benoclor-3-C" by W. Harold Hirst, which appeared in your April issue speaks of the weedkiller Benoclor as a "chemical." The phrase "chemical compound" would be more accurate, as the other usage may be misleading. The Benoclors are actually compounded of several chemicals for adaptation to different field conditions, and rendered useful through varying emulsifying agents. There is also connoted in the use of the word "chemical" the idea that the weed killing action is a chemical one, whereas the Benoclors perform more as a solvent than as such simple chemicals as sodium chlorate or calcium hypochlorite used in the weed-killing field.

While I have never met Mr. Hirst, I would appreciate it if you would extend to him my compliments for the accuracy with which he described the present techniques utilized in connection with Benoclor-3-C, and the results ascertained to date.

Incidentally, I live on Long Island, not in New Jersey.

Sincerely yours,

Herman Seydel, *Director.*

NEXT MONTH

A full report by Edward J. Cleary, executive Editor of *Engineering News Record*, of his reconnaissance of reclamation projects.

ALSO "Holing Through in 1909" by G. J. Van Gieson of the Branch of Design and Construction, Denver, Colo. The story of the famous Gunnison Tunnel.

United States Department of the Interior
J. A. Krug, Secretary

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The Reclamation Era regrets to announce the death of Superintendent L. J. Windle, of the Shoshone project, Wyoming, Region VI. W. F. Kemp has been appointed Acting Superintendent of the project.

Name	*Address*

"Get Acquainted" Copies

If you have friends or associates who would be interested in the *Reclamation Era*, please list their names and addresses in the box to the left, clip and send it to the Commissioner, Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues so that they can get acquainted with your magazine.

What "Multiple Purpose" Means

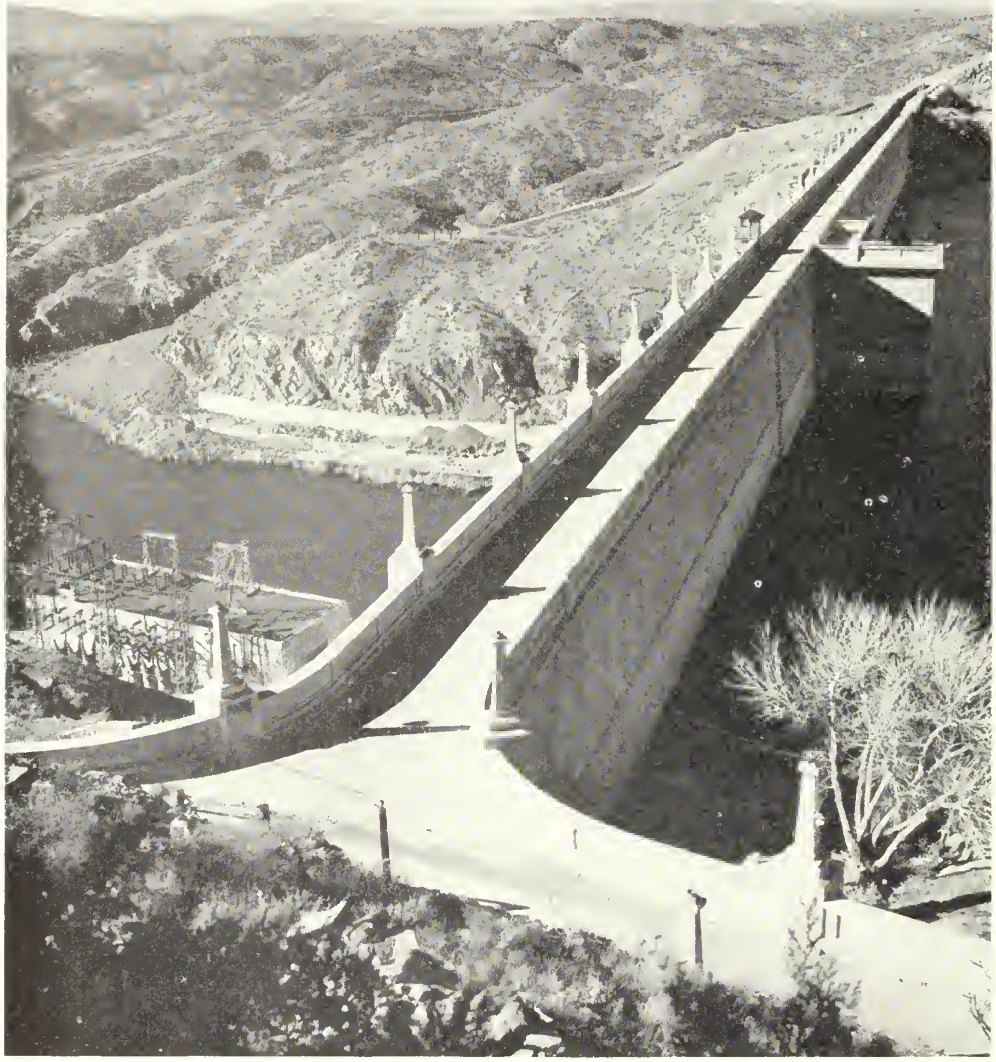


Photo by D. B. Parker, Region V

Elephant Butte Dam, Rio Grande project, N. Mex., source of hydroelectric power and municipal water.

NOT ONE of the irrigation storage reservoirs constructed by the Bureau of Reclamation can be considered as a single-purpose reservoir.

Although it may be planned, built, and operated for that one purpose, and the repayment of the cost of construction be made only by the irrigation interests, some measure of flood control, recreation, and fish and wildlife benefits is apparent in each of our storage reservoirs.

People have begun to recognize the existence of these multiple benefits more and more during the last 15 years, especially since the Bureau of Reclamation started to prepare plans for Hoover Dam. With this recognition has come the necessity of determining, within certain limits, the priorities of use among the various purposes. The State and Federal Governments have given, and are continuing to give, attention to this subject, and their ideas are reflected in the form of legislation. The operation of projects for irrigation and other purposes is dependent upon Federal and State policies, and the contracts with the beneficiaries. Design and operation of reservoirs have been changed to keep pace with these factors.

There is not a great deal of uniformity, and no standardization, apparent in the measures which have been adopted from year to year in the allocations to different purposes or in the methods of operations, but the examples which are given in the following paragraphs will, to some extent, explain the principles which are involved. The operating characteristics cannot be divorced entirely from the financial ones, because in Reclamation projects each is dependent on the other. Consequently, information on the cost allocations will be treated briefly in some cases.

The Rio Grande project of New Mexico and Texas, which covers 155,000 acres of irrigated land, extends nearly 180 miles along the Rio Grands upstream and downstream from El Paso. The international boundary between the United States and Mexico, beginning at a point immediately above El Paso, is formed by the river. Water regulation and storage are provided by the Elephant Butte Reservoir of 2,219,000 acre-feet capacity in 1940 (the date of the latest survey) 22 miles above the project lands; and the Caballo Reservoir of 345,000 acre-feet capacity, immediately above the project lands. A power plant of 24,300 kilowatt installation is situated at Elephant Butte Dam.

Caballo Dam and the power plant at Elephant Butte Dam were added to the project works about 23 years after Elephant Butte Dam was completed. Caballo Dam was constructed in part to provide control of arroyo floods, but its principal function was to provide afterbay storage capacity to reregulate releases from Elephant Butte Reservoir and make possible the generation of a large block of saleable power at the Elephant Butte plant.

The initial contract with the project water users, signed in 1906, called for repayment to the Federal Government of all costs of Elephant Butte Dam and Reservoir. In 1907, $1,000,000 was declared nonreimbursable by appropriation from the General Treasury in accordance with the Treaty with Mexico, signed May 21, 1906, whereby 60,000 acre-feet of water would be stored annually in Elephant Butte Reservoir and delivered to Mexico at a point near Juarez. The treaty contains a schedule of water delivery for each month, but for a diminished supply in years of extraordinary drought or serious accident to the irrigation system in the United States.

Although there was a storage allocation to flood control of 416,000 acre-feet, which covered the upper portion of the reservoir from the inlet of the cylindrical gates (elevation 4396) to the spillway crest (elevation 4407), there were no nonreimbursable funds allotted for this purpose.

After Caballo Dam and the power plant were completed (in 1938 and 1940 respectively), the cost allocations and repayment contract were revised. Approximately $1,500,000 was transferred to construction funds from the State Department to cover the flood-control allocation for the Caballo Dam. This action was a part of the program of the International Boundary Commission for flood control and river rectification along the international boundary.

An agreement was reached between the United States and the project water users whereby the remaining part of the costs for Caballo, the cost of the power plant and facilities, and the costs of construction of Elephant Butte Dam and appurtenant works were to be repaid solely from net power revenues.

An agreement on the operation of Caballo

by Wesley R. Nelson. Regional Director, Region V, Amarillo, Tex.

Dam also serves for flood control.

Photos by A. E. McCloud, Region V

Irrigation—number one priority.

Dam was reached with the State Department, whereby 100,000 acre-feet of storage would be available for flood control from June 1 to November 1 of each year. Although the major portion of the costs of storage works must be repaid from revenues derived by sale of power, water may be released from Caballo Dam only as it is needed for irrigation or if it must be spilled during floods after both reservoirs are encroaching upon their flood-control pools.

It is obvious that the reservoirs must be operated very carefully to obtain the maximum power development, and at the same time stay within the flood-control limitations, and avoid all discharge of unusable water from Caballo Dam. This situation is further complicated by provisions in the compact among Colorado, New Mexico, and Texas, which governs the distribution of use of Rio Grande waters above Fort Quitman, Tex., 80 miles below El Paso.

Benefits to fish and wildlife, recreation, and sediment detention have always been substantial at Elephant Butte Reservoir, but no allocations have been made to these uses.

The city of El Paso obtains a part of its water supply from project works. When the project was first planned, the city was given an opportunity to participate and receive a water supply. It elected to continue to get its supply from underground sources.

Recently, the increased population of the city, the influx of industry, and the establishment of a large army post produced a much greater demand on the underground reservoir than could be met by recharge. Since all the waters stored at Elephant Butte were required for project lands, it was necessary for the city to purchase lands and thus obtain rights to water that could be used for domestic purposes.

It was necessary to operate the project storage works for flood control in the spring and summer of 1942. Unusually large inflow into the reservoir in May and June in 1941 was followed by heavy run-off from the basin above the reservoir in the following spring. The outflow from both Elephant Butte and Caballo Reservoirs was held substantially below the rate of 11,000 cubic feet per second as required by the agreement with the State Department, but some damage was caused in areas near Hot Springs, between Elephant Butte and Caballo Reservoirs, where property had encroached upon the flood plain.

Under normal conditions, the discharge from Caballo Dam is entirely for irrigation, and Elephant Butte Dam and power plant are operated to avoid raising the elevation of Caballo Reservoir to a level that would make spills of nonirrigation water necessary.

Farmers on the project inform the ditch rider when they will need water, and how much will be required. This information is passed on to the project office where the figures are compiled and orders given for the release of water from Caballo. The operator at Elephant Butte Reservoir is notified of the amount of water that can be spilled from the reservoir during each month. On some occasions, particularly in the spring, when it is necessary to evacuate the flood-control pool at Caballo Reservoir, operations of the power plant are restricted.

The principal factors to be noted in the Rio Grande case are that decisions, with regard to allocations, were reached only when exigency demanded, as the circumstances indicated, and without an analysis of all benefits and potential allocations. However, the project works are so designed that they can be operated satisfactorily for irrigation, flood control, power development, and other purposes.

Although considered originally as a single-purpose project, the Alamogordo Reservoir on the Pecos River, 247 miles above the Carlsbad, N. Mex., project, which it serves, has captured or reduced the peak of several floods since 1937, when the dam was under construction. The present capacity of the reservoir is about 132,000 acre-feet.

Recognition of its flood-control potentialities is expressed in a Federal act (the act of August 11, 1939), which provides for the determination by the Corps of Engineers of the benefits the reservoir affords.

There are some fish and wildlife and recreational benefits, and prior to 1946 the draw-down was held to 5,000 acre-feet remaining in the reservoir. In 1946, the water shortage on the Carlsbad project became so acute that the reservoir was lowered to 1,500 acre-feet, the maximum draw-down that could be accomplished without damage to the outlet valves. No loss of fish was apparent.

Conchas Dam on the Canadian River in east central New Mexico, 35 miles northwest of Tucumcari, was completed by the Corps of Engineers in 1939. Storage capacity amounting to 600,000 acre-feet was assigned as follows: 100,000 acre-feet to sediment detention; 300,000 acre-feet to irrigation; and 200,000 acre-feet to flood control. Storage capacity for flood control is in that portion of the reservoir above the permanent crest of the dam spillway.

The Bureau of Reclamation is building the 38-mile canal from the Conchas Reservoir to the project lands and the irrigation distribution and drainage systems for a

Photo by Dale A. Horey, Region V

Recreation, last but not least of multiple purposes.

project area of 45,000 acres which surrounds the city of Tucumcari.

None of the costs for the reservoir is to be repaid by the water users. The Corps of Engineers operates the dam reservoir, and all outlet works including the one for the irrigation canal. Releases of irrigation water are made as requested by the Bureau of Reclamation.

There is considerable fishing and boating at Conchas Reservoir, but no allocations have been made to benefits of this nature. It is probable that some fish will be lost from the reservoir through the irrigation outlets. This condition might be rectified by screening the outlets or by placing a trap in the main canal. A small 150-kilowatt plant provides power for the dam and camp operations. Water for operation of the plant is taken from any water available in the reservoir, without reference to a specific allocation.

The principal features of the Austin project in southwestern Oklahoma are the Austin Dam and Reservoir on the North Fork of the Red River, and a canal and distribution system for the irrigation of approximately 70,000 acres of land south of the dam. The reservoir capacity is 188,414 acre-feet.

The allocations made by the Bureau for regulation purposes are silt, 43,000; municipal supply, 4,800; irrigation, 103,850; and flood control, 36,764 acre-feet. The allocation of space for flood control is above the crest of the ungated spillway. The cost allocations, as established in the findings of feasibility, dated January 21, 1941, were $1,130,000 for flood control; $1,080,000 for municipal supply; $2,000,000 for irrigation; and the remainder, $1,390,000 for unemployment relief through the participation of the Works Project Administration. The estimated cost of the project has increased since the findings of feasibility but the increase has not as yet been allocated.

This is one of the projects for which the Secretary of War is to prescribe regulations for use of storage allocated to flood control under the terms of section 7 of the Flood Control Act of 1944 (act of December 22, 1944).

The tentative agreement, which has not yet been approved by the Interior and War Departments, is that the flood control discharge facilities shall be operated under the direction of the District Engineer of the Corps of Engineers whenever the pool stage reaches the crest of the ungated spillway. The District Engineer would then direct the operations of the discharge facilities to prevent flood damage below the reservoir and to limit the pool stage to an elevation 3 feet above the crest of the ungated spillway so far as possible.

Hoover Dam, one of the Nation's most successful multiple-purpose projects, is located on the Colorado River, 420 miles above its mouth, where the river forms the boundary between Nevada and Arizona. The dam is 8 miles east of Boulder City, Nev., and 71 miles northwest of Kingman, Ariz. The reservoir, Lake Mead, has a capacity of 31,142,000 acre-feet. The power plant, located at the toe of the dam, will have a total capacity of 1,322,300 kilowatts, of which 1,034,800 kilowatts are now installed.

The purposes for which the reservoir and power plant were built, as set forth in section 1 of the Boulder Canyon Project Act, are for (1) controlling floods, (2) improving navigation and regulation of the flow of the Colorado River, (3) providing for storage and for the delivery of the stored waters for reclamation of public lands and other beneficial uses within the United States, and (4) generating electrical energy as a means of making the project a self-supporting and financially solvent undertaking.

Engineering studies indicated that the lower 300 to 360 feet of the reservoir should be allotted to silt and sediment detention; the next 155 to 215 feet for active storage or river regulation; and the upper 75 feet for flood control.

The approximate reservoir capacities are 3,000,000 acre-feet for silt detention; 20,000,000 acre-feet for active storage and river regulation; and 9,000,000 acre-feet for flood control.

The initial legislation provided that the cost of all the works, exclusive of the allocation to flood control, would be repaid in 50 years at 4 percent interest through the sale of stored water and electrical energy, but that no charge should be made for water stored for the Imperial and Coachella Valleys.

The sum of $25,000,000 of the construction cost was allocated to flood control and was to be repaid to the United States out of a percentage of the revenues which were in excess of the amount needed to meet periodic payments during the period of amortization.

The Boulder Canyon Project Adjustment Act of July 19, 1940, revised the repayment plan. It provided that the payment of the $25,000,000 allocation to flood control was to be deferred, without interest, to June 1, 1987. The recreational and fish and wildlife benefits are very great at Lake Mead, but allocations have not been made for these purposes.

The balance of the cost of the dam and power plant was to be repaid with 3-percent interest from revenues from the sale of power and water.

As of May 31, 1945, the end of the project's operating year, $37,700,000 had been returned to the Treasury.

Among the unique provisions of the act were those providing for payment from power revenues to each of the States of Arizona and Nevada of $300,000 per annum, in lieu of taxes, for the operating years 1938 to 1987, and for the transfer, also from power revenues, to a special fund in the Treasury, designated as the Colorado River development fund, of $500,000 a year for the operating years 1938 to 1987 to pay for studies, investigations, and construction of projects in the Colorado River Basin.

In accordance with the terms of the initial authorizing legislation, contracts for the sale of water and power were obtained before construction was initiated. After the adjustment act was passed, the contracts were amended and arrangements made for two power allottees to operate and maintain the electrical generating and transmission facilities. The Bureau of Reclamation, however, operates all valves and gates which control the flow of water from the reservoir.

The water stored in Lake Mead must be conserved for municipal and irrigation uses downstream; therefore, power and flood-control releases must be regulated in such manner that the water may be used to full advantage on the projects below the dam.

Among the more important projects already constructed below the dam are the Parker Dam power plant and the pumping plant of the Los Angeles aqueduct immediately upstream from Parker, Ariz.; the Palo Verde Irrigation project near Blythe, Calif.; Headgate Rock Diversion of the Colorado River project of the Indian Service; and the diversion dams for the Imperial Valley and Yuma projects near Yuma, Ariz. These vary in distance from 150 to 300 miles from the dam. Their needs for water fluctuate from day to day and because of the long distances involved, careful scheduling must be followed in order to avoid wastes on one side or water shortage on the other.

In addition, water releases and river control are required for the delta area in Mexico, under the terms of the Mexican Treaty, which became effective November 8, 1945. These requirements make it desirable to route all water requests to a river control officer of the Bureau of Reclamation, who compiles the data, coordinates it with the required operations of Lake Mead for power development and flood control, and designates the amount and time of water releases from Hoover Dam.

The Davis Reservoir is being built 65 miles downstream and will provide river regulation for power development, irrigation, flood control, improvement of navigation, and for municipal water supply. When completed, this structure should aid materialy in increasing the efficiency of operations of Hoover Dam. As the development of the Colorado River Basin progresses and the States of the basin reach an agreement on the allocation of the river's waters, the importance of Hoover Dam as the key structure in the river basin development will become increasingly apparent.

An enormous amount of study has been given to the design and operation of the Columbia Basin project, in the State of Washington, to obtain the maximum control and use of the Columbia River waters and provide the greatest benefits for multiple purposes.

Grand Coulee Dam, the principal feature of the project, is situated on the Columbia River 94 miles northwest of Spokane. Other features of this project are the 9,500,000 acre-foot reservoir back of the dam; power plants situated one at each end of the dam, which will have a final capacity of 1,944,000 kilowatts, of which 648,000 capacity is installed; the pumping plant of 16,000 second-feet capacity and 650,000 horsepower, which will raise water a maximum of 360 feet from the reservoir to the irrigation project works; a regulating reservoir of 1,202,000 acre-feet capacity; and 440 miles of main canals to serve the project area of 1,022,000 acres, lying in the Grand Coulee south of the dam. The power plant is connected to the high-voltage power network of the Bonneville Power Administration, which markets the power from the Bonneville plant, built by the Corps of Engineers at a site 450 miles below Grand Coulee Dam.

The principal purposes served by the Grand Coulee Reservoir are navigation, flood control, irrigation, power, and river regulation. Specific allocations of storage capacity have not been made to different purposes, the benefits being obtained through appropriate regulation of the reservoir.

Several more of the 54 operating projects of the Bureau of Reclamation could be described to point out certain distinguishing characteristics of design and operation, but the general principles would be similar.

The Rio Grande project is typical of those where there are definitely recognizable multiple purposes. Here it is evident that reservoirs can be operated for many purposes, without appreciable conflict between purposes, provided the various potential uses are recognized in the planning stage, and the designs prepared accordingly.

The designs and particularly the operation of reservoirs on Federal irrigation projects are not dependent solely on engineering considerations, river discharge characteristics, or the regulation of streamflow for optimum benefits for all purposes.. They are influenced in considerable degree by financial and legislative matters which apply to each separate project.

It is extremely desirable to analyze all potentialities of proposed projects in order to avoid costly reconversion or duplication of construction features, and it is desirable, where feasible, to build and operate the works for all practicable purposes. At the same time, there should be recognition of all benefits in multiple-purpose projects and general uniformity and standardization provided in the determination of cost allocation. These objectives will be attained only as fast as the States and Federal Government make their decisions on water policies. This is especially true with respect to Federal agencies.

At present, there is much dissimilarity in the approach by different agencies to problems of investigations and operations, with consequent confusion in the handling of water matters. This situation can be rectified only by the adoption of an adequate national water policy. When this is done, and only when it is done, will it be possible to attain any appreciable uniformity in the determination of allocations for various purposes in multiple-purpose projects.

The above article is an adaptation of Mr. Nelson's speech delivered at the January 16th morning session of the annual meeting of the American Society of Civil Engineers, held in New York City during the week of January 13, 1947.

"Friendship of a Day"

Valley Evening Monitor, McAllen Tex., Photo

"*Amistad de un dia*" is what the Mexicans call it.

This fragile, paper-white flower is popular in the Lower Rio Grande Valley of Texas, where the Bureau of Reclamation is planning a gravity canal irrigation and drainage project to serve 700,000 acres of citrus fruit and vegetable producing land.

"Friendship of a day" is the English translation of the Mexican's name for the flower which blooms in profusion throughout its 2- to 3-month season.

Senator Klaghorn notwithstanding, some persons confuse the blossom with the Confederate rose.

Mexicans have another name for the flower, "algodon," or cotton, because its leaves are shaped like those of the cotton plant.

Mrs. T. J. Powell of McAllen, who belongs to the school of garden lovers which practices its belief that flowers bloom to be shared with one's friends, says the flowers, in spite of their fragile appearance, are admirable for luncheon corsages. They are sturdy, hold their shape well and do not wilt readily, whether in water, on the tree or pinned to a woman's frock. However, they would never do for dinner or dance corsages, because night closes them into tight red balls.

If these flowers be kin to the Confederate rose, Senator Klaghorn would have an answer for their refusal to bloom at night. "Why," he would demand to know, "should a southern beauty be spied on by the North Star?"

New Map Available

Western half of the United States showing Reclamation projects and the 7 regions. Map, No. 47-1, revised May 1947. Size 18 x 22 inches. FREE. Send your request to the Commissioner, Bureau of Reclamation, Washington 25, D. C.

Copy Photo by Paul E. Norine, Region IV

Arrival of the Mormons in Salt Lake Valley, July 1847, as depicted in artist J. B. Fairbanks' mural.

UTAH'S CENTENNIAL

By Mack C. Corbett
Region IV, Salt Lake City, Utah

Utah celebrates her centennial this year.

One hundred years ago, come July 23 and 24, the Mormon pioneers (143 men, 3 women, and 2 children) arrived in the Valley of Great Salt Lake, then a desolate wasteland. Practically their first act was to irrigate the land.

Historians vary in their interpretation of the significance of this and related events, but most authorities agree that July 23, 1947, is also the centennial of modern irrigation in America.

Aside from the year-long celebration throughout the State, including parades, carnivals, national athletic championships, light operas, theatricals in most communities, and a summer exposition in Salt Lake City continuing through September 20, the Utah Centennial may serve to bring about a broader understanding—at least in the minds of the thousands of visitors—as to the proper niche which Brigham Young and his colonists should occupy in the history of America.

Meantime, perhaps the estimate of Governor Osborn of Arizona would be of acceptable help in arriving at a true appraisal of what and how much Utah's Centennial means—to sister States of the West at any rate. In *Arizona Highways*, Governor Osborn writes:

"The arrival of the Mormon Pioneers in the Valley of the Great Salt Lake one hundred years ago was a momentous event. It began the orderly colonization of the West. It began the heroic task of turning desolate wasteland into a productive empire, an achievement truly unequaled in the pages of history."

Encyclopedia Britannica (11th edition) says: "Irrigation of the western regions of the United States began in the Great Basin of Utah when the Mormon pioneers in 1847 diverted the waters of City Creek upon the parched soil of Salt Lake Valley."

Whether or not the Mormon pioneers can truly claim this "first," certainly theirs was one of the first instances of modern irrigation by Anglo-Saxons and certainly, in the words of Dr. John A. Widtsoe, it represented the first building of "communities of modern, civilized people under the ditch, comparable or superior to those in the rainfall regions from which they came." (See May 1947 *Era*.)

But in the last analysis, more importance attaches to what has become of all these beginnings.

The State of Utah now is a commonwealth of some 600,000 persons who enjoy living conditions comparable to the finest of present-day civilization.

Not without the greatest sacrifices, toil and bitter disappointments was Utah's progress, through 100 years of irrigation, made possible. Yet by the turn of the century, more than 1,000 miles of hand hewn canals had been dug and most of the lands irrigated in Utah today were under the ditch.

The Federal Government since 1906 has aided Utah's irrigationists, but chiefly in stabilizing the water supply to lands previously irrigated.

As a new century of irrigation dawns, Utah reclamationists are looking in desperation to the Colorado River Basin for a new water supply, and are seriously considering improvements to conserve existing water supplies.

The pioneer attributes of self-help and cooperation continue to be demonstrated in the Mormon State. In a larger sense, the Utah Centennial commemorates those attributes and commends them most strongly to the Nation as the basis for future understanding and progress.

Damming of City Creek by the Mormons marks beginning of irrigation in Utah.—J. B. Fairbanks mural.

Copy Photo by Paul E. Norine, Region IV

by Randall Henderson
Editor of The Desert Magazine

In the late summer of 1913 the meandering Colorado River threatened to change its channel and leave the intake of the Palo Verde water system high and dry. C. K. Clarke, chief engineer for the water district, decided it would be necessary to install brush jetties on the Arizona side to divert the current to the California side where the Palo Verde intake was located.

But the Arizona shore was in the Colorado River Indian Reservation, and this made it necessary to go to the Department of the Interior for a permit, involving a delay that might be disastrous.

Because of the urgency of the situation, Ed Williams, then a director of the water company, volunteered to take a gang of workmen, smuggle them into the reservation, and get the control work underway while the application to Washington was going through the customary channels of red tape.

The river bottom on the Arizona side was a jungle of mesquite, cottonwood, and arrowweed. To find a route over which it would be possible to transport men and equipment through that jungle was Williams' first job. And since I had been a member of the United States Land Office survey crew which mapped the reservation the previous year, Ed invited me to go along.

We crossed the Colorado on the Ehrenberg ferry and spent 3 days finding a route through the dense thicket of trees and brush. Part of the time we were on horseback, part of the time on foot, and sometimes it was necessary to leave our horses and crawl on hands and knees. At night we rolled up in our saddle blankets and slept under the stars.

Out of those days together in that thorn-infested jungle developed a friendship which has remained warm to this day. And here is the story of the man who was my companion on that trip, and has remained one of my idols through the intervening years.

He Helped Combat Ol' Man River

When Ed F. Williams went to Washington in 1930 to ask that $1,000,000 be appropriated out of the United States Treasury to compensate the landowners in Palo Verde Valley for flood damage caused to their holdings by the building of Laguna Dam, 70 miles down the Colorado River, officials to whom he made his appeal were not sure whether he was a colossal beggar, or just plain crazy.

"That's ridiculous!" exclaimed Dr. Elwood Mead, then Commissioner of Reclamation. "How could an 11-foot diversion dam in a river with a fall of one and a quarter feet to the mile affect the flood level of the channel 70 miles upstream?"

Phil D. Swing, Congressman from the Eleventh District of California, Williams' home district, also was skeptical. But being a diplomatic Congressman he did not ex-

This rock weir raises the level of the Colorado and keeps water flowing into Palo Verde intake just above. In the old days the same purpose was served less effectively by jetties extending out from the Arizona shore on the far side of the picture.

press his doubt as bluntly as did Dr. Mead.

"If you will show me how it would be possible for Laguna Dam to cause broken levees in the Palo Verde Valley, I'll give you what help I can," Swing assured him.

Before he had been in Washington many days, Williams saw he would get nowhere with his million-dollar request until he could prove to hard-headed engineers and indifferent Congressmen that there was engineering data to support contentions.

So he became a daily patron of the Congressional Library. He dug up old engineering reports from Egypt and India and Italy—some of them written 2 or 3 hundred years ago. It was necessary to have some of them translated into a language he could understand. For 6 weeks he read everything he could find about the hydraulics of a silt-laden stream.

He also found convincing proof from the records of the Colorado itself. For instance, the old adobe walls of the town of La Paz in Arizona opposite the Palo Verde intake had remained intact on the river bank through the highest floods on record since 1870. Then in 1914, 4 years after Laguna Dam was completed, a comparatively moderate flood crest overflowed the townsite and melted the walls to mere piles of mud.

When Williams finally appeared before the committees that were to consider his proposal, even Dr. Mead had been convinced there was good engineering authority to bear out Palo Verde Valley's complaint.

Williams returned to Washington again in 1931 and 1932 to press claims of his neighbors in the Palo Verde water district. Before the grant was made, however, there was a New Deal in the National Capitol, the RFC was born, and the Palo Verde landowners eventually received the aid they sought through the refinancing of their $4,500,000 bonded indebtedness at 25 cents on the dollar.

With the building of Hoover Dam the danger of flood damage from the Colorado River ceased to be a problem to the Palo Verde community.

Ed Williams' million-dollar errand at Washington merely was one of many tough assignments his neighbors have given him during the 36 years he has lived among them.

He was leader of the delegation which represented Palo Verde Valley during those highly explosive conferences when Los Angeles, Imperial Valley and other claimants were dividing California's share of the water allotted to the state under the Six-States Compact.

The Palo Verde delegates were not as strong in numbers or as eloquent in speech as some of the more powerful claimants—but they had two winning cards to play. One of them was a water filing on the Colorado River which was prior to all others in the lower basin. The other was Ed F. Williams.

Williams had spent many years of his life on the cattle range where gift-o'-gab was neither a virtue nor even an asset of any great value. He doesn't go in for speechmaking. He told the conference in a few words what his district wanted. Some of the others thought it was too much, and stormed and threatened. In the end they gave way to the quiet-spoken delegate from Blythe who refused to be stampeded by professional oratory.

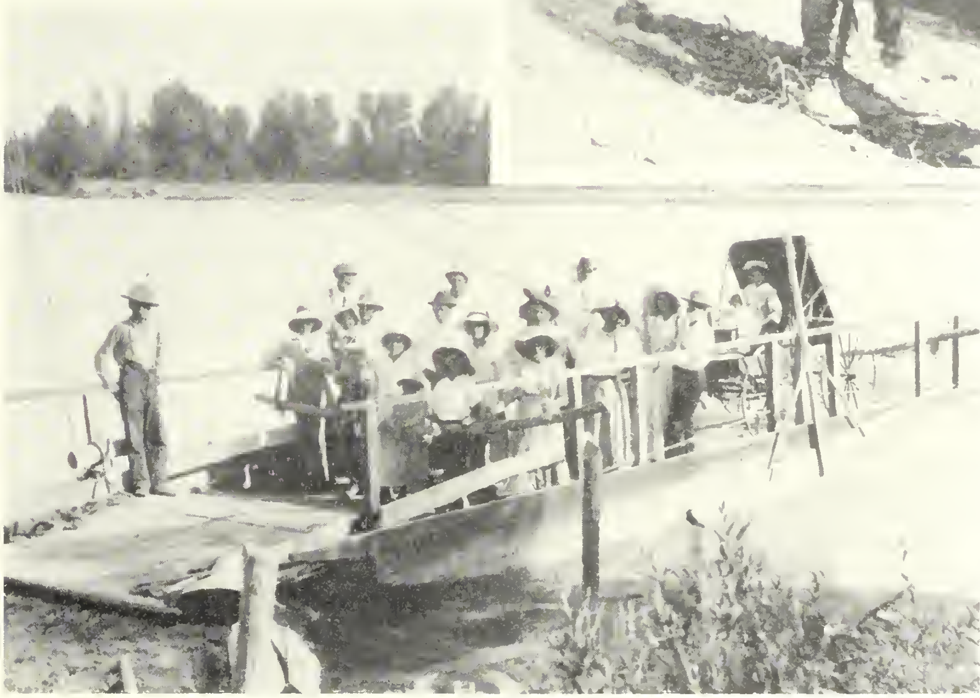
Ed Williams is 81 years old, with clear blue eyes that still sparkle with the enthusiasm of youth. Since 1912 he has played a leading role in the public affairs of Palo Verde Valley.

It is inevitable that a man so conspicuous in community leadership should be the target of rebuff and criticism. But Ed Williams takes the bitter with the sweet, and never loses his quiet good humor. He is loyal to his friends and tolerant toward erities. His strength is that of a man who seeks neither wealth nor power for himself—and in whose heart there is charity toward all.

Williams has been on the frontier all his life. Born in Waverly, Iowa, in 1866, he was 16 years old when his parents moved to Dakota Territory in the heart of the Sioux Reservation.

He was a rosy-cheeked youngster, none too robust in health. His playmates in Dakota were mostly Indian boys, and his determination to equal their agility in the field

C. K. Clarke, who helped keep the Colorado "in a straight-jacket" for many years. He is now dead.



This old ferry operated between Blythe and Ehrenberg before the present bridge was built across the Colorado.

of sports soon developed his muscles to the point where he was a match for the best of them.

His parents had moved to Dakota when President Arthur opened part of the Sioux Reservation to white homesteaders. The Indians resented the encroachment on their lands and their attitude became so threatening President Cleveland revoked his predecessor's order and restored the land to the Indians.

This brought hard times to the Williams family along with other settlers, and Edwin, now 19 years of age, decided to fulfill his boyhood dreams and go West.

The next few years were spent in western Nebraska and Wyoming, trapping, herding, riding range—anything he could find to do. He was a novice cowhand at first but his likable personality gave him work when more experienced men were idle.

His schooling had been cut short when his parents moved to Dakota and after 2 years on the range he became conscious of the fact that he needed more education if he ever was to rise above a $30-a-month job.

To earn money for his school expenses he bought a trapping outfit and a winter's supply of grub and moved out into the uninhabited sandhill country of western Nebraska. He built a dugout and settled down for the winter alone with his traps and pony.

He had collected a sizable pile of coyote furs when the damp air of his crude dwelling brought on rheumatism. His condition became so bad it was an agonizing experience to move out of bed for food and water. Two horsemen stopped at his camp one night, and he persuaded them to lift him on his horse and guide him to the nearest cow camp, 40 miles away.

To this day Williams believes the men were cattle rustlers, but they were charitable enough to escort him along the trail to within view of his destination where they bade him goodbye and disappeared. It was many weeks before he was able to walk. When he returned to his dugout he found his pelts water-soaked and valueless.

But his determination to go back to school was not dampened. The next winter he outfitted for another trapping season. This time he went up into the Big Horn country. But the fates were against him. He was caught in a blizzard and frozen so badly before he was found, the doctors wanted to amputate his legs. He fought against the idea and finally compromised with the loss of the toes on one foot. It was 5 months before he was out of bed and a longer time before he could mount his saddle pony without help.

"I did not give up the idea of getting an education," Williams explained today, "but my immediate problem was to recover my health and get a job to repay the debts that had accumulated."

That was in 1887. When he could ride again Williams went to Buffalo, Wyo., where he worked for several months with a cattle outfit. Then he and Buck Taylor took the old Mormon trail and headed for Nevada and went to work on the ranch owned by Governor Sparks.

A few months later Williams took the trail again, crossed the Colorado River at Lee Ferry and found a job near Flagstaff, Ariz. He spent the next 8 years around Flagstaff and Williams, eventually becoming range foreman under George Thornton, manager of the Bill Williams Cattle Co.

The old urge for an education returned and he spent much of his spare time reading and studying correspondence courses in English and grammar.

One winter he took a herd of 2,000 steers down into the Salt River Valley. That was before Roosevelt Dam was built and he became interested in tracing the prehistoric irrigation system and the Indian ruins found there. Some of his conclusions re-

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garding the mysterious Hohokam people have been borne out by recent research work of archeologists.

In 1902 Williams formed a partnership with Ed A. Tovrea, cattleman and packer, and made frequent trips into Chihuahua, Mexico, to buy livestock. On these trips he became acquainted with Col. Wm. C. Greene who was interested in the Sonora Packing Co. at Cananea. Later a three-way partnership was formed by Tovrea, Greene, and Williams. The firm prospered at first and had a high financial rating.

Then came the revolutionary outbreak in Mexico and Greene lost his concession. The United States was in a money panic at the same time and the partnership ran into financial difficulties. The net result was a reorganization in which Williams signed over his interest to his partners in return for the cancellation of certain indebtedness.

In the meantime another Arizona cattleman, Frank Murphy, had taken a lease on 43,000 acres of the old Thomas Blythe estate in Palo Verde Valley and was running cattle there. Murphy and Williams had been friends of long standing through their cattle dealings in Arizona.

In 1908 Murphy and the Hobsons with a group of California associates closed a deal for the purchase of the Blythe property. The old Blythe irrigation system was restored and extended and the land placed on the market for settlers. Murphy induced Williams to buy 160 acres and become a farmer. Later Williams filed on a homestead which he still owns.

Murphy and the Hobsons, operating as the Palo Verde Land & Water Co., found a ready sale for the lands in their newly-opened irrigation project, and the townsite of Blythe was laid out.

In the spring of 1912 the Colorado River broke through the protective levees at the upper part of the Valley and overflowed many thousands of acres of newly reclaimed land. This disaster hastened the climax of a feud which had been in progress between settlers and the holding company for many months over the management and financial set-up of the irrigation project. Murphy and the Hobsons had formed a subsidiary corporation, the Palo Verde Mutual Water Co., to manage the water system, reserving a large block of the unsold water stock for themselves.

The settlers objected to the terms of the contract between the land company and the water company, and resented the fact that the control of the water company was entirely in the hands of the Murphy-Hobson group. They felt they should have a voice in levying water assessments and selling water stock.

A general meeting between representatives of the two groups was held at Hotel Blythe in the fall of 1912. In the compromise settlement reached at this time the farmers were granted the right to name one member of the board of five water company directors—and Ed F. Williams was the unanimous choice for the post.

Thus began Ed Williams' active leadership in the public affairs of Palo Verde Valley. He was put on the board to represent the farmers who were his friends and neighbors—and he has been fighting their battles from that day to this. He has not always been on the winning side in the many controversites which are inevitable in a pioneer community—but no fair-minded person ever has raised a doubt as to Ed Williams' integrity, or his loyalty to the cause which he believed to be just.

One of the first things Williams asked for when he went on the water board was an engineer qualified to strengthen the river-front protection and plan an efficient canal system.

Frank Murphy said an engineer was a needless expense—anyone with common sense could build levees and plan irrigation works. Williams fought for his idea—and in doing so incurred the lasting enmity of his old-time friend from the Arizona range.

Williams finally was empowered to employ an engineer. He induced C. K. Clarke, who had been on the firing line in closing the break which threatened to inundate Imperial Valley in 1905 and 1906, to take the job.

"I am looking for an engineer who isn't afraid to tell the whole board of directors to go to blazes if he thinks they are wrong," Williams told Clarke. That kind of a job suited C. K. Clarke perfectly and he went to work. Williams worked with him, day and night, and together they planned and rebuilt the entire canal system.

Williams served on the water board 10 years, much of the time as president. At one time he also was on the drainage district board of directors and the levee district board. He knows the Colorado River and its vagaries as well as most of the veteran river engineers.

He was married in 1912 to Miss Edyth Everitt of New Mexico. Mrs. Williams was an artist of more than usual ability and the walls of the cabin they built on the top of a sand dune at the homestead are hung with many of her paintings. She died in 1934. Their one son, Edwin, Jr., was graduated from Stanford University and is now assistant to the librarian at Harvard University.

In 1923 while mowing hay on his ranch, the team of horses Williams was driving ran away and he was thrown into the sickle. As a result of this accident his right arm was amputated below the elbow. But such a handicap means little to Ed. Williams. He had to give up farming and today he is assessor and land agent for the Palo Verde irrigation district and secretary of Blythe Chamber of Commerce.

He likes to write, and has contributed short sketches on his frontier experiences to a number of publications. He has a portable typewriter with a cap keyboard and pecks away with his one hand, keeping contact with friends in all parts of the Southwest.

Williams never has amassed much wealth. He couldn't. He will fight for the interests of his friends and neighbors—but not for dollars or glory for himself. He belongs on the desert. He would be a babe in the woods in the fierce competitive struggle of the modern city.

He is an unusual combination of idealist and practical diplomat. He held his own in the rough-and-tumble days of the West of a half century ago—but his weapon was not a six-gun, although he could use one very handily. He fought with the quiet persistence of a man with infinite courage in his heart and a faith that believes there is some good in the heart of every human being.

The above article was reprinted through the courtesy of the publishers of the DESERT magazine, published monthly at El Centro, Calif. The story appeared under the same title in the September 1946 issue of that magazine. Minor changes have been made to bring it up to date.

AN ELEVENTH COMMANDMENT

"Thou shalt inherit the Holy Earth as a faithful steward, conserving its resources and productivity from generation to generation. Thou shalt safeguard thy fields from soil erosion, thy living waters from drying up, thy forests from desolation, and protect thy hills from overgrazing by thy herds, that thy descendants may have abundance forever.

"If any fail in this stewardship of the land thy fields shall become sterile, stony ground and wasting gullies, and thy descendants shall decrease and live in poverty or perish from the face of the earth."

By Dr. W. C. Lowdermilk, in an article on Palestine,
From "Farmers Newsletter," March 1947, New South Wales.

Films for Reclamationists Abroad

Reclamationists abroad have frequently asked the Bureau of Reclamation if they could borrow some of our motion pictures and slide films. Unfortunately, we do not have a sufficient number of prints available to loan them for excessive periods.

However, arrangements have been made so that films may be obtained for use outside the United States. Contact your nearest American Diplomatic or Consular Office. The film you want may be already available in their film library. If it is not, that office, upon request, will contact the Department of State in Washington, D. C., and obtain a film suitable for the purpose for which it is intended.

OUTPUT AT INTAKE

Shortages of supplies and equipment were a problem, but "Joe McGee" design and construction came to the rescue of the farmers on the Intake project in Montana.

by Joseph W. Grimes

Construction Engineer, Terry, Montana, Region VI

THE situation looked bad.

Farmers on the small (840-acre) Intake project had hoped to irrigate their crops last summer. The Bureau of Reclamation had anticipated that enough construction would be completed to permit delivery of water to their lands for the 1946 irrigation season. Crops had been planted, and an exceptionally early irrigation season materialized.

But shipments of equipment needed to hook up the power lines for pumping water from the main canal of the Lower Yellowstone project were not forthcoming. The plan had been to furnish water to Intake, which is located on both sides of the Lower Yellowstone project canal, by means of two pumping units.

Construction of irrigation facilities had been begun during June 1945 and were finished during March 1946. Everything looked fine, until it was found that the electric power features would not be completed in time to start pumping water to the lands. The manufacturers solemnly pointed to the materials shortages which were plaguing them, and which have created problems in Reclamation activities both during and since the war.

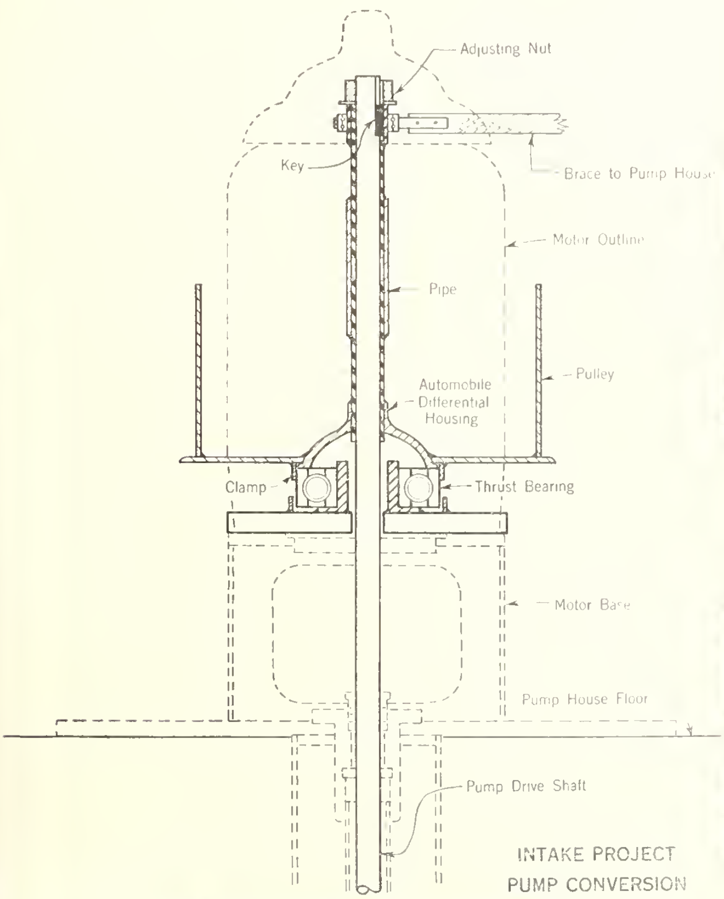
From an over-all viewpoint, the possibility of losing Intake project crops might not be considered very great, but to the farmers on the project, and the Bureau's engineers, it was a heavy blow.

They refused to let the shortage of critically needed materials beat them. A few parts from the "junk" pile, a borrowed gasoline engine, and "Joe McGee" design and construction combined to save the farmers from a dry summer. A drive pulley and thrust-bearing mechanism were fabricated. A gasoline power unit was borrowed from an aggregate screening plant, and to deliver water to the lands on the other side of the main canal, two construction unwatering pumps were used.

The photograph shows the pumping setup. The sketch shows the drive pulley assembly. Although use was anticipated only for a short time, this temporary installation furnished enough water throughout the 1946 season to save the crops which had been planted.

The Intake project is located in Dawson County, Mont., northeast of the town of Glendive. It is a water conservation and utilization project authorized under the legislation popularly known as the Wheeler-Case Act. Typical of W. C. U. projects, Intake has a small acreage, receives some rainfall, but is in need of irrigation to stabilize the agriculture of the area.

Sufficient substation equipment is now installed to provide for normal electric operation, but the people around the Intake project fondly remember their "junk pile" pumps which were developed out of a combination of dire necessity and ingenuity, to beat the shortage of materials, and give them enough water to produce their planted crops on schedule.



"Joe McGee" design and construction plans.

Improvised pumping system in action.

Photo by Ray L. Wiggins, Region III

Bahmeier and some of the "gang" talk it over.

Careers

Presenting some of the
of the West who create

by John

Davis Dam
Bould

You can tell them a mile away.

Dam builders on western rivers they are. At first you aren't sure what it is that makes them stand out. You may never know unless you happen to see Hoover or Shasta or Grand Coulee, or any one of the Bureau of Reclamation works. But you will know then. For they are men who dare to challenge nature, and win.

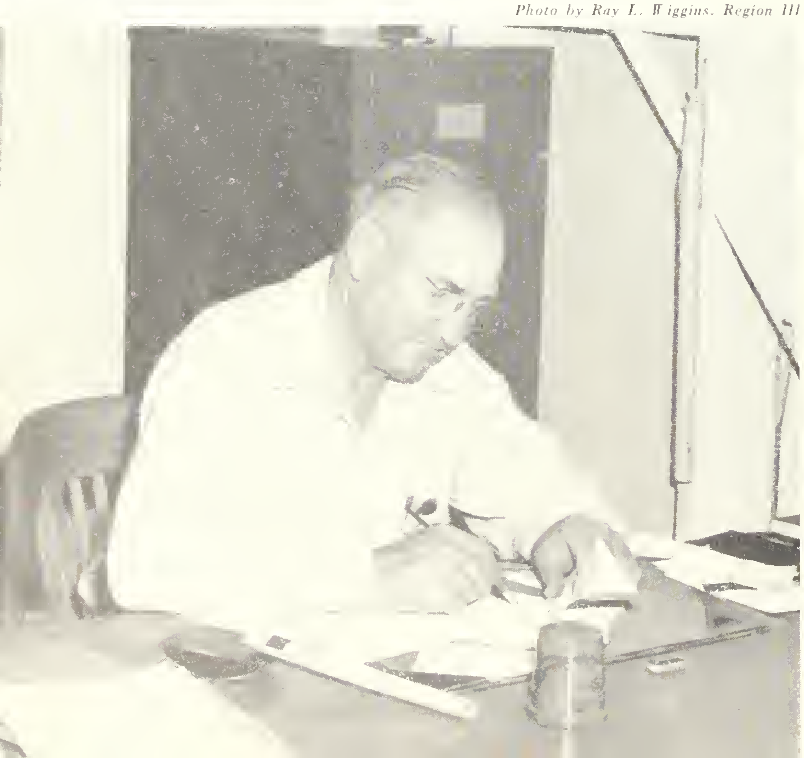
Conquerors they are. They have harnessed rivers in stone. Not ordinary rivers, but the wild, turbulent, powerful rivers of the West—and they have fashioned a harness that keeps them under control.

At Davis Dam, Reclamation's huge postwar project, you can see many of these men. They are preparing another harness on the lower Colorado River to wrest irrigated crop lands and electric power and flood control and other useful attributes from that mighty stream. They swarm over the cuts and fills. Engineers, foremen, muck shovers, bulldozer wranglers—all kinds and types of men are there.

Some have risen to places of responsibility. Others are "construction stiffs" without engineering education but with plenty of know-how. Whatever they are doing, they are dam builders to the core, and already they are looking to the next "tallest-in-the-world" or "largest-in-the-

H. F. Bahmeier, the Bureau's "head man" at Davis.

Photo by Ray L. Wiggins, Region III



Howard S. Doolittle, electrical boss for Utah Const. Co.

Photo by Ray L. Wiggins, Region III

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world." For they will help build those, too. Once a dam builder, always a dam builder.

Jobs are big, done in a big way. That does something to a man. Other occupations seem tame, uninteresting. And underneath is the warm glow which comes from knowing that you have achieved. The reclamation works and their results speak for themselves. The dam builder's career in stone is a mark to man's progress.

At Davis Dam you can see these men. H. F. "Pete" Bahmeier, Jack Lloyd, Harold R. Orr, H. E. McInnis, Howard Doolittle, H. E. "Ernie" Williams, T. L. "Ted" Terry, Paul Newell, Jean Walton, Jim Fordham, George W. Lyle, Bill Matthews, Gus Larson, and many a Joe Blow who takes the jolts of a jackhammer for 8 hours a day or snakes a bulldozer over the rocky hills at the dam site—they are all there.

In the last two decades of the Bureau's accelerated building program their trails have crossed many times, and some of them knew each other on Bureau projects as long as 30 years ago, working from Arrowrock, to American Falls, to Gibson, to Shasta.

At Davis now you hear, "Hello, Jack. I haven't seen you since Hoover. What the devil have you been doing? Farming?"

Many of the older engineers of the Bu-

Photo by Ray L. Wiggins, Regi

Action at Davis. Slope of channel is dynamited to flatten sidewalls.

H. E. Williams, project manager for Utah Const. Co.

Photo by Ray L. Wiggins, Region III

Chief Clerk James H. Fordham is the detail expert at Davis.

Photo by John A. Leveritt, Regi

reau have spent entire careers as dam builders. Some are internationally known. The dean is John L. Savage, former chief designing engineer, who now travels far and wide as a consultant for dams and irrigation developments in such places as China, India, and Palestine.

The younger engineers are there, too. They are adding to their careers the "know-how from the school of hard-knocks." And brother, in the construction branch of that school, the knocks really come hard.

This is also true of the forces for the Utah Construction Co., contractors for the dam. From the general superintendent down to the last foreman they have to be smart and fast or get back on the working end of a wagon drill—working for somebody else.

There is Construction Engineer H. F. Bahmeier, the top Bureau representative on the job. He gained experience at Island Park, Vallecito, and Anderson Ranch Dams. Mr. Bahmeier carries easily the responsibility of directing the $77,000,000 Davis Dam project. Thousands of details of such a job are at his fingertips, but he is never too preoccupied for a friendly greeting.

Project manager for the Utah Construction Co. is H. E. Williams, a veteran western engineer. You would swear that he is joking when he blandly admits that he is 62 years old. His vitality matches his 40-year-old look.

T. L. Terry is the contractor's general superintendent and he is not the kind of superintendent who runs a job from an office. In covering the job he forgets that his shiny sedan can't keep pace with a bulldozer everywhere it goes, and often the dozers have to get him out of spots. Pleasant and smiling until things get fouled up, he is sometimes as explosive as a 16-inch rifle. His nicknames tag him. Some of them are "TNT," "Little Giant," and "Terrible Ted," all of which indicate he is a guy who gets things done.

A couple of real veterans on the job are Jack Lloyd, superintendent of excavation, and Howard S. Doolittle, electrical superintendent, both of whom got their first jobs on Bureau projects about 1913.

Jack has over 30 years of almost continuous service either working for the Bureau or for contractors on Bureau jobs. He started as a laborer on the Strawberry Valley project in 1914 and by 1931 had enough experience to become the excavation superintendent on the swing shift at Hoover Dam. Jack did take a little time off from dam building during the war. Working for the Army engineers, he was flown all over the Pacific to show GI's how to move dirt for the construction of air fields. He nearly made it safely but a Kamikaze pilot bombed him after VJ-day. Besides Hoover, he worked on American Falls, Gibson, Parker, Bartlett, and Shasta Dams. He is rather proud of moving a million yards of muck during the first month of operations at Shasta.

Howard Doolittle in his field can match Lloyd's experience. He started on the Meadow Creek Dam in 1913 and was working for the Bureau on the Tieton Dam in 1924, when he joined the Utah Construction Co. on the American Falls Dam. Since then he has worked for contractors on Gibson, Deadwood, Hoover, Bartlett, and Grand Coulee Dams.

A young engineer is Paul R. Newell, project engineer for the contractor, who is a "chip off the old block." His father, R. J. Newell, is director of the Bureau's Region I. Paul had a hand in Hoover and Grand Coulee, too.

Like an adjutant in an army unit, Davis' chief clerk, James H. Fordham, keeps details from foundering the project. He didn't learn his way around a construction project pushing a pencil. He worked for the contractors on Hoover Dam and was raised in the home of a Bureau master mechanic who is now retired. Jim served with the United States Navy during the war and upon his return to civilian life was transferred to the Davis Dam project.

Another dam building veteran is George W. Lyle, assistant chief clerk, who joined what was then the Reclamation Service in 1912. Mr. Lyle's first dam was Arrowrock. Since then he has worked in the Boise and Minidoka project offices, at Parker, and at Alcova and Seminoe Dams on the Kendrick project. He expects to retire when Davis Dam is completed.

Harold R. Orr is the office engineer for the project. Quiet and methodical, he is second in command and takes over when the construction engineer is away from the office. Harold has worked in the design section of the Denver office of the Bureau and has a varied engineering background.

Mr. Bahmeier's other chief assistant is Field Engineer Jean R. Walton, who joined the Bureau in 1936 on the Vallecito Dam. Another young engineer who is piling up a winning record on Davis Dam, Jean served with the Army Engineers during the war.

Gus C. Larson, general plant foreman for the contractor, cut his dam-building teeth at Echo Dam in 1929 and has since worked at Hoover, Parker, and Shasta Dams.

Such are the dam builders at Davis. As they work on this new venture, their thoughts race on beyond the verdant farms their dam will make from desert wastes to the next job ahead. For they are conquerors of rivers. Optimistically, the contractor's men say, "We'll be through here just in time for Bridge Canyon. Taller than Hoover and longer. That's the one we want to make."

Weed Control Research Program to Aid Farmers and Irrigation Districts

Recent studies made by the Bureau of Reclamation on present costs of weed control and losses created by weed infestations are bringing about a better understanding of irrigation weed problems, and the urgent need to solve them more permanently and economically.

Definite steps are being taken to determine which of the widely varied methods of control are the most economic, to improve these methods and, if possible, to find new ones which will be even more effective. In the past temporary, but costly, methods were often used because little scientific research had been conducted on weed problems peculiar to irrigation conditions.

Realization of the need for more basic research led to an agreement with the Department of Agriculture to conduct such research for which the Seventy-Ninth Congress made an appropriation to that department. The research work is under the direction of Mr. L. W. Kephart, Senior Agronomist, Bureau of Plant Industry, Soils and Agricultural Engineering. The Bureau's cooperation consists of furnishing some of the facilities and giving information on weed problems needing further study. This phase of the program is under the direction of Agronomist R. B. Balcom of the Commissioner's office in Washington, who in turn is furnished data by the Weed Specialists of each region.

So far two field stations have been set up by the Bureau of Plant Industry. One is located in the Boise Valley near Boise, Idaho, and is directed by Agronomist J. M. Hodgson; the other, in the Salt River Valley near Phoenix, Ariz., is directed by Agronomist L. S. Evans. At these two stations tests are being made to find more effective methods of combating weed problems of the Northwest and Southwest respectively. It is planned to establish a third station later at Prosser, Wash.

The Chemical Laboratory in connection with the Chief Engineer's office in Denver, Colo., is also cooperating in the program and much of the initial research will be conducted there in cooperation with Bureau Chemist W. T. Moran and his associates, and Bureau of Plant Industry Plant Physiologist Dr. R. S. Rosenfels. The laboratory work consists of life history studies of certain plants (particularly of water-weeds which infest irrigation channels) and primary tests on the effect of various chemicals on weeds and crop plants. As the screening tests are completed in the laboratory, the most promising findings are turned over to the field stations where tests are made on a larger scale and under field conditions. Much of the work is also being conducted in cooperation with the State colleges in the West. As soon as recommendations can be given, they will be made available to both private and Federal irrigation projects.

The Bureau of Reclamation has also in-

(*Continued on page 167*)

My Experiences as a Ditchrider

by Charles A. Lory

EDITOR'S NOTE: Dr. Charles A. Lory, President Emeritus of the Colorado State College of A. & M. is a well known authority on reclamation. He has served on a number of occasions as a consultant for the Bureau of Reclamation and in 1937–38 served as chairman of the Repayment Commission. In this latter capacity he visited Federal reclamation projects, including Indian irrigation districts, meeting with groups of water users and State and agricultural college officals. The Commission was authorized by Congress to study the reclamation projects and to devise a more equitable and more flexible permanent plan for repayment of the construction costs.

Five years' residence in the Big Thompson Valley, Colorado, work as a farm hand one season, teaching school a short term, farming with my father four seasons, and 6 months on a canal construction job were my qualifications when President Jay H. Parish and the Board of Directors of the Hillsboro Irrigation Co. employed me as ditchrider in the Spring of 1893.

The Hillsboro Canal furnishes water to about 9,500 acres on the Divide between the Big Thompson and Little Thompson Rivers. Its diversion dam is about 3 miles east of Loveland and its total length to the Little Thompson Extension, 14 miles.

Its water right consisted of 1.25 second-feet, priority No. 30; 99.46 second-feet, priority No. 42; and 45.69 second-feet, priority No. 54, or a total of 153.4 second-feet when the Big Thompson River flow was 2,358.56 second-feet.

The Miners inch, approximately 40 to the second-foot, was the unit used in distributing water. The canal depended entirely on river flow, and daily fluctuations were large.

I reported for duty in April, assisted in repairing the diversion dam, rating flume, many headgates, and supervised the cleaning of the canal. In May another rider was employed to care for the headgates and upper 4 miles of canal. We had no telephone connection with the office of the Water Commissioner, and since ours was the lowest large canal on the river, both of us were convinced it got all the drops in river flow and few of the raises. We rode horseback and were required to ride the bank of the canal.

The rider of the upper section met me each morning at the end of his section, and reported the flow at the head, and what he had distributed. I then distributed by allotment, as called for, to the farmers, in my 10-mile section. In order to distribute the water as accurately as possible, I generally rode my section twice a day.

I know that honesty is the only policy for a ditchrider. I soon learned not to expect a man whose crop is "burning" to be reasonable, that gossiping causes trouble, and it is foolish to tell men on the upper section of the canal what some on the lower section think of them—especially in a dry year. Nineteen hundred and three was a very poor water year and crop losses, due to lack of water, severe.

The worry of the job, the physical strain of long days in the saddle, and the pioneer habit of using ditch water for domestic purposes brought on an attack of typhoid fever early in July, and my work as ditchrider was over for the season.

The next season I accepted the position of ditchrider on the Big Cut Lateral and Reservoir System, which furnished water for about 2,400 acres in the Oklahoma District, on the south side of the Poudre Valley, midway between Loveland and Greeley, Colo.

The system consists of the Big Cut for conveying water from the main canal of the Greeley Loveland Irrigation Co., the Lake Canal, Highline Canal, Reservoir, and North and South Laterals.

The system was quite short of water. In its development 4 years before, due to extreme shortage of funds, the stockholders purchased only 80 acres' rights from the Greeley Loveland Irrigation Co. for their quarter sections of land, depending on their reservoir, which holds 4,931 acre-feet, to supply the deficiency. This storage, however, proved too small, and in later years most of the farmers purchased reservoir rights in Lake Loveland, the Seven Lakes Reservoir System, Boyd Lake, and recently from the Colorado-Big Thompson transmountain diversion project, now under construction.

The Colorado statute inch (38.4 statute inches equals 1 second-foot) was used in water distribution and measured over rectangular weirs. The water from the Greeley Loveland Canal was distributed to the farmers, according to their investment in Big Cut Lateral and Reservoir stock, and in Greeley Loveland rights. When a majority of them wanted more water, the Board of Directors ordered this drawn from the reservoir, and directed how much per share, until the reservoir was empty.

This plan worked well for the farmers growing grain and alfalfa, but was a distinct disadvantage for potato growers. This was before sugar beets became an important crop. The potato growers tried to provide late water by exchanging with the grain growers, but risked loss through deficiency in late Greeley Loveland water.

During my service as ditchrider we developed a system of distributing the water on order by using the reservoir for reserve storage and supply. It required much argument and some trips to the experiment station at the State agricultural college to determine how much reservoir water should be credited to the stockholders, how much loss should be charged for evaporation and seepage of the reservoir, whether to cancel all accounts if the reservoir should be filled during the irrigation season, and the form of report to the farmers.

From the official survey of the reservoir and a careful record of withdrawals, the board was able to assign credit for reservoir water at the beginning of the season, with assurance. A record of the water distributed every day, on orders placed not later than the day before, showed the amount drawn by the farmer, how much of this came from the Greeley Loveland Canal, how much from the reservoir, or how much was stored to his credit, and a complete statement for the week, with balance of water to his credit was given him on Sunday.

This system encouraged planning of work, efficient use of water, good methods of irrigation, and resulted in better crops. The farmer ordered the volume of water he could best handle on his type of land for his particular crop, and when through, he ordered the water shut off.

Homemade recorders of depth of flow on the master weirs at the Big Cut and Reservoir outlets were effective in checking fluctuations and the accuracy of measurements. Later, I used meters that recorded the dis-

(Continued on page 168)

Black Diamonds

Above photo taken by Joe W. Buller, Region VI, represents a bortz drill bit enlarged to three times its original size. This particular drill has already cut through more than 375 feet of solid rock.

No mere ornaments, these sleuths of the underground do their share in developing the Missouri Basin project.

by R. L. Branam

Region VI, Billings, Mont.

THE JEWEL ON MILADY'S HAND, and the untouched water resources of the Missouri Basin have something in common.

With nearly every force known to man being thrown into the gigantic task of harnessing the waters of the Missouri River and its tributaries, it is appropriate that the diamond, one of nature's most precious possessions, has been called on to do its full share.

In spite of its background of glamour, the diamond is performing a workman-like job in a most unspectacular manner—taking samples from the earth's crust as part of the exploration of subsurface formations.

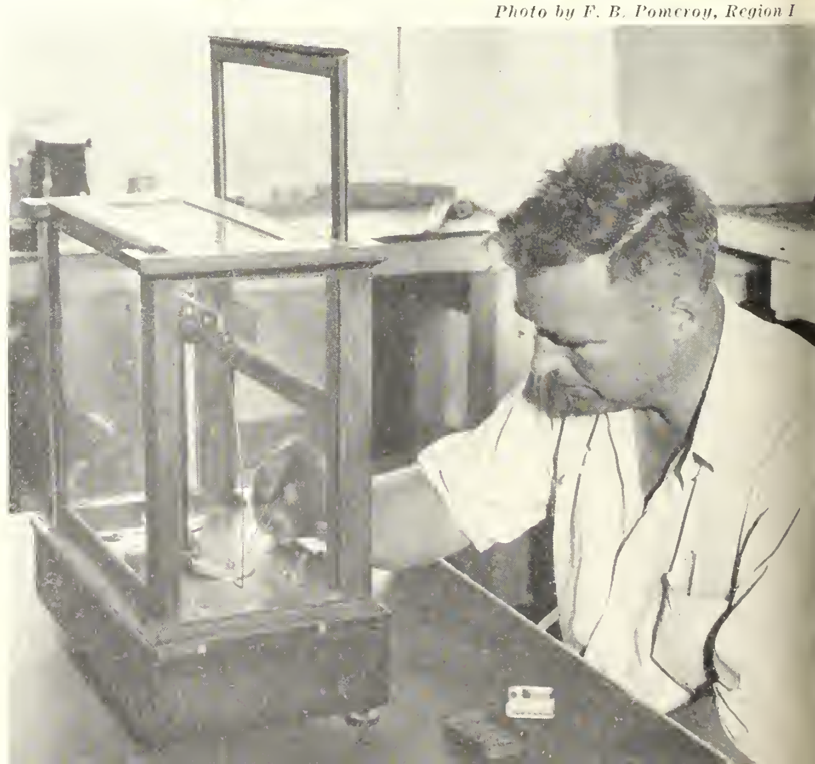
The diamond used for this work is not of the type that adorns the jeweler's show window, but is nearly as rare and costly and

Looks like coal? THAT is $25,000 worth of diamonds.

Photo by Joe W. Buller, Region VI

"Weighing them in" at the Coulee Dam geology laboratory.

Photo by F. B. Pomeroy, Region I



even more important to the future of man. It is the tough noncrystalline black diamond or carbonado.

Contributing directly or indirectly to many phases of the program currently underway for greatest possible utilization of water resources of the Missouri River drainage basin, the black diamond and bortz (an imperfect gem-type stone) have come to the forefront with the recognition of their excellence as the cutting edge for core drill bits.

The units to be constructed for irrigation, power production, and flood and silt control in the river basin, must last for years to come. To make sure that all structures are built upon a firm foundation, every effort is being put forth to assure complete preconstruction investigations.

Particularly important in this phase are investigations made in connection with the location of dam foundations.

After selecting tentative sites for a dam, engineers call on the geologists to explore the vicinity and decide whether it's safe to build.

The geologists then look over the selected site and adjoining areas (they call it a "reconnaissance") and point out the places where more detailed explorations by diamond core drilling are needed to yield more information.

It is in this phase of work that the diamond assumes its all-important role as the Sherlock Holmes of the underground.

Unlike the sleuth of fiction, however, the black diamond does not work alone: it must be teamed with others. An experienced commercial diamond setter drills a number of cavities (usually varying from 6 to 16) on the circumference of the steel bit to be used. Each hole must be custom-made for the diamond it is to receive. Up to this operation, the diamond setter's job is like that of a dentist. From then on, he becomes a jeweler, dealing with a mammoth mounting of irregular stones. Each diamond is encircled by a thin strip of lead or copper to act as a cushion, then two heavy chisel cuts are gouged out of the metal and punched around the stone to calk it. Only one-fourth to one-tenth of the stone is allowed to project beyond this "setting." The secret of setting these stones (and the most difficult part of the operation) is to make these projections even. This is no easy task when dealing with stones of irregular shape.

When the diamonds go to work, all set in their core type bit (a short metal cylinder) they are sometimes accompanied by another hollow tube called a reaming shell, also set with a few diamonds around the outside. This protecting cufflike apparatus is used to keep the hole up to gage and to provide space for the bit cuttings. These two companions, coupled to the core barrel, are rotated by a drill machine and begin boring into the depths of the earth.

As the bit advances, water is pumped through the drill rods to remove the cuttings from the hole. These round cores of rock (varying in diameter from 1 to 4 inches in the Missouri Basin investigations) rise up through the core barrel as the earth gives up a cylindrical cross-section of its secrets to be deciphered by the geologists.

The drill rods and core barrel are taken off at intervals and the section of rock removed, thus giving the geologists a continuous sample of the underground formations.

The samples are then classified, logged, and plotted so that the engineers can determine whether the earth beneath is suitable for the construction of the engineering feature under consideration.

The diamond core drill, in addition to being the fastest means of cutting samples from the underlying rocks, does not disturb the bedrock through which the hole is drilled. Consequently, it is possible to utilize cored holes for purposes other than providing a means of identifying formations.

Drill holes for dam sites are often subjected to water pressure to determine presence of openings through which excessive seepage could result and may be used for drain holes and grouting purposes.

In Region VI, Bureau of Reclamation diamond drilling operations have been completed on the proposed Tiber and Canyon Ferry Dams in Montana; Boysen, Owl Creek and Lake Solitude in Wyoming; Dickinson, Heart Butte and Broncho in North Dakota; and Shadehill in South Dakota, all units of the Missouri Basin project.

Drilling explorations are now underway on the proposed Cheyenne Dam in North Dakota, Angostura in South Dakota, Big Muddy Creek and Yellowtail in Montana, and diversion dams throughout the region.

Typical of drill explorations is the work in progress on the site of the proposed Yellowtail Dam, part of the Hardin Unit, Missouri Basin project.

This dam, as planned, will be one of the highest in the Northwest, thus necessitating extensive foundation explorations.

Three drills are now operating on the site selected by engineers for location of the massive structure, expected to be about 475 feet high.

Because of the tremendous weight of this high dam, the physical character of the rock must be accurately determined and the diamond core drill, as the best method of accomplishing this, is called upon to do its share.

Before work passes to the construction phase of Yellowtail dam, the sheer walls of

Vise holds drill bit as diamond sockets are bored.

Making diamonds fit into an unusual setting.

Photos by F. B. Pomeroy, Region

Big Horn Canyon will have been explored, drills will have extracted continuous cores from the formation under the Big Horn River and investigations will have been made on the area surrounding the damsite. In this manner a firm foundation for the structure is assured.

The diamonds playing such an important role in speeding the basin-wide development program are of two classes.

The black diamond or carbonado, mined exclusively from the gravel beds of a practically unexplored region of Brazil, is a dull, lustreless, porous stone composed of tiny interlocking diamond crystals. Having no straight cleavage, it is tremendously tough and therefore the most highly prized stone for industrial use. Its chemical composition is exactly the same as that of the clear stone. It is the hardest and toughest substance known and is much less liable to fracture than the clear diamond.

The industrial diamond or bortz is similar to the gem-type stone but because of poor color and imperfections it is useless for this purpose. Nevertheless, although it does not have the toughness of the black diamond, it is of the customary diamond hardness and is used successfully for commercial purposes.

Although core drilling is the most important commercial operation using diamonds, it is but one of a legion of uses for the diamond.

Diamonds, reportedly, were first discovered before 800 B. C., in India. Two hundred years later the stones were found in Borneo.

These precious stones were used principally for the apparel of kings until 1430 when the custom of wearing diamonds for adornment was introduced.

As new fields opened in South America, Brazil, and later in Africa, scientific study was directed to the stone and with this inquiry the supreme hardness of the diamond was discovered and its use was turned to practical lines.

It was not until the turn of the nineteenth century, however, that the use of diamonds for commercial purposes was really started.

In the late 1930's, as hard alloys were discovered, use of industrial diamonds grew by leaps and bounds. Importation of these stones increased from 46,901 carats in 1929 to 3,809,071 carats in 1940.

The Bureau purchases the black diamonds through competitive bids. The call is frequently for diamonds weighing approximately 2.0 carats (1 carat=0.0065 ounce).

The announcement states, for example, that the Bureau wishes to purchase 25 stones of the first quality, without cleavage planes, of high density, homogeneous structure, rounded with no sharp corners, natural stones to be adequately chipped to show structure, bidder to submit his stones in parcel lots, state the price per carat of the entire lot in each parcel and the price for a selection of any stones in the lot. Bidders or their representatives either appear with the stones in person or send them by express or registered mail. When diamonds are not delivered in person it is always stipulated that the receiving representative of the Bureau be permitted to examine and check the contents before signing the receipt for them. The price of a first-grade black diamond, like that of the gem, is determined by its size. The going price (tax free) of a stone varies from $25 to $70 per carat.

The carbonado, demanding excessive prices until recent years, still sells for a price comparable to gem stones. Bortz, however, has consistently sold for a reduced price and can now be purchased for as little as $5 a carat.

As the demand for the stones increased, so did the supply. This was accomplished by introduction of byproducts or "common goods" (small chips of bortz and foreign material) and because of this development, the diamond now reaches into almost every field of industry.

It is fitting that the diamond, which has evolved from the stone of kings to an essential in the progress of mankind, should be employed directly in the Missouri Basin project, a program designed for the progress of the people in the river basin and the Nation.

The Truth About the Boulder Gold Rush

Tradition has it that when workmen began to excavate around Black Canyon, rumors spread that large deposits of gold were being unearthed at the site of Hoover Dam. In the absence of proof, the Bureau tried to squelch all such conjectures, but stories about the gold continued to circulate. Finally, at a meeting presided over by the late chief engineer of the Bureau, Raymond F. Walter, a citizen arose and shouted, "I want to ask you a question, and I want an answer. Did you or did you not strike gold in Boulder Canyon?"

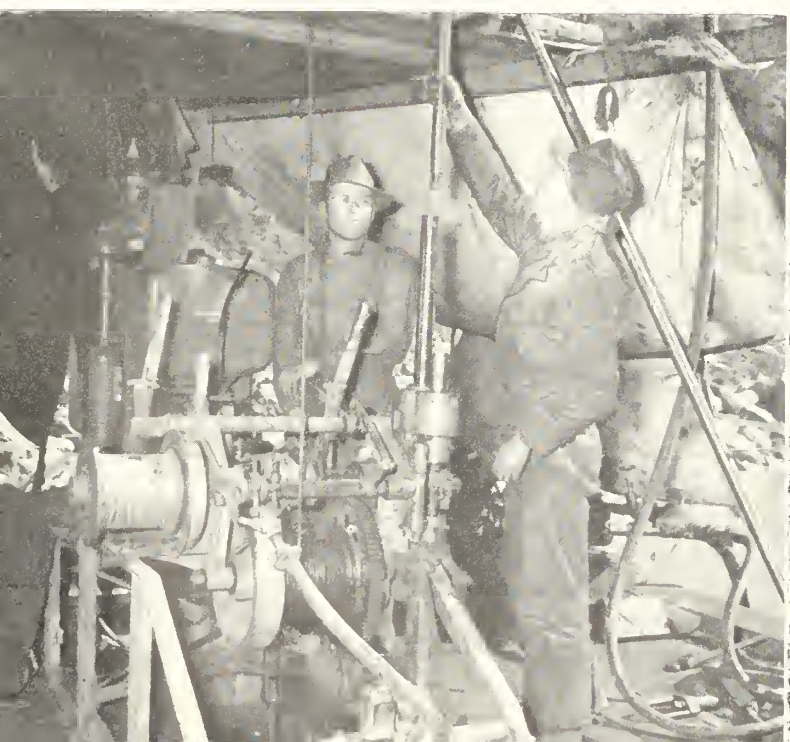
"No," retorted Walter thoughtfully, "No, we didn't strike gold, but—we found diamonds."

"Diamonds? What do you mean?"

Walter said, "We found an old diamond bit that we lost back in 1929 when we were investigating the canyon. It was worth about $10,000."

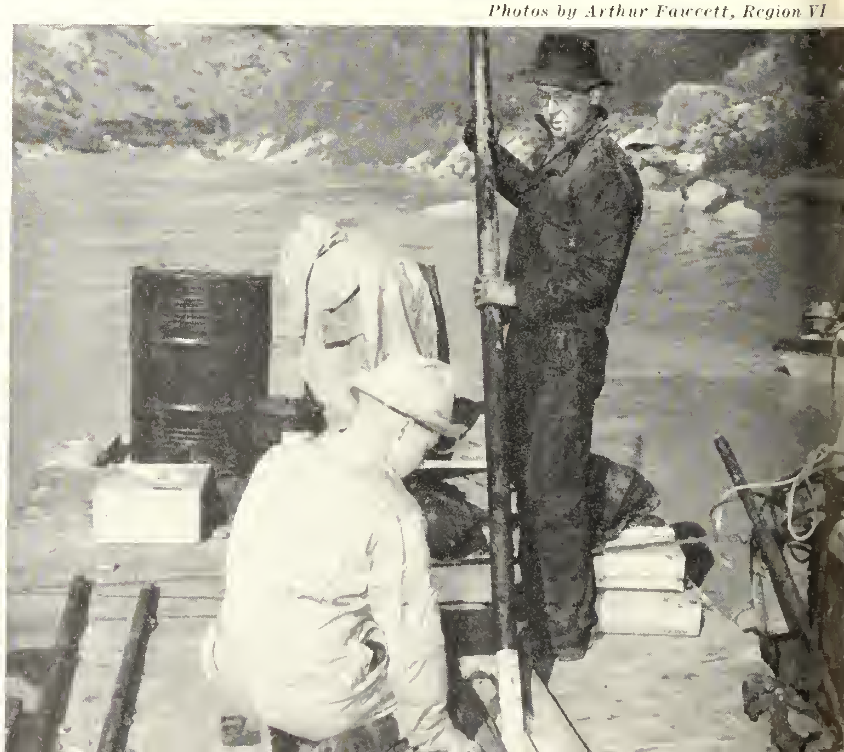
According to legend, no more was heard about the gold mine in the canyon.

Diamond drilling machine about to start cutting cores at damsite.



Rock buried beneath the earth for ages enters light of day.

Photos by Arthur Fawcett, Region VI



The 20th Century HOHOKAM

In the San Simon Valley "the people who are gone" are not forgotten, nor are the lessons they learned from bitter experience.

by William Scudder Gookin, *Engineer, Phoenix Office of Project Planning, Region III*

Photo by William S. Russell, Region III

ARIZONA ABOUNDS IN MUTE EVIDENCES of the Hohokam, "the people who are gone." Long abandoned canals, deserted villages and scattered artifacts tell the story of this ancient people who came to the Valley of the Sun in ages past. Here they built a civilization, founded on irrigated agriculture, only to retreat before some mysterious adversary, leaving their homes and gardens to sear and wither under the blazing sun. When white men first came to this area even the memory of these departed ones had been lost. Only through the studies of archeologists are we able to unravel the mysteries of the Hohokam.

But Arizona contains evidences of another and more recent "people who are gone." About 10 miles south of Safford, abandoned canals, deserted homes, and scattered belongings tell a story of nineteenth century settlers who entered the San Simon Valley to pioneer new homes and communities. Subsequent events forced the abandonment of fields and homes and drove these people into other regions. In the San Simon Valley however, the facts of the story have not yet been lost. It is a story that began when our parents were young.

The story of the San Simon Valley is one that is of vital interest to all who are interested in irrigation. It is of value because a study of the story of the San Simon may serve to avoid a repetition of the heartbreak and economic ruin that was brought to many families by a deterioration in the agricultural economy of a community that was founded in a spirit of hope and progress.

Chiricahua, Dos Cabezos, and Pinaleno Mountains bound the San Simon Valley on the west while the Peloncillo Range forms the eastern limit—beautiful names surrounding a beautiful valley nestled between these peaks in the southeastern corner of Arizona. From the foot of these mountains the land slopes gently down to form the great shallow trough that is the valley of the San Simon.

Less than a decade after the Civil War, prairie schooners carried the first white settlers into this lush valley. Soon vast herds of cattle stood knee deep in the luxuriant grasses which covered the ground upon which the early ranches were established. Before long the San Simon Valley became known throughout the State as one of the most bountiful range lands in southern Arizona.

But man and nature conspired to strip this valley of forage. Ever-increasing herds of cattle overgrazed the lands in a relatively few years. Years of drought concurrent with this overgrazing served to destroy permanently many of the range grasses. A cycle of erosion started and progressed with a rapidity which made this valley famous among students of soil erosion.

For a short time it seemed that the area was destined to become a barren badlands after only a few short years of productivity. The range land had been rapidly exhausted, and farming was impossible without irrigation. The only dependable source of water in the valley was a few wells. Although ground water was less than 100 feet below the surface, and was adequate for domestic supplies, these wells did not yield enough for irrigation development.

However, in 1910 the situation changed overnight. A deep well was drilled in the valley, and tapped a basin of artesian water that lay hidden beneath an impervious layer of blue clay. As the water in this well rose to the surface, so rose the value of San Simon land. Here was a small scale bonanza, for in a country where water is the most precious commodity, finding an artesian belt is akin to discovering a gold mine.

Wells were drilled throughout the area in rapid succession. Many of these failed to strike artesian water, but by 1915 artesian water was flowing from 127 wells. These ranged in depth from 200 to 2,000 feet and served to delineate the artesian field, which covered an area about 15 miles long and 10 miles wide in the center of the valley.

However, once again the San Simon Valley was due to complete a cycle in a very few years. Expanded to a maximum neither cased nor capped. When the valley soon started another decline.

Developed as it was, without any knowledge of the physical limitations of land and water, it was inevitable that the San Simon Valley should suffer from a lack of long-range planning and orderly development. Most of the wells that were drilled were neither cased nor capped. When the artesian water was not needed, there being no way to stop the flow, it was allowed to dissipate into the desert. Such withdrawals from the artesian belt, while serving no useful purpose, decreased the pressure and consequently the flow from all wells in the area. In some cases various individuals installed pumps and attempted to supplement artesian flows by pumping. Inefficient pumps of the period, located far from any source of low-cost power, were not the solution to the problem.

Many of the uncased wells caved in or filled with sand, and their output was further reduced. Owners of these wells were faced with the expensive alternatives of drilling new wells or cleaning out the old.

Only by bitter experience did the settlers learn that water in the western part of the flowing well area contains alkali or salts in such combinations and quantity as to be classified as "injurious to unsatisfactory" for irrigation.

Early irrigators, proceeding without the benefit of soil analyses and classification, did not in many cases select the best land for irrigation. The farmers were unorganized and unable to take any united action toward soil improvement and erosion control. As a result the lands in the valley progressively deteriorated.

Within the San Simon Valley may be found graphic examples of the effects of an enforced reduction in the irrigated acreage of a farming area. Scattered throughout the area are homes and improvements which in a few short years have decayed to the point where they are of practically no value. Here is a crumbling house that stands as a tombstone for one man's shattered dreams. Over there a few gnarled sticks arranged in orderly rows show where a vineyard used to be. A rusting pump of ancient vintage tells the story of one home owner who tried to supplement the artesian flow by pumping, only to be forced eventually to pack his belongings and join the trek out of the valley. Those tall trees rising from verdant oases in the distance mark the locations of artesian wells abondoned to spill their ever-decreasing streams onto the thirsty desert sands and form small, marshy, seeped areas.

By 1940 only about 400 acres were farmed in the San Simon Valley, and those were planted only to crops having a low-water requirement. Those farmers who weathered the storm endeavored to put their remaining resources to the best possible use. They sought and obtained the cooperation of such Government agencies as the Groundwater Division of the Geological Survey, the Soil Conservation Service, the Agricultural Extension Service, and the Rural Electrification Administration.

A program of water conservation measures to restore the artesian area has been recommended. This conservation would be accomplished by capping or plugging abandoned wells, by properly casing wells in use, and by restricting water withdrawals to the amount needed, taking cognizance of the physical limitations of the area as determined by the safe annual yield.

Plans have been laid for providing relatively low-cost power for the area. Soil conservation measures and crop programs have been studied. The farmers of the San Simon Valley have a difficult, but by no means insurmountable problem. By sound planning and good management they can eventually put their agriculture on a sustaining basis. This may be seen by the results already obtained. Today the irrigated acreage in the San Simon Valley is once more increasing and now totals about 1,000 acres.

However, the heartbreak and the tragedy suffered as a result of this agricultural decline during the past three decades can never be negated. They can only serve to emphasize the importance of sound, comprehensive planning, and the necessity for orderly development of potential irrigation projects.

Note.—The cooperation and assistance furnished by Messrs. S. F. Turner and H. R. McDonald of the Division of Groundwater of the Geological Survey, in the preparation of this article is gratefully acknowledged.

Bureau Sends Data on Masonry Dams to A. S. C. E.

In compliance with the request of a recently established subcommittee of the American Society of Civil Engineers, known as the Subcommittee on Uplift in Masonry Dams, the Bureau is making available a large amount of the technical data on the subject that it has collected over a period of years.

Photo by William S. Russell, Region III

The San Simon Valley is mute evidence of what happens through failure to unite in a soil improvement and erosion control campaign.

Sage-Growing in the Yakima Valley

Variety is the spice of life, and the postwar outlook for American-grown condiments is full of variables

by W. H. Farmer

Land Use Specialist, Region I, Boise, Idaho

Photo by H. Wayne Fuller, Region I

Irrigating field of sage by means of underground water system.

Time was when the sages of Yakima Valley were adding spice to the meals of America.

That was when sage-picking Yugoslavian goat herders along the Dalmatian coast became victims of the wartime shipping ban, dropping the United States' main source of supply to zero. Then it was that a dozen Yakima Valley farmers began raising commercial sage and other hard-to-get herbs and spices cut off by European shipping restrictions.

This planting of domestic or garden sage was concentrated mainly on the Bureau of Reclamation's Roza Division which was receiving its first water above Sawyer, Wash., in 1941 where experimental plantings were made. Shortly thereafter, the farmers began removing valueless native sage from virgin land and replacing it with its high-value cousin, *Salvia Officinalis*. In 1942 these farmers had formed a marketing organization, Sage Growers, Inc., and pioneered in large-scale sage culture. By 1944 the enterprise covered 100 acres.

The largest planting was that of E. C. Price and Cecil Clark who put sage plants on 25 acres of new Roza land. Others set out plants on tracts ranging in size from 1 to 11 acres. A combination of temporary wartime scarcity and excellent quality sent Yakima Valley sage prices soaring from their prewar low of 5 cents per pound in 1935 to $1 per pound in 1941. In 1943, the valley's first sizable sage crop brought 75 cents per pound for table sage yielding an average of 4,000 pounds per acre. By 1944 the price had dropped to 60 cents and in 1945 the growers were barely breaking even. The present price of European sage in our eastern market is between 20 and 25 cents per pound.

Commercial sage is a hardy perennial of the mint family, widely cultivated in gardens. Its growing characteristics and color resemble the native sage in many ways. Farmers say that sage is easily cultivated and will grow in any well-drained fertile soil in areas with a 180-day growing season and mild winters. Loss by freezing during the winter in the Yakima area was 5 to 10 percent.

For cultivation on a large scale the seeds are sown either in hot beds and transplanted or in field rows 2 to 3 feet apart. When the plants are well up, they are thinned to stand about 12 inches apart in the row. The original seedling plants had a tendency to produce narrow leaves so the Roza farmers selected broad leaved plants that did not flower so readily and produced a larger yield of leaves.

The sage affords a single harvest of leaves the first year, and two cuttings, one in June and one in October, beginning the second year. While cultivation and growing of sage is relatively simple, it is costly to harvest and process. After the first year, the plants bloomed profusely and the seed pods and stems had to be removed by hand before the harvest started. Harvesting is strictly a hand proposition, because the foliage must be kept free from dirt and older stem growth. Mexican nationals equipped with sickles and knives did the harvesting job for four cents per pound of green sage. Local hop kilns handled the curing process for the growers. Sage requires double the drying time of hops. It takes from 4 to 5 pounds of green leaves to make 1 pound of dry sage.

Removing stems from the sage leaves was a vexing problem until Walter Ludwig, resourceful Roza farmer, built a stemming machine in his farm workshop. The Ludwig machine took dried sage from the kiln, removed stray bits of soil and reduced the stem content to less than the 12 percent permitted by Government standards.

Packed for market in hop-size burlap bags, the sage was sold through the growers marketing organization in carload lots to a nationally known meat packing concern.

Admittedly, the sage growers had a war baby and a highly speculative crop. They kept individual acreages small and stopped production in 1946 when costs exceeded returns. A revival of sage production depends upon cheaper labor and improved machinery to compete with foreign imports. The domestic market is limited. During prewar years United States consumption was only 750 to 1,000 tons per year.

Peppermint as a farm crop has gained in popularity during the war years and Roza Division acreages have increased in 1946 over previous years. The latest available crop report for 1945 shows that 1,585 acres of mint were produced on the Roza, Sunnyside, and Kennewick divisions of the Yakima project with a value of $300 to $500 per acre.

Mint is propagated from young plants or by runners, similar to strawberry plantings. Its culture varies from that of other farm crops in two essentials. The water requirement is high and the crop must be kept weed-free to avoid off-flavors of the oil. Harvesting is similar to alfalfa, the crop being mowed and shocked. Peppermint plants contain the maximum amount of oil when they are in bloom so harvesting is done at that stage.

Other herbs and spices less well known to this northern latitude which were grown successfully by Yakima Valley farmers in a limited way include sweet Marjoram, Tarragon, Paprika, Basil, Thyme, Horehound, and Anise as condiments in food; Belladonna, Henbane, and Wormwood as drugs; and Tobacco for insecticides and stimulants. The wartime boom prices for these products has passed with the resumption of imports from Europe but a small group of Roza farmers still remember the fantastic prices received from their small plots for these herbs. From Bureau of Reclamation crop yield records on the Roza Division covering the period, 1942 to 1945 inclusive, we find the highest record per-acre yearly average values for all farms as follows: Sage, $2,170; Basil, $2,560; Marjoram, $1,500; Paprika, $8,050; Wormwood, $6,000; Belladonna, $1,600; and Henbane, $4,800.

AMARILLO'S WEATHER

"Howdy pardner—how's the weather in Amarillo?"

Everywhere an Amarilloan goes, that's the first question asked by those unfortunates who live in Washington, D. C., Seattle, Wash., Miami, Fla., San Francisco, Calif., or Newark, N. J.

Anyone but a native would imagine, upon hearing the question asked so frequently, that the United States Weather Bureau maintained its home office in Amarillo, cooked up all the vagaries of weather, and tried them out on the Plains before issuing the latest styles for use in other parts of the continent.

Some people don't care whether the weather in their locality is going to be fair, warm, cold, or indifferent. But let them come face to face with a citizen from Amarillo, Tex., and they can't wait until they get an opportunity to say, "How's the weather in Amarillo?"

If you reply that the weather is fine—lots of sunshine, cool nights, just enough wind to pump water for the finest cattle and horses ever coveted by an Oklahoma nester, the interrogator will shake his head sadly, slowly back off, and mutter something about "chamber of commerce" influence.

The wind **does** blow occasionally in Amarillo. Once in a great while you **can't** play golf in the winter. Some housewives **do** complain now and then because they have to keep putting blankets on the bed through the summer months while Washington, Chicago, Nashville, and Oskaloosa swelter.

Amarilloans are proud of the wind that blows across the Texas Plains. They know that it does something for people here that makes them grow bigger, live longer, burn up more energy, become handsomer and prettier, have better physiques, more brains, have larger bones and less fat, than the people in any other part of the country.

Gene Howe, Amarillo newspaperman, and noted columnist, is one of the greatest authorities on this subject of Amarillo weather.

Dust storms, which once in a great while come into this country from Colorado or North and South Dakota, Nebraska, and Kansas, are held by Gene Howe to be added blessings. He believes the dust contains vitamin K, a sure cure for anything that might ail a human being.

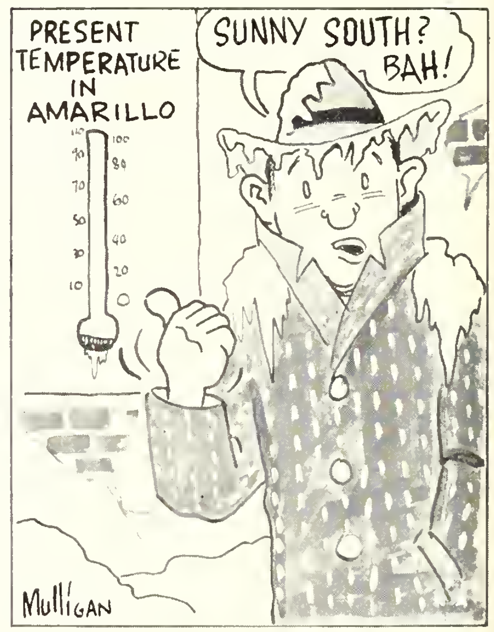
Another thing Amarilloans are proud of is their water. Hard water is known to have qualities that are much better for people than soft, slick water. Water with a punch in it: solid as concrete; that's the kind of water we have in Amarillo and we like it. Gene Howe believes our water has atoms in it. Perhaps it has. Anyhow, it's got what it takes.

Amarilloans don't take any stock in the story told by a newcomer here, who was engaged in the poultry business. This individual had a splendid flock of Black Minorca chickens. One day he whitewashed his poultry house. Suddenly the wind began blowing. It blew so hard that it swished the whitewash off the poultry house onto the Black Minorcas and made White Minorcas out of them.

Once in a while, but not nearly as often as we'd like, we get a light snow in Amarillo. If the wind happens to be blowing while its falling, a fellow might not be able to see the back of his neck, but that's hard to do at any time.

And every time we do get a belated snowstorm, some yokel from "the outside" laughs and laughs and laughs while telling about the old sourdough who started out from Amarillo to discover the North Pole. If you don't know the story, don't ask an Amarilloan.

How's the weather over your way, pardner?



Comparison of Climatological Conditions in Selected Cities of the United States

These data were made available through the courtesy of the Division of Climatological and Hydrologic Services, Weather Bureau, United States Department of Commerce

City—State	Average annual precipitation	Average hourly wind velocity	Average maximum temperature	Highest temperature of record	Average minimum temperature	Lowest temperature of record
	Inches	*Miles per hour*	*Degrees*	*Degrees*	*Degrees*	*Degrees*
AMARILLO, TEX	20.99	11.9	69.5	107	44.5	—16
Newark, N. J	47.14	10.2	61.2	104	43.7	—14
Miami, Fla	57.77	9.3	81.7	96	68.8	27
San Francisco, Calif	22.02	9.1	62.6	101	50.4	27
Seattle, Wash	34.03	8.8	58.6	100	45.1	3
Washington, D. C	42.16	7.3	64.4	106	46.4	—15

Hayden Lake Project Report Sent to Idaho Governor

The Bureau of Reclamation's report on improving the irrigation facilities of the Hayden Lake Irrigation District in Kootenai County, Idaho, and preserving the water supply has been approved by Secretary of the Interior J. A. Krug as his proposed report and sent to Governor C. A. Robins of Idaho. A copy of the report has also been sent to the Secretary of War. The Hayden Lake unit embraces an area of approximately 1,000 acres and is a part of the Rathdrum Prairies project. It is one of the units recommended in the Bureau's comprehensive Columbia Basin project report.

Record Purchasing of Columbia Basin Lands

Reports from Region I indicate that more than 12,000 acres of land were purchased by the Government for resale and settlement in the Columbia Basin project during the period April 1–15. This is the largest single acreage purchased during any single reporting period. Total acreage purchased to date is approximately 60,000 acres.

More Public Land Openings Planned

According to present plans the Bureau proposes to issue notices of the opening of public lands to homestead entry on four projects in the near future. The tentative number of units and estimated total acreage on the projects are as follows:

Project	Number of units	Total acreage
Gila, Ariz.	54	4,900
Riverton, Wyo.	68	8,000
Shoshone, Wyo.	31	5,400
Yuma, Ariz.	27	1,400

Lugert-Altus Project Renamed

The name of the Lugert-Altus project in Jackson, Greer, and Kiowa Counties, Oklahoma, has been changed to the W. C. Austin project in honor of the late Judge Austin (see December 1946 ERA), whose efforts helped in a large degree to make possible the construction of the project. This action was the result of the passage of Senate bill 211, which was signed by President Truman May 16, 1947. The project is designed to supply irrigation water for approximately 52,000 acres of land which have suffered from droughts in the past, control floodwaters, and supply municipal water to the city of Altus.

Divinity Limited

The banquet was in honor of an old settler who had played a major role in transforming the desert into a beautiful irrigated valley.

Said the toastmaster in lauding the honored guest:

"God and Art Smith turned this desolate waste into the prosperous community of irrigated farms and thriving cities that we have today."

The old man beamed.

When called upon to speak, he said calmly, yet seriously:

"It is true that God and I worked to transform the sagebrush waste into fertile irrigated farms. But God hadn't really done much with it until I got here."

Hospital Facilities Under Study

U. S. Public Health Service doctors have recently completed a study of the hospital facilities at Boulder City, Nev., to determine whether they are adequate to meet the needs of the community. A similar survey will be undertaken at Coulee Dam, Wash. Both studies were arranged at the specific request of Commissioner Straus.

Air Coordinating Committee

Archie B. Goodman of the Washington O. & M. staff will represent the Department of the Interior on the working subcommittee of the Interdepartmental Air Coordinating Committee. The ACC was established in September 1946 for the purpose of achieving the fullest development and integration of United States air policies and activities. It is comprised of representatives of Government agencies possessing a primary interest in aviation.

Savage En Route to Europe

Consulting Engineer John L. Savage recently left for Europe where he will be engaged as consultant on several large dam projects. He expects to visit France, Spain, Switzerland, and possibly Portugal. While abroad he will attend a United Nations conference at Geneva and upon his return will go to Mexico where he will consult with officials of that government on several dams.

Weed Research Program

(Continued from page 158)

cluded prevention of weeds in its program. This phase of the cooperative research activity can result in inestimable savings to farmers and irrigation districts on the Central Valley, Missouri Basin, Columbia Basin, and other new projects. Preventing new weeds from starting and old weed patches from spreading is also stressed on operating projects.

Most farmers know the losses they sustain when growing a crop on weed-infested land. These losses include: costs of weed control; increased cost of preparing the seed bed, cultivating, irrigating, harvesting, and marketing a crop; extra irrigation water; reduction of crop yield and quality; dockage; and reduction in land and loan values. Such losses seriously reduce the farmer's income.

Perhaps fewer people are aware of the weed problems which concern the irrigation systems. Noxious and other weeds on canal banks are a source of infestation to crop lands because the seeds are carried by the water. Weeds constitute one of the major problems of irrigation systems because they prevent proper inspection of the ditches; transpire enormous quantities of water needed for growing crops; prevent proper cleaning of the channels; and hinder the efficient delivery of water.

Water weeds reduce the capacity of canal channels making it difficult to deliver sufficient irrigation water; their desilting action necessitates costly dredging; and when they raise the water level, the result is loss of water through increased evaporation and seepage, erosion damage to canal banks, and often costly ditch breaks. Water weeds greatly impair the efficiency of drains which contributes to the water-logging of farm land and alkaline deposits in the soil.

The research program will be good news to both project farmers and irrigation district officials because it holds excellent prospects of helping change weed control from expensive but often temporary procedures to an orderly program based on economic, permanent, and scientific methods.

RECLAMATION READING

Miscellaneous Publications

A Program for American Forestry, by the Board of Directors, American Forestry Association, in *American Forests*, March 1947, page 104. Illustrated. This program of American forestry—formulated to meet the Nation's forest resource problem—has been submitted by the Board to its membership for adoption by referendum vote. (*American Forests* is published monthly by the American Forestry Association, Washington, D. C.).

Plan for Missouri Basin Includes Power Development, by Max Coffey, farm editor, The Omaha World-Herald, in *Rural Electrification*, February 1947, page 16. Illustrated. The author observes that in spite of wartime shortages in material and labor, public power has increased rural consumption of electricity in Nebraska fourfold in 5 years. (*Rural Electrification* is published monthly by the National Rural Electric Cooperative Association, Washington, D. C.).

Two Towns, by Angus McDonald, in *New Republic*, February 3, 1947, page 36. The author advances the theory that "large-scale, big-business, corporation, absentee-ownership farming is like a rotten apple that ruins the whole barrel" and describes the contrasting towns of Arvin and Dinuba, Central Valley, Calif., as proof.

Fourteenth Biennial Report of the Department of Reclamation, State of Idaho—1945–46 prepared by Mark R. Kulp, State reclamation engineer, Boise, Idaho. 126 pages. According to the report, due to satisfactory water supplies during the past 2 years controversies have remained at a minimum; and interest in water for mining purposes has increased. Cooperative investigations of the Department of Reclamation continue with the United States Bureau of Reclamation in irrigation investigations, with the United States Geological Survey in surface and ground water investigations, and with the Soil Conservation Service in snow surveys.

Comprehensive Plan for Columbia River Basin, in *Western States Reclamation Journal*, March 31, 1947, page 2. Illustrated. After careful consideration, Secretary of the Interior J. A. Krug, has given his approval to the plans of the Bureau of Reclamation for the most ambitious and comprehensive development of water and agricultural land resources for electric power and irrigation in history.

Cities Built on Water, by Miriam Roher, in *Western City*, March 1947, page 21. Illustrated. In the Colorado River Basin—an enormous, beautiful expanse 242,000 square miles large—40 cities and towns lie scattered, settlements flung over 7 of the United States. (*Western City* is published by the League of California Cities, Los Angeles, Calif.)

Engineering Publications

Available from the Design and Construction Technical Library, Bureau of Reclamation, Customhouse, Denver, Colo.

Principles of Leadership, by Col. John H. Carruth (P. O. box 66, Grayson Street Station, San Antonio, Tex.).—This booklet merits wide distribution not only among military personnel, but among the personnel of various organizations and individuals. Upon reviewing the book, the head of a large corporation ordered 3,000 copies to distribute to his supervisory employees. Cost: 1 to 200 copies, \$0.50 each; 200 to 500 copies, \$35.00 per 100.

Car Radio Static Reduced by Powder Blown Into Tube, in *Electrical World* (News Issue), April 5, 1947, Volume 127, No. 14, page 29, published by McGraw-Hill Publishing Co., 330 West Forty-second Street, New York 18, N. Y.—A powder that can be blown into automobile inner tubes to reduce static shock and car radio static will soon be available to motorists through certain tire distributors.

Static electricity is often evident to motorists through annoying clicks in their radios or through electric shocks they receive from the car doors when they step in or out of the car. This electricity is built up by the moving tires of the automobile and is affected by weather conditions and road surfaces, it was explained.

Realizing that the rubber tires prevent discharge of the static electricity to the ground, tire engineers developed the powder for application in the inner tubes of the tires. An air hose and a specially designed container are used to inject about one tablespoonful of powder into each tube after the tube has been deflated and its valve core removed.

The powder tends to cling permanently to the walls of the tube for the duration of the tube's life, modifying the electrical behavior of the tire and tube to eliminate or reduce static.

The powder was an outgrowth of research on conductive rubber tires for industrial trucks and tractors. Such tires were developed especially for munitions plants and other facilities where static electricity might easily cause fires and explosions.

Canal Lining Manual, by Carl Rohwer, Senior Irrigation Engineer, Soil Conservation Service, United States Department of Agriculture, November 1946.—From one-third to one-half of all the water diverted for irrigation is lost before it reaches the farmers' fields. Seepage from canals and laterals, leaks through structures, and evaporation and transpiration all help to dissipate the water supply. Control measures, which consist of treating the canal bed or lining it with other material, are described in this manual. (NOTE.—The above manual may be secured, in limited numbers, from United States Department of Agriculture, Soil Conservation Service, Division of Irrigation, College Hill, box D, Logan, Utah.)

My Experiences As a Ditchrider

(*Continued from page 159*)

charge rather than the depth of water over the weirs. The total discharge for any period of time could be rapidly determined with a planimeter.

This is the first irrigation system in northern Colorado, as far as I know, to work out an effective method of furnishing irrigation water on demand and for storing it when not needed. The method has demonstrated its worth through continued use for 50 years.

My experience as ditchrider gave me broad knowledge of the difficulties confronting farmers growing crops under irrigation, of the importance of water in the semiarid and arid regions of the West, of the urgent need of better methods of measurement and distribution of irrigation water, of improved methods of irrigation, and the value of storage and of conservation of our water resources.

The salary helped pay my way as a student in the Colorado State Normal School and University of Colorado, and ditchriding later proved good basic training for a college president.

Adams Tunnel Dedicated

As water began to follow its man-made itinerary through the 13-mile Alva B. Adams tunnel, it heralded the beginning of benefits to the population of the Big Thompson and South Platte River Valleys, and climaxed a near miracle of engineering.

On June 23 record breaking crowds gathered on both the eastern and western sides of the Continental Divide as the crop-saving irrigation water began to trickle from the Pacific slope of the Rocky Mountains to the Atlantic slope where it will provide supplemental irrigation for more than 600,000 acres of inadequately watered lands.

The dedication was marked by the attendance of many notables including Under Secretary of the Interior Oscar L. Chapman, State Governors and members of the congressional delegations from Utah, Wyoming, Nebraska, Kansas, and Colorado, and Commissioner Michael W. Straus who delivered the principal address of the evening. Others in attendance included Mrs. Alva B. Adams, widow of the late Senator Adams for whom the tunnel, key feature of the Colorado-Big Thompson project, was named because of his tireless efforts to equalize the supply of water on both sides of the Continental Divide.

U. S. GOVERNMENT PRINTING OFFICE 1947

NOTES FOR CONTRACTORS

Contracts Awarded During May 1947

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
1638	Missouri and Columbia Basins.	May 1	5 gate assemblies for Angostura, Long Lake, and Potholes Dams.	Willamette Iron & Steel Co., Portland, Oreg.	$61,727.00
1652	Central Valley	May 15	Electrical equipment for Shasta and Keswick switchyards' schedules 1, 2, and 6.	General Elec. Co., Denver, Colo.	470,606.20
1652	do	do	Electrical equipment for Shasta and Keswick switchyards' schedule 3.	A. B. Chance Co., San Francisco, Calif.	93,337.28
1652	do	May 7	Electrical equipment for Shasta and Keswick switchyards' schedule 4.	Southern States Equipment Corp., Hampton, Ga	45,018.72
1652	do	do	Electrical equipment for Shasta and Keswick switchyards' schedule 5.	Westinghouse Elec. Corp., Denver, Colo.	25,502.10
1663	Boise and Colorado-Big Thompson.	May 12	Hollow jet valves and accessories	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	191,918.00
1668	Boise-Payette	May 1	Construction of Conway Gulch lateral and "C" line East Canal.	Humphrey-Ketchen Co., Boise, Idaho	251,381.00
1677	Rio Grande	May 6	Electrical equipment for Alamogordo and Hollywood substations' schedules 3, 6, 7, 10.	General Elec. Co., Denver, Colo.	49,365.71
1677	do	do	Electrical equipment for Alamogordo and Hollywood substations' schedules 4, 5.	Electric Power Equipment Co., Philadelphia, Pa.	11,328.83
1701	Yakima-Roza	May 16	Motor control equipment for various pumping plants.	Wolfe & Mann Manufacturing Co., Baltimore, Md.	15,300.00
1711	Boise-Payette	May 21	Clearing part of Cascade Reservoir site	Wixson & Crowe, Redding, Calif.	288,720.00
1712	Rio Grande	May 9	Construction of spillway alterations at Elephant Butte Dam.	J. H. Ryan, Albuquerque, N. M.	65,115.00
1718	Davis Dam	May 20	125-ton gantry crane and auxiliary trolley	Judson Pacific-Murphy Co., Emeryville, Calif.	144,325.00
1719	Deschutes	May 1	Construction of Willow Creek Siphon and Wasteway.	Morrison-Knudsen Co., Boise, Idaho	195,161.00
1734	Davis Dam and Colorado-Big Thompson.	May 23	9 governors for turbine regulation	Woodward Governor Co., Rockford, Ill.	230,990.00
1740	Colorado-Big Thompson.	May 9	4 pumping units for Granby pumping plant	F. H. Whiting Co., Denver, Colo.	19,750.00
1741	Davis Dam	May 16	Control board for Tucson substation	General Elec. Co., Denver, Colo.	13,771.00
1742	Central Valley	May 21	50 residences for Antioch and Tracy Government camps.	Green Lumber Co., Laurel, Miss.	131,180.00
1743	Hungry Horse	May 19	Clearing part of Hungry Horse Reservoir site	J. J. Reese, Columbia Falls, Mont.	408,320.00
1751	Central Valley	May 13	Radial gates and hoists, schedule 2 and 3	Pacific Coast Engineering Co., Alameda, Calif.	19,396.00
1753	Scofield	do	Clearing part of Scofield Reservoir site	Burks & Co., Denver, Colo.	20,000.00
1757	Deschutes	May 15	96-inch diameter steel pipe for Willow Creek siphon.	Pacific Coast Engineering Co., Alameda, Calif.	68,436.00
1766	Shoshone-Heart Mountain.	May 28	Construction of Ralston lateral and sublaterals' schedule 1.	Askevold Construction Co., Missoula, Mon	208,959.00
1766	do	May 27	Construction of Ralston lateral and sublaterals' schedule 2, 3.	Sharrock & Pursel, Casper, Wyo.	253,091.50
E-33,090-A-2	Central Valley	May 14	Treated and untreated lumber	Niedermeyer-Martin Co., Portland, Oreg.	58,686.99
1707	do	May 23	2 aluminum accordion doors, one aluminum sash window.	Seattle Bronze Co., Seattle, Wash.	34,000.00
1710	Colorado-Big Thompson.	May 1	Two 72-inch outlet pipes for Horsetooth dam outlet works.	Thompson Pipe and Steel Co., Denver, Colo.	55,270.00
1722	Missouri Basin-Kortes	May 22	3 bulkhead gate-frames and 3 storage supports for Kortes Dam, item 2.	American Bridge Co., Denver, Colo.	17,201.00
1726	Mirage Flats	May 23	Sand and coarse aggregate	L. R. Olson, Gering, Nebr.	11,019.20

Construction and Supplies for Which Bids Will Be Requested During July 1947

Estimated date to be invited	Estimated date bids to be opened	Project	Description of work or material
July 1	Aug. 5	Boulder Canyon, Nevada	Laying 6 miles of 12- and 14-inch diameter high-pressure steel pipe, and erection of 50,000- and 2,000,000-gallon storage tanks for Boulder City.
Do	do	Central Valley, California	Materials for Elverta-Tracy 230-kilovolt transmission line (75 miles).
Do	do	Colorado-Big Thompson, Colorado	Materials for Loveland-Greeley transmission line (30 miles).
Do	do	Columbia Basin, Washington	Control and station service boards for Grand Coulee pumping plant.
Do	do	do	Unit substations and exciter switchgear for Grand Coulee pumping plant.
Do	do	do	Station service 6,900-volt switchgear and 460-volt power distribution boards, station transformers, battery control and distribution equipment, and battery chargers for Grand Coulee right powerhouse.
Do	do	Missouri Basin-Boysen, Wyoming	Generators for Boysen power plant.
Do	do	Missouri Basin-Kortes, Wyoming	Ring-follower gates for Kortes Dam and power plant.
July 7	Aug. 11	Missouri Basin-Boysen, Wyoming	Turbine and governor.
July 12	Aug. 15	Austin (Altus), Oklahoma	Construction laterals and structures for irrigation of 10,000 acres of land.
July 15	Aug. 19	Colorado-Big Thompson, Colorado	Surge tank for Granby pumping plant.
Do	do	do	50-ton and 75-ton cranes for Estes Park and Marys Lake power plants.
Do	do	Columbia Basin, Washington	Earthwork and structures, West Canal station 405 to 1213.
Do	do	do	Earthwork and structures, Potholes East Canal, station 0 to 436.
Do	do	do	Construction of 12,000-foot Soap Lake siphon. Concrete, 25-foot diameter; steel, 23-foot diameter.
Do	do	do	Concrete canal lining and structures, Main Canal, station 751+94 to 1109+90.8.
Do	do	do	Pumping plant bus structures for Grand Coulee pumping plant.
Do	do	do	De-icing motor-generator sets for Grand Coulee power plant.
Do	do	Davis Dam, Nevada-Arizona	Crossarms, conductor, and conductor hardware for the Tucson-Cochise transmission line.
Do	do	Missouri Basin-Angostura, South Dakota.	50- by 30-foot radial-gate hoist, Angostura Dam.
Do	do	Missouri Basin-Frenchman-Cambridge, Nebraska.	Two 60-inch hollow-jet valves for Enders Dam.
Do	do	Missouri Basin-Kortes, Wyoming	60-ton crane for Kortes Dam and power plant.
Do	do	Palisades, Idaho	Materials for Palisades-Goshen 115-kilovolt transmission line (55 miles).
July 16	Aug. 20	Klamath-Tule Lake, Oregon-California	Construction pumping plants G, H, J, K, L, M—capacities 7 to 15 cubic feet per second.
July 25	Aug. 29	Davis Dam, Arizona-Nevada	Erection and installation of cableway and gaging station, Davis Dam.
July 28	Sept. 2	Central Valley, California	Excavation, concrete footings, and gravel surfacing for Keswick switchyard.
Do	do	Columbia Basin, Washington	Pumping units for Burbank pumping plant.
July 30	Sept. 3	Colorado-Big Thompson, Colorado	Siphon No. 1, Horsetooth Feeder Canal.

Photo courtesy of the Utah Centennial Commission

MONUMENT TO PROGRESS

Here is the artist's conception of "This Is the Place" monument, which will be unveiled on July 24, 1947, climaxing the Utah Centennial celebration. The monument is located at the mouth of Emigration Canyon overlooking the Salt Lake Valley and was sculptured by Mahonri M. Young. It is comprised of 15 separate statues and groups aggregating 30 tons of bronze. It has been designed to commemorate the explorations and activities of white men in the Intermountain region from the advent of Catholic padres in 1776 to the coming of Brigham Young and his pioneers in 1847.

AUGUST 1947

Featuring:

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The stories of two Reclamation tunnels, the oldest and newest

•

LAND SPECULATION
by
ssistant Secretary of the Interior ILLIAM E. WARNE

•

Does Beekeeping Have a Part in Reclamation Planning?
by
ames I. Hambleton

THE *Reclamation* ERA

Nelson Named Assistant Commissioner

Krug Congratulates Nelson

Wesley R. Nelson, Regional Director of Region V, and a reclamation engineer with many years' experience, was sworn in as Assistant Commissioner of the Bureau of Reclamation on July 1. Secretary of the Interior J. A. Krug, who was present when Mr. Nelson took the oath of office, stated that Mr. Nelson has the complete support of the Secretariat of the Department of the Interior and the Bureau of Reclamation. He commented on Nelson's past performance in difficult assignments and said that it was because of his ability to cope with such situations that he was chosen for the job. Nelson in reply expressed his appreciation for the Secretary's belief in his integrity and ability and said that he would do his level best to merit the confidence placed in him through this appointment. He succeeds William E. Warne, who took the oath of office as Assistant Secretary of the Department of the Interior, on the same day.

Prior to joining the Bureau in 1922 as chief of a survey party and junior engineer on the Grand Valley project, Nelson was part owner and manager of an irrigated cattle ranch in Colorado. He left the Bureau to work for private engineering firms in 1927, returning in 1931 as assistant engineer and later as associate engineer during the construction and until the completion of Hoover Dam.

Subsequently Nelson was transferred to Washington, D. C., to head up the Division of Engineering. In this capacity he served as a member of various technical and policy-making committees representing the Department of the Interior and the Bureau of Reclamation. During his stay in the Capital he was associated with some of the very first groups studying proposals for river-basin development.

As Regional Director it was his responsibility to direct and coordinate all Bureau activities in Texas, Oklahoma, a part of Kansas, most of New Mexico and the San Luis Valley in Colorado. He supervised and directed project planning, marketing of hydroelectric power, gave administrative assistance to the officials of the districts in charge of operating projects and assumed general responsibility for projects under construction.

Mr. Nelson was born at Norwood, San Miguel County, Colo., and attended the Universities of Colorado, and Southern California. He is a graduate Cum Laude, B. S. in civil engineering of the latter named institute. He is married and has been making his home in Amarillo, Tex.

H. E. Robbins succeeds Nelson as Acting Regional Director. He is a career engineer of thirty years' service and was in charge of the Valley Gravity Project when appointed.

Reclamation ERA

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Ruth F. Sadler, *Editor*

Our Front Cover

Symbol of Thrift and Industry

A close-up of a bee at work. Frequent visits from pollinating bees aid the continued growth of these fragrant blossoms and other forms of plant life. Photo was taken by Philip Merritt, Region 1. See story on page 181.

The RECLAMATION ERA regrets to announce the sudden death of T. W. Parry, irrigation adviser at McAllen, Tex., who passed away shortly after his arrival in Washington to attend a conference. His loss will be mourned by a host of friends made during his many years with the Bureau.

A REPORT ON RECLAMATION

by EDWARD J. CLEARY

Executive Editor, *Engineering-News Record*, New York City, N. Y.

Returning recently from a reconnaissance of reclamation projects in the Southwest, I found on my desk in New York an invitation from the editor of the RECLAMATION ERA to submit a brief report on my observations. Being a reporter for a technical journal, my first impulse was to comment on the engineering and construction features of the work visited. But I found myself possessed with another—and even stronger—desire. And that was to give some expression to what might be termed the "personality" of the Bureau as revealed by its staff.

Impressed as I am with the achievements of the Bureau which are manifested in steel and concrete, I find myself even more profoundly stirred by the spirit that typifies the men and women who work for the Bureau.

Here are people who take great pride in the work they are doing. Each one seems to display a personal responsibility for maintaining and enhancing the prestige of his organization. And this responsibility is discharged with such friendliness and good will that obviously it is a natural response and not simply an assumed attitude.

What can be the explanation of this *esprit de corps*, this loyalty and conscientiousness, that distinguishes the personnel of the Bureau?

Among other things, it must stem from the knowledge in the heart of every employee that he is playing an essential role in an unusually constructive enterprise. Regardless of the position he holds, the Bureau employee cannot help but identify himself as a builder. A builder, if you please, in the business of creating new empires; and a member, incidentally of an organization that has traditions of sound public service dating back almost half a century.

Furthermore, being in the happy position of knowing that the result of his efforts eventually finds expression in some tangible form such as a dam, a power house or a canal, there comes with this a genuine feeling of solid accomplishment. Simply to look upon the flowing water that converts desert wastes into green fields and to know that you have had some part in making this possible, is an experience that must provide tremendous satisfactions.

These, I believe, are some of the reasons why the Bureau of Reclamation is staffed with people whose attitude stamps them and their work as of a highly superior grade.

My recent experience with scores of employees in Regions III and V confirmed—

and strengthened earlier impressions received in other regions of the bureau. In my every contact I have found that the reclamation employee is enthusiastic about showing what he is doing, eager to describe how he is doing it, and competent in his explanation of why it is being done.

The exigencies of travel being what they are, there have been occasions when my schedule of job visits intruded on evening off-hours or week-end holidays of project personnel. But if I wanted to see and talk about reclamation activities—which I did—there was no lack of cordial cooperation in making this possible.

That this attitude is an integral part of Bureau of Reclamation staff philosophy should be evident to even the most casual visitor at any of the projects, but notably so at Hoover Dam. Hundreds of visitors are accommodated daily at this monument to engineering skill. The courteous manner in which they are received and conducted about, and the way in which explanations are given and questions answered is a convincing demonstration of public relations exercised by those who know the real meaning of public service and take satisfaction in its practice.

In devoting so large a part of this brief report to what might be termed the "personality" of the Bureau of Reclamation, I am not unaware of its physical accomplishments. In both size and scope, the projects conceived by the Bureau have by their very boldness stirred the imagination of people throughout the world. And it is also apparent that in the translation of these projects from dreams to reality, courageous private contractors have been inspired to revolutionize many aspects of construction practice.

Not so much in the public view, but nevertheless one of the most vital operations of the Bureau is that which is conducted under the rather prosaic title of engineering laboratories.

Based on the simple premise that no structure can be any better than the materials that go into it, there has been developed what is probably the world's greatest research organization in the field of civil engineering and construction.

Over the relatively short span of 17 years in which these laboratories have been operated there have come findings that have had a profound influence on the improvement of engineering practice. More tangible, perhaps, is an appraisal of the laboratories' accomplishments in terms of dollars' and cents' saving on reclamation projects. This is estimated to have reached the astounding sum of $20,000,000!

How these savings have been achieved is dramatically illustrated in connection with the selection, utilization and control of concrete materials. Among other things, these studies have resulted in obtaining concrete of required quality with one-tenth barrel less cement per cubic yard than was heretofore considered possible. Since some 30,000,000 cubic yards of concrete have been put in place under these specifications, the resultant saving is estimated to be $6,750,000. Equally spectacular from a monetary point of view was the redesign of the Grand Coulee spillway based on laboratory findings and which is said to have cut costs on this item alone by some $5,000,000.

A visit to the engineering laboratories of the Bureau in Denver provides a singular opportunity to learn how the skills of the engineer, the geologist and a host of other scientific specialists have been coordinated to improve reclamation practice and otherwise aid in the advancement of technical knowledge.

Like many others, I feel it a happy privilege to be a witness to the work of the Bureau, and in so doing associate with a group of men and women whose competence is exceeded only by their devotion to the task in hand.

United States Department of the Interior

J. A. Krug, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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Do You Plan To Move?

If so, please notify the *Reclamation Era* so that you may continue to receive your copy regularly.

Letters to the Editor

THANK YOU, SENATOR CAPPER

Washington, D. C.
June 10, 1947

Dear Mrs. Sadler:

I have just received the June issue of your very interesting magazine, *Reclamation Era.* I hasten to send my sincere congratulations. You may well be proud of this very attractive magazine. I have no doubt it will be a success in every respect.

Cordially yours,

Arthur Capper,
United States Senate,
Chairman of the Committee on Agriculture and Forestry.

The Bureau is doubly appreciative of this comment, coming as it does from a busy statesman and well-known publisher of midwestern papers, who along with all his many other official duties found time to commend a Government publication dealing with the problems of reclamation farmers.

An Easterner's Appreciation

One Mountain Avenue,
Maplewood, N. J.,
May 28, 1947.

Dear Editor: Accept my appreciative thanks for your memorandum of May 23 and for the accompanying photographic prints and copies of the Reclamation Era.

It is going to give me a great deal of pleasure to make use of the material that has been sent me so that the public and the world at large will have a still better grasp of what the Bureau of Reclamation is doing to turn the dry lands of the country into richly productive and profitable areas for the benefit of the nation as a whole. With kindest regards.

Yours sincerely,

Robert G. Skerrett.

Reader Skerrett's request dealt with irrigation developments and particularly canal construction on the Friant-Kern canal and in the Columbia River Basin. The Era is gratified to note the widespread interest by people of the East in Western reclamation activities.—Ed.

Among Widtsoe Fans

Logan, Utah,
June 2, 1947.

Dear Mrs. Sadler: Please send me one dozen copies of the May Reclamation Era, together with statement of cost.

I am especially interested in the article by Dr. John A. Widtsoe entitled "A Century of Irrigation." Thank you kindly.

Yours very truly,

O. W. Israelsen,
Research Professor of Irrigation & Drainage.

College Caliber

Route 2, Box 142,
Denver 7, Colo.

Dear Editor: We have been highly pleased with the Reclamation Era. The articles have been well written, the pictures clear and distinct, the plans and progress data full and well arranged.

Our daughter uses it as material at the University (Denver) for class discussion and enlightenment, clearing up misunderstandings as to work and plans of Reclamation.

Enclosed is check for a Five-Year Subscription.

Sincerely,

Henry H. Nicholson.

NEXT MONTH

"Owyhee Reservoir" the story of a Reclamation "Fisherman's Paradise," in the Northwest, by Lyle M. Nelson, formerly Assistant Regional Information Office at Boise, Idaho. ALSO an account of how Reclamation Safety Engineers have contributed to the decrease in accident frequency on construction jobs. The difference between the number of accidents when the Gunnison Tunnel was constructed and the number during the construction on the Alva B. Adams Tunnel.

Name	*Address*

"Get Acquainted" Copies

If you have friends or associates who would be interested in the *Reclamation Era,* please list their names and addresses in the box to the left, clip and send it to the Commissioner, Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues so that they can get acquainted with your magazine.

EAST *Meets* WEST

Photo by Thompson, Region VII

A view from the top of East Portal, Alva B. Adams tunnel, of the first water coursing through during the dedication ceremonies.

By Vaughn Mechau

Region VII, Denver, Colo.

Contrary to Mr. Kipling, the East and West can meet.

They met on June 23 when, with Nature's process reversed, snow waters from the high country of the Colorado River in western Colorado rolled under the towering 14,000-foot Continental Divide and out upon the fertile foothills of eastern Colorado.

The occasion was the first diversion of Colorado River water through the 13-mile-long Alva B. Adams Tunnel of the Colorado-Big Thompson project of the Bureau of Reclamation.

It was a long-awaited day—a day of celebration.

The first flow of water, which will later reach large proportions to nourish 615,000 acres in northeastern Colorado, is the realization of a pioneer dream.

In 1889, the first proposal for such a diversion was made in the Colorado Legislature by Representative Hiram Prince. It required years of need and necessity before Representative Prince's hopes began to materialize. Not until 1935, through the untiring efforts of the late Senator Alva B. Adams, was the Bureau of Reclamation allotted funds to make surveys and prepare plans for bringing water to eastern Colorado.

During the 10 years before the Colorado-Big Thompson project was begun, farmers of the irrigation area to be served suffered approximately $47,000,000 in crop losses because of late summer water shortages. The irrigation district, once considered the wealthiest agricultural section in the world, suffered great losses.

Under the plan, Green Mountain Dam was first to be constructed to insure irrigators on the Colorado River of no loss of water from the diversion to eastern Colorado. The dam was built on the Blue River, a tributary of the Colorado, to hold the spring floods or release water as needed.

The perplexing problems of driving a tunnel under the Continental Divide for the diversion of water were next to be solved. Engineering skill, perseverance, and plain, dogged tunneling put through the granite divide of the continent the longest tunnel in the world driven from two headings.

When the job was completed it had been not only one of the safest tunnel jobs on record but the closure was within seven-sixteenths of an inch perfect on line and three-quarters inch on grade. It was an engineering feat that amazed engineers whose only standard was perfection.

Work on other functions and facilities followed. But the need for water was great. A temporary diversion was agreed to following serious crop losses last year as a result of the almost-annual curse—lack of water for maturing crops. Five of the irrigating companies of the northern Colorado water conservancy district, the agency contracting with the Government, raised $110,000 to construct a 38-inch pipe line for delivery of water.

Completion of the pipe line and diversion

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Photo by Norton T. Novitt, Region VII

Governor Lee Knous of Colorado pushing the button that opened the Adams Tunnel gates for the first flow of water from western to eastern Colorado.

of life-giving water was sufficient reason for a celebration. The idea swept the foothills country like wildfire.

Promptly at 10:30 a. m., George Field, chairman of the Grand County Commission, opened the proceedings at the west tunnel portal. A thousand persons—among them growers of fine Hereford cattle, hay growers, resort owners, "fancy Dan dudes,"—looked out over Grand Lake, a natural body of water, and its sister lake, Shadow Mountain Lake.

Carl G. Breeze, representing Colorado River water interests, told the group:

"This day, this very hour marks a new and significant period in Colorado's irrigation history . . . I am referring to the meeting of minds and the understanding that exists between two different groups in order that both mutually benefit so that the State and Nation will benefit."

Colorado's Governor, Lee Knous, followed. With newsreel cameras grinding, Governor Knous rammed the red button with his thumb and the gates slowly lifted.

"There it goes," went up from a thousand throats.

Governor Knous and his party then raced the water across the Great Divide. They cut across Trail Ridge Road, one of the highest automobile highways in the Nation, snowbound the night before but cleared by rotary plows, enabling the Governor to keep his appointment at the east portal.

About the time Governor Knous was pushing the button at the west portal, on the east side of the divide, at Estes Park, the planning and construction of the project was being outlined at a luncheon by Chief Engineer Walker R. Young, Project Engineer C. H. Howell, and former Supervising Engineer Porter J. Preston. The group then convened at the east portal of the Adams Tunnel to await the arrival of the Colorado River water. Spectators crowded the hillsides.

Governor Knous' transmountain tour ended at the east portal prior to the arrival of the water. Oscar Chapman, Under Secretary of the Department of the Interior, handed to him a special communication from President Harry S. Truman, which the Governor read to the assemblage. In his letter the President congratulated the people of Colorado and the engineers responsible for the project and predicted that it would bring continual wealth and prosperity to the West.

Following the Governor, J. M. Dille, secretary-manager of the northern Colorado water conservancy district, spoke on "The District and the Project." He was followed by Judge Clifford H. Stone, director, Colorado water conservation board, whose subject was "The State and the Project."

Under Secretary of the Interior Oscar L. Chapman, who had participated in the holing-through of the Adams Tunnel and had signed the contract between the district and the Government, then began his address.

Hardly had his first sentence been spoken when a distant voice proclaimed, "Here she comes!" Voices picked up the phrase, "Here she comes," and all eyes were focused on the first roily serpent of water to course its way from the tunnel mouth, 3 hours after the west gates were lifted, exactly as scheduled by the Bureau.

As the crowd quieted, the Under Secretary's voice could be heard, saying:

"With this first diversion of water, the Alva B. Adams Tunnel is being put to its intended use. When other engineering works of the whole Colorado-Big Thompson project, of which the Alva B. Adams Tunnel is a part, have been completed, it can do its full job and serve more than 300,000 acre-feet of water to more than 600,000 acres of land, thus insuring full crop production.

"Because the waters drop about 2,900 feet on the eastern slope—22 miles from the Continental Divide—they produce a high potential for the generation of power. Sale of power that is in excess of irrigation pumping needs will not only service a large area but it will provide funds for repayment of a major portion of the presently estimated $128,000,000 construction costs.

"It is estimated that almost 1 million people in this region will share in project benefits. It is also estimated that the gross return to farmers and to processors of crops and livestock in the area will be increased by $21,150,000 annually. If we consider the returns for 40 years—this increase will amount to $846,000,000 in values of agricultural products.

"In addition to these, the power revenues are expected to total $151,700,000 during the repayment period. Recreational benefits will add $12,720,000 in this length of time. Thus, the total benefits from the Colorado-Big Thompson project over the repayment period will exceed $1,000,000,000," Mr. Chapman concluded.

By now the dream of Colorado River water in eastern Colorado had become a reality. The retaining dam below the portal was backing up more and more water and the thousands could see for themselves the life-giving liquid.

That night, at the closing banquet in Loveland's fine community building, Commissioner Michael W. Straus sounded a prophetic note:

"A lot of people will be watching because this is one of the great water projects of the world. If it fares well and fulfills its promise, the rest of the plans—the plans that will move forward for almost a century in both the Missouri Basin and the Colorado Basin—will proceed. If it fails, the plans will falter and the hopes of many of your neighbors will be dashed.

"Cherish and preserve this project. It is a project of all the people—all the people of the valley and all the people of the Nation. Let no man abuse it. Watch your property, keep up your canals and ditches, maintain your gates and drains, guard and protect it and, in turn, in dry seasons and in times of drought and dust, it will guard and protect you."

The dreams and concrete efforts of man were dedicated June 23, and the celebration, now over, opened a vista of security and insurance against the vagaries of nature.

Accidentless Month at Davis Dam

A recent report from the Personnel Safety Engineer's office shows that there were no lost time accidents on the Davis Dam project during the month of April. This marks the first accident-free month since the construction began on the project in April 1946.

Archway erected at Montrose, Colo., in honor of the late President William Howard Taft who personally attended the tunnel celebration.

Holing Through in 1909

The Story of The Gunnison—Reclamation's First Major Tunnel

By G. J. Van Gieson

Branch of Design and Construction, Denver, Colo.

September 23, 1909, was a balmy Indian Summer day on the western slope of the Continental Divide in Colorado.

There was no wind in the Uncompahgre Valley as the sun shone brightly on 900 residents and visitors who had gathered to celebrate an auspicious occasion—the opening of the Gunnison Tunnel. The big moment of the day came at precisely 5:18 p. m. when President William Howard Taft touched a golden plate with a silver bell to release a flow of water through a 6-mile bore to the thirsty Uncompahgre Valley.

Earlier in the day the Presidential Special—a narrow-gage train especially fitted for the occasion—churned its way through the Rocky Mountains and came to a stop outside the city of Montrose at the outlet portal of the tunnel. Here the Presidential party was met by a blaring brass band, a delegation of Spanish American war veterans in colorful campaign uniforms, and the cheering citizens of the valley.

The fanfare marked the end of the first step of a construction job that was as full of romance and tragedy as many of the sagas of the Old West. The driving of the Gunnison Tunnel was indeed a pioneering achievement in the annals of western reclamation development. The bore was driven 6 miles through granite, quartzite, gneiss and shale, and layers of sandstone, coal, and limestone, first by manual labor, then later with power equipment. In the early stages of construction, candlelight was the only illumination. During the course of construction, 26 men lost their lives and over 100 suffered serious injuries.

Some of the first information about the Uncompahgre Valley came from explorations made by Capt. J. W. Gunnison in 1853 who declared it was a desert, "unfit for cultivation and inhabitable only by savages." At that time the territory was inhabited by the Ute Indians. In 1881, the Utes were removed to Utah and the following year, the Denver & Rio Grande Railway was constructed through the center of the valley. Settlers came with the "iron horse" in hopes of making the area an important agricultural center. It was supposed by these early settlers that the Uncompahgre River would supply an abundance of water, and large irrigation canals were constructed. However, it soon became evident that the water to be obtained from the Uncompahgre would not adequately irrigate the lands.

L. C. Lauzon, a farmer who had formerly been a miner, told the people of Montrose that he dreamt of a tunnel to carry water from the Gunnison River into the Uncompahgre Valley. The Gunnison flowed through a rugged, unexplored canyon to the east of the Valley and was separated from it by a mountain range 2,600 feet high. Whether the dream part is true or not, it is certain that Lauzon first conceived the idea of the tunnel and for many years afterward the proposal was known as "a farmer's dream." After several years, Lauzon's idea took hold and a public subscription was secured to pay for surveys. The people of the valley were desperate for an adequate water supply. The idea received the early support and untiring backing of the late Congressman John C. Bell and the Uncompahgre Valley Water Users' Association, which was formed in 1903.

Investigations showed the Gunnison River flowed through the Black Canyon at an elevation higher than the Uncompahgre Valley and a plan was evolved for the gravity diversion of water from the Gunnison by a tunnel 6 miles in length and a canal approximately 12 miles long to supplement the flow of the Uncompahgre River. In 1901, the Colorado legislature appropriated $25,000 to locate and construct a tunnel.

Work was begun on driving a tunnel in December but was suspended in the fall of 1902 when funds were exhausted after driving 900 feet.

In 1902, the Reclamation Act was passed by the Congress and the following year the Colorado Legislature authorized the conveyance of the tunnel property and rights to the Reclamation Service. Within a few months, the Uncompahgre Valley water users approved a repayment contract with the Reclamation Service for construction of a tunnel and in 1903 the diversion plan was approved by the then Secretary of the Interior, Ethan Allen Hitchcock of Missouri.

The tunnel started by the State was abandoned and a new site chosen 5 miles up the Gunnison at Boat Landing Gulch. This was done because further investigations by Reclamation Service engineers revealed that the length of the tunnel could be shortened and more land irrigated. In January 1905, the Taylor-Moore Construction Co. of Texas was awarded a contract for the construction of the tunnel and began work at the new site. The company threw up its contract in May and turned the work back to Reclamation Service engineers when it was unable to fulfill its obligations. At this point both a consulting board and the Uncompahgre Valley Water Users' Association recommended that the tunnel be completed with Government forces. As soon as approval was received, the Reclamation Service immediately took over construction.

The first serious accident occurred in the tunnel at 9:55 a. m. on the morning of May 30, 1905, just 3 days after the Reclamation Service began construction. Timbering in the heavy ground at the west portal gave away, burying ten men and imprisoning 19 others between the cave-in and the heading of the tunnel. Rescue work started immediately. Twenty-one men were taken out through a shaft sunk from the surface on the morning of May 31 and 8 others were rescued on the following day. Of the 29 men involved in the accident, 23 were rescued and 6 perished.

In 1906, in a premature explosion at the east portal, two men lost their lives and one had his eyes blown out. Tragedy struck again in 1910 when 13 miners were overcome by powder smoke in the tunnel which resulted in the death of 9 of the men.

Notwithstanding these and other accidents, work continued apace on completion of the tunnel, despite unexpected engineering difficulties. Prior to the commencement of work in the tunnel, it was believed that difficulties from water seepage would be relatively small. In December 1906, work was halted for 6 months on the west end when a seam was encountered carrying warm water and carbonic gas. Because of the extreme heat and the strong flow of gas it was physically impossible to continue work until a ventilating inclined shaft was sunk to supplement the existing pipe ventilating system.

In April 1908, a water flow was tapped at the east end which stopped all progress in the heading for months and was overcome only after the pumping mains had been increased by the addition of 10-inch pipes and additional pumps. The tapped water vein produced a flow of from 8 to 10 second-feet in the tunnel, about 4,000 gallons per minute.

For over 2,000 feet the tunnel was driven through a geological fault zone which brought about a weird and unholy assortment of grief. Working in a saturated atmosphere at a temperature above 90° F., the miners were obliged to exercise the utmost caution to prevent fatalities. The Uncompahgre Valley project history reports. "At frequent intervals rushes of water would break through from the sides or face, carrying in hundreds of yards of sand which buried tracks, tools, and everything else within 500 or 600 feet of the heading."

A flash flood in July 1908 washed away a temporary dam at the west portal, flooding the west end of the tunnel and the portal cut. Timbers were washed out and from 10 to 14 feet of sand and gravel were deposited in the portal cut. At the time of the flood, 30 men in the bore were forced to make their escape through an inclined shaft about 9,000 feet from the west portal. It was almost a month before a complete investigation of damage could be made. Other than the damage already mentioned, it was found that approximately a mile of track had been overturned, and silt was deposited on the floor of the tunnel for a depth of 2 to 4 feet for a distance of three-quarters of a mile.

When work was first started at the Gunnison Tunnel, all drilling was by hand. One miner would hold a heavy drill and rotate it as a second miner whanged away at it with a sledgehammer. It took husky, hard-working men to do the drilling. Muck was removed in cars on tracks but with a horse for motive power instead of an electric or gas engine. Some months after construction began, power plants were installed at each end of the tunnel, thus permitting the use of compressed-air drills and other power equipment.

New construction records were set on the Gunnison Tunnel despite the many difficulties encountered. One gang of miners, working in three shifts, drove 7,500 feet in 12 months. Two world's records were set in boring through granite and shale. In a single month a record 824 feet of heading advance was made through shale. The record for granite was 449 feet in a month.

Not the least of the hair-raising adventures that occurred many times every day was the transportation by wagon-teams of all supplies and equipment over the mountain to the east end of the tunnel. Tough,

(Continued on page 182)

At left, the night shift at Gunnison takes time out for a photograph. Time—1905. Note tallow candles, only source of illumination in the tunnel. At right, the Reclamation office force at Lujane, Colo., in 1907. Left to right are James L. Luney, Harry Essley, and the Misses Nellie Cummings, and Nancy Shackleford.

The Problems of a Project Manager

All photos by Philip Merritt, Region I

At left, Forest Sower, Manager of the Boise Board of Control, inspects the gauge on the New York Canal. At center, he is seen checking a section of the canal, one of the main canals of the 320,000-acre development. At right he is talking it over with dragline operator Carl Hamilton. Good public relations are only a small part of his job.

By Elma Hill Neal

Like the old Roman god, Janus, who was supposed to be able to look more than one way at once, is the manager of an irrigation project.

He is generally a graduate engineer with an education that enables him to cope with men and handle situations that require a fine technical discernment. Yet he must be a human sort, too, who has not lost the common, practical touch, and is sympathetic with the vexatious problems of all the farmers down to the one on the tail end of the ditch. He must be familiar with tomes of irrigation law, for there is hardly any irrigation project to date that has not fought its way to the top through a torment of legal confusion.

He must have a reserve supply of administrative ability, based if possible on experienced appreciation of the multitudinous duties of employees. He must be a good public relations man, able to deal fairly with water users and their innumerable requests, and with labor, both organized and unorganized.

While the snows are still lying deep in the cold blue canyons among the Teton peaks and are glistening white along the high ridges of the Sawtooth Range, the project manager is making plans. He is carefully checking reports on snow depths. He is calling his ditchriders together for conferences. He is making plans that include coping with drainage difficulties, as well as assuring the efficient delivery of water. He is sizing up the labor situation, scanning the field for capable men as ditchriders.

His mechanics are busy with dragline, tractor, and truck, getting the last sparkplug cleaned and the last nut and bolt in place. As soon as weather permits, he and his men are going over the big ditch, foot by foot, inspecting riprap and linings, looking for faulty headgates and weathered concrete works. He knows what fill is sandy and has to be watched, what section is favored by the gophers as summer homes, the exact bend in the canal that is subject to swirls of silt. He lays a campaign of strategy as exact as that of a general, and when the first gurgle of mountain water hits the dry bed of the main canal, all is ready.

The fact that he is reasonably sure that all is well, does not keep him from being mentally alert at all times. There is a tenseness in the atmosphere that is felt even in his home, for the job of project manager is a 24-hour job during the water season, with minutes stolen for eating and sleeping. Often when sweet Morpheus has the man soothed for a brief time, the far-off distant ringing of a phone brings him instantly wide awake, for the fear of a break in the canal is ever in the back of his mind.

His wife lays plans, too, that include dinners which will keep fairly palatable, for he is usually delayed. The morning and evening meals are hectic, constantly interrupted by the jangle of the phone or the heavy knock on the door. Everybody who can crowd into the old Ford goes with Dad to watch the water come down, and young and old feel the excitement and thrill of "water in the ditch."

Breaks may occur at any time, but are most likely in the beginning of the season. But the project manager has prepared for this contingency, too. Some canal outfits have a "break trailer" loaded with shovels, canvas, and other necessary equipment to be hooked onto a truck in a moment.

One of the most melancholy sights that I have ever seen occurred years ago on a raw May evening. A young manager, newly assigned to a run-down irrigation project, stood on the torn edges of a high fill that had broken out. Dark water poured out of a huge ragged gap. He had done what he could. A lot of the supply had been diverted at the nearest point, but there was the water, vital to the life of the land, flooding out over the low farms, drowning a fine field of alfalfa seed, spreading out over young wheat to a damaging depth. He stood helplessly watching, and I knew he was thinking of the crops farther on down the canal that would soon parch for need of the water wasting at his feet.

He was not alone long. Men and teams with scrapers were in the canal almost before it was safe, bringing up dirt and rocks and filling in the great breach. People came for miles around to stand and peer in the darkness of the chilly night. Bonfires were built for warmth and light, and women brought kettles of coffee and baskets of sandwiches to stay the men who worked so feverishly, and sweat and swore in the muck at the bottom of the ditch. The manager did not sleep that night nor yet the next day. But before 24 hours had rolled around, obvious headway had been made in the rebuilding of the destroyed bank. This youthful manager had learned overnight the principle of cooperation on a grand scale and friendly sympathy of farmer for farmer—priceless talismen on which project managers depend for added strength and skill.

By mid-July the flush of the floodwater has passed. The canal banks have settled. Moss grows long and green and slimy in the bottom of the canal. It waves gracefully in the gentle current and takes up a lot of space that could be filled with water. Men with tractors drag great links of chain down the canal, scraping up ropes

(Continued on page 182)

LAND *SPECULATION*

National Archives photo

"SPECULATORS WHO BOUGHT THE LAND BEFORE IT WAS IRRIGATED MADE FORTUNES. . . ."

by William E. Warne
Assistant Secretary of the Interior
Formerly Assistant Commissioner of Reclamation

Land speculation in the early years of the national reclamation program came very close to ruining it.

Seldom did the first settlers in the land boom era receive the benefits of Government expenditures on irrigation. Speculators who bought the land before it was irrigated made fortunes instead.

The settler was the victim. He paid the speculator a price which not only included the value that the Government had added by the construction of irrigation works, but often the value that the settler himself would have to add by patient husbandry over the years. On top of that, he had to borrow the money for the purchase from the bank a high rate of interest.

The farmer, who could not figure out how he had been hoodwinked, staggered under the load for a few years and went down. The next man who attempted to carry the obligations fastened upon the land often went down also. They could not understand how the Government could be so hard as to press for repayment of the money it had invested for them in the irrigation project, and they sent their spokesmen to camp on the trails of the Congress, seeking relief.

Looking backward, the destructive aspects of land speculation on Federal irrigation projects are clearly delineated.

Speculation plagued Reclamation for 20 years after the Reclamation Act was passed in 1902. The framers of the act thought that they had found an adequate way of dealing with the speculation problem when they inserted the acreage limitation provision. After hard experience and a series of investigations, more effective speculation controls were added, but still they were entwined with the acreage restrictions.

A number of boards of enquiry, appointed by Secretaries of the Interior and by the Congress, and one committee after another of the Congress itself investigated. They found that speculation brought disaster to the actual settlers on project land, jeopardized the Federal investment in the projects, and delayed the orderly settlement of the projects. As a result, through the years, the Congress added provisions calculated to put teeth into the control of speculation in project lands. For more than 20 years these controls have proved effective.

The history of the fight against speculation in Reclamation project lands reveals why the Congress has written safeguards into the law.

Early Land Booms

Away back in 1913 the Reclamation Service became alarmed by wild land speculation on the 25 projects which it had initiated up to that time. Project engineers and managers were asked to report what the value of unimproved land had been prior to construction of each project and what that same unimproved land was being sold for in 1913 at the time of the survey. The results of that survey are shown the table on pages 178 and 179.

It shows that as of 1913 the average price of unimproved land had increased by 759 percent on the 25 projects studied. This tremendous increase in the price of land took place quickly. For 11 of the projects, only 7 years had elapsed since construction began. Two other projects had been in existence only 6 years; another for 5 years; and another only 1 year. For 4 others, 8 years had elapsed; and another 4 had been started 9 years before the survey was made. Only 2 projects had had a life of 10 years.

Speculation varied considerably from project to project. On the Tieton division of the Yakima project, Washington, the prices of unimproved land increased by almost 5,400 percent; on the Minidoka project, Idaho, 1,525 percent; on the Okanogan project, Washington, 2,400 percent; and on the Shoshone project, Wyoming, 5,000 percent.

What was happening to the value of land that was not affected by Federal expenditures for irrigation and reclamation in these same States? The facts are shown in the table on page 179 indicating that from 1905 to 1913 the value of all lands in farms in the 11 Western States increased by only 110.8 percent, compared to the dizzy heights reached on the reclamation projects. The greatest increases in values of land occurred in the States of Arizona, Montana, and Washington, where they amounted to 227, 150, and 125 percent, respectively. In New Mexico the increase was as low as 37 percent during this same 8-year period.

These data prove that speculators were cashing in on the Government's expenditures for irrigation projects.

This was the era when the deprecating remark gained currency that "it takes three crops of settlers to make a successful irrigation project." Nearly everyone of the original settlers who bought into projects at such inflated prices found it impossible to make a go of it. There is a great difference in the real worth of unimproved, dry land and that of developed, irrigated land, but the difference is made up of two principal elements. One of these is the labor of the settler who must construct his farm ditches, clear and level his land, and plant and raise his first crop. The other is the construction cost of the project which is charged against the land, and, although the terms are generous, must, nevertheless, be repaid to the United States. The settler who bought in at boom prices found he still had these two factors against him, although often he had paid prices that were as high as a debt-free, improved, irrigated farm should bring.

Public and Private Lands Involved

The experience of those early days demonstrated that it is not enough simply to place a limit on the amount of land for which

"Land speculation in the early years of the National Reclamation Program came very close to ruining it"

"THE FARMER . . . STAGGERED UNDER THE LOAD FOR A FEW YEARS AND WENT DOWN."

any one landowner might receive water. When that fact had been adequately demonstrated, the Congress added in 1926 the anti-speculation teeth to the law. The factors contributing to the speculation are clear.

Public Lands

Almost as soon as surveys were commenced in an area, it would become known that a Federal Reclamation project, perhaps involving the expenditure of millions of dollars, was in the offing. Immediately, filings would begin on public lands for homesteads, even though everyone knew that it might be years before the irrigation water could be delivered.

It was a frailty, later corrected, of the original act of 1902 that, although the public lands could be withdrawn for Reclamation purposes, the law did not at the same time prevent the filing for homesteads. Premature entry and settlement occurred, largely by those bent on speculation.

The minority report of the Senate Committee on the Irrigation of Arid Lands in 1911, which looked into this problem, and the Director of the Reclamation Service, in his eleventh Annual Report, pointed out that homesteaders were frequently able to demand high prices for relinquishment of their title to later bona fide settlers, or to the Government, which often had to purchase rights of way through the same lands for canals after the surveys that touched off the boom had been completed. These relinquishments were sold as high as $100 an acre and more, though the lands remained dry.

Thus the second comers to the project lands, who were the real farmers, had terrible burdens. Not only must they clear and level the land and prepare the soil, while building their houses and barns, and not only had they to pay for the construction of the works, but they also had to shoulder the burden of paying from 8 to 12 percent interest (in those days) on the unearned increment in the inflated prices which the speculators had charged for the land. Many such settlers, in fact, lost their farms to the third comers to the land, thus giving color to the "three crop" derision.

As a result, the Congress in the act of June 25, 1910 (36 Stat. 836), section 5, provided that no entry should be thereafter made and no entryman permitted to go upon lands reserved for irrigation purposes until the unit of acreage per farm unit and water charges and date of delivery had been fixed and publicly announced.

In addition, the Bureau of Reclamation, under powers still later conferred, has devised methods for selecting the settlers on public lands to keep out those whose sole interest might be that of land speculation.

Today there is no speculation in public lands of the projects.

Private Lands

It is not generally understood that the Reclamation Act of 1902 provides for the irrigation of both public and private lands. At first, it was believed that mainly public domain would be involved. At the very outset, however, the advantages of the areas where part of the land was already in private ownership were vigorously pressed and, in many instances, these locations did afford greater opportunity for the development and settlement of a project than could be found in areas composed exclusively of public domain.

Some of the early projects included only privately owned land, and on nearly all of the projects there was a considerable proportion of private land. More than one-half of all the lands included was privately owned at the time the projects were authorized, and about two-thirds of all lands under water contract with the Government in 1924 were in private hands by the time water was ready for delivery on the projects.

After the owners of these private lands agreed to divest themselves of their holdings in excess of the permissible 160 acres, there was no way in the early days of Reclamation to prevent the placing of any extravagant price on the excess land.

Some prices were so high as to prevent the purchase and settlement of projects.

The Fact Finders Report, made in 1924 by a distinguished group of men appointed by Secretary of the Interior Hubert Work to look into the problems of irrigation and reclamation, contains many instances of these private lands being sold to settlers at prices that proved unbearable.

The effects of these "land-boom" prices for project land seriously jeopardized the economic feasibility of the projects. Again and again the settlers came to Washington or sent their representatives to plead for a reduction in their construction charges, to seek to postpone their payments, and otherwise to seek relief so that they could continue to farm the project land. In many instances this resulted in breaking down the repayment principles and the program.

In many areas, land prices rose to such heights that bona fide farmers passed the project by. This slowed down the settlement and development of the lands, which also postponed the date when water users could begin to repay construction charges. Canals without customers became the order of the day on some projects.

Speculators in these ways defeated to a large extent the economic and social purposes of the Federal, interest-free expenditures for irrigation projects.

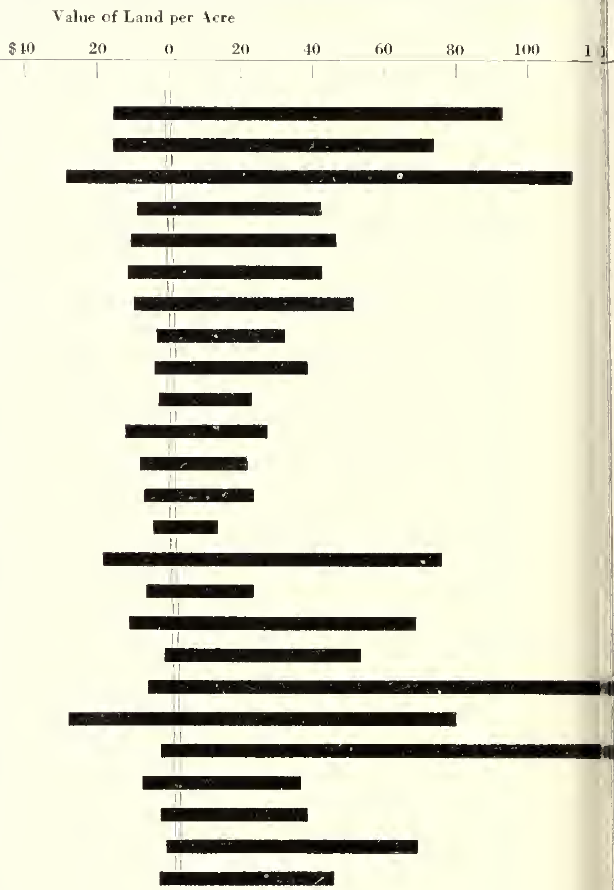
The Fact Finders Committee and also the Congress, as evidenced by the passage in 1926 of the Omnibus Adjustment Act, believed that the owners of excess land should be required to sell that land at prices which represented its actual value regardless of the proposed construction of the irrigation works. Section 12 of the Reclamation Extension Act of 1914 (38 Stat. 689) and section 46 of the Omnibus Adjustment Act (44 Stat. 636) so provide, and section 46 also provides that these restrictions on the price at which such land may be sold are to hold until at least one-half of the construction charges against the lands are paid.

Fortunately, the record has been sufficiently preserved, as a result of testimony before congressional committees and through reports to permit careful summarization by projects of all salient details on land speculation. A project-by-project review leaves no room for doubt of the

HOW SPECULATION I

FOR UNIMPROVED LAND ON RECLAMATION PROJECT

State	Project	Number of acres	Date construction began	Before construction began
ARIZONA	Salt River	240,000	1903	$17.50
ARIZONA-CALIFORNIA	Yuma	90,160	1905	17.50
CALIFORNIA	Orland	14,000	1908	29.00
CALIFORNIA-OREGON	Klamath	30,908	1906	10.00
COLORADO	Grand Valley	53,000	1912	10.50
COLORADO	Uncompahgre	140,000	1904	11.50
IDAHO	Boise	30,000	1906	11.25
IDAHO	Minidoka	132,000	1904	2.00
MONTANA	Flathead Indian	138,000	1907	7.00
MONTANA	Huntley	28,835	1906	4.00
MONTANA	Milk River	251,906	1906	12.50
MONTANA	Sun River	16,397	1906	10.00
MONTANA-NORTH DAKOTA	Lower Yellowstone	63,603	1905	10.00
NEVADA	Newlands-Truckee-Carson	206,000	1903	6.00
NEW MEXICO	Carlsbad	20,073	1906	25.00
NEW MEXICO	Hondo	10,000	1904	10.00
NEW MEXICO-TEXAS	Rio Grande	175,000	1906	17.50
OREGON	Umatilla	20,240	1906	5.00
WASHINGTON	Okanogan	10,000	1906	10.00
WASHINGTON	Yakima-Sunnyside	100,000	1906	32.50
WASHINGTON	Yakima-Tieton	34,000	1907	2.75
NORTH DAKOTA	N. Dak. Pumping, Williston	12,097	1906	11.00
SOUTH DAKOTA	Belle Fourche	100,000	1905	4.00
WYOMING	Shoshone	131,900	1904	1.25
WYOMING-NEBRASKA	North Platte	129,239	1905	5.00



TOTAL ACRES INVOLVED 2,

AVERAGE INCREASE IN LAND VALUES PER ACRE . . . . . .

need for speculation controls on Reclamation projects. I shall not try to cover all projects, but will give a review of some that are typical.

Rio Grande Project

Construction began on the Rio Grande project, New Mexico-Texas, in 1906, but as the plans were developing, the prices for the unimproved desert land had risen by that year to $15 or $25 an acre. In 1913, only 7 years later, the prices of this same unimproved land had risen to $50 and $75 an acre. In February 1916, the Central Board of Review, discussing certain recommendations for project development, said:

> About three-fifths of the American lands under this project are held by owners in comparatively large areas, so that the greater part of it is excess land which must be sold. From the best information obtainable, much of this land was not bought for the purpose of making homes, but for the purpose of reselling it at a profit to actual settlers. The prices at which it is being held are so far above the original cost as to make this a serious obstacle to development. In other words, it is an attempt to collect from the actual settler all the advantages of the Government's expenditure in the way of enhanced prices. This is a more serious obstacle than project costs.

In explaining the failure of the project lands to be settled completely, in spite of extensive promotional activities, the president of the Elephant Butte irrigation district stated in a report to the Board of Survey and Adjustment that:

> The reason is that even the most unthinking and inexperienced would-be farmer is wise enough to know that he can't clear, level and build up the fertility where leveled, crop his farm, feed his family and pay the tremendous overhead.

He was referring to the amortization and interest charges on land purchases and irrigation construction cost charges when he referred to "overhead."

In discussing what action should be taken with respect to a plea from the water users to reduce the construction charges against the land, the Board had this to say:

> It will, however, only add to the injustice and wrong to the ultimate actual user of water on this project if the project cost is reduced now, because the benefits will not go to the settler but will be appropriated by the speculative owner.

The Board advocated immediate action to protect the bona fide settler against loss of time and money through a program to warn prospective farmers of the total land and water charges they would have to face if they undertook to purchase at the then inflated prices. The Board also recommended that the Government purchase the land and settle it under a system of organized aid and direction, with low interest rates and long-term credit such as was being done in Australia. This plan was adopted in 1943 for the control of speculation on the great Columbia Basin project.

Salt River Project

Construction began on the Salt River project, Arizona, in 1903. Of the land originally included in the project area, only about 16,000 acres were public lands.

Some of the private holdings, such as those held by the Chanler Land Improvement Co. and Messrs. Murphy and Fowler, were large. A typical land boom was unleashed at the time the project was begun. Land changed hands rapidly, with increases of from $5 to $10 an acre between each sale. Finally, the eventual settler was faced with the impossible job of earning enough to pay high interest rates and amortization on his land, and construction charges as well.

A few farmers in the Valley had gained a virtual monopoly on truck farming at the time, and most of the settlers could not afford the long development period required to get citrus trees into production. This became the sole prerogative of a few wealthy landowners. Most settlers were restricted

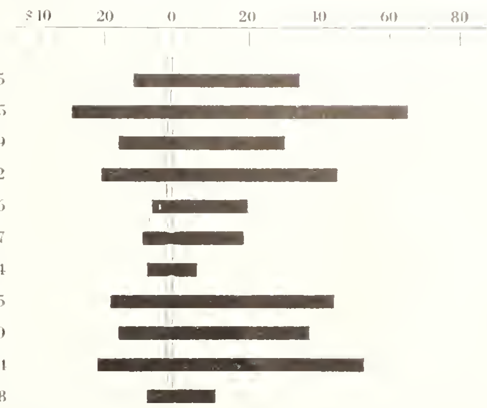
EASED LAND VALUES

As of 1913
$92.50
67.50
110.00
40.00
45.00
40.00
17.50
32.50
36.00
18.00
25.00
17.50
20.00
12.50
67.50
20.00
62.50
50.00
250.00
75.00
150.00
32.50
35.00
62.50
10.00

. 759.2%

ON ALL FARM LANDS IN ELEVEN WESTERN STATES

Value of Land per Acre



State	In 1905	As of 1913
ARIZONA	$10.35	$33.84
CALIFORNIA	30.65	61.50
COLORADO	16.59	30.19
IDAHO	20.92	45.65
MONTANA	7.76	19.38
NEVADA	9.37	18.10
NEW MEXICO	6.74	9.21
OREGON	18.65	11.25
UTAH	18.00	34.00
WASHINGTON	22.94	51.53
WYOMING	7.28	12.14

AVERAGE INCREASE 110.8%

practically to the planting of alfalfa. Until 1914 there had been a good market for alfalfa in the Los Angeles area, but then the crop began to be grown in Southern California. All this led to serious financial consequences for the settlers.

In 1913 the project engineer reported that by the time construction began 10 years before, the price of unimproved desert land had risen to $17.50 an acre. Seven years after construction began, this same unimproved land was selling for an average of $92.50 an acre, an increase of 440 percent. Much of it was disposed of at from $200 to $300 an acre, and some that was close to Phoenix proper sold for $500 an acre.

The effects of this speculative rise in unimproved land prices, both on the settlers and on the repayment prospects of the project, were described by the then Director of Reclamation, Mr. F. H. Newell, during hearings before the House Committee on Irrigation of Arid Lands on January 27, 1912:

The water users on the project believe that important concessions in making repayments are necessary, especially in the case of the numerous settlers who have recently come to the valley and who have purchased lands at a high price and which are now heavily mortgaged. These men are struggling under a debt with large interest charges and will, of course, have great difficulty in making prompt payments to the Government for water if they consider the real estate dealer or former owner of the land as a preferred creditor. They figure about this way: A man has bought land at about $150 an acre and has paid, say, a tenth down, with interest at 8 percent on the remainder. Supposing thus that he now owes $120 an acre, next year he must pay 8 percent on this $120, or $9.60 an acre, and must pay a tenth payment of $15 more, or $24.60 an acre, and must support his family in addition. He therefore arrives at the conclusion that he cannot afford to pay the Government. He forgets that it is the water furnished by the Government which alone gives value to the land. There is constantly before him the fact that the rich Government does not need the money and may be put off, while at the same time he believes that the money lender or man who holds the mortgage on his property cannot be thus held off.

The existence of this class of landowners, namely, those who have bought at high prices and are loaded with debt, constitutes the main argument in favor of concessions regarding payment and leaves the Government with the alternatives—

First, enforce payment at the rate of one-tenth each year for 10 years. This, it is stated, will send many of the small landowners to the wall, as they cannot keep up their payments to their creditors and maintain the high rate of interest and support their families if in addition they must refund to the Government.

Second, grant such concessions in the way of extension of time or graduated payments as will enable these debt-burdened landowners to succeed, thus placing the Government in the attitude of waiting while the original holder or speculator collects the earnings of the settler.

Yakima Project—Tieton Division

Construction on the Tieton Division of the Yakima project in Washington began in 1907. Apparently speculation on the lands in this area did not begin before construction as it had on many other projects, for the project engineer reported that large blocks of unimproved land within the project area had sold at $0.50 to $5 per acre (the average was $2.75). After the construction was started, the prices of unimproved land advanced to from $100 to $300 an acre. Many tracts were sold to prospective settlers at these inflated prices.

Okanogan Project

Values of unimproved land on the Okanogan project, Washington, before the construction of the project began in 1906, had reached about $10 an acre. Shortly, they soared and by 1913 unimproved land was being sold for from $250 to $300 an acre. Loose, sandy land on what is locally known as "The Flat" was selling for $75 an acre in 1913. Land with 3- or 4-year-old orchards was selling from $400 to $525 an acre at that time, although the early flush of speculative prices was reported to be falling off somewhat by then.

Commenting on the general conditions on the project in 1913, the project supervisor stated:

Poverty here as elsewhere has undoubtedly in many cases rendered the best (agricultural and irrigation) methods impossible, due to cost. It is thought that these hard times being experienced will continue for two or three years on this project, and within that time considerable fruit will undoubtedly be shipped, and the growth of other crops will also aid materially. The speculator will have to sell by that time to some bona fide farmer and at such a price as will make it possible for the buyer to live. The high prices of land and over-speculation have undoubtedly caused the stagnation which is affecting the entire country at present.

The speculative story on these projects was more or less the same as those of others which had been undertaken up to 1913 when the survey was made.

Repayments Jeopardized

These case histories indicate that the farmers' ability to carry their repayment obligations for the irrigation construction charges was lessened by the speculation. By 1923 the situation had become so acute that the Fact Finders Committee was appointed by the Secretary of the Interior to see what should or could be done. The Secretary reported that as of December 31, 1922, $6,000,000 of construction and operation and maintenance charges were due and unpaid by the water users.

The committee studied each project. Again and again in its report, the Committee commented on the important part which land speculation had played in creating the conditions that it found. The following statements in the report are typical:

The greedy owner of private lands, ready to trade upon the natural desire of vigorous, hard-working men, for independent homes, should and could have been squelched.

* * *

Of great importance also in explaining the difficulties of the Reclamation Service, is the failure of the original act to provide such control over the rights as to acquire at the time of each transfer a proper proportion of increased value to be paid on construction charges. As a result existing construction charges have been ignored when transfers were made, thus leaving the last purchaser burdened with the increased land value as well as the construction cost. This combined burden of indebtedness made it difficult and in some instances impossible for the settler to meet his annual obligation to the Government.

The table on this page shows that in the main those projects on which the greatest amount of speculation occurred in their formative years had, a few years later, the most delinquency. The delinquency on projects which had had relatively little speculation was negligible.

One example: the Shoshone project, on which the value of unimproved land increased by 5,000 percent from 1904 to 1913, had in 1923, 23.7 percent of construction charges due and unpaid.

Little speculation took place on the Newlands and Carlsbad projects. Between 1903 and 1913, the prices of unimproved land on the Newlands project, Nevada, increased by only 108 percent, little more than the increase of 93.2 percent in value of all farm land in the State. In 1923, only 4.5 percent of the construction charges were unpaid on the Newlands project. Similarly, on the Carlsbad project the value of unimproved land rose 170 percent from 1906 to 1913, and its unpaid construction charges in 1923 were only 8.3 percent.

While the correlation shown on the figures in this table between speculation and delinquency is not perfect, and there were undoubtedly other factors which influenced delinquency, there can be no doubt that in 1923 the early speculation in project lands still adversely affected repayments and the projects.

The delinquencies in construction, and operation and maintenance, payments have been greatly reduced, the latter entirely eliminated, since 1926, when teeth were put in the speculation controls.

The provisions in the Omnibus Adjustment Act of 1926, calling for the securing of recordable contracts from owners of excess land, have been applied on many Reclamation projects since that time.

Vale Project

On the Vale project in Oregon, begun 20 years ago, recordable contracts were signed with owners of excess land for the entire excess acreage on that project. The owners since have disposed of all of this excess land. The average price at which that unimproved land was sold was $10 per acre. This took place since 1926, when the present law was enacted, and is in sharp contrast with the earlier history.

Owyhee Project

On the Owyhee project, Oregon and Idaho, a new project, recordable contracts were secured for approximately 12,500 acres of excess land. The excess land was mainly in the ownership of two large land companies, the Eastern Oregon Land Co. and the Oregon and Western Colonization Co. Both companies executed recordable contracts and disposed of the excess land over a period of several years. These excess lands were sold at the appraised price established by the Secretary of the Interior. The average appraised price was slightly less than $10 per acre. In the case of each sale, the agent of the company and the purchaser joined in an affidavit to the irrigation district setting forth the sale price.

An additional 5,000 acres in the Gem and Black Canyon irrigation districts on the Owyhee project were excess land owned by the State of Idaho. The State sold its land under its usual procedure of advertisement and auction to the highest bidder. Some of these lands were sold for as high as $25 per acre, by contrast with the procedure on the other lands. The Secretary ruled that a purchaser of State land within the Gem or Black Canyon irrigation districts might obtain a water right upon the execution of a separate contract with the United States which required the application to construction charges of one-half of any increment in price above the Secretary's appraised price from the sale of these lands to a second owner. Purchasers of State lands all executed these separate contracts.

Deschutes Project

On the Deschutes project, Oregon, there were excess lands in the Jefferson water conservancy district. Recordable contracts for 98 percent of this excess land have been obtained—and approximately 40 percent has been disposed of at appraised prices varying from $23 for Class 1 land to $20 for Class 3 land. Irrigation is just starting on this project, which is getting off to a good beginning.

Minidoka Project

On the Minidoka project, Idaho, recordable contracts were obtained for 100 percent of the excess land in the American Falls Reservoir district No. 2, and to date 6,738 acres, or 94 percent, has been disposed of at an average appraised price of between $25 and $30 per acre, depending on the class of land.

Columbia Basin Project

On the Columbia Basin-Grand Coulee Dam project, Washington, 4,659 recordable contracts have been signed by owners of 988,950 acres of land on this, the largest Reclamation project. This represents 79.3 percent of the entire acreage and more than two-thirds of the 6,748 owners of the project. The average appraised value for land on this project is $10.54 per acre. Irrigation cannot begin for several years, since large canals are yet to be completed. In general, there has been understanding and support for the acreage limitation and anti-speculation provisions of the law on this project.

The present law works. The speculation controls of the Omnibus Adjustment Act of 1926 have functioned successfully on later projects and have prevented speculation. Other examples could be given.

Land Prices and Repayment Ability

In determining the economic feasibility of proposed projects, a determination is required of the ability of farmers on the lands to repay all or parts of the costs of construction that are allocated to irrigation. A number of budgetary studies for various types and sizes of farms which either exist now or will exist on the various projects have, therefore, been made. These studies take into account all factors which enter into returns from agricultural production and the legitimate costs of securing that production, including family living costs. They usually arrive at an amount designated in Reclamation parlance as the "Return to Water," which is indicative of the farmer's ability to pay for construction out of his farm activity. This is usually expressed in both per-farm and per-acre ability to repay construction costs.

Consideration is given in such analyses to the farmer's capital investment in land and irrigation structures, and a cost item of 5 percent is usually set up as interest on this land investment. This is one of the items which must be deducted from gross income before the amount available for construction charges can be determined.

Now it is clear that if the farmer's investment in land increases, the total interest payable annually on that investment will also increase, and because of this increased cost the repayment ability of the farmer will decline, assuming that all other factors remain stable. It is possible, therefore, to determine, through the ratio of interest on land to the amount available for construction payments, the point at which an increase in land values will completely absorb the farmer's ability to repay the Government.

Studies have shown that even a 70- and 80-percent rise in the price of land would increase interest payments on farms on the Frenchman-Cambridge Unit of the Missouri Basin project in Nebraska and on the Ogden River project in Utah to a point at which the ability of the farmers to pay for irrigation construction would be wiped out.

For example, the total interest payments at 5 percent on a 99-acre general farm on

(Continued on page 186)

Percent increase of values of unimproved land by 1913, and proportion of unpaid construction charges by 1923 on certain reclamation projects.

Project	Percent increase in value of unimproved land by 1913	Percent construction charges due and unpaid by 1923
Shoshone	5,000	23.7
Okanogan	2,100	29.0
Belle Fourche	775	36.2
North Platte	700	27.8
Yuma	291	36.3
Minidoka	1,525	10.1
Umatilla	900	12.3
Huntley	350	8.2
Sun River	75	12.3
Carlsbad	170	8.3
Newlands	108	1.5
Klamath	300	5.1

Does BEEKEEPING *Have a Part in RECLAMATION PLANNING?*

by Jas. I. Hambleton

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture

This heap of pollen (approximately 50 pounds) was gathered by a single colony of honeybees during the pollination of a variety of flowering plants. The pollen trap shown in the photo detaches the two pellets of pollen from the hind legs of the bees as they enter the hive. It is fed back to them during periods of brood rearing and inclement weather.

Department of Agriculture photos

The beekeeper examines hives for sealed honey combs. Honeybees, which are essential for the pollination of some of our indispensable fruit and seed crops also provide the only source of honey. With honeybees assuming a primary role in pollination, honey may some day be considered a by-product of the apiary.

A reclamation project involves such extensive planning and such tremendous undertakings in changing vast areas unfit for growing crops into highly productive agricultural tracts that it might seem incongruous to mention beekeeping as having any possible connection. From a monetary standpoint the production of honey and beeswax is a small part of any agricultural undertaking.

In any given area in its natural state there unquestionably exists a fairly good balance between the pollinating insects, or those that use nectar and pollen as food, and the flowering plants that produce nectar and pollen, many of which in turn require the visitation of insects for the production of seed and fruit. Any alterations in the land will doubtless affect both factors—that is, the numbers and species of plants as well as the pollinating insects that are indigenous to the area.

Most of our native pollinating insects, such as bumble bees and the solitary bees—*Megachile*, *Nomia*, *Osmia*, and others—either nest in the ground or build close to the ground in hollow stems and similar places. Almost every agricultural practice that is in vogue today has an adverse effect upon these useful insects. Plowing and cultivating the soil, irrigation practices, the use of insecticides and weed killers, burning brush, removal of wood lots, planting huge acreages to single crops—all contribute to their destruction. In fact, there is ample evidence that their numbers are steadily decreasing throughout the United States where agriculture is carried on in an intensive manner.

Although no adequate surveys have been made of the prevalence or of the number of species of indigenous pollinating insects before and after an area has been reclaimed for agricultural purposes, the remaking of an area is sure to bring about profound changes in the insect populations. Even though insects capable of effecting pollination once inhabited the area, a complete readjustment of their means of survival and propagation to meet the new ecological surroundings becomes necessary. Granting that many crops are dependent on insect pollination, a fact not fully appreciated, are we going to leave to the slow changes of time the matter of readjustment in the new area until there are enough insects to insure adequate seed and fruit production?

The native pollinating insects, unlike the honeybees, do not store food for periods of drought or adversity. Since they do not store food, a succession of bloom is necessary for them to complete their life cycles. What happens, therefore, when 500 acres of new land are sown to alfalfa? The 500 acres at one time perhaps carried a mixed flora, which supplied pollen and nectar over a long period through successive bloom. Such flora is destroyed when the land is sown to alfalfa. Moreover, it is only on the alfalfa that is left for a seed crop that the insects have an opportunity to make their living. Although 500 acres of a crop plant which secretes nectar abundantly and furnishes ample pollen would enable the bees to live well for a short time, a single species usually does not adequately meet their food requirements. It is doubtful whether the insects in the immediate vicinity, even if their nests have not been destroyed, can muster sufficient numerical strength to trip and cross-pollinate adequately, during a 2-weeks' period, the millions of alfalfa blossoms with which they are confronted. Yet hundreds of farmers attempt to produce alfalfa seed, for example, without providing for pollination. Would it not be just as logical to rely on nature to control weeds and insect pests and to fertilize the soil?

Little is known about the life history and flying habits of most of the native pollinating insects—not enough to provide a basis for making recommendations for their conservation and propagation. Man is left, therefore, with only one species of insect that he can move into an area for pollination purposes. This insect is the honeybee, which strangely is not native to this hemisphere.

Many of our agricultural crops are completely dependent on nectar and pollen-gathering insects. Foremost of these are alfalfa and the clovers—red, alsike, white, and ladino, as well as sweet clover. Then there are important vegetables, the seed production of which requires pollinating insects. Among these can be mentioned onion, carrot, cabbage, brussel sprouts, cauliflower and other species of Brassica, and the family of cucurbits, including melons, cucumbers, pumpkins, and squash. Many of the small fruits require insect pollination. The same is true of most of our deciduous orchard fruits. Altogether about 50 crops benefit from the activities of those insects whose existence requires season-long availability of nectar and pollen.

It would be folly to sow a crop without preparing the seedbed and without making certain that the right growth elements exist in the soil and that proper moisture conditions prevail. Measures must be taken to control injurious insects and plant diseases; yet pollination, which is essential for so many crops, has been generally left to chance. Today we readily see the results of this neglect. Through a period of many years there has been a steady decline in the per-acre seed production of our principal legumes. Unquestionably one of the reasons why many seed and fruit growers are not producing maximum crops is the lack of sufficient insects to bring about flower fertilization.

In an area newly developed for agricultural purposes the need to supply pollinating insects must be even greater than in one that has been long established, where commercial beekeeping has gotten a foothold, and thus made available millions of pollinating insects to supplement the rapidly disappearing native insects.

Although from a monetary standpoint beekeeping does not rank high among agricultural pursuits, there is little doubt that the services of bees to agriculture in seed and fruit production are worth many times the value of the crop of honey and beeswax. Beekeeping can thus be thought of as an agricultural catalyst, without which maximum seed and fruit production is not possible. Should beekeeping not have a place in reclamation planning, even if it has to be fostered on an artificial basis for a few years until the honeybees can pay for their keep in honey and pending the possible establishment of native pollinators in numbers to insure good crops?

NEXT MONTH—Officials of the Bureau of Reclamation answer Mr. Hambleton's question, with actual facts and figures regarding beekeeping in the reclamation area.

Holing Through in 1909

(*Continued from page 174*)

hard-bitten muleskinners drove six-horse teams down the mountain over a road that dropped 2,000 feet in 4 miles with horses and wagons practically skidding down grades as steep as 25 percent. Drivers had to manipulate the lines and wagon brakes with considerable agility to avoid mishaps.

The tunnel was holed through in 1909 although it was not until approximately a year later that enlargement work and the lining of some sections was completed. Since delivery of water was begun, the tunnel has served the farmers of the Valley regularly and faithfully without a major shut-down during an irrigation season.

Problems of a Project Manager

(*Continued from page 175*)

of filmy moss that are forked out in spongy piles near headgates and bridges. The evaporation from surface water in the hot sun cuts down the amount that finally reaches the thirsty fields. Demands for water and more water increase as the crops grow heavy and stretch up toward the harvest.

The project manager relies at this time more than ever on the office crew to carry on while he drives the canal banks, chats with farmers briefly, and keeps his eyes on the general trend of water conditions and the crops. Foremen and ditchriders, repair crew, and extras are using all of their skill and ability and experience to get the water to the farmers, for this is the peak of the water season. Not the least of the project manager's attributes is the tact that he is sometimes required to use in handling farmers and farmers' wives, who, in spite of everything, feel that they are not getting their just proportion of water.

There is a legend in the Boise Valley of a woman farmer with a rugged disposition who contended mightily with her neighbor over a stream of water. The neighbor contended just as mightily in return. Regularly as the water was turned down the lateral and the headgate was raised, the lady arrived with a shovel in her hand and slammed down the headgate. Hot conferences, punctuated with loud arguments, wild threats, and dire maledictions accomplished little. The ditchrider, always anxious to avoid trouble, was called in and used all the reasoning he could muster.

Finally an injunction was issued against her, and when the papers were served she promptly sat down in the lateral, being of a build that would obstruct the law as well as the free flow of water. Only the finesse and adroit strategy of the manager who arrived shortly and saw the humor in the situation persuaded the lady to arise and conciliate. Many such issues are met and peacefully settled. Some have in them the elements which might lead to actual bloodshed.

As the season advances, the crops mature and the need for water lessens. Though the haystacks that dot the still green fields of September are not the actual possession of the man who runs the canal, yet he feels that he has had a part in their abundance. Though the vast potato acreages are not his own, his pride is unbounded as the smooth tubers roll down the belt of the digger and the sacks bulge with their fatness.

By the time the last truck of sugar beets roars up to the railroad siding and is unloaded, the manager is out on a final inspection tour of the system with his foreman, looking for evidence of the summer's wear and tear on the canal and lateral, planning again the work of the coming spring.

For the project manager, his life is wrapped up in water, and for the farmer, water means growth and life.

Tucumcari's Champions

The inside story of the many obstacles met and surmounted by progressive pioneers in their long fight for an irrigation project at Tucumcari, N. Mex.

by John P. Woodward
Chief of the Project Activities Section, Region V, Amarillo, Tex.

Photo by D. B. Parker, Region V

Henry R. Priddy, Tucumcari businessman, farmer and civic leader, president of the Arch Hurley conservancy district.

Photo by Dale Hovey, Region V

Arch Hurley whose efforts helped make Tucumcari's long-sought irrigation development possible.

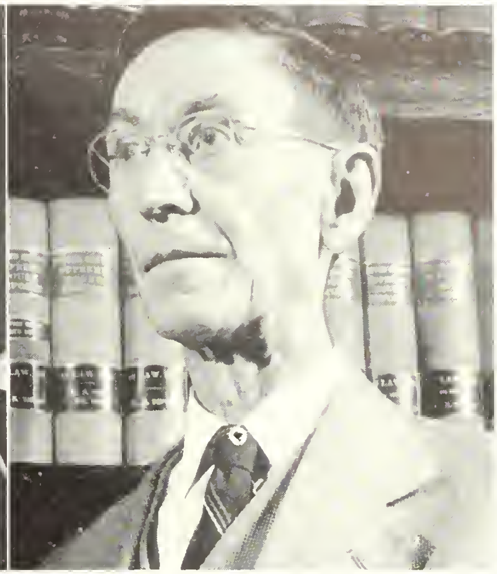


Photo by D. B. Parker, Region V

Royal A. Prentice, who worked for 40 years to convert 45,000 acres into productive cropland.

In northeastern New Mexico, where the rolling foothills of the Rocky Mountains diffuse into flat prairie, 45,000 acres of dusty grazing land are being converted into cultivated fields by the time-tested practices of irrigation. The irrigated acreage is being developed by the Bureau of Reclamation near the fast-growing city of Tucumcari, whose population, approximately 10,000, has doubled in the past six years.

Tucumcari derives its name from an ancient Indian legend involving two lovers, Tocom and Kari. In conflict with a tribesman over the affection of Kari, Tocom was slain. Heartbroken over the loss of her lover, Kari leaped to her death from an escarpment in the vicinity, now known as Tucumcari Mountain.

Tocom and Kari were members of the semi-civilized Pueblo tribes who settled in the upper reaches of the Canadian River. Pueblo ruins in the vicinity show evidence of Indian culture dating back to a period from 1000 to 1200 A. D.

The home-building, farming Pueblos were driven back toward the Rio Grande by marauding bands of nomad Indians, then living on the plains to the east, who stole the Pueblo women and children and destroyed the crops stored by the farmers. In turn, the Plains Indians were driven out by the early Spanish settlers who repaired and extended the irrigation systems built by the Pueblos. All of these developments along the Canadian and its tributaries were destroyed by floods, but faint traces remain of the many miles of irrigation ditches which were built by the Spaniards and the Indians.

It was a long time before the Anglo-Americans displayed as much faith in the country as their predecessors had shown.

People began trickling into the area as early as 1832. After the Civil War came the days of the huge land grabs in the Southwest and the cattlemen moved in. The idea of farming this semi-arid region was buried under an obsession for obtaining more and more land on which to graze herds of cattle which were rapidly increasing in size during the late nineteenth and early twentieth centuries.

At the turn of the century homesteaders had tried farming in the Tucumcari area but by 1910 most of these, failing to make a success of dry-land farming, had disposed of their interests to the livestock men. But a small group near Logan on Ute creek, a tributary of the Canadian, clung to their holdings. They realized that this would be a wonderful country if water were available when needed. The idea of irrigation was germinating.

The man who was chiefly responsible for the revival of irrigation interest in the Tucumcari area after several hundred years of dormancy is Royal A. Prentice. An alert, bird-like man, whose sharp eyes and brisk movements belie his 72 years, Prentice practices law from his Tucumcari residence when he is not otherwise occupied, usually with some Boy Scout enterprise or civic development program.

Prentice was born in New York State at the time that Horace Greeley was at the height of his popularity. His parents may have been influenced by the teachings of the great journalist and statesman to "go west." At any rate, in 1879 Prentice was in Las Vegas, N. Mex.

The Spanish-American War found an eager volunteer in Royal Prentice, who was mustered into service at Santa Fe and joined Teddy Roosevelt's Rough Riders. He is one of three known veterans of that famous unit still living in New Mexico. From 1904 to 1908 he was employed by the Old El Paso-Northeastern Railway Co., leaving in 1908 to go to Tucumcari as Register of the United States Land Office.

It was in this capacity that Prentice first became interested in the possibilities of irrigation. In the Land Office he had access to records of the Red River Company and noted that a dam had been built on the Bell Ranch. Inquiry proved discouraging, as the Bell manager stated that the dam had been washed out a few days after it was built. However, settlers on Pajarito Creek and Ute Creek, both Canadian tributaries, were interested and in 1910 had formed the Interstate Land and Development Company and employed John H. Marks, a civil engineer, to make preliminary surveys.

Ralph J. Freeland, a Ute Creek resident, was particularly interested and in 1911,

Photo by Ray Reynolds, Region V

Directors of the Arch Hurley conservancy district, Murel Starr, U. S. Devor, G. A. Eager, Arch Hurley, Earl George, Ben Munoz, H. R. Priddy, Mrs. Irene Kearns, and James L. Briscoe.

W. B. Freeman, another civil engineer, was brought in to make a survey on both Ute Creek and Pajarito Creek. Freeman's extensive report covered a plan to irrigate 30,000 acres in the vicinity of Tucumcari. The project looked good, but there was the big problem of obtaining funds.

An important event in the development of the Tucumcari irrigation project occurred in 1918 when Gen. George W. Goethals, who had gained fame in construction of the Panama Canal, came to Santa Fe. Al Renehan, a Santa Fe attorney, knew General Goethals and interested him in the Canadian river development. Prentice was notified, went to Santa Fe and returned with General Goethals. After inspection of a stretch of the river, Goethals offered an opinion that a site on the Canadian just below its confluence with the Conchas river appeared best suited for a dam. He selected almost the exact location of the present Conchas dam, which created the Conchas Reservoir, source of water supply for the Tucumcari project.

John Morrow of Raton was New Mexico's representative in the National Congress in 1920 and his constituents in the upper Canadian Valley solicited his support for the project. A party including Prentice, Sisney and M. B. Goldenberg took Morrow on an inspection tour of the Canadian and when Morrow returned to Washington he immediately went to work to interest the Army Engineers in an investigation. This same year, 1920 brought support from interests in other States following serious floods on the Canadian and Arkansas rivers. The 1924 Flood Control bill included surveys for the Cimarron and Canadian rivers. On May 23, 1924, after the bill had been passed by the Senate, Morrow wrote: "The first step is completed. It is now up to us to cooperate with Oklahoma for flood control."

Ralph J. Freeland, who had worked for the development of irrigation along Ute Creek shortly after the turn of the century, had maintained a keen interest, and in the early 1920's became the leader of the plan for a project near Tucumcari. In 1923 the New Mexico Land and Development Company was formed with R. A. Prentice as the first statutory agent. One of the most important developments under Freeland's supervision was organization of the Canadian Valley Development Association in 1925.

The Association was formed to foster flood control and irrigation through storage of waters of the Canadian and its tributaries. An interstate compact was sought between New Mexico, Oklahoma, Texas and Arkansas. In the meantime, E. E. Blake of Oklahoma City was instrumental in the organization of an Arkansas River Control Commission.

Two other Tucumcari men, who had long been identified with progressive development of the area, actively entered the fight for an irrigation project in the 1920's. Freeland's right-hand-man was James L. Briscoe, an attorney and pioneer settler of the territory who unselfishly devoted much of his time, the greater portion without pay, to activities of the Canadian Valley Development Association.

The other notable addition to the fight was H. B. Jones, a banker who came to New Mexico from Michigan in 1910. He lent financial stability to the movement and played an important part in the increasingly frequent drives for funds to carry on the work.

Freeland, Jones and Briscoe in 1925 were appointed by the Governor of New Mexico as permanent Commissioners for the Canadian River Project in New Mexico. In this capacity they made frequent trips to points in New Mexico and neighboring states. Irrigation became secondary to flood control as support for the latter phase grew in Kansas, Arkansas, Oklahoma, Texas, and Louisiana. At an interstate meeting at Little Rock, Ark., in January 1926, it was stated that the practical place to control floods was in the Mountain States near the source, and the lower States would support such a plan. Freeland, Jones and Briscoe returned from the interstate meeting and immediately started work on the formation of a Tri-State compact.

Freeland died in the saddle. Beginning in 1922, he had devoted most of his time and a considerable amount of money to promoting the development of the upper Canadian basin. He became ill in Santa Fe while working for his project and died in March 1927, not knowing that the Tri-State pact for which he was plugging had been approved by the legislature.

Following the death of Freeland, Judge Briscoe and banker Jones continued the crusade. But a man was needed to carry the battle to the Federal Government.

Arch Hurley was selected for the job. The choice proved an excellent one. Hurley cleared almost unsurmountable obstacles in the succeeding years and carried on the fight when many a less courageous standard bearer would have surrendered.

Briscoe had asked that Hurley be included along with Jones in a delegation to attend a National Drainage Congress at Amarillo in April 1927. Hurley proved an able representative and was appointed by Governor Dillon of New Mexico as the State's representative to the Flood Control Conference held in Chicago during June 1927. At the conference he was elected to the executive committee.

Hurley's position was strengthened through appointment to two organizations resulting from the Flood Control meeting—the important Mississippi Flood Control Association and the Arkansas Basin Committee. The former represented 31 Mississippi Basin States, and the latter the 7 Arkansas Basin States (Arkansas, New Mexico, Colorado, Kansas, Texas, Oklahoma, and Missouri).

Passage of the Flood Control Bill of 1928 was threatened with a veto but Hurley was able to convince President Coolidge that $325,000,000 was necessary for the work and the bill was signed.

An investigation and survey of the Arkansas River and its tributaries was included in the River and Harbor Act of January 21, 1927, and the Mississippi River Flood Control Act approved May 15, 1928. Certain studies to be made on the Canadian were included.

A preliminary examination of the Canadian River and its tributaries in New Mexico was authorized by an act approved February 12, 1929. This was carried out by the Corps of Engineers, War Department, which on April 24, 1930, reported unfavorably on a flood control project, stating that "no further survey of the Canadian, with a view to the control of its floods, is advisable at this time."

This temporary setback served only to stimulate Hurley to greater efforts. One of the reasons for dropping the project given

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Shoshone's "*Irrigation Institute*"

Veterans of World War II, settling on the Heart Mountain reclamation project, don't have to go to school to learn to make a success of irrigation farming. Under the G. I. Bill of Rights, the school comes to them.

by John K. Black

Settlement Specialist, Shoshone Reclamation Project, Powell, Wyoming, Region VI

Photo by C. I. Conaway, Region VI

John K. Black, settlement specialist (left) and Lloyd J. Klingle, engineer in charge of predevelopment on Shoshone, show Forest J. Neville lay-out of land openings.

"If I had only known!" is the plaintive cry of many a reclamation farmer as he looks back upon his first years of living "under the ditch."

Experience is still the best teacher, but when a man and his family are alone with a new type of farm, far from neighbors or counselors, this best of teachers often turns out to be mighty expensive.

After more than forty years of reclamation experience, plus the great strides recently taken in the art of agriculture, it appears about time to discard the old trial and error methods and take advantage of the accumulated experiences of irrigation farmers.

On the Heart Mountain Division of the Shoshone Reclamation project in northwestern Wyoming, settlement specialists are seeking to do that very thing, with the help of the "G. I. bill of rights." Reclamation personnel who are assisting settlers in getting started on their new farms have made it a part of their job to consider all phases of the G. I. bill to determine where it could be put to use in furthering successful settlement of the project.

They found that one feature of the G. I. bill provides for veterans' training in agriculture. A veteran may either sign up for training with an experienced farm operator as his instructor for on-the-farm training, or he may take advantage of institutional training through a public school system. In the latter case, the veteran selects the phase of agriculture which he wants to study, and a suitable course is designed and supervised by the vocational agricultural section of the school.

At Heart Mountain, veteran settlers are situated about twelve miles from the nearest vocational agricultural department. As they can't take time out from their rigorous first year of irrigation farming to travel the distance from homestead to class room and shop, the school is being brought to them.

So far, the program is in the planning stage. In making the plans, all existing training facilities in the area have been rounded up. Various agricultural agencies in Park County, the Wyoming State Department of Education, and the Veterans' Administration are working together to make a success of the program which will help the soldier-turned-farmer to make a success of his farm.

A United States Department of Agriculture Council was already functioning in Park County when the program was first discussed, and it was determined that this council should act as the agricultural training committee. The council was given responsibility for initiating the program and advising the State Department of Education, and the Veterans' Administration of the plan's progress. The USDA council, in addition to the agencies of the Department of Agriculture, includes other agencies working on agriculture, such as the Bureau of Reclamation and local vocational agricultural instructors.

The Wyoming State Department of Education has been given the responsibility for hiring instructors and approving the course of training for each veteran. At the present time qualified instructors are difficult to obtain. Representatives of the State Department of Education have been keenly interested, however, in getting the program under way and are determined to find instructors who can teach farm management right out on the farms in a way that will most definitely benefit the veterans.

The Veterans' Administration must certify each veteran for training and satisfy itself that the veteran is eligible for subsistence payments of $65 per month to single veterans and $90 per month to those with dependents. Representatives of the Veterans' Administration have been extremely desirous to get their end of the job under way and have expressed the belief that this type of training is definitely in keeping with the spirit and interest of the G. I. bill. In order to qualify for training the veteran must make application at the nearest Veterans' Administration Office. He must present a copy of his service discharge so that the period of training for which he is eligible can be determined. After he is certified as being eligible for training, the State Department of Education is notified and it then becomes its responsibility to provide instruction. This will be accomplished either through vocational agricultural departments of nearby high schools or by hiring full-time instructors. The latter method is planned for Heart Mountain, and instructors will spend their full time with the group assigned to them. To date 28 veterans on the Heart Mountain Division have made application to the Veterans' Administration for training. These applications are being processed as rapidly as possible. It is planned that two groups of from 12 to 20 veterans will be organized soon; each group to have a full-time instructor.

The school districts or other sponsoring agencies are to be reimbursed by the Veterans' Administration which finances the

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Land Speculation

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the Frenchman-Cambridge unit, worth at present \$93 an acre, would amount to \$461.50 a year. Analysis shows that on a farm of this type there would be available a maximum of \$359 a year for repayment of construction charges. An increase of land values to \$167 per acre, or 77.7 percent, on this farm would destroy all of its estimated repayment ability.

The value of the Reclamation law to landowners in terms of benefits from interest-free money and subsidies from power and municipal water revenues is not thoroughly understood even by those who live right on the Reclamation farms. All too frequently it is forgotten that the costs of the irrigation works, if they had to be privately financed at even $2\frac{1}{2}$ percent for a period of 40 or 50 years, would be almost twice as great as they are under Federal Reclamation law. Again, on many projects the landowners are required to repay only a fraction of the construction costs allocated to irrigation. This may be in some instances as low as a fourth of these costs—the balance, or three-fourths, being repayed to the Federal Government by reason of power and municipal water revenues received from the operation of the project. These savings to landowners, which under private development they would have to pay, result in water costs of only a fraction of what they would be under private development. Lower costs mean greater net returns to farmers. Greater returns from the land mean greater land values. It is these increased land values derived from Federal aid which the antispeculation features of the law have kept the speculators from grabbing.

To jog the memory of those who may have forgotten, after a score of years of operation under the present satisfactory law, here is a statement by Senator Carl Hayden of Arizona (then a member of the House) during the hearings of the Committee on Irrigation and Reclamation on the Fact Finding Bill (H. R. 8836 and H. R. 9611) during May 1924. At that time the United States had had 22 years of reclamation experience.

It has been the history of every project up to this date (1924) that somebody realizes when a land boom is coming and buys land as cheaply as it can be obtained. He does not intend to cultivate it and does not cultivate it, but waits until about the time the water is supplied, and then he can paint a beautiful picture, the water is going to be provided, and the desert is going to blossom and bloom like a rose, and he sells it. And who comes on? The actual farmer to whom the United States must look for a return, and we have had around this table year after year the water users complaining that they could not meet their charges and that the Government was a harsh creditor. They never realized it, but when we came to analyze their private finances we invariably found that they owed \$4 to somebody else for every dollar they owed to the United States.

You ask one of those men, "What is your financial situation," and he will tell you, "I came into the project when it was about to be opened, and I paid \$200 an acre for irrigable land, and that was about the price for land at that time, and I paid \$50 down and have a mortgage for \$150 more at 8 percent."

His construction charge may be \$50 or \$60 an acre on which he has no interest to pay, and the principal spread out over 20 years, and it does not amount to but about one-fifth of his debt or his immediate obligations, yet he is asking to be relieved from that while he cannot get any relief from the man to whom he gave the mortgage and to whom he paid this fancy price for the land.

Year after year the settlers, who were the people for whom the projects had been built and who were the victims of the speculators, besieged the Congress seeking relief from their construction charges. Representatives and Senators have been spared that since 1926.

In summarizing, our experience with land speculation on the early projects shows that it produced land-boom prices 759 percent above actual values; it led to widespread delinquency in payment of construction charges on project after project, and it bankrupted settlers, but fattened speculators. The antispeculation provisions incorporated in the law of 1926 have effectively curbed speculation on projects begun since then.

Australia's Rural Reconstruction Commission in its Eighth Report (1945) on *Irrigation, Water Conservation and Land Drainage* to the Minister for Post-War Reconstruction stated:

The Commission makes the following recommendations. . . .

(*a*) That attention be paid to determining the most equitable allocation of the capital costs of any irrigation work between the State and the water-users.

(*b*) That without penalizing existing landowners, steps be taken to prevent them from making capital profits out of a rise in land values consequent on irrigation proposals and plans.

Shoshone's Irrigation Institute

(Continued from page 185)

entire program, for expenditures incurred because of the Veterans' Training Program.

Instruction will consist of three parts:

(1) The instructor will visit the trainee on his farm at regular intervals for a minimum of 100 hours per year for the purpose of providing instruction in management and operation of the farm.

(2) The trainee will receive 200 hours per year of organized off-farm related instruction in the class room, shop or laboratory. This instruction will be given by the instructor who visits the veteran on his farm.

(3) Instruction in the form of trainee improvement assignments will be made which will include all phases in the operation of the farm.

At Heart Mountain it is planned that emphasis will be placed on planning the irrigation system and laying it out on the farm. In the shop, irrigation structures can be fabricated using lumber salvaged from buildings formerly used by Japanese evacuees who lived at the War Relocation Authority camp located on the project during the war. Many of the settlers have never operated irrigated farms before and will require individual assistance. It is felt that on-the-job visits by the instructor will be invaluable to the new settler in making the adjustments necessary on the irrigated farm.

One purpose accomplished by planning for the Veterans' Training Program is the fact that it has brought together all agencies concerned with agriculture on a common program. It has assisted in the establishment of a cooperative relationship between Bureau of Reclamation officials, USDA agencies, the Veterans' Administration, and the State Department of Education.

This one-purpose program—the joint efforts of settlers, Government agencies and local institutions—offers the opportunity of materially improving the prospects of the veteran homesteaders in developing successful farm homes.

Tucumcari's Champions

(Continued from page 181)

by the Corps in its adverse report was the small amount of damage resulting from floods. Hurley and a group of interested persons toured the entire length of the Canadian gathering data on flood damage. Hurley continued his frequent trips to Washington where he received invaluable assistance from the New Mexico Congressional delegation. Senators Carl A. Hatch and Dennis Chavez and Representative John J. Dempsey worked faithfully in behalf of the project.

In 1934 an Arkansas Basin Committee was created by Secretary of the Interior Harold L. Ickes to make a complete investigation of the watersheds of the Arkansas River. Hurley was appointed a member of this committee by the late President Franklin D. Roosevelt. This proved an opportunity to keep the Conchas Dam proposal in the picture, and gain valuable support for the project.

The construction of the dam by the Corps of Engineers was approved by President Roosevelt on July 29, 1935, under the Emergency Relief Appropriation Act. It was adopted by Congress in the Flood Control Act of June 22, 1936, to provide flood control, irrigation and municipal water supply benefits. An Engineer District of the War Department was established at Tucumcari August 1, 1935. Excavation operations were begun December 20, 1935. Construction was completed in 1939.

Meanwhile, Hurley was at work on the Tucumcari irrigation project. A reconnaissance survey was made by the Bureau of Reclamation in March 1936. Authorization for a detailed investigation was made in July 1936 and surveys were started in October of that year.

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NEWS ROUND-UP

Veterans' Preference Revised

When the President signed H. R. 603 on May 31, 1947, the Veterans' Preference Act of 1944 was amended to grant preference to honorably discharged veterans who were in the military or naval forces of the United States for a period of at least ninety days at any time on or after September 16, 1940, and prior to the termination of the present war for homestead entry on public lands. Previously only those who were in the armed services on or after December 8, 1941, for a period of at least 90 days held this privilege. It also permits a spouse, either husband or wife, to take over the veteran preference benefits in case of death of the qualified veteran. In the event of marriage of the surviving spouse, the preference is carried over to the surviving children of the deceased qualified veteran.

Commissioner Authorized To Award Top Value Contracts

When Commissioner Straus recently awarded the $5,888,000 contract for construction of the 2½-mile Delta-Mendota Intake Canal, including the Tracy Pumping Plant and discharge lines for the Central Valley project in California, it marked the first contract award by a Reclamation Commissioner in excess of $500,000 in the Bureau's history.

Under Secretary Krug's new delegation of authority the Commissioner is authorized to award contracts without limitations as to the amount involved for construction equipment and supplies, and services. Heretofore the amount of a contract that could be awarded by the Commissioner without specific delegation of authority by the Secretary of the Interior was limited to $500,000.

The Delta-Mendota Canal is one of a system of canals in the Central Valley project which constitutes the major irrigation feature of the project. The system will provide irrigation for new lands as well as supplement the water supply to inadequately watered lands which combined are in excess of 2,000,000 acres. The pumping plant near Tracy, also covered in the contract, will lift water from the Delta-Mendota Intake Canal to a height of 200 feet and send it flowing for a distance of 120 miles, through the Delta-Mendota Canal, along the west side of the San Joaquin Valley. Six large electrically-operated pumps for the plant are now being fabricated under a contract awarded last year.

Frenchman-Cambridge Repayment Contract Signed

Clyde Payne (left) President of the Frenchman-Cambridge Irrigation District, is shown signing the new repayment contract between his district and the United States during the recent Enders Dam Celebration. Shown with Payne are Secretary of the Interior J. A. Krug, and Don Thompson, Secretary-Treasurer of the Frenchman-Cambridge District. See NEW REPAYMENT PROPOSALS FOR THE MISSOURI RIVER BASIN, February 1947 ERA for contract details.

Climatic Trends in Irrigated Areas

Sumner P. Wing of the Branch of Design and Construction has tentatively concluded that irrigated areas have been getting hotter and drier the past 50 years as a result of a study he has been conducting on climate fluctuations.

He has collected long-time weather records on various parts of the world, including a graph of run-off variations of the Nile River during the past 13 centuries from engineers representing foreign governments who have visited the Bureau of Reclamation. While the apparent decrease in rainfall is not well established by hydrologists, Mr. Wing's study cites an abundance of evidence to support the increasing temperature.

San Diego Aqueduct Nearing Completion

Construction of the San Diego Aqueduct is expected to be completed in October according to the present schedule. This project was initiated in 1944 under the direction of Assistant Secretary of the Interior, William E. Warne, then Assistant Commissioner of Reclamation, who was appointed Chairman of the Committee to study the problem, by the late President Franklin D. Roosevelt.

The aqueduct is designed to relieve a critical municipal water shortage in the San Diego area. Bureau personnel played a large part in assisting in the investigations, and in preparing the plans, specifications, and estimates for the project which is being constructed by the Navy Department.

As Australia Sees It

In the recent edition of Australia's Handbook on Testing Soils, the Bureau of Reclamation is featured on the opening page, as follows: "The procedures used, with the exception of the direct tear sheet test, are based on those adopted by the American Society for Testing Materials, Harvard University, and the United States Bureau of Reclamation."

Attention Visitors From Abroad

If you are planning to include a visit to a Reclamation Project in your itinerary during your stay in the United States, we suggest that you first go to the American Embassy, Legation, or Consulate in your country and discuss your plans. By doing this, a direct clearance may be expedited for you, thus saving you considerable time during your travels.

ITA Suspends Operation

At a recent meeting of the Board of Directors of the International Training Administration, Inc., it was voted to suspend operatitons of the institution.

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Landownership Survey on Federal Reclamation Projects.*—Available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

2. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals*, by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939. 7-page mimeographed study with graphs.

Available from the Superintendent of Documents, Washington 25, D. C.

1. *High-Pressure Reservoir Outlets*, by J. M. Gaylord and J. L. Savage—a report (1923) on Bureau installations compiled from correspondence, project histories, feature reports, technical papers, special reports prepared for this purpose, and from personal inspection of the installations described. Obtainable from the Superintendent of Documents.

2. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

3. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest release is: Standards and Levels of Living, studies by the Department of Agriculture for Problem 9—20 cents.

Problem 14, Financial Aid for Settlers—25 cents.

Problem 23, Rural and Village Electrification—25 cents.

Problem 24, Agricultural Processing Industries—30 cents.

Problem 26, Recreational Development of Roosevelt Lake—75 cents.

4. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

5. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

Engineering Publications

Available on Loan from the Design and Construction Technical Library, Bureau of Reclamation, Customhouse, Denver, Colo.

Building Code Requirements for New Dwelling Construction, Report No. BMS-107, by U. S. Department of Commerce. For sale by Superintendent of Documents, $0.20.

In this publication the National Housing Agency, with the cooperation of the National Bureau of Standards, has recorded its views on what constitutes reasonable building code requirements for dwellings. These requirements have as their base a number of standards that have been developed by representative committees. Where specialized experience in the housing field has made it seem advisable to make additions, modifications, or exceptions to these basic standards, this has been done. The aim has been to provide sound construction without excessive cost and with adequate provision for recognizing new developments in the building field as they occur. Farmers should find this code useful in determining minimum insurance requirements for building. It contains good standards for plumbing.

Recent translations by the Technical Library:

A Contribution to the Chemical Investigation and Treatment of Clay Soils, by K. Endell, from "Bautechnik," 1935, Vol. 13, No. 18.

Electro-Chemical Method of Increasing Bearing Power of Pile Foundations in Clayey Soils, by L. Erlenbach, from "Bautechnik," 1936, Vol. 14, No. 19.

Soils Consolidation by the Electro-Chemical Method, by Leo Casagrande, from "Bautechnik," 1939, Vol. 17, No. 16.

Large Scale Test to Increase the Carrying Capacity of Floating Pile Foundations by Electro-Chemical Treatment, by Leo Casagrande, from "Bautechnik," 1937, Vol. 15, No. 1.

Miscellaneous Publications

Agriculture and Peace, by Clinton P. Anderson, Secretary of Agriculture, in *The Western Farm Life (1947) Annual Livestock Review*), page 10. Illustrated. Secretary Anderson concludes, "We recognize the interdependence of the agriculture of the West with the agriculture of all other regions of this country, and we are beginning to realize the interdependence of our own agriculture with that of the whole world." For information write to *The Western Farm Life*, Denver, Colo.

Tucumcari's Champions

(*Continued from page 186*)

The Secretary of the Interior was authorized to construct a Federal Reclamation project for the irrigation of lands in the Arch Hurley Conservancy District by the act of August 2, 1937 (50 Stat. 557). This act was later amended by the act of April 9, 1938 (52 Stat. 211).

The big hurdle had been made, but events proved there was a lot of work yet to be done. There was no provision under the laws of the State of New Mexico whereby a conservancy district could enter into a contract with the Government. Hurley went to Washington and got help in preparing a bill authorizing contractual relationship between the conservancy district and the United States. Hurley returned with the bill and submitted it to the Fourteenth New Mexico Legislature, which passed it in the early spring of 1939.

The first Conservancy District Board was comprised of H. B. Jones, J. W. Bullington, Arch Hurley, G. A. Eager, and U. S. Devor. David S. Bonem was named secretary. Hurley, Eager and Devor are still members. H. R. Priddy is now president, Ben Munoz, secretary-treasurer, and Earl George is a director. James L. Briscoe is the attorney for the district.

Bids for the construction of the first 20 miles of canal were opened November 16, 1939. Satisfactory bids were obtained on all schedules and contracts awarded. It appeared as though the dreams of early settlers were becoming a reality, but delays were still ahead. In December 1942, work was suspended by order of the War Production Board on many western reclamation projects including Tucumcari.

Through the efforts of Hurley and Senator Hatch it was reopened as a war foods project.

Construction was resumed after a delay of 18 months and, late in 1945, water was first delivered to the project. In 1946 crops were irrigated on 2,526 acres. By the close of 1947 the Bureau is scheduled to have facilities completed for the irrigation of approximately 22,000 acres, with about 6,000 acres actually receiving water for 1947 crops.

It was a hard fight won by the tenacious efforts of men with faith and vision, many of whom did not live to see the realization of their dreams. It would be impossible to name all who contributed in one way or another. In addition to those already mentioned there were O. S. Greaser, H. K. Grubbs, L. D. Stith, Lee G. Person, Leon Sands, the McFarland brothers, C. B. Hamilton, E. J. Corn, O. B. Erskine, and perhaps a score of others. Names like Prentice, Freeland, Jones, Briscoe, Hurley, and these others should be long remembered by those who will reap the benefits of the Tucumcari Irrigation project.

NOTES FOR CONTRACTORS

Contracts Awarded During June 1947

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
1729	Shoshone-Heart Mountain, Wyo.	June 2	Electrical equipment for Heart Mountain switchyard and Garland substation, schedules 2, 3, 4.	General Elec. Co., Denver, Colo.	$38,281.84
1745	Colorado-Big Thompson, Colorado.	June 11	3 vertical-shaft 6,600 volt synchronous motors for Granby pumping plant.	....do	376,210.00
1751	Davis Dam, Ariz.-Nev.	June 13	5 45,000/56,250/60,000 kva transformers for Davis power plant.	....do	1,081,300.00
1762	....do	June 30	Electrical equipment for Phoenix and Tucson substations, schedules 2, 3, 9.	....do	274,308.00
1768	Rio Grande, N. Mex.-Tex.	June 20	Electrical equipment for Socorro substation schedule 1.	Westinghouse Elec. Corporation, Denver, Colo.	47,439.00
1769	Missouri Basin-Kortes, Wyo.	June 30	Electrical equipment for Kortes switchyard, schedule 1.	Pacific Elec. Mfg. Corporation, San Francisco, Calif.	105,710.00
1769	....do	June 17	Electrical equipment for Kortes switchyard, schedule 2.	Southern States Equipment Corporation, Hampton, Ga.	32,946.32
1772	Missouri Basin-Frenchman-Cambridge, Nebr.	June 5	1 84-inch diameter welded-plate-steel outlet pipe for Enders Dam.	Thompson Pipe & Steel Co., Denver, Colo.	26,073.00
1774	Columbia Basin, Wash.	June 16	Electrical equipment for units L1, L2, L3, L5, L6 Grand Coulee power plant, schedule 1.	General Elec. Co., Denver, Colo.	22,500.00
1777	Gila-Yuma Mesa, Ariz.	June 11	6 pumping units for relift pumping plants at A and B Canals and laterals.	Crane-O'Fallon Co., Denver, Colo.	14,878.00
1779	Davis Dam, Ariz.-Nev.	June 4	10 turbine draft-tube pier noses for Davis power plant.	Columbia Steel Co., San Francisco, Calif.	34,530.00
1780	Columbia Basin, Wash.	June 11	Preparation concrete aggregates at Potholes deposit, schedule 1.	J. G. Shotwell, St. John, Wash.	83,450.00
1781	Central Valley, Calif.	June 2	Steel partitions for Shasta power plant	George T. Gerhardt Co., San Francisco, Calif.	18,087.00
1787	Columbia Basin, Wash.	June 30	Construction 13.8 kilovolt transmission line	Agutter Elec. Co., Seattle, Wash.	74,322.80
1810	Central Valley, Calif.	June 23	Construction Delta-Mendota Intake Canal and Tracy pumping plant and discharge lines.	Stolte, Inc., United Concrete Pipe Corp., Ralph A. Bell, Duncanson-Harrelson Co., Oakland, Calif.	5,838,695.00
1813	Provo River, Utah	June 30	Construction pipe line, tunnels, and structures, Salt Lake Aqueduct, schedule 2.	United Concrete Pipe Corp., Baldwin Park, Calif.	1,620,884.00
1816	Colorado-Big Thompson, Colo.	June 30	Excavation and concrete lining for tunnels 2, 3, 4, 5, Horsetooth Feeder Canal	Tunnel Constructors, Denver, Colo.	1,838,352.75
1817	Central Valley, Calif.	June 30	Preparation concrete aggregates at Friant deposit, Friant-Kern Canal.	George Pollock Co., Sacramento, Calif.	191,550.00
1824	....do	June 30	Six 22,500 hp vertical-shaft synchronous motors for Delta-Mendota pumping plant.	Allis-Chalmers Mfg. Co., Denver, Colo.	1,710,000.00
1825	Colorado-Big Thompson, Colo.	June 30	Construction Olympus Dam	David G. Gordon and Bressi and Bevanda Constructors, Inc., Denver, Colo.	1,375,479.00
1830	Central Valley, Calif.	June 30	Two-50,000 kva condensers and starting autotransformers for Delta substation.	General Elec. Co., Denver, Colo.	692,800.00
1835	Columbia Basin, Wash.	June 30	Electrical equipment, Grand Coulee power plant	General Elec. Co., Denver, Colo.	17,717.00
1836	Minidoka, Idaho	June 27	Electrical equipment for Burley and Rupert substations, schedules 1, 2.	General Elec. Co., Denver, Colo.	55,110.33
1836	....do	June 27	Electrical equipment for Burley and Rupert substations, schedule 3.	Allis-Chalmers Mfg. Co., Denver, Colo.	62,210.00

Construction and Supplies for Which Bids Will be Requested During August 1947

Estimated date bids to be invited	Project	Description of work or material
Aug. 1	Boulder Canyon, Nev.	Supplemental water supply pipe line for Boulder City.
Aug. 1	Central Valley, Calif.	Construction of Delta-Contra Costa-Clayton and Ygnacio 69 kilovolt transmission lines, including 39 miles of single wood pole, and 9 miles of 2.3 kilovolt underbuild.
Aug. 1	Davis Dam, Ariz.-Nev.	Construction of 83 miles of 230 kilovolt transmission lines from Davis Dam to Parker Dam. Steel structures and towers.
Aug. 1	....do	Construction of 25 miles of miscellaneous transmission lines, 34.5 kilovolt, wood poles, Yuma-Arizona area.
Aug. 1	....do	Draft tube bulkhead gates for Davis Dam.
Aug. 1	....do	23-ton gantry crane for Davis Dam.
Aug. 1	....do	Motor driven air compressors, after cooler and air receivers for Davis power plant.
Aug. 1	Missouri Basin-Frenchman-Cambridge, Nebr.	60-inch hollow jet valve for Enders Dam.
Aug. 1	Missouri Basin-Kortes, Wyo.	Water supply piping and gallery drain piping for Kortes Dam.
Aug. 1	Provo River, Utah	Siphons and pump discharge lines for Jordan Narrows pumping plant.
Aug. 1	....do	18-inch and 30-inch butterfly valves for Jordan Narrows siphons.
Aug. 1	Shoshone, Wyo.	Construction of 4 miles of laterals and 25 miles of sublaterals for irrigation of 10,000 acres.
Aug. 3	Missouri Basin-Boysen, Wyo.	Turbines and governors for Boysen power plant.
Aug. 5	Davis Dam, Nev.-Ariz.	Construction of five 22 ft. diameter welded, plate steel penstocks for Davis Dam and power plant.
Aug. 10	Columbia Basin, Wash.	Motor driven air compressors, after cooler and air receivers for Grand Coulee power plant.
Aug. 11	Missouri Basin-Frenchman-Cambridge, Nebr.	Construction of earthwork and structures for 12.5 miles of Cambridge Canal.
Aug. 15	Boise, Idaho	Construction of Willow Creek 41 cfs. concrete pumping plant and appurtenant structures near Middleton, Idaho.
Aug. 15	Central Valley, Calif.	15-ton warehouse crane for Tracy pumping plant.
Aug. 15	Colorado-Big Thompson, Colorado	75-ton crane for Estes power plant.
Aug. 15	....do	50-ton crane for Marys Lake power plant.
Aug. 15	....do	Construction of Loveland-Greeley 115-kilovolt transmission line (30 miles).
Aug. 15	....do	Installation of overhead ground wire, Brush-Sterling 115-kilovolt transmission line (35 miles).
Aug. 15	Columbia Basin, Wash.	De-icing motor-generator sets for Grand Coulee power plant.
Aug. 15	Davis Dam, Ariz.-Nev.	Construction of 30 miles of 115-kilovolt transmission line from Coolidge Dam to substation ED5 near Eloy, Arizona; wood poles, overhead ground wires.
Aug. 15	....do	Stilling well piping for Davis Dam.
Aug. 15	Missouri Basin-Angostura, S. Dak.	Stilling well piping for Angostura Dam.
Aug. 15	....do	50- by 30-foot radial gates and embedded anchorages for Angostura Dam.
Aug. 15	Missouri Basin-Kortes, Wyo.	Stilling well piping for Kortes Dam.
Aug. 15	....do	Crane for Kortes Dam.
Aug. 15	....do	Generator protective equipment and power cables for Kortes power plant.
Aug. 15	Missouri Basin-Savage Pumping Unit, Mont.	Construction of 12 cfs. pumping plant, canals, and laterals on Yellowstone River near Savage, Montana.
Aug. 15	Missouri Basin, Nebr.-Colo.	Construction of Sterling-Sidney 115-kilovolt transmission line (40 miles).
Aug. 20	Davis Dam, Ariz.-Nev.	Oil circuit breakers for Coolidge substation.
Aug. 20	....do	Oil circuit breakers for Blythe substation.
Aug. 20	....do	Transformers and oil circuit breakers for Prescott substation.
Aug. 20	....do	Unit type substation for ED 2 substation.
Aug. 20	....do	Unit type substation for ED 4 substation.
Aug. 20	....do	Unit type substation and oil circuit breakers for ED 5 substation.
Aug. 20	....do	Unit type substation and oil circuit breakers for Maricopa substation.
Aug. 20	Fort Peck Power, Mont.	Transformers, lightning arresters, oil circuit breakers, fuses, disconnecting switches, instrument transformers, for the Circle substation.
Aug. 20	....do	Transformers, oil circuit breakers, disconnecting switches, lightning arresters, fuses, instrument transformers, for the Wolf Point substation.
Aug. 29	Central Valley, Calif.	Excavation, concrete footings, and gravel surfacing, Keswick Switchyard at Keswick Dam.

Photo by William S. Russell, Region III

Ancient But Active

Around the farm of R. A. (Pete) West in the Muddy River Valley of Southern Nevada are tractors, trucks, and all the modern paraphernalia necessary for irrigation farming, but the water from the Muddy River which makes his irrigated acres rich with growth is delivered by a device which reaches back to the dawn of history—a water wheel. This 38-foot water wheel, creaking on its wooden bearings, lifts water 30 feet for distribution on the West fields. The Bureau of Reclamation is conducting an investigation to determine the feasibility of a project which will give the farmers of the Muddy River Valley a more stable water supply for irrigation.

U. S. GOVERNMENT PRINTING OFFICE: 1947

EPTEMBER 1947

Featuring:

Builders of a Nation
by
Asst. Commissioner
KENNETH MARKWELL

prinkler Irrigation in the Willamette Valley
by K. W. Sawyer

iver-Size Canal
by
Wafford Conrad

THE *Reclamation* ERA

Engineer Jackson Looks Back

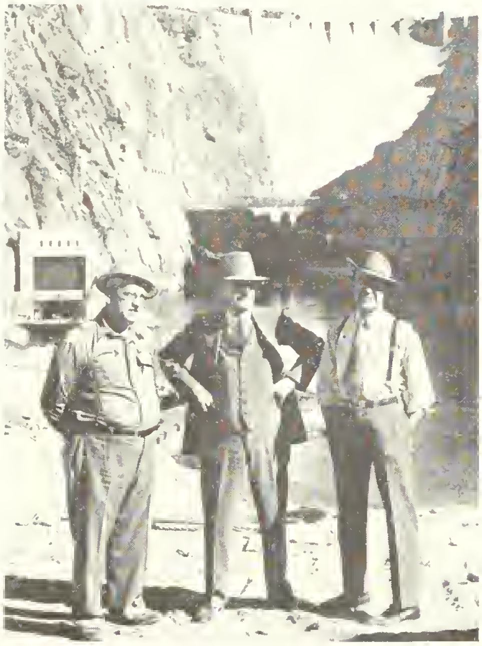

Photo by Wm. S. Russell, Region III

Engineer Jackson (left) talks it over with two of the original crew, Walker R. Young (center) and Tom O'Neil (right).

"There's not much more than a foot or two of this ground I haven't covered and mapped . . . from Boulder Canyon to a few miles below the damsite," reminisced Engineer C. M. (Jack) Jackson as we stood at the turn of the road leading to Hoover Dam power plant and looked over the surrounding tumble of rocky canyons.

"It was in 1922 that I first came out to this section on survey work for the Bureau of Reclamation, and now, 25 years later, all that's left of my job here is to have that pile of old lumber over there cleared away." Jack grinned to belie the sentimental sound of the words, but his eyes showed a proud satisfaction.

"Those days in the early twenties were pretty rugged. The heat and the wind and the sand fought a mighty battle for superiority and almost won. The practically naked bodies of the crew were raw from the wind whipping sand into flesh already tender from the sun. The cook's helper never set the table until after the mess call and even then the men had to wipe the sand off their plates before eating. Nights were stifling. The men dipped their sheets in the river and rolled themselves into the wet sheets for some relief. A couple of young rookies from the East were told that with the rapid evaporation in the desert there was danger of their bodies freezing in the wet sheets . . . but the joke didn't last many nights."

For the past 3 years Mr. Jackson has been construction engineer for the Government in charge of river channel and tunnel improvement at the Boulder Canyon project. Now this job has been completed and he will take his talents elsewhere, leaving a work which has been his prime interest for most of the past quarter of a century.

As he was supervising some of the clean-up work on the job, I learned that he comes from Maine and noticed he retains a "Down East" accent, although his appearance is more typical of the land of his adoption.

A large man, Jack's thatch of white hair is in colorful contrast to his bronzed features, and his blue eyes encompass the horizon in the way of sailors and engineers. Having received his World War I discharge in San Diego, ex-Marine Jackson decided that his first glimpse of the West held

(Continued on next page)

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Ruth F. Sadler, Editor

Our Front Cover

Dave Frost, irrigating a section of his 40 acres of alfalfa on his farm near Meridian, Idaho, beats the forces of gravity with the aid of a portable canvas dam. When water goes downhill too fast to do any good, Frost merely locates his damsite, and drops his canvas diversion dam into the lateral until the water is high enough to permit diversion to his fields. This photo was taken by Philip Merritt of Region I, Boise, Idaho.

Letters to the Editor

Hudson Bay Customers Only

CRESTON, BRITISH COLUMBIA,
CANADA, MARCH 27, 1947.

DEAR EDITOR: In your March issue under "Miscellaneous Publications—Foreign Entries" you noted an article from the London, England "Engineering" emphasizing that navigation of the Columbia River to its mouth is reserved under the Oregon Treaty of 1846 to British subjects.

I quote hereunder the clause in the treaty which refers to this—

"From the point at which the 49th parallel of north latitude shall be found to intersect the great northern branch of the Columbia River, the navigation of the said branch shall be free and open to the Hudson's Bay Co., and to all British subjects trading with the same, to the point where the said branch meets the main stream of the Columbia, and thence down the said main stream to the ocean, with free access into and through the said river or rivers; it being understood, that all the usual portages along the line thus described, shall in like manner be free and open.

"In navigating the said river or rivers, British subjects with their goods and produce, shall be treated on the same footing as citizens of the United States; it being, however, always understood that nothing in this article shall be construed as preventing, or intended to prevent, the Government of the United States from making any regulations respecting the navigation of the said river or rivers, not inconsistent with the present treaty."

You will note from the foregoing that this right of navigation is limited to those British subjects trading with the Hudson's Bay Co. as well as to the company's own servants.

Yours truly,

GUY CONSTABLE,
President, Kootenay Valley Associated Drainage Districts.

¶Many thanks to reader Constable for his interesting historical commentary on the rights possessed by British subjects to navigate the Columbia River.—Ed.

Interest Abroad Continues

BRNO 19, *June 1947.*

GENTLEMEN: I have subscribed to RECLAMATION ERA for a year and I have received the numbers from May 1946 to April 1947, with exception of the June number, which has not reached me.

To complete your worthy magazine I beg you to send me the missing number of June 1946.

The subscription of $1.50 for the next year of the RECLAMATION ERA beginning with the number May 1947 I shall send you in a short time through my son:

Jan Bazant, Jojutla 55, Mexico, D. F.

Yours very truly,

JAN BAZANT
Professor Techn. College,
Brno, Veveri 95, Czechoslovakia.

Engineer Jackson

(Continued from preceding page)

enough attraction for him to make his working career in this part of the country.

After his survey job for the Bureau on the Colorado River, in 1922, he transferred to the Umatilla Rapids in Oregon, working on the location of the canal. The following year, 1924–25, was spent with the Forest Service, his only break in service with the Bureau. Back again to reclamation, he worked in Berkeley, Calif., and Ellensburg, Wash. The years from 1929 to 1935 found him on preliminary work and construction at Hoover Dam, after which he transferred to the All-American Canal at Yuma, Ariz., until 1938. Next came Shasta Dam at Redding, Calif., where he spent 6 years before returning to the Boulder Canyon project.

Flipping his cigarette over the parapet and shielding his eyes from the glare of the desert sun on the face of the dam, Jack murmured with feeling, "There may be mightier and bigger dams built, but she's the baby that'll show 'em how!

"In 1929 I came out here again on preliminary work which was being supervised by 'Brig' Young (Chief Engineer Walker R. Young). I have good reason to remember the famous incident about finding diamonds in the canyon. As a matter of fact, I was working on the shift that found the diamond drill bit, looking exactly the same as it did the day it was lost, and none the worse for its ten-year bath. (Editor's note: see July *Reclamation Era*, p. 162.)

"In 1930 the site of the early construction camp 'Rag Town' was picked out and in 1931 the first contract of the Boulder Canyon project was let . . . the building of a road between the new campsite and the damsite. I was resident engineer on this contract and occupied one of the first twelve houses built in Boulder City by the Bureau for its employees. Dave Armstrong is the only other employee now here who moved into the first of those houses."

We walked back to the car to drive through the vehicular tunnel which makes it possible to get equipment and supplies to the power plant without using the 150-ton carriage which swings from the high line hundreds of feet above the power plant.

I was surprised to find the tunnel nearly a half mile long and to learn that there are approximately 90 tunnels honeycombing the dam and its abutments, one of which runs under the dam through the original rock.

Our time growing short, we started back to Boulder City along the road familiar to all those who have visited the dam. Snatches of conversation from Jack gave me a series of pictures not so familiar . . . of the bighorn mountain sheep which could be seen in the cool of the evening in the early days . . . of the old mine which a prospector had worked as far back as 1880 . . . of the burro trail to the river . . . of the silver and copper strain believed to be in the hills through which the road ran . . . of the hill in Sullivan's Gulch where the Indians mined turquoise . . . of the pure alum to be found in the hills . . . and the tracks of one of the busiest railroads in the country from 1930 to 1935 during the construction of the dam.

I saw the achievement of Hoover Dam in the comparatively short years from the time Jack had worked with a small crew in the hills, with not so much at 50 feet of rope to start operations, to the present magnificent structure.

Tom O'Neil, who is on the janitorial staff of the Bureau, and Jack are the only remaining members of that early group still employed by the project. Tom was a cook for the first crews, and according to Jack, "a darn good cook at that."

The bronze tablet, which stands at the entrance of the Arizona elevator tower commemorating the original field staff, lists the name of C. M. Jackson, the last engineer left of that staff in the Boulder Canyon project. With his departure, Boulder City will be minus a colorful personality, but he leaves many traces of his sojourn there—enduring marks of engineering skill on the structure of which he is so proud—Hoover Dam.

ANCIENT WATER CODES

—by Charles E. Cone,

Research Assistant, Columbia Basin Commission

Hammurabi, sixth king of the First Dynasty of Babylon, reigned for 55 years about 2250 B. C. His elaborate code of laws dealing with many angles of human relations included some water laws which are significant in our present plans for the use and control of rivers.

Hammurabi gave men and beasts first rights to water. Water for household use was second. Irrigation was third; navigation, fourth.

Hammurabi also decreed the penalties for wasting water to the damage of a neighbor's crops or property. Paragraphs 53–56 from *The Code of Hammurabi* read as follows:

"If a man neglect to strengthen his dyke and do not strengthen it, and a break be made in his dyke and the water carry away the farm land, the man in whose dyke the break has been made shall restore the grain which he has damaged.

"If he be not able to restore the grain, they shall sell him and his goods, and the farmers whose grain the water has carried away shall share (the results of the sale).

"If a man open his canal for irrigation and neglect it and the water carry away an adjacent field, he shall measure out grain on the basis of the adjacent fields.

"If a man open up the water and the water carry away the improvements of an adjacent field, he shall measure out 10 GUR of grain per GAN."

About 2000 B. C. Queen Semiramis, an Assyrian ruler, extended her reclamation activities to Egypt as indicated by the proclamation on her tomb:

"I constrained the mighty river to flow according to my will and led its waters to fertilize lands that had before been barren and without inhabitants."

Perhaps some of our modern statesmen could achieve political immortality by earning the right to make a similar proclamation.

—by Fanny R. Connolly,

Region III, Boulder Canyon Project Boulder City, Nev.

The author is compensation clerk with the Bureau of Reclamation, in the safety office of the Boulder Canyon project in Boulder City, Nev. She worked 2 years for the "Detroit Times" and spent 10 years as personal secretary to Walter P. Chrysler. Coming West with her family because of the health of her daughter, she received her first appointment in Government work in 1945, being reports officer at Poston, Ariz., a W. R. A. Japanese relocation camp. After the liquidation of that center, she was transferred to the Boulder Canyon project. Her duties include the publishing of an 18-page mimeographed monthly magazine, the "Safety News," for which this article was originally written. She was born July 18, 1905, in Brooklyn, N. Y., and now lives at 1333 Denver Street, Boulder City, Nev., with her husband and two children.

Builders of a Nation

Photo by Stanley Rasmussen, Region 1

The chatter of jackhammers—prelude to Cascade Dam, Idaho

There is a common bond between the Bureau of Reclamation and the workmen of America. For without the skilled help of the men operating the bulldozers and draglines and the men on the factory production lines, such magnificent structures as Hoover, Shasta, and Coulee Dams would have remained blueprints on engineering drafting boards.

by KENNETH MARKWELL,
Assistant Commissioner.

The following article is based on an address prepared by Mr. Markwell and presented by Glenn D. Thompson, chief personnel officer of the Bureau of Reclamation, before the American Federation of Labor Council, on Tuesday, July 8, in Washington, D. C.

Approximately 100 of our projects now constructed or being built in the 17 western States, where water is the measure of prosperity, represent the combined efforts of men in the Middlewest, the North, the East, West, and the South. Although these irrigation and multiple-purpose projects are located in the West, their construction creates job opportunities from Maine to California.

For every man on the construction site there are several helpers thousands of miles away. The off-site workers produce the materials needed for building. They manufacture such basic products as iron and steel, cement, electrical equipment and supplies, foundry and machine shop products too numerous to list. Much of this work is done in the 31 States outside of the 17 irrigation States of the West.

These supplies from their beginnings as raw materials, their transportation to the factory for fabrication, their processing, and again their transportation to the place where they are used, require thousands of man-hours of labor in mines, forests and factories, and in transportation, distribution, and administration.

The start of one of our projects in Arizona, or California, the State of Washington, or in one of the other States where Reclamation since 1902 has been responsible for water conservation and use, sets up a chain of employment that produces economic reactions across the continent.

Cross-Country Combine

We can visit almost any part of the United States and find workers turning out materials for dam, canal, and power-plant construction. To cite only a few examples we find men in New York State making cranes; perhaps for placing concrete blocks in a dam now rising from a western river bed. In Baltimore, Md., as well as in Alabama and Indiana, they are fabricating high-pressure gates and valves to operate irrigation distribution systems. Workmen in the New England States are producing assorted electrical equipment which will travel far before it is put to use for the first time.

Generators come from Milwaukee. Then in Virginia they make hydraulic turbines. Ohio and Indiana supply road machinery and draglines. The mines of Colorado, Ohio, and Pennsylvania turn out coal, and the Mesabi Range of Minnesota produces the iron for building many Reclamation structures in the West. The South yields cotton for making tarpaulin and miles of wire braiding. Lumber also comes from the South as well as from Washington State and Oregon. Subcontracts for special castings are filled in the Southeast, and orders for iron and steel fabrication are delivered by the Middle Atlantic States.

Thus workmen from every part of America contribute their part to the construction of great irrigation and power projects that are laying the foundations in fertile river basins for the increasing security of the Nation.

Completion of Reclamation projects does not mean the end of employment opportunities. Rather it is just the beginning. For there are jobs on new irrigated farms—farms where veterans are anxious to settle and rear their families—there are new openings for business and professional people in communities serving these rural homes—doctors, lawyers, dentists, school teachers, home-town merchants—all of these are needed with the growth of Western population. There are jobs in food processing plants and in other industries in towns that thrive with the development of low-cost power.

What of the rest of the country? Here, too, employment increases even after Reclamation projects are completed. The farmer can buy what he needs with money from his crops—and he makes good money—last year, farmers on 5 million acres of land irrigated by Reclamation-served projects produced 12 million tons of food and fiber crops worth a half billion dollars. This amount for 1 years' crops, incidentally, is far greater than the cost of irrigation facilities serving the lands.

What happens to Western dollars? Many of these silver cartwheels roll eastward where they are exchanged for tractors and refrigerators and other farming and household equipment. This is a reciprocal type of prosperity that helps America. It is an example of one part of the Nation bulwarking the other parts and the whole benefiting by the solidarity of the structure.

I do not mean to imply that we are in the business of creating jobs. Employment opportunities are a result rather than a reason for Reclamation construction. Our job is to see that the Western farmer gets water to grow crops. The primary purpose of the Bureau of Reclamation is the conservation of water and land resources to turn nonproductive lands into wealth-producing, tax-bearing communities and self-supporting farms for veterans and others. Because of its long-range view, our program is an economic stabilizer instead of a stop gap for a possible depression period.

In addition to supplying irrigation water, hydroelectric power, flood control, navigation improvement, recreational benefits and other multiple purposes of a project, the results from Reclamation include not only good homes and jobs, but better nutrition for the Nation.

People in the East would be hard put for winter vegetables and fruits were it not for the shipments of lettuce, tomatoes, and citrus fruits from the winter gardens of the West. The supply of meat in the national market may rise and fall with the production of alfalfa hay and sugar beets on irrigated farm lands. Sugar beets not only yield large quantities of domestic sugar but their tops and pulp are valuable stock feed.

It is indeed a miracle that a part of the country which was once labeled as "The Great American Desert" is now one of our greatest food producing centers. Irrigation has wrought the change.

I have mentioned that irrigation is the first purpose of a Reclamation project. Power, a corollary development, has a special place in each of the Reclamation river basin designs, such as the Columbia, the Missouri, the Colorado. Power also has a

Photo by F. B. Pomeroy, Region I

Eastern product being unloaded at Grand Coulee Dam, where this water wheel from Newport News, Va., will drive the world's largest hydroelectric generator.

place in some 20 more major plans now in the blueprint stage. River power not only pumps water, lights homes, eases the drudgery of farm life, and spark-plugs industry, but in so doing it makes itself a very valuable financial asset to Uncle Sam. The sale of low-cost power pays all power construction costs and helps to pay irrigation costs of a project. This salability of power consequently lowers the cost of water to the irrigationist.

Sharing Dividends

Reclamation projects are not give-away propositions. Under the law, the cost of irrigation and power works—that is, the money advanced by the Federal Government through appropriations—must be repaid to the Treasury. Power rates are established so that the cost of the power development is returned to the Treasury with interest at 3 percent. Also irrigation costs that are beyond the repayment ability of the irrigation water user are returned from power revenues. Under our present laws, the interest paid for the Government money on the power investment may be applied to the irrigation cost if needed. This is right and proper because the indirect benefits to the Nation from the land made highly productive by irrigation far exceed the costs. Navigation and flood control features, of course, are not directly reimbursable to the Treasury.

In the East, it is hard to realize that there are parts of the country where rainfall is not plentiful or well-distributed throughout the crop-growing season. Without water-conservation projects, the natural resources of one-third of our country would remain undeveloped with a consequent loss of markets, of employment opportunities, and taxable wealth for the Nation.

Of the 750 million acres in the West, 21 million acres are now irrigated. Only about half of these irrigated acres have enough water. It is estimated that our western rivers and tributary streams can supply sufficient water to irrigate an additional 22 million new acres and to provide additional water for the 11 million acres now inadequately served.

Unfortunately, we will never be able to develop and irrigate more than 6 percent of the West because there isn't enough water to go around. It is a case of trying to make a fair apportionment so that more people will have a chance for prosperity. That is basic in the Reclamation creed—conservation and wise use of water for the benefit of the greatest number of people.

This policy of trying to serve the people also applies to power. So long as the Government sells hydroelectric energy over Federally built transmission lines to the consumer, there is the assurance of the little man getting the power he needs and at a very reasonable cost.

Forty-five years of Reclamation have proved the worth of building projects for the people. We have a good foundation for future building. We need everyone, especially the workmen of America, to help us roll forward.

More Money for Missouri Basin

When President Truman signed H. R. 4347 on July 31, the bill providing for supplemental appropriations during the fiscal year of 1948, an additional $6,400,000 was made available for Bureau of Reclamation construction in the Missouri Basin.

These funds will be used to step up construction on 2 dams now under way and to initiate early construction on 11 others. The 13 locations, and the amounts appropriated for work on each under the terms of the bill are as follows:

Bixby, S. Dak., $500,000; Bonny, Colo., $800,000; Boysen, Wyo., $700,000; Cannonball, N. Dak., $400,000; Cedar Bluff, Kans., $900,000; Culbertson, Nebr., $300,000; Enders, Nebr., $700,000; Heart River, N. Dak., $400,000 (for Heart Butte and Dickinson Dams); Keyhole, Wyo., $200,000; Moorehead, Mont., $900,000; Narrows, Colo., $300,000 and Shadehill, S. Dak., $300,000.

In his message to Congress requesting funds for flood control, President Truman said:

> Vast areas of the most productive sections of the Missouri and upper Mississippi River Valleys have been subjected to a series of the most destructive floods in our history. Measures for flood control should be integrated with plans for the use and conservation of water resources for other purposes. This will insure maximum control of floods at the least cost and will permit the full utilization of water resources in the development of this vast region.

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Sprinkler Irrigation in the Willamette Valley

Man-made rain is produced scientifically, on schedule, and according to specification in this section of Oregon.

by K. W. Sawyer, *Manager, Agricultural Department, Portland Chamber of Commerce*

Several weeks ago. Weather Bureau officials, with the aid of airplanes and "dry ice," created an artificial snow storm over an area a few miles east of Portland, Oreg. Farmers, with the aid of agricultural engineers and equipment manufacturers, have been creating artificial rain over Willamette Valley farms for the past 15 years. The man-made snow storm was purely a matter of experimentation. Man-made rain is no longer a matter of experimentation—it is an accomplished fact—practiced regularly on approximately 45,000 acres of Willamette Valley land.

Oregonians are referred to the Nation over as "Webfeet." This gives the impression of continual rain—an impression that is not entirely true. Annual precipitation averages about 40 inches throughout the Willamette Valley in western Oregon. The highest precipitation is recorded throughout the winter months. While spring and fall recordings are considerably lower, the maximum low is recorded during the summer. During the growing season, from May to October, there falls only about 9 inches of rain. In the months of June to September, there is only about 3 inches of rain. It is during these 3 dry months that farmers must turn on their artificial rain if they are to grow certain high-value, intensive crops, and if they are to get maximum yield and quality of some extensive crops.

The Bureau of Reclamation bulletin "Farmer's Irrigation Guide" devotes some 40 pages to an explanation of irrigation methods and practices most widely used on reclamation projects. These methods are: (*a*) corrugation or furrow, (*b*) border or strip, and (*c*) ridge or bed systems. The bulletin concludes by listing 8 sound rules to follow, including among others the rule: "Irrigate your crop, don't drown it. Control the water flow, don't leach or erode your soil." These methods of irrigation presuppose an adequate volume of water above the land to be irrigated, or in other words, an extensive canal system, and land reasonably level to permit surface irrigation.

Right where this bulletin stops is where sprinkler irrigation, as practiced in the Willamette Valley, starts. There are no canals to carry water to the land; the source is from streams, ponds, or wells, always below the level of the land to be irrigated. Often the volume of water is limited and the land is too uneven to permit economical leveling for surface irrigation. Advantages over surface irrigation may be listed as follows:

(1) More efficient use of water—saves one-half to two-thirds of the water otherwise necessary.

(2) Complete control of water at all times, eliminating leaching and erosion.

> The Bureau of Reclamation is analyzing the development of sprinkler and pipe irrigation and is now studying the types best suited to serve its projects in the western States.
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> On existing projects water may be pumped to the higher lands for pipe delivery, thus supplementing the supply to land served by gravity from open canals and laterals. Pipe irrigation may result in substantial savings from seepage. In addition, sprinkler irrigation can be used to irrigate lands within a farm that are impractical to irrigate by gravity from open canals and laterals, such as lands with a rolling terrain which may be irrigated by sprinklers without leveling the land and disturbing the topsoil.
>
> The Bureau will report on both portable and permanent pipe systems. Information will be collected on installation and operation costs, labor requirements for operation, pumping requirements, useful service life, application rates and water supply requirements for various soils and crops, sprinkler effects on soils and crops, water savings, evaporation losses, and lay-outs and operation data of successful systems.

(3) Uniform application of water over an entire field regardless of soil type or topography.

(4) No expensive leveling or grading.

(5) No ridges, rills, or ditches to farm over or around.

Proponents of sprinkler irrigation feel that its advantages will result in its wide use on reclamation projects—especially where water supply is limited and where soil type and topography make complete control necessary. Others will contend that power and equipment costs make it impractical. However, it is not the purpose of this article to argue the merits or demerits of either system.

A wide variety of field crops and fruits adapted to the temperate zone have been grown in the Willamette Valley for the past century. A stable and highly diversified agriculture has developed without irrigation. Why, then, should farmers expend money and labor to irrigate? Those 3 dry months, while being ideal to mature and harvest certain crops, make it impractical or impossible to grow other crops. Crops which could not be grown successfully are, for the most part, those which produce a high per acre return. Two in particular—ladino clover and improved grass pastures—have been badly needed by the dairy industry. This is where progress was made back in the early 1930's. It was at about that time that the Oregon State College became active in promoting sprinkler irrigation for pastures. It was also at about that time that equipment manufacturers started making improvements resulting in greater efficiency of pumps and entire systems. Latest improvements are light aluminum pipe with self-locking couplings, and sprinkler heads designed for the particular job.

According to latest estimates, there are approximately 60,000 acres of irrigated land in the Willamette Valley with three-

Sprinkler system in action. In the foreground—summer squash; center—land being readied for lettuce; background—cucumbers.

fourths, or 45,000 acres of the total, under sprinklers. Wartime scarcity of materials and labor brought the program to a virtual standstill. At the present time, equipment is coming into good supply and acreage is expanding rapidly. To predict a stopping point in this development would be pure speculation. However, there are certain factors which will have their effect on ultimate total acreage.

Plenty of Water

It has been estimated that water is available for upwards of 100,000 acres without benefit of storage or distribution facilities. Therefore, water supply is not an immediate limiting factor, except as it applies to a particular tract of land.

Approximately one-third of the total acreage is devoted to ladino clover and improved grass pastures; one-third to vegetable crops for processing; one-third to various specialty crops and extensive field crops.

The current outlook for dairy products seems to warrant any expansion that can reasonably be expected. Up to three cows per acre can be carried on good irrigated pasture. Production can be maintained at a high level throughout the pasture season. One cow for each 3 acres is about the limit without irrigation. Therefore, a substantial increase in irrigated pasture can be expected.

The one-third of the total acreage which is devoted to vegetable crops for processing is the basis for a multi-million-dollar food canning and freezing industry. Green beans, sweet corn, beets, and carrots, are the major crops in their order of importance. The volume of such products which can be absorbed by the market at fair prices seems to impose a limiting factor on expansion of acreage devoted to these crops.

As to the other one-third, devoted to specialty crops, fruit crops, nuts, and some extensive field crops, future development of sprinkler irrigation seems to become a matter of economics. With the possible exception of mint for oil and a few others, most crops in this group can be grown without irrigation. The amount and value of crop increase due to irrigation, weighed against its cost, will determine the extent of acreage increase.

Regardless of these factors, the rain makers, during 1947, will probably have their biggest year to date.

While sprinkler irrigation is way past the experimental stage, it is far from being standardized. In fact, it never can be standardized so that a farmer can go to his dealer, purchase and take home a system to install on his farm. Every installation must be tailored to fit the job. Volume of water available, acreage and kind of crop to be covered, total lift, and other factors must be carefully determined to do the "tailoring" job. The equipment manufacturer or distributor, electric-power companies, and county agricultural agent offices are all qualified, ready and willing to provide the essential technical help.

Individual Ownership

Each system is purchased, owned, and operated by the individual farmer—there being no district organization involved. No one can deny the fact that it is expensive to install such systems; but so is it expensive to build canals, level land, and lay out surface irrigation systems. Costs will range from $50 per acre for an ideal situation to as much as $100 or more—depending upon the factors involved and whether the farmer wants and can afford the very best type of installation. Therefore, a system to irrigate 30 acres might cost $1,500 to $3,000 or more. The crop to be irrigated will also have an effect on costs. A system which would prove satisfactory for pasture where it can be operated continuously throughout the season, might not be at all satisfactory for intensive vegetable crops where a larger volume of water is necessary so as to get over the field quickly.

A trip through the Willamette Valley during the coming summer will reveal local "showers" falling without a cloud in the sky; tons of water flowing up hill to be spread through whirling sprinklers; and crops, untouched by drought, yielding six times more than adjacent fields. Artificial rain no longer has to be "sold" to farmers of this area. It is an important factor in our highly diversified and rapidly expanding agricultural economy.

The author is indebted to R. M. Wade & Co., Portland, Oreg., for photographs and other material contributed for this article and to the Oregon State College Extension Service, Corvallis, Oreg.

Lack of Precipitation

A couple from the East were touring the West one summer.

Driving along the road in an irrigated district they noticed a farmer throwing buckets of water out of a barrel onto the roof of his house. They stopped and watched this unseemly procedure in amazement. Finally their curiosity got the best of them and they walked to the farmhouse.

"If you don't mind my asking," said the Easterner, "what the Sam Hill are you doing that for?"

"Well, stranger, I built this here house four years ago, and I'm just trying to find out if the roof leaks."

Reclamation's Construction Program

Irrigation water for 192,000 additional acres of Western farm lands and an increase of 574,000 kilowatts in hydropower capacity is the goal of the fiscal year 1948 Bureau of Reclamation work program, Commissioner of Reclamation Michael W. Straus announced after a 5-day programming conference of top-ranking Bureau officials at Salt Lake City. Secretary of the Interior J. A. Krug participated in the conference.

Nearly 50,000 acres of public lands are expected to be opened for settlement and other settlement opportunities will be available on privately owned lands.

Adjusted to appropriations recently made by the Congress, the 1948 construction schedule is the first leg on a Bureau of Reclamation program to push authorized projects to the point where by 1954 irrigation water can be supplied to 3,875,000 additional acres of land which constitute about 40,000 farms, and new capacity of 2,250,000 kilowatts of hydropower will be installed.

The Reclamation construction program in 17 Western States for the fiscal year ending June 30, 1948, amounting to $195,000,000, will operate on a "full speed ahead" schedule to use most efficiently the available funds, the Commissioner said.

Full-year construction is forecast on all but five major projects during the current fiscal year. The appropriations plus carry-over of 1947 funds on these—Columbia Basin and Yakima-Roza in Washington, Colorado-Big Thompson in Colorado, Davis Dam on the Arizona-Nevada border and Central Valley in California—will be insufficient to meet anticipated earnings by contractors for the full year on contracts already let, it was pointed out.

"The full prosecution of this program will require supplemental appropriations amounting to $36,000,000 early in the next session of the Congress, beginning in January," the Commissioner explained.

Any carry-over of funds into 1949 fiscal year will be due to certain projects where local conditions may make it uneconomical or impossible to carry construction forward.

Reclamation funds are appropriated to definite projects, it was explained, and they cannot be interchanged among the projects. This may create a situation of a deficiency of funds on some projects and carry-over on others, it was pointed out. Furthermore, allocations for specific projects or features of projects may be adjusted in order to conform with construction progress.

In conjunction with the 1948 construction program, 27 repayment contracts with irrigators are scheduled to be worked out. A major problem in programming the construction schedules was created by the limitation placed in the appropriation act on personnel engaged in design and specification work in the Denver engineering offices. This makes necessary delegation of certain design and specification functions to projects, with loss of time and additional expense. Another limitation on force account work, the Commissioner said, will sharply curtail activity in certain cases where the normal contracts cannot be readily used.

In the Missouri River Basin, in addition to dam construction, irrigation features will be continued under the regular appropriation act. In addition, $4,800,000 will be available to complete detailed investigations and preconstruction work to bring new units to the construction stage in the Basin. The Missouri Basin program also includes $2,600,000 for construction of transmission lines to deliver power to construction sites and to publicly owned power users in critical power areas.

The $195,000,000 program includes, in round figures, construction expenditures for the following major items:

REGION I (HEADQUARTERS, BOISE, IDAHO)

Idaho

ANDERSON RANCH DAM: $3,370,000; resume dam construction on full schedule to limit of funds.

BOISE PROJECT, PAYETTE DIVISION: $4,175,000; construction on Cascade Dam and clearing of reservoir site; canal and laterals construction.

LEWISTON ORCHARDS: $500,000; initiate and substantially complete reconstruction of existing irrigation system.

MINIDOKA: $500,000; construction on canal and laterals and establish farm units.

Idaho-Wyoming

PALISADES: $780,000; continue detailed investigation and development studies.

Montana

HUNGRY HORSE DAM: $2,900,000; start dam and reservoir construction; award turbine and generator contracts.

Oregon

DESCHUTES: $3,400,000; continue clearing Crane Prairie Reservoir site and construction of North Unit Division including Wickiup Reservoir; river channel improvement; complete canal and work on laterals. Emergency rehabilitation Arnold irrigation district siphon.

OWYHEE: $200,000; complete work on canal system.

Washington

YAKIMA: $3,050,000 (including supplemental appropriation needed); continue pump and lateral construction on Roza Division.

COLUMBIA BASIN: $32,000,000 (including supplemental appropriation needed); no new contracts, but continue on all existing contracts until funds are expended. Complete installation of three generating units in left powerhouse and work on auxiliary features such as the switchyard. Suspend work on main pumps and motors for irrigation system. Continue construction of Potholes Reservoir and the main canal system including Long Lake Reservoir.

REGION II (HEADQUARTERS, SACRAMENTO, CALIF.)

California

CENTRAL VALLEY: $40,380,000 (including supplemental appropriation needed) virtually complete installation of drum gates, penstocks, and two generators in Shasta Dam, and of gates and other appurtenances on Friant Dam; install two generators at Keswick Dam; virtually complete construction on Contra Costa, Clayton and Ygnacia Canals and expedite construction on the Delta-Mendota and Friant-Kern Canals including new contracts; construction Tracy pumping plant; construction of part of two transmission lines and start of work on a tapline.

KLAMATH: $1,680,000; complete Adams pumping and construction of canal and other irrigation facilities, and flood protective works. Open almost 10,000 acres to settlement.

REGION III (HEADQUARTERS, BOULDER CITY, NEV.)

Arizona

GILA: $2,190,000; complete contract on major construction of canal and laterals for Yuma-Mesa Division; predevelopment work on farm lands; initiate Welton-Mohawk Division preconstruction.

California

ALL-AMERICAN CANAL; IMPERIAL DIVISION: $340,000; repairs to dam and desilting works Coachella Division, $6,150,000; construction of main canal, as modified; start on distribution system in Coachella Valley and advance flood protective construction.

Arizona-California

PARKER DAM: $140,000; final minor construction on dam powerhouse and transmission plant to be completed.

Arizona-Nevada

BOULDER CANYON: $630,000; drilling, grouting and miscellaneous operations including drainage system.

DAVIS-DAM: $20,670,000 (including supplemental appropriation needed), reduced-scale construction of dam and transmission until available funds are exhausted.

REGION IV (HEADQUARTERS, SALT LAKE CITY, UTAH)

Colorado

MANCOS: $1,680,000; construction Jackson Gulch Dam.

PAONIA: $320,000; complete land classification; economic surveys; start Spring Creek Dam and reservoir construction; design work on canal system.

(Continued on page 208)

OWYHEE RESERVOIR

A practically nonexistent "road," a lack of camping facilities, and a rough terrain, only seem to add to the lure of this fisherman's paradise

by Lyle M. Nelson

Director of Information, Oregon State System of Higher Education

Photo by Stanley Rasmussen, Region I

Leslie Gulch empties into Owyhee Reservoir, 40 miles above the dam.

A band of wild horses scampered up the draw and out of sight over the canyon rim. In full view was the lake—a narrow body of water, hemmed in by steep canyon walls, smooth as glass one minute and choppy with white caps the next.

This was the famous Owyhee Reservoir, home of the fantastic bass which struck at almost anything which disturbed the tranquillity of their mountain fortress. This was the spot proclaimed by many fisherman as one of the best bass fishing areas in the Nation.

But what seemed of even more importance at the moment was the spectacular beauty of little-known and less-explored Leslie Gulch. Located in the famous Owyhee breaks region of southeastern Oregon—one of the few primitive areas still remaining in the Nation—Leslie is reached from the one-family town of Rockville, Oreg., by 22 miles of what, with some stretch of the imagination and an apathy to overstatement, might be called a road.

The "road" is not shown on highway maps. In omitting it, the map makers have done the public a favor. It is little more than a trail hacked out of sagebrush, around boulders too big to move, and up and down dogpatch-type "onnecessary" mountains. Its inaccessibility, however, has not kept its fame from spreading.

What tremendous values accrue to a region, from a recreational standpoint as well as directly, is well illustrated by reservoirs such as Owyhee.

In 1946, sportsmen estimated that they took at least 18,000 pounds of cooperative-type bass from the reservoir behind Owyhee Dam. This represented the limit for most of the fishermen who made their way into the area. In addition, several large catches of silver trout were made and limits of crappie virtually caught themselves.

Of equal importance to the sportsman who likes a fight when he hooks a bass, there were plenty of 5- to 7-pound "babies" to churn up the water before being taken. Silver trout, which usually stay in the cool, deep water near the dam, were even larger.

With construction of the dam, hunting in the area also has improved and a sizeable number of sportsmen from Oregon and Idaho now make it their fall headquarters for deer and antelope. In addition, ducks and geese are plentiful on the upper reaches of the reservoir.

A recent National Park Service report of the recreational advantages of the reservoir contains this significant statement: "Fishing is said to be phenomenal . . . because the fish have had an opportunity to adjust themselves to reservoir conditions without any appreciable hindrance from fishermen, they have multiplied until today the reservoir is probably one of the best fishing areas in the region."

The report continues: "It is the belief of fishermen that a great percentage of this resource is going to waste and that the sport actually would be improved if the waters were fished more."

Actually true! Such sportsmen as "Tex" Everhart, one of Idaho's most enthusiastic sportsmen, believe that fishing would be better if the lake were used more extensively. So much so that they are willing to share their secret and their good luck with additional fishermen, hoping in so doing that they will benefit the sport.

"Tex" swears to this story. He says that one day the lake was exceedingly rough and choppy, sending great waves over a shallow sandy beach. "That day we didn't even have to get out our tackle, we just grabbed the bass as they were flung onto the beach."

The fame of Owyhee has spread throughout the Nation. Its visitors last year included fishermen from California, Florida, New York, Missouri, and 2 dozen other States. This year a couple of businessmen are flying in from New York chiefly to fish its waters.

Having tested the fruits of this recreational gem, fishermen form a habit of returning. In the words of Mickie Freeman, an old-time bass fisherman from Missouri, "A large portion of my life has been spent in the middle and far-western States on fishing expeditions with bass as the great objective. In all my travels and fishing efforts, I have never found a place where bass fishing is as good as it is at Owyhee Reservoir."

"It has been my good fortune," Mr. Freeman continues, "to be at the right spot on that reservoir at the right time and using the right lure with the result that my boat has been weighted heavily with 4- to 6-pound large-mouths and my casting arm tired and sore. . . . Its full advantages will never be utilized until a satisfactory road is built so as to permit sportsmen to enter the reservoir about 40 to 50 miles above the dam. With such a road, I predict that Owyhee Reservoir will soon become the most popular bass fishing spot in the entire Northwest."

There is a fair road to the dam, but from there to the main fishing areas is too far for a day's trip by all but the largest boats.

To take care of the large number of boats being put in at the dam, Superintendent Dick Stockham in his spare time constructed a small hoist from odd parts salvaged after the structure was completed. The hoist has since been taken over and operated by a local boat club.

Stockham, whom sportsmen regard as a friend as well as helpful advisor, is himself an ardent fisherman. On more than one occasion he has come to the aid of a fisherman marooned or hard-put by an unseasonable storm.

The lake is a perfect habitat also for crappies, which are flat and stocky, resembling sunfish. These are so plentiful that fishermen often throw them back so that their limit might be expended in bass. During a single hour, one Sunday in May, 5 Bureau sportsmen caught 50 of the crappies along a stretch of shore not exceeding 100 yards in length. One of these fishermen caught a fish for each of 8 consecutive casts.

The need for a road to the middle or upper end of the reservoir is recognized by the Park Service. In its report, there is a recommendation for investigation of the possibility of establishing an overnight camping area in the vicinity of Leslie Gulch, and of building a road to this location.

Cliff-sheltered Camps

At present, fishermen usually camp out at the mouth of the small draw which leads into Leslie. There are no trees, but the camp is fairly well sheltered by steep cliffs.

When, and if, the road is finally built into Leslie Gulch, the sportsman will be able to bring his entire family for an outing. The remarkable scenery—tall, jagged peaks, unusual and varied formations sculptured out of multicolored rock and earth, caves and Indian writings—has been described as more beautiful than some of the national parks.

Leslie Gulch is an amazing spectacle of erosion, seen by relatively few. As one fisherman put it "All hades must of broken loose here at one time."

Among the impressive sights in the area are jagged pinnacles rising 300 to 400 feet above the canyon floor, and massive Gibraltar-like formations, in brilliant red, forming sheer walls along the reservoir's edge, a thousand feet high. A natural horse corral is formed by a side canyon, into which the bands of wild horses are driven for capture. Mahogany Creek is bordered by scattered junipers and mahogany trees. Lizards, colorful snakes, eagles, hawks, and other birds nest in the crevices of the weird formations. Giant "blow holes" are formed in rows of sharp, rocky sawtooths. Deep, cool caves are carved out of the mountainsides. Rolling hills of blue minerals, sharply accentuated with juts of bright red, and giant vari-colored boulders pockmarked with dozens of sharp openings, add to the spectacular wonders of the area.

For almost all of its entire length, Owyhee Reservoir is confined in a narrow winding gorge between the towering Owyhee Ridge on one side and such peaks as Burnt Mountain and Red Butte on the other. The bold shore line was made to order for camera experts.

It seems as if nature has done its best to hide this precious jewel, tucking it away between two commanding mountain ranges and buffering it with mile after mile of uninhabited sagebrush—the primitive and desolate Owyhee breaks which have served as the locale for many a story about western badmen.

A glance at a good road map probably would scare away the mild adventurer. Such names as "Coyote Wells," "Skull Springs," "Folly Farm," and "Rattlesnake Creek," reflect the nature of the country. In short, it's no place for a tenderfoot nor for a Sunday drive.

Indeed, if a description of Owyhee's scenery were limited to two words these would be "spectacular" and "rugged." Rugged to reach, and cast from a rugged die in nature's workshop, but spectacular once seen.

There are few fishermen who have made the trip who will not agree that the combination of outstanding fishing and inspiring scenery make this materpiece of Reclamation engineering one of the finest recreational spots in the Nation . . . so fine, in fact, that most of them have turned into enthusiastic promoters of the area and of the road which would open it up to countless additional thousands of visitors.

Superintendent Dick Stockham's boat hoist, busy since he built it.

Photo by Stanley Rasmussen, Region 1

Earl Ackley and Tex Everhart preparing fish fry at Leslie Gulch.

NEVER

Underestimate

A BEE

Reclamation officials and other authorities answer the question raised in last month's issue, "Does Beekeeping Have a Part in Reclamation Planning?"

H. A. Bushby, of Star, Idaho, Boise project, puts the bees at ease with smoke treatment before making routine hive inspection. →

Photo by Philip Merritt, Region I, Boise, Idaho

Red Clover stretched in a waving expanse. Twenty-thousand irrigated acres—as pretty a sight as a man could want to see. But the farmers were not happy.

The place was Colorado's lush irrigated Otero County; the time, 1928. Two years before a progressive farmer had decided the climate and soils were ideal for raising Red Clover seed, and every inch of his land went into this crop. He made a killing. The seed sold for 26 cents a pound—better than $180 per acre. The next year his neighbors caught on to what looked like a good thing and the Arkansas Valley communities were prosperous.

But this was the second year—1928. A shocking thing had happened; only the fringe of the huge irrigated Red Clover area was developing properly. The seeds failed to set in the remainder of the crop. Hurried calls to the State Extension Service failed to indicate why the seeds had failed to develop. Within a few days a specialist from the Department of Agriculture in Washington, D. C., was on the site. He looked it over. The Red Clover was beautiful; the plant grew strong and was covered with blossoms; except for the setting of the seeds the crop appeared to be ideal. Why this blight on the seed pack?

The answer, immediately apparent to the Washington specialist, was—*Bees*. In 1926, when the acreage of Red Clover was comparatively small, there were enough honeybees in the valley to pollinate the clover. But when the acreage jumped to 20,000, there was too much ground for them to cover—they couldn't double their numbers or their duties in time to meet the expanded workload.

Since then, irrigation farmers in the Arkansas Valley have held the honeybees in deep respect, and have kept them in mind when expanding acreage or planting new crops.

This is typical of the replies to the question posed by Mr. James I. Hambleton, in charge of bee culture for the Department of Agriculture, who asked, "Does beekeeping have a place in reclamation planning?" in the August issue of the Reclamation Era.

The question was answered by officials in six of the seven regions of the Bureau of Reclamation, who sent in information which indicated that bees are becoming part of irrigated farming just as livestock is looked toward to balance the reclamation farmer's budget.

Region VII summed up the general attitude by reporting that until comparatively recent times the production of honey was considered a minor agricultural activity and the pollination of growing crops by the bees as a minor blessing of nature. Recent experiences, however, are rapidly changing the attitudes of both beekeepers and crop farmers, with particular accent on the latter.

There are about 6,151,000 colonies of bees in the entire country, and according to the 1946 crop report, 1,519,000 colonies (almost 25 percent of the total) are located in 15 reclamation States.

Value of Pollination

Obviously, reclamation farmers, particularly orchardists, are well sold on the value of bees for pollination.

The Regional Director of Region I says, "Bees are highly important in Canyon County, which is one of the outstanding seed-growing counties in Idaho."

Mr. C. F. Webster, associate agent in Reclamation, employed jointly on the Yakima project by the Bureau of Reclamation and the Extension Service, State College of Washington, Pullman, Wash., comments on the economic value of bees, especially the honeybee, by saying "regarding the future of bees in the valley, it might be stated that without bees the Yakima Valley would suffer an irreparable loss."

Region II, with its large package bee business, importation of migratory bees, leading honey production and many bee

(Continued on page 200)

How to Make a Mechanical Post-Hole Digger

By H. H. Kob and O. J. Trenary

Extension Service,
Colorado College of A. & M.

Discovered! A boon to the new settler on a Reclamation project—a machine which takes the labor out of digging post holes!

Mr. Victor Norman, a successful farmer in the Colorado-Big Thompson project, had a lot of post holes to dig each year as a result of rotating his pastures and replacing broken posts on his sheep-tight fences. Norman foresaw many days of back-breaking work, so he applied literally the old adage, "Let your head save your heels," and invented a digger which would operate from the power take-off of his tractor. The machine was a success from the start and Victor Norman says he couldn't farm without it.

The Mechanical Engineering Section of the Agricultural Experiment Station of Colorado A. & M. College has perfected the design for this machine and has brought forth a mechanical device which will bore a post hole 2½ feet deep in less than that many minutes.

This machine, which could be adapted to almost any farm tractor with a power take-off, can be readily manufactured in a good farm workshop or in the community blacksmith shop and would become a favorite "drudge killer" on many Reclamation project farms. On projects where farm units are small, the digger could be built and owned by several farmers. On larger combination range-livestock and irrigation-ranges, its individual ownership will quickly make it an indispensable part of the farm operation equipment. Design of the part and instructions for making the digger are outlined below. Circled numbers and letters on the drawing refer to the following instructions.

1. The principal working parts of this tractor attachment consist of the propeller shaft, differential, and rear axle housings from an old car—in this case a Ford Model A. Following are the changes made on these parts:

(*a*) Completely disassemble the differential.

(*b*) Remove spider and spider gears and replace with a flat steel plate having a 1-inch square hole in the center. This plate must be cut to fit and securely attached to the ring gear with cap screws through the spider bearings.

(*c*) Cut off axle housings.

(*d*) Cut out a portion of the propeller shaft housing from just back of the roller bearing to 18 inches from the differential housing; then weld the two ends back together. Be sure to line them up properly. Finished housing should be 24 inches long.

(*e*) Cut off spliced end of propeller shaft, leaving a shaft 32 inches long. This shaft must be set up in a metal turning lathe and a new bearing surface turned to fit the roller bearing at the end of the propeller shaft housing.

(*f*) Cut a key-way in the end of the propeller shaft for ¼-inch key.

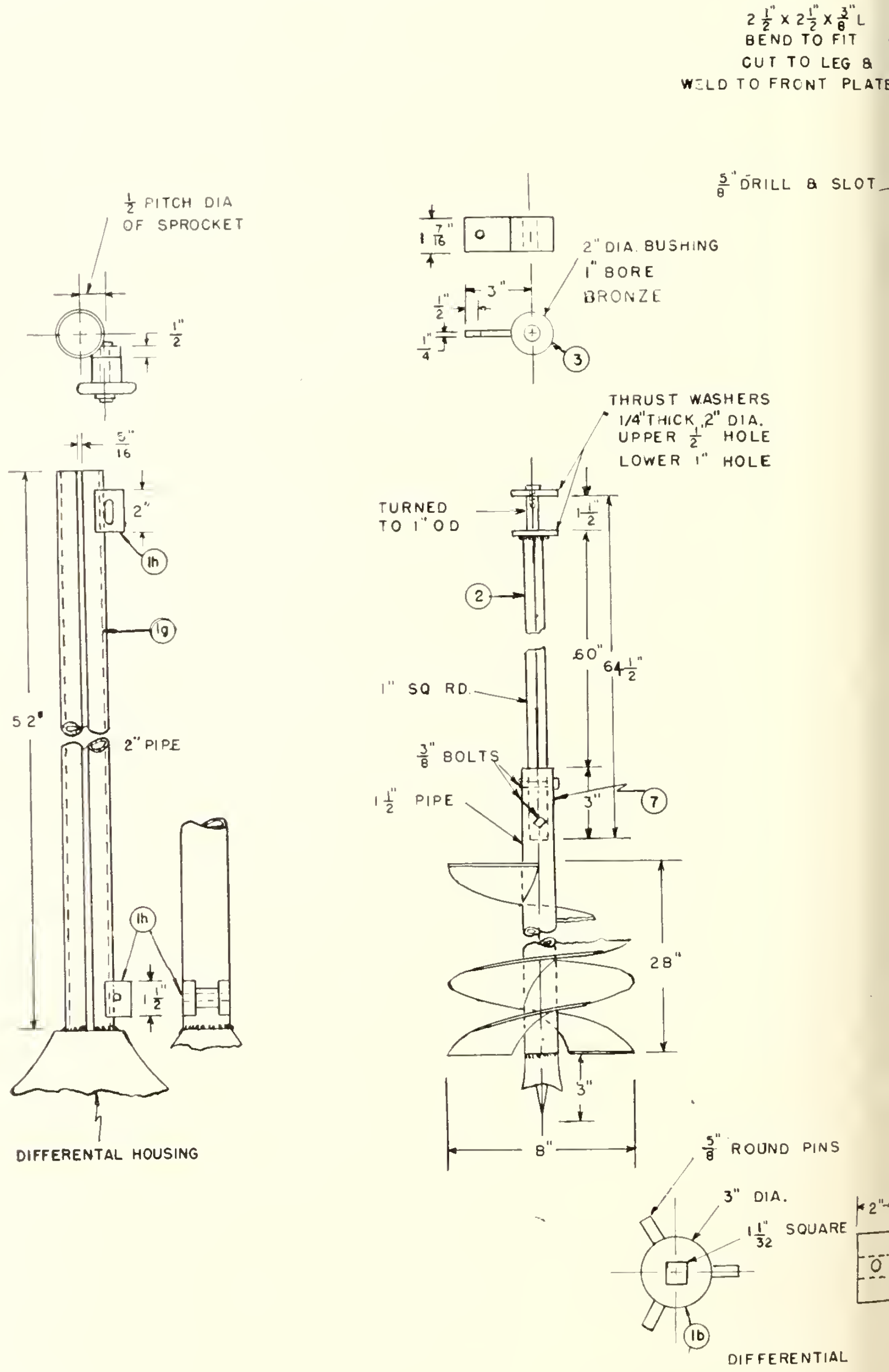
(*g*) Cut a 5/16-inch slot through the full length of a piece of 2-inch pipe 52 inches long. The pipe should be threaded on one end. Then weld this pipe to end of rear axle housing next to differential, using the end not threaded.

(*h*) Weld onto this pipe the brackets for the raising and lowering sprockets, the upper bracket being slotted to allow adjustment for the chain.

(*i*) On the opposite side of the differential housing where the axle housing was cut off, weld a steel dust-protecting disk with a round hole in the center. The hole should be just large enough for the square auger drive shaft to revolve freely.

(*j*) The vertical adjustment lever arm is welded on the propeller shaft housing at a point 3 inches from the differential housing.

(*k*) Reassemble these parts.



2. Secure a 1-inch square shaft 65 inches long and mount it in a lathe. Turn down in the lathe 2 inches of one end to a diameter of 1 inch. This end also is drilled and tapped for a ½-inch cap screw.

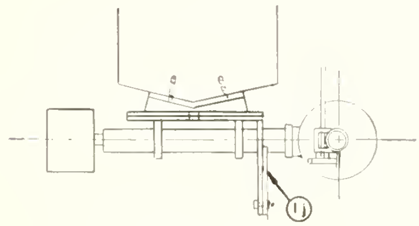
3. Make a round steel bearing 1¾ inches long that will slide through the 2-inch pipe (see No. 1 (*g*), with a bore that will make a running fit on the turned end of the square shaft. The bore should be bushed with bronze. To the side of this bearing weld the bracket that will later be bolted to the raising and lowering chain. Make a steel thrust washer 2 inches in diameter and ¼ inch thick with a 1-inch bore and place it on the turned end of the square shaft. Weld to square shaft. Make another steel washer 2 inches in diameter and ¼-inch thick with a ½-inch bore. Assemble bearing on end of square shaft. Hold in place with a ½-inch cap screw and steel washer. Bore two ⅜-inch holes in opposite end of square shaft for attaching auger.

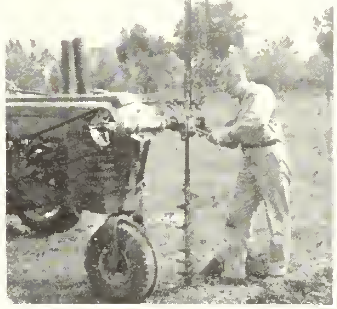
4. Cut two steel plates as shown for mounting on tractor. To the back plate weld angle-iron brackets and braces for attaching to tractor. Brackets and braces shown are for attaching to John Deere Model A. Adaptations can be made for other tractors. On front place weld brackets for holding attachment and vertical adjustment bracket.

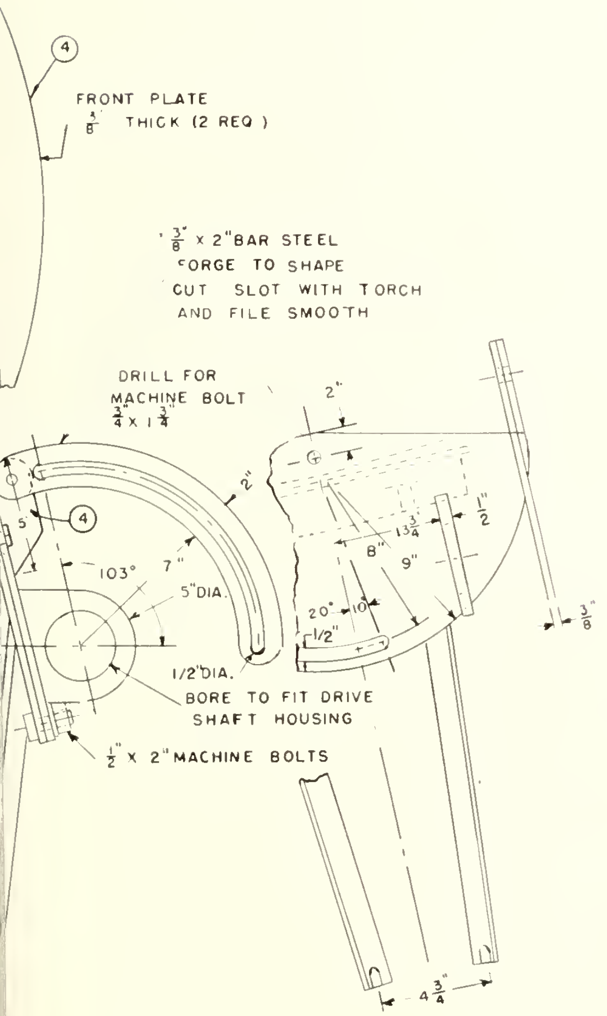
5. Make angle-iron bracket that bolts to rear axle of tractor for carrying, raising, and lowering wheel.

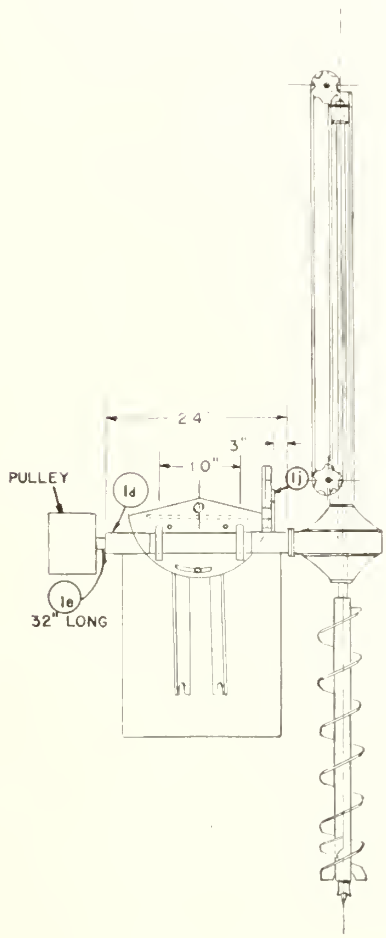
6. Raising and lowering shaft connects to the lower sprocket shaft through a universal joint by means of a bolt at the forward end and a loose-pipe bearing at the handwheel end, bearing being fastened to angle-iron bracket (see No. 5).

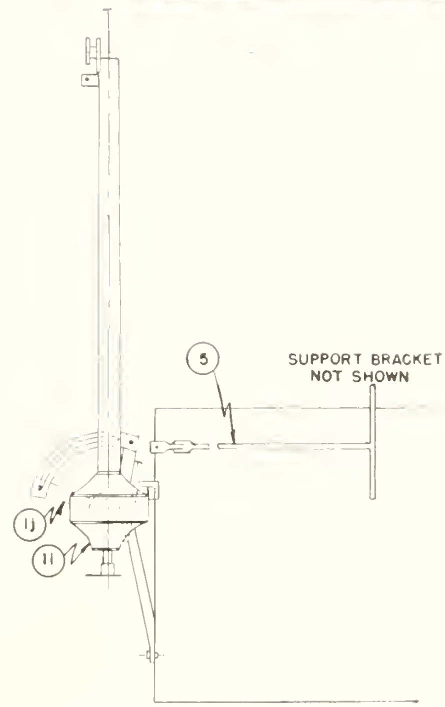
7. The auger can be made, purchased, or a grain auger used. It should be approximately 8 inches in diameter and 30 inches long. To upper end of auger shaft, weld a square tube 1-inch by 1-inch inside measurements and 6 inches long. Drill ⅜-inch holes in this square end to match holes in end of square drive shaft. Machine bolts are used for attaching the shaft to the auger. Auger cutting lips should be hard-surfaced to limit excessive wear. The drive pulley should be about 10 inches in diameter and 4 inches wide, with a bore to fit the drive shaft.











Drawing and photograph courtesy of the Extension Service, Colorado A. & M. College, Fort Collins, Colo.

Never Underestimate a Bee

(Continued from page 197)

colonies pollinating orchards, has good reason to realize the value of beekeeping. Mr. H. A. Hill, agricultural aid for the Sacramento Valley District, points out that honeybees were war workers, putting the value of pollinating foremost, as evidenced by the fact that during the war years no restrictions were placed on the manufacture of apiary supplies to take care of bees that were used to increase pollination. This was not the case where honey and wax were the main concern.

Region III states unequivocally that bees greatly aid in the pollination of alfalfa bloom for seed production.

Although pressure of business did not permit Region IV to reply to Mr. Hambleton's question in time for this issue, this year's Utah centennial has called attention to the fact that the Mormons chose the name of *Deseret* for their provisional State while awaiting congressional action giving them territorial government. Deseret means "honeybee," and symbolizes thrift and industry. Obviously, this aid to agriculture has been and is appreciated in the Great Salt Lake region.

Region V's Rio Grande project personnel report that in those areas of the project where alfalfa is permitted to seed, farmers "borrow" from apiaries one stand of bees for each acre in alfalfa seed. Bees are also used in onion seed pollination.

In the San Luis Valley, one of the largest honey-producing areas in the State of Colorado, project engineer D. M. Forester says, "The local beekeepers all fully realize the necessity and value of the use of bees in pollination of fruit and clover crops. Most of them place the value of honey secondary to the value of crop pollination."

And from the project engineer of the Valley Gravity project came a mass of material indicating the interest of Texans in the migratory bee business, and the value of honeybees for increasing productivity in the citrus groves.

The Regional Director of Region VI says that the Yellowstone Basin produces a great deal of honey due to the prevalence of sweet clover.

The Regional Director of Region VII, with his graphic story of the Red Clover crop and his information on other projects in the region where beekeeping is practiced, also says, "In irrigated areas where farm produce is quickly converted by nearby canning factories into processed foods, honeybees are coming into their own. Cucumber growers, anxious to receive top prices for prime cucumber pickles, hire the services of a beekeeper to reduce the number of nubbins, crooked and otherwise undeveloped cucumbers caused from inadequate pollination by honeybees. Other crops in the Rocky Mountain area depend as well on pollination by bees. To produce a profitable alfalfa seed crop it is essential to have an abundance of insect pollinators. Similarly, insects must transport the pollen from one plant or tree to another to produce a profitable cherry, apple, or pear crop. Actually bees produce much more cash income for the alfalfa seed grower and orchardist than is procured from the yield in honey and beeswax, harvested by the beekeeper."

He concludes that, "It is not unlikely that seed growers of the future will either own their honeybees or rent them from a beekeeper for use in tripping and cross-pollinating their alfalfa such as fruit growers now do. Cross-pollination not only results in a more abundant seed set, but also in more vigorous seeds.

"Growth of the bee industry in Colorado is indicated by the legislation approved by the recent session of the general assembly, under which the State may guard against the spread of American or European foulbrood. It also prohibits the sale or movement of bee colonies, nuclei or used equipment that is diseased and makes compulsory certificates of inspection. With the influx of 'migrant bee labor' from other States, the amendments added by the legislature to present laws provide for inspection of bees and the issuance of permits. Further protection to the industry is provided by an amendment making it unlawful to spray or dust with any poisonous material injurious to bees any agricultural crops or fruit trees which are attractive to bees while in bloom," he added.

According to the Department of Agriculture, most of the States now have legislation on their books requiring inspection of bees and bee equipment.

Diseases of Bees

In addition to stringent legislation to control such diseases as American and European foulbrood, caused by bacterium which attack the bee larvae, other measures are taken by farmers in the reclamation area.

Charles Williams of Meridan, Idaho, states that he has had good luck with the use of sulfathiazole to counteract foulbrood. He feeds it to the bees in a solution of sugar sirup or sugar and water. Colonies which were infected appear to be clean, William said.

In the Sacramento Valley District of Region II, some experimental work has been done with sulfathiazole to combat American foulbrood. In the past the average loss has been around 2 percent from this disease. The majority of the keepers prefer to burn the diseased colony and eliminate any possibility of the bacteria being present in the honey.

Despite encouraging results in other places from the use of sulfathiazole, some Rocky Mountain area beekeepers are reluctant to use it to combat foulbrood. Some entomologists claim the drug prevents the spread of the disease but fails to cure it.

The project engineer of the San Luis Valley project, with headquarters at Monte Vista, Colo., states that sulfa drugs are used quite extensively by most of the beekeepers in that area and are considered a very good cure for American foulbrood. Many drugs and experiments have been tried in order to find a cure for European foulbrood, but so far nothing has been found in that locality to combat it.

Mr. E. B. Ault of Weslaco, Tex., president of the Valley Bee Association, attacks the problem of foulbrood more fundamentally. He breeds three races of bees, the Italian, Caucasian, and a resistant stock which is mixed with several races, but more of the Italians than any other and is presumed to be more resistant to foulbrood than the other races.

Although the project engineer on the Valley Gravity project, headquarters at McAllen, Tex., reports that foulbrood is not prevalent in the valley, he says precautionary measures are taken. Bees are fed one-half gram of sulphathiazole to a gallon of sirup during the spring months.

Poisonous Sprays

More destructive than foulbrood or other diseases to which bees are susceptible are the insect and weed-control measures put into effect by progressive, successful reclamation farmers.

"Dusting" crops precipitated a small drama in the Boise Valley of Idaho. One beekeeper threatened to move his bees to Montana because of the danger of poisoning if seed-growing farmers in Canyon County insisted on dusting their crops. The farmers disregarded the threat and proceeded with their dusting. The beekeeper accordingly transported his colonies elsewhere. During the subsequent harvest the farmers found that their yield had been tremendously reduced, and since then bees have been made welcome in the Boise Valley. Last year a group of farmers came from northern Idaho offering to pay transportation and a rental charge of $2 per colony (which appears to be the prevailing rate) if the Boise Valley beekeepers would move bees into their area to pollenize their white Dutch and Alsike clover. Farmers in the Emmett Valley of Idaho, near the Boise area, also rent bees for pollenizing the cherry orchards.

Beemen, orchardists, and dusting airplane operators in the Yakima Valley have worked out cooperative agreements so that not many of the bees are lost annually because of the drift of insecticides carrying poison sprays or poisonous dust.

Arsenic Poisoning

The Yuma project in Region III reports a decrease in value of the bee population from more than $27,000 in 1945 to about $16,000 in 1946, due principally to the number of bees which were killed by arsenical vegetable dusting. Cooperative agreements between the vegetable growers and the beekeepers resulted in agreements

(Continued on page 205)

TOO MUCH WATER

ON A CLEAR DAY the Texas Gulf Coastal Plains sparkle like gems as the sun's rays strike velvety, moss-embroidered bayous, quagmires of the region's rice fields, innumerable lakes, and then bounce skyward.

The vast area, virtually as flat as the storied pancake, extends westward 300 miles from the Louisiana border to Corpus Christi. It sweeps inland from the coast on an average of 70 miles, and the land is saturated, like a submerged sponge. There is too much water: a Gargantuan irrigation project without drainage.

Here is a diabolical problem. While too much water remains on the land to permit full cultivation and maximum yields on millions of acres of staple crops and pastures, the area's rice farms, which yield the second largest amount of this grain in the United States, require a great deal of moisture. But even rice lands, without adequate drainage, also suffer from unwanted water at planting and harvest time. The result is a perplexing problem of drainage, coupled with a need for improved, dependable irrigation facilities for rice and perhaps some speciality crops.

Photo by Dale Hoves, Region V

Flooded rice field near Houston, Tex. Levee break in foreground is method used to drain rice lands

The Bureau of Reclamation, now making investigations in the region, estimates that 11 million acres of Gulf Coastal lands may be subject to reclamation. Of this total only slightly more than 2 million acres were under organized drainage works in 1939, according to the 1940 census. However, less than 400,000 acres of the total area under organized drainage works were reportedly cultivated in 1939. The census also indicates that only 1,441,341 acres of the total area were drained sufficiently to produce normal crops.

This subtropical area receives an annual average rainfall of about 45 inches, but there are years when 100 inches drench the country. Rainfall measuring from four to eight inches within a period of 24 hours is not uncommon. A record was established in 1946 at Beaumont, in Jefferson County, when one Gulf storm released 17 inches of unwelcome moisture.

Much of the area that is too wet for cultivation is devoted to livestock grazing, but even pasture lands suffer from excessive moisture. Farmers and ranchers lose enormous sums annually because there is a lack of efficient drainage. The result is a lessening of soil productivity, floods, siltation, and human erosion.

The area is plagued with water-borne diseases, including typhoid, dysentery, and malaria. Industrial concerns often find it difficult to locate building sites in parts of the region. Some have been compelled to drain and fill large areas to gain firm foundations for plant construction. Frequent floods and overflows damage highways, bridges, culverts, and road ballast. A sudden downpour, or a prolonged rainfall, leaves some highways hazardous, others closed against traffic.

The problem of inadequate drainage is not new. The grandfathers of today's modern farmers and ranchers, who lived in the area 100 years ago, suffered also. They knew, as do present day residents in the area, that a lack of drainage affected their soil, crops, livestock, health, and pocketbooks. The Plains were settled by colonists in the early 1800's. A majority of the original settlers were planters from the Deep South, and they turned to growing cotton and sugarcane. The soil was fertile, and the yields were plentiful. New Orleans was a profitable market.

Chenango plantation, 3 miles north of Anchor, a station on the Columbia Tap Railroad in Brazoria County, is symbolic of the area's history and the planters' losing fight against drowning soil. Chenango was founded by Monroe Edwards and a merchant in New Orleans long before the War Between the States. Negro slaves, arrived from Africa, were purchased in Cuba. Slave labor constructed a sugar mill on the plantation, and toiled in the cane fields. Recognizing the need for draining the lands of excess water, the plantation owners set their slaves to digging outlets to nearby streams. Remnants of these crudely engineered and constructed drains, now nourishing large trees and subtropical plant life, are still in evidence. The ivy-covered walls of the old sugar mill, and the bell that summoned slaves to work at sunrise, are all that remain of the old plantation system, if one fails to take into account the problem of inadequate drainage.

After the War Between the States, the production of sugarcane slowly gave way to cotton culture. Former slaves and their children were classified in three groups. Prices for labor ranged from 40 to 75 cents a day. But Chenango, and other plantations in the area, fell victim to the seeping paralysis of insufficient drainage. From those days to the present time, Chenango has passed through numerous ownerships. Each succeeding owner experienced greater difficulty in producing crops than had his predecessor. By 1930, Chenango was lying idle.

The Chenango Experiment

For the past 12 years Chenango has been owned by one man—Brig. Gen. R. C. Kuldell of Houston who purchased the plantation in 1935, a West Point graduate with 15 years' service in the United States Corps of Engineers. He remembers his first trip to Chenango.

> I had to mount a horse to see over the weeds, I was told, and I believed my informant, that it was an abnormally wet year. I soon learned, however, that a lack of drainage was the basic cause for the plantation having been abandoned.

At first, the trained and experienced engineer did not immediately give attention to the installation of drains. Instead, he purchased a supply of agricultural books and accumulated a library of extension bulletins concerned with the breeding and growing of poultry, livestock, and row crops. During his initial fling with nature, he took a terrific beating. But it was the land's failure to produce that brought the engineering training to the fore. When General Kuldell returned to his plantation in 1946 after serving in the armed forces in World War II, he marketed most of his livestock, purchased an engineering level, and began laying out a drainage system on the plantation. After he had constructed his drains, he seeded the fields to pasture, purchased beef-type cattle, and stood by to see what happened.

This year, General Kuldell is grazing 500 head of cattle on the Chenango plantation. The soil that had been exhausted in the struggle to grow cotton on watersoaked land is producing pasture grasses in abundance. In one pasture, 75 head of Brahmans were wintered on 50 acres of grass, where formerly seven to 10 acres were required for grazing one animal. Supplemental, concentrated feed left them in the bloom of butcher cattle.

General Kuldell is more fortunate than most farmers. His training as an engineer enabled him to design and construct effective on-the-farm drains. Even more important, he has a large wooded area in the lower edge of Chenango into which he turns the excess water from his pastures. Were it not for owning a low-lying area to receive waste water, General Kuldell would face a problem that would prove insurmountable for a majority of individuals. He could not have drained his land without damaging the lands of a neighbor.

The crux of the Plains problem is draining on-the-farm water into major outlets which in turn drain it into the Gulf of Mexico without damaging the lands of in-between property owners.

"We have all recognized that drainage is the chief agricultural problem in the Gulf Coastal Plains," said General Kuldell, "but the problem has appeared to be so big that little progress has been made in the over-all solution."

As an engineer, General Kuldell also recognizes and calls attention to the need for **maintaining** drainage systems after they are constructed. The Gulf Coastal Plains are carved with drainage experiments that failed largely because no provision had been made to keep them sufficiently clear of plant growth and sedimentation to allow free passage of water.

Practically all attempts to date to construct adequate drainage outlets in the region have been on a district rather than a watershed basis. Even in the comparatively few successfully drained districts, there are numerous instances where lands on the Gulf coast side of the districts were damaged by waters drained from the areas above them. Many drainage districts have witnessed the deterioration of costly works because there was no provision for maintenance. The drainage works fell prey to Nature's eternal effort to heal man-made scars in the earth.

Drainage Demonstration

Further evidence of the economic worth of drainage in the area has been uncovered by Texas A. & M. College on its experiment station at Angleton. Research men set up seven pastures; ranging from one with native grass, and which received no drainage, conservation or soil building treatment, to others that were properly drained, plowed, disked, seeded, and fertilized. Cash expenditures on pasture No. 7, including cost for applying phosphoric acid, amounted to $16.44 per acre.

Eighty-four head of beef-type heifer calves were divided into groups, and turned into the different pastures in October 1944. At the end of the experiment in May 1946, there were 2,500 more pounds of cattle weight in pasture No. 7 than in pasture No. 1. While gaining an average of 114 pounds more than those on native range, they consumed only $15 worth of feed, compared with $35 worth of feed for those on native pasture. Important also was the fact that cows on the improved pastures produced heavier calves.

Possibly, without exception, each of approximately 21 counties in the Gulf Coastal Plains has its reminders of successive eras in which settlers established homes on the land, farmed a few years, became impoverished, and moved away. From the days of the planter and his slave-operated holdings, the years have been marked by the trek of colonists, who believed they had the skills and the courage needed to overcome the fundamental problems. Mennonites established communities in various sections of the region; Czechs and Bohemians, farmers from Iowa, Illinois, Missouri, Kansas, were brought into the area by promotional schemes. A great many settlers, some with considerable wealth, built substantial homes and farm buildings, but their inherent systems of farming and attempts to raise northern grains resulted in failure. Of all the settlers in the area, the Germans and Poles appeared to be the most successful, and their descendants are among the leading, prosperous farmers in the area at the present time.

Early day ranchers apparently fared better than the farmers, and in recent years some ranch lands have been devoted to rice production, although beef cattle production still is an important industry. Rice and cattle grazing follow a pattern of rotation. From 1 to 2 years following a rice crop, rice farmers graze livestock on the idle land. This system has been successful, but the maximum income from either source cannot be achieved until facilities are made available for efficient drainage.

Good surface drainage is as necessary for successful rice culture as is a dependable supply of fresh irrigation water. Without useful drainage it is difficult to prepare satisfactory seedbeds, to obtain good stands, to produce and harvest satisfactory crops; for, unless fields are drained quickly and sufficiently to support tractors and binders, the grain shatters, and much of it is lost in the soil.

Recent years have witnessed an increased effort to achieve drainage for the Plains country. Drainage districts have been created, organizations of farmers have joined with chambers of commerce in attempts to find a solution to the problem; but, as noted by General Kuldell, the problem is so big that little progress has been made in the over-all solution. Rice growers, cotton farmers, ranchers, and other property owners believe that their lands would double present yields and that the quality of their products would improve greatly if a way could be found to get rid of excess water.

Complete relief, however, depends upon a closely integrated plan for drainage systems in each of the various watersheds in the region. There is urgent need for a comprehensive study of the problem by the people in the Gulf Coastal Plains and the several agencies of Government, including the United States Corps of Engineers, the Bureau of Reclamation, and the Department of Agriculture, all of whom have special skills with which they may serve the property owners.

Landowners, farmers, businessmen, and community leaders are intensely interested in the Bureau's present surveys in the Coastal Plains region, which are expected to be completed this fall. From these studies and from the drawing boards of the skilled engineers, soils technicians, economists, and other specialists will come the basis of a pattern that could result in the reclamation of millions of acres.

Sometime, perhaps in the not distant future, the people, assisted by their agencies of government (local, State, and Federal), will roll up their sleeves and dig drainage outlets to the sea. When that time comes, it will be a national achievement: it could easily become the signal for the beginning of a program to reclaim millions of acres of wet lands in other States.

There are 75 million acres of unreclaimed swamp and overflow lands in the humid and subhumid areas of the Nation which, according to some agricultural economists, possess even greater agricultural potentialities than western arid lands.

Conditions now cramping and stifling human life could be removed if people calculate the amount of prosperity that could result from reclamation, rather than how much reclamation costs.

If proof were necessary, it could be provided in the river basins of the West, where reclamation has transformed millions of acres of wasteland into areas of maximum usefulness.

RIVER-SIZE CANAL

Speed and skill mark the excavation of the main canal of the Columbia Basin project in Washington

by Wafford Conrad,
Region 1, Coulee Dam, Wash.

At right, aerial view of Columbia Basin project's main canal. Walking dragline is dwarfed by size of excavation.

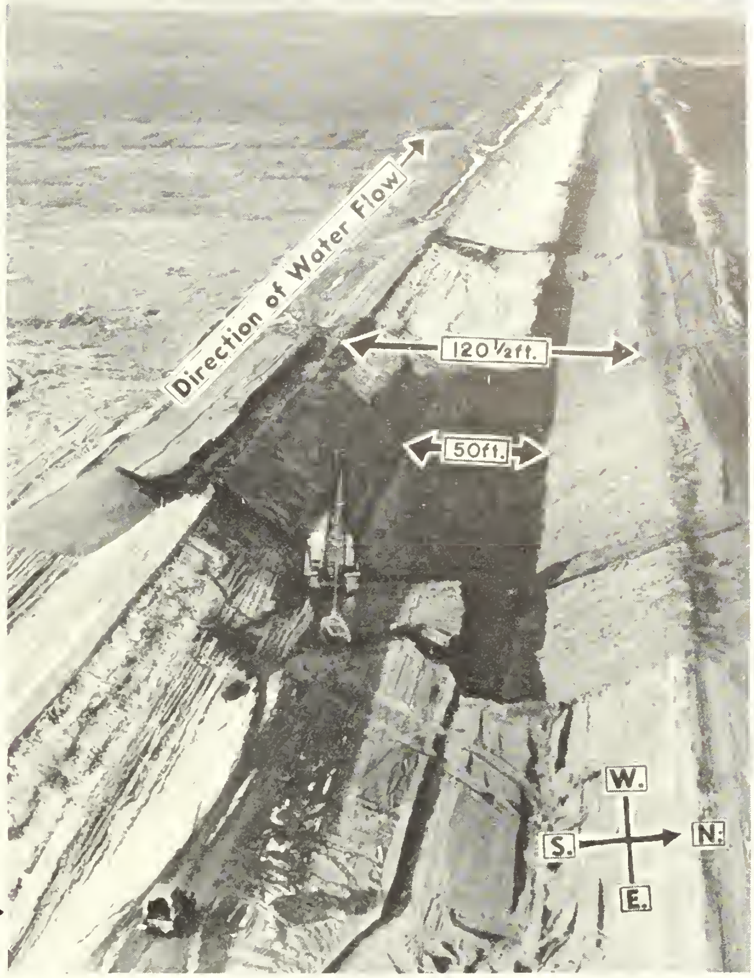


Photo courtesy Seattle Post-Intelligencer, Seattle, Wash.

From our distant vantage point, the canal looked like some gigantic prehistoric serpent twisting its way across the plain.

Coming nearer, we could see only a high embankment that for the most part followed along the base of a low range of sagebrush-dotted hills. Our guide, Philip M. Noble, Columbia Basin project resident engineer for the construction job, drove out upon a light steel bridge spanning the canal, and stopped.

"This is an army Bailey Bridge," he said. "War surplus. Several of them are being used to carry county roads over the canal until permanent bridges can be built." We climbed out of the car and peered over the bridge railing.

It was like looking into a deserted city street from the top of a three-story building.

The two railroad men from St. Paul, the school teacher from Chicago, and the war veteran from Seattle expressed surprise at the size of the canal. It was much bigger than they had imagined.

"A good-sized stream would only wet the bottom," one of the railroad men commented.

Engineer Noble pointed out that the canal could carry the combined average flows of several medium-sized rivers. It was 120½ feet wide at the top, 50 feet wide at the bottom, and 23½ feet deep. Irrigation water some day would flow nearly 21 feet deep down the canal.

Our eyes followed along the smooth, sandy floor of the canal and up its sloping sides to what appeared to be shelves near the tops of the banks.

"What are those?" asked the school teacher.

"Berms", Noble answered.

"And what are berms?"

"They are benches along sloping embankments, made to accommodate a path or road," he explained. "The berms you see here will carry rails upon which trimming and paving machines will ride. One machine will trim the canal to its final shape; the other will apply a lining of concrete. This work will be done under a contract yet to be awarded.

"Small draglines and trucks also can operate on the berms. After the canal is lined, the berms will be filled in with earth to the level of the tops of the main banks. This will give the banks extra stability.

"But where the canal is built along a hillside, and this is done whenever possible, only the berm on the downhill side of the canal will be filled in. The hillside bank will be stable enough. The top of the downhill bank will be 28 feet wide, and will provide a permanent roadway for ditchriders."

As the engineer talked, the job of building an irrigation canal loomed bigger and bigger. There was a lot more to it than digging a ditch and piling the excavated material along the sides.

First of all, the canal route must be determined by surveys, and by tests of the materials that will have to be excavated. Then rights-of-way must be obtained, designs and specifications prepared, bids called, contracts awarded, and the work staked out for the successful contractor. On Bureau of Reclamation projects, these preliminaries are done by the Government.

This particular canal job marked the start of construction on the distribution system for the million-acre Columbia Basin project—the largest single irrigation enterprise this Nation has undertaken. And it was the first contract completed.

The Morrison-Knudsen Co. of Boise, Idaho, had underbid 15 competitors, offering to build the 6.6-mile southern section of the Main Canal for $619,000. This section would run from the site of Long Lake Dam, near Stratford, Grant County, Wash., westward to its terminus, about halfway to Soap Lake, a health resort town. Bureau engineers had estimated the job would require excavating more than 2,000,000 cubic yards of earth and rock, and the building of about 500,000 cubic yards of compacted embankments. A 4½-inch concrete lining, and other canal structures, would be covered in a later contract.

The Boise contracting firm, which holds construction contracts around the world, did not let any sagebrush grow under its feet. Weeks before the Bureau's official notice to proceed was issued in June 1946, M-K officials had successfully overcome initial problems such as the shortage of building materials and housing.

Company workmen, including a number of ex-GI's, bulldozed access roads out of the volcanic ash soil which sent up choking clouds of dust when disturbed. They laid more than 2 miles of 4-inch pipe to bring water to the job from the nearest source of supply—a farmer's well. They cleared the canal right-of-way by grubbing up the sagebrush that thrives even in this semiarid area. They drilled holes in rocky portions of the right-of-way, and blasted the hard basalt to pieces. They ploughed the ground surfaces on which the canal embankments would be built up.

Most of the excavation work was done by a huge Bucyrus-Monighan walking dragline which the contractor had first used in constructing a Mississippi River levee, and had shipped to the eastern Washington job from a Nebraska project. Engineer Noble described it something like this:

The Monighan scoops up dirt with a steel-toothed bucket suspended on cables from the end of a 110-foot boom, or arm, like ordinary draglines. But instead of being mounted on caterpillar treads, the Monighan sits firmly on its circular base when working, and walks by raising and lowering pontoon-like feet suspended from big revolving cams in its sides.

Like that storied bird which flies backwards because it doesn't care where it's going—just where it has been, the Monighan waddles backward along the center of the right-of-way. It tosses earth right and left as it goes, leaving a canal behind it.

Where the earth along the right-of-way was suitable for compacting into canal embankments, the Monighan was preceded by sprinkling trucks, and tractor-pulled carry-alls and sheepsfoot rollers. The soil was sprinkled to give it the correct moisture content for compacting. Bureau men tested samples frequently. Then carry-alls scraped up the damp soil and deposited it in 6-inch layers for the inner core banks. The rollers, with their scores of hoof-like appendages, compacted each layer of earth. The Monighan completed the excavation, dumping the excavated material to form an outer main bank of loose earth or rock.

This two-section bank construction was used the entire length of the canal on its downhill side, and for both sides where the canal was not built along a hillside. The inner core bank was necessary to provide a stable foundation for the concrete lining wherever it was to be placed on filled material above the natural ground surface. This was unnecessary where a cut in a hillside formed one bank.

On-the-site supplies for constructing the compacted embankments were not always available. Most of the material encountered consisted of sand and gravel overlain with one to three feet of fine soil, which made ideal core banks when moistened sufficiently. Approximately 1 mile of the excavation was almost wholly in fine, sandy loam. But scattered deposits of pumice and some tough basalt were entirely unsuitable.

The pumice discoveries, however, aroused considerable local interest. Building blocks made of pumice had proved popular in some areas of the Pacific Northwest, and some businessmen envisioned a new industry for the region. But the excitement was short-lived. Investigations indicated the deposits were not suitable for commercial use.

A half mile of the canal was located along the foot of a lava cliff. Weathered rock, which had fallen from the cliff, covered the right-of-way. This loose rock and the underlying bedrock were used in constructing the outer bank of the downhill side of the canal, and in filling an excavation made outside and just below the right-of-way to obtain material for building up the core bank. Silty loam was dug from this "side borrow" pit by a small dragline and cast onto the core bank, where it was spread with a bulldozer and rolled with a sheepsfoot roller.

When this source of material was exhausted, the shovel was moved to a "borrow pit" several hundred yards from the canal. Earth excavated from this pit was hauled to the core bank in trucks.

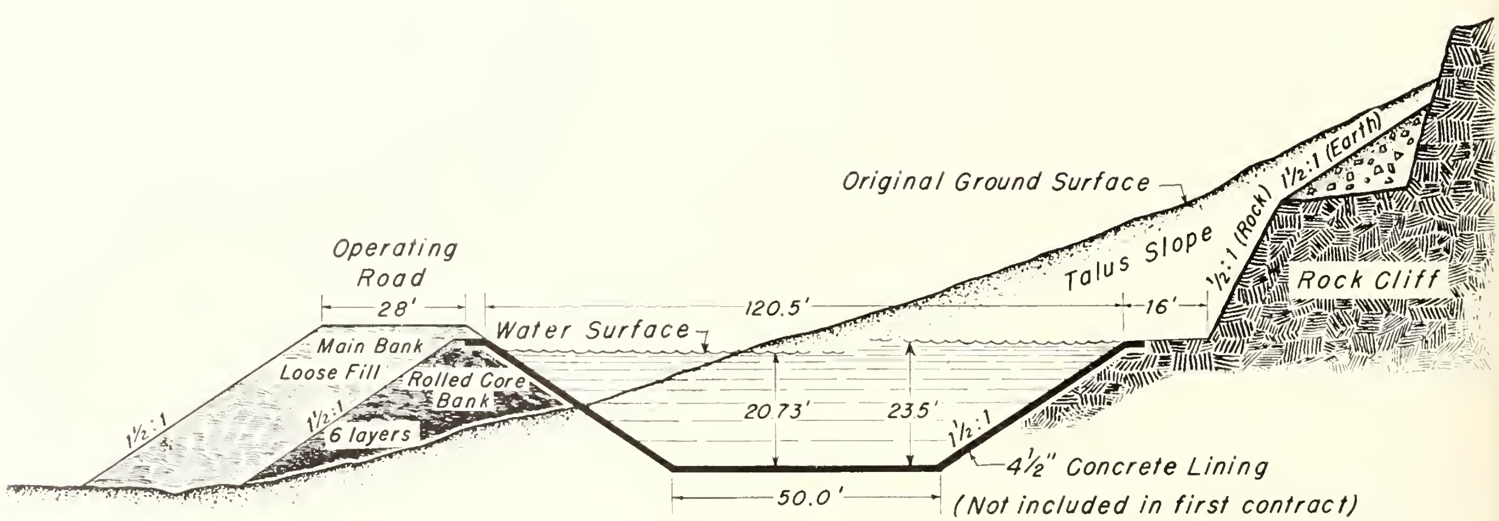
Noble explained that Bureau designing engineers try to lay out irrigation canals so that the contractor can obtain sufficient earth and rock from the excavation to build up the core banks and main banks. Borrowing the material outside the canal right-of-way is slower and more expensive.

Big as it looked, this southern portion of the Main Canal will be dwarfed by the northern section, and by the Feeder Canal which will carry water from the Grand Coulee Dam pumping plant on the Columbia River to a 27-mile reservoir that will feed the Main Canal. The Feeder Canal will carry 16,000 cubic feet per second, the northern section of the Main Canal 13,200, and this section 9,700.

"How much water is 9,700 cubic feet per second?" the school teacher asked.

"Well," replied the Bureau of Reclamation engineer, starting the car, "it's more than 70,000 gallons per second—enough to irrigate 800,000 acres of the million-acre Columbia Basin project, or to supply the normal domestic water needs of about 35,000,000 people."

"Whew!" said the veteran, "some ditch!"



Drawing by Philip M. Noble, Columbia Basin Project Engineer

Typical cross section of the Main Canal from Long Lake Dam to East Low Turnout.

BEES (Continued from page 200)

and regulations which now presumably prevent the use of arsenical insecticides in areas where beekeeping is practiced.

The chief drawback to bee culture on the Rio Grande project in Texas is the arsenicals which are used to dust cotton plants in late summer and fall for cotton-leafworm control. Hive mortality is often 100 percent from arsenic poisoning, it is reported. During the period of cotton dusting, the bee not only comes in direct contact with the arsenic preparation, but also feeds the hive brood with the poisoned honey dew. During the season of cotton dusting, bee hives are usually moved out to the mesas away from the cotton fields in an effort to prevent poisoning.

From the Valley Gravity project comes the same complaint—valley beekeepers lost a large number of colonies of bees last fall due to the calcium arsenate used in dusting crops to kill insects. This project reported that DDT and sulphur also used in dusting crops and trees did not appear to be harmful to bees.

Mr. C. F. Webster, of the Yakima project, reports that beekeepers bring the hives into the orchards just before blooming-time and remove them as soon as the farmer is ready to apply the calyx spray, to avoid poisoning the bees.

Agricultural aid H. A. Hill of the Sacramento Valley District forwarded a hopeful note from the May 1947 volume of *Gleanings in Bee Culture* which stated: "It would seem unnecessary to continue the use of calcium arsenate or other arsenicals for the control of insect pests on tomatoes, deciduous fruits, and most field crops when DDT will give better control and be less toxic to bees, domestic animals, and to man."

Migratory Bees

A "bee-line" is usually understood to mean the shortest distance between two points and Charles Williams of Meridian, Idaho, claims that a bee should not be required to travel more than a mile and a half on plain wing-power to gather his honey and pollen. But bees are great travelers and have probably taken advantage of additional means of locomotion for centuries. For example, the *Encyclopedia Brittanica* states that it is believed the honeybee originated in southern Asia, and was first imported to New England in 1638. Evidently bees are highly mobile, for they now travel to their destinations by way of truck, railroad, and airplane.

Bees are frequently sent on short trips or "vacations" for their health, especially to get away from poisonous spraying or inclement weather. In the spring, beekeepers of the Boise Valley move their colonies into the nearby hills to feed on brush and chokecherries. After a winter of living off the stored honey, they become more or less self-supporting in the hills, and when alfalfa and sweet clover begin to bloom, they are moved back into the agricultural areas of the valley.

Longer journeys are taken by honeybees, as they follow the honey flow. It is estimated that 800 colonies of bees are on the Orland, Calif., project the year round—and that an additional 800 hives are brought into the district by migratory beekeepers for an indefinite period. These bees are considered workers for the community and aid in pollination and also supply honey for commercial purposes.

Perhaps most of these migrant bees come from the San Luis Valley in Colorado with its more than 30,000 colonies, as the project engineer writes that approximately 90 percent of the bees are migrated to other parts of the Nation, mostly Texas and California, during the winter months, to aid in the pollination of fruits. A small percentage of the bees are kept in the Valley during the winter, and beekeepers "spoon-feed" these stay-at-homes on soybean flour and sugar sirup.

Mr. Ault, the Weslaco, Tex., apiary owner, ships colonies north after the citrus trees stop blooming in the spring and returns them to the Rio Grande Valley later in the season. He has developed a commercial "winterover" feed which is also used to start brood rearing before natural pollen is available.

"Package Bees"

More exclusive transportation is provided for "package bees." Packages made up in Glenn County, Calif., consist of a small screen cage large enough to hold three pounds of worker bees (a pound of bees averages 5,000 to 7,000 individual bees). The queen and six worker bees travel in a deluxe compartment within the package. Room service is provided by means of a quart can of sugar sirup which is attached in the top of the package and is considered sufficient for a 10-day trip, and "air conditioning" is carefully controlled. These package shipments are used to restock hives that have lost their bees through the cold winter months in the northern States and Canada.

Recently six queen bees, valued at $100 per queen, each with two mates and a private compartment, were flown to Australia by the University of California to improve Australian hives.

The package bee business in California's Sacramento Valley is large, with an estimated 125,000 packages shipped annually. At an average of $2\frac{1}{2}$ pounds, this allows 150 tons of bees, with a value of well over a half million dollars to leave the valley each season.

Packaged bees are transported into Region VI from the south to replenish natural colony losses, and to stabilize bee population. The Regional Director states that it has been noted that air transport is being used for this purpose.

Beekeepers in the San Luis Valley, Region V, also buy package bees in the spring to use during the following season.

Although pollination appeared to be the main concern in the reclamation area, this does not mean that the production of honey can be overlooked as a means of supplementing the farm income. According to the 1946 honey producing report, California leads all the States in the production of honey, followed by Minnesota and Iowa. During 1946 California beekeepers obtained an average of 48 pounds of honey per colony from 461,000 colonies. The total honey production was 22,128,000 pounds, which was sold for $4,526,000 or approximately 20 cents per pound, received by the producers. The United States production for that year was 213,814,000 pounds.

The latest reports from Bureau of Reclamation projects indicate that honey is paying off at the Boise, Idaho, and Yakima, Wash., projects, and the San Luis Valley project in Colorado, where the total of 30,000 colonies makes this project the largest honey producer in the State.

An experiment in Arizona, reported by the district manager of the Gila project demonstrates how honey, as a byproduct, can add revenue to the farmer's budget. Bureau of Reclamation officials persuaded a local beekeeper to put 80 stands of bees on tract 9 to insure better pollination of 40 acres of ranger alfalfa being grown for seed purposes. A total of 7,800 pounds of honey was produced and sold for $1,326, or slightly more than 17 cents per lb. As tract 9 was isolated from the surrounding alfalfa fields, there is assurance that all of the nectar and pollen was gathered from these 40 acres. The return from honey alone was approximately $33 per acre, entirely apart from the value of the increase in seed production which resulted from the pollination carried on by bees.

Mrs. E. J. Walker, whose articles covering various aspects of beekeeping are carried by a number of Texas journals, reports an unusual use for honey: Experiments have been made in soaking seeds 4 hours in 1 part of honey to 99 parts of water, which reportedly tripled the yield of seeds.

Evidently beekeeping does have a place in reclamation planning, and furthermore reclamation farmers, particularly orchardists, have already made a place for the honeybee, fully appreciating its primary value for pollination, and its secondary honey-producing potentialities.

A word of advice was given by the Regional Director of Region VII:

"Veterans who settle on reclamation projects and have an interest in bee culture, are strongly advised by entomologists to learn all they can about bees from their agricultural agents before starting their first colonies. The farmer with little or no knowledge of bees is liable to find his hard-earned cash all going into bees, bee-stands, and sugar, with little or nothing in return, experts agree."

So—*never* underestimate a bee.

Safety on Reclamation Projects

by A. R. Hines,

Safety Engineer, Bureau of Reclamation

Reclamation projects in the West require a multitude of correlated operations from the time the project initially takes shape on the drafting table until the first irrigation water finally is brought down the farmer's ditch.

Safety plays its part as one of the elements that goes into the construction and operation of any Reclamation project. To the casual visitor who first views a project under construction or in its final operating stage, many of the safety features may not be apparent at first glance.

The Bureau safety program is concerned with the protection of both personnel and property whether in the design, construction or operating stage. In general, the safety program is concerned with the prevention of accidents as it pertains to Bureau employees or contractors engaged on Bureau work. However, the responsibility for the protection of the public is not overlooked. Every reasonable precaution is taken to protect the public from possible injury in connection with, or as a result of, any work or operation of the Bureau of Reclamation. It has been found advisable in some instances to erect vista houses where the public can get a view of the work in progress without entering construction zones. In other cases, visitors are conducted about by experienced guides who give constant consideration to the safety of the group.

In order to carry out a sound and practical safety program, a safety handbook was issued to provide standards and procedures for the guidance of all employees of the Bureau. Provisions for accident prevention also are incorporated into all contract specifications and form the basis for the safety measures to be taken by contractors performing work under jurisdiction of the Bureau.

Since every hazard cannot be eliminated or every accident avoided by the simple process of complying with a set of safety rules, accident prevention becomes largely a matter of personal behavior. To help develop the proper attitude and behavior on the part of supervisors and employees, certain techniques and tools of safety education are employed.

Safety Training

Safety training is planned as an integral part of the job. When new steps in the work program are planned and laid out, such steps include consideration of the safe method of accomplishment. Foreman and other supervisors are responsible for properly instructing their men, and "follow through" to see that instructions are understood and properly carried out.

Sample safety poster.

Safety meetings are used as an important part of promoting safety as well as a means of providing safety education to all concerned. The size and composition of these meetings depend upon the type of work under way on any particular project. Meetings composed of supervisors, all foremen, or all members of a craft, are held each month for the purpose of renewing the safety record; to consider the schedule of safety activities planned for the ensuing month; to receive safety instructions; to discuss correction of physical hazards and unsafe work methods encountered.

First-Aid Training

First-aid training is also recognized as an effective means of promoting safety and is sponsored by the project safety organization. All classes are conducted according to the standards of the American Red Cross or the Bureau of Mines. Where practical, all foremen are required to have first-aid training so that in case of an accident proper first-aid care may be rendered.

Suggestion System

A suggestion system is used as a means of stimulating employees' interest in the improvement of working methods. Suggestion boxes are provided as an easy method of obtaining new ideas on safety.

As a further means of providing safety education, full use is made of posters, signs, displays, bulletins, and magazines.

In the standard method of computing accident statistics, reference is generally made to the frequency and severity rates of an establishment. The frequency rate is defined as the number of lost time injuries per 1 million man-hours of exposure. This rate is obtained by multiplying the number of injuries occurring by 1 million, and then dividing the product by the number of man-hours that were worked during the period under consideration. The severity rate is defined as the number of days of lost time (due to injuries) multiplied by 1,000 and divided by the number of man-hours of exposure. The standard frequency and severity rates serve as a "barometer" to indicate the effectiveness of the safety program. They also are used as a means of comparing the relative safety standing of organizations performing similar types of work.

On the above basis, the "barometer" shows that the frequency and severity rates for Bureau employees have decreased from 36.5 and 2.59, respectively, in 1939 to 25.1 and 2.17, respectively, for the year ending December 31, 1946. During the same period, contractors engaged on Bureau work as a whole have lowered their yearly frequency rate from 84.6 to 46.1 and reduced the corresponding severity rate from 10.11 to 6.66.

Hazards of Tunneling

Tunneling is recognized as the most hazardous of construction jobs. Due to the relatively small number of men that can be employed, a high accident frequency rate is expected. It is difficult to convert early accident reports into modern frequency and severity rates. However, striking contrasts are found in the following notes on Reclamation tunnels. According to reports of the disasters following the construction of the Gunnison tunnel (see August 1946 Reclamation Era) between 1905 and 1909, 26 men lost their lives and over 100 suffered serious injury.

On the Alva B. Adams tunnel of the Colorado Big-Thompson project (see July and August Reclamation Era) two fatal accidents occurred during the total period of some 2,800,000 man-hours of contract work required to drill and concrete this 13-mile tunnel from 1940–46. The frequency rate was 114.0 and the severity rate was 5.81.

On May 18, 1941, J. A. Tertelling & Sons holed through the 1¼ mile long Tule Lake tunnel on the Klamath project without a single lost-time accident.

NEWS ROUND-UP

More Reclamation Farms Available

The Bureau of Reclamation has announced the opening of 10,065 acres of land in Wyoming which will be divided into 99 homestead farms on two of its projects, the Riverton project and the Heart Mountain division of the Shoshone project.

These openings mark the fifth and sixth public land openings since the War. There will be 6,850 acres, comprising 68 farms on the Riverton project and the time for filing applications during the veterans' preference period will expire at 2 p. m. October 8. Applications should be filed with the Project Engineer, whose address is Bureau of Reclamation, Post Office Building, Riverton, Wyo.

On the Heart Mountain division of the Shoshone project 3,215 acres which will provide 31 farm units will be opened to entry. Applications for these homesteads should be filed with the Acting Project Superintendent, Bureau of Reclamation, Powell, Wyo. The veterans' preference period for filing applications on this project will expire at 2 p. m. October 22. As in the case of the settlers on the Gooding division of the Minidoka project in Idaho, qualified veterans whose applications are approved for farm units on the Riverton and Heart Mountain projects will be given a "bonus" in the form of barracks buildings, located at the evacuated Shoshone Heart Mountain War Relocation Authority camp. These can be converted into living quarters and farm buildings.

Additional information on these land openings can also be obtained by writing the Regional Director, Bureau of Reclamation, Stapleton Building, Billings, Mont., or Commissioner, Bureau of Reclamation, Interior Building, Washington 25, D. C.

Governor Dewey Visits Shoshone Project

Gov. Thomas E. Dewey, his family and other members of his party, who were guests of Senator E. V. Robertson of Wyoming, visited the Shoshone project during the latter part of July.

Regional Director K. F. Vernon and Acting Project Engineer W. F. Kemp of the Bureau of Reclamation conducted the tour over the project. Included in the visit were stops at the Heart Mountain division, Garland division, and the storage works at Buffalo Bill Dam. When the Governor was escorted to a high vantage point where he was able to get a broad view of entire project set in the green valley as contrasted with the surrounding barren nonirrigated area, he seemed greatly impressed by the sight and the value of reclamation so graphically presented.

The Governor's visit to the project was preceded by a luncheon at Cody, Wyo., given in his honor by the American Legion and the Cody Club. Approximately 300 guests were in attendance.

Interim Colorado River Basin Report Sent to Congress

An interim report containing a comprehensive inventory of potential Reclamation projects for developing water and related resources of the Colorado River Basin was sent to the Congress by Secretary of the Interior J. A. Krug on July 24, 1947. The report now contains the comments of the seven Colorado Basin States to which it was submitted for review in June 1946.

With the interim report, Secretary Krug transmitted to the Congress his conclusions that:

> A comprehensive plan of development for the Colorado River Basin cannot be formulated at this time;
>
> Further development of the water resources of the Colorado River Basin, particularly large-scale development, is seriously handicapped, if not barred, by lack of a determination of the rights of the individual States to utilize the waters of the Colorado River system. The water supplies for projects to accomplish such development might be assured as a result of a compact among the States of the separate basins, appropriate court or congressional action, or otherwise;
>
> The States of the Upper Colorado River Basin and the States of the Lower Colorad River Basin should be encouraged to proceed expeditiously to determine their respective rights to the waters of the Colorado River consistent with the Colorado River compact.
>
> The Basin States—Wyoming, Colorado, Utah, Nevada, California, Arizona, and New Mexico—still have before them the question of settling their respective claims to the waters of the Colorado.
>
> However, in accordance with existing congressional authority, the Bureau of Reclamation and other Interior Department agencies are proceeding with engineering and economic studies hoping for early agreement among the States for some other arrangement that would clear the way for further development of the resources which are now going to waste.

Secretary Krug explained that he hoped that the interim report to the Congress, by making full details of the problem available to all interested parties, would help to expedite a solution.

The problem hinges on the fact that the Colorado River system does not normally yield sufficient water for all of the potential Reclamation developments.

Comprising about one-twelfth of the land area of the United States and located in the southwestern corner of the Nation, the basin is a vast, rugged, arid area. Virtually all economic activity and civilized life there depend upon the conservation of water resources, irrigation of the land, and development of hydroelectric power from the streams of the Colorado River system. At the present time, the basin's population growth and its irrigation, hydropower and other water resource needs are outstripping developed water and related resources.

The construction of some of the major Reclamation developments in the Basin, including Hoover, Parker, and Davis Dams and other irrigation and hydropower facilities, was made possible under the Colorado River compact of 1922.

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Landownership Survey on Federal Reclamation Projects.*—Available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

2. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals*, by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, 7-page mimeographed study with graphs.

3. *Questions and Answers About Forming an Irrigation District to Further Irrigation Under the Missouri Basin Development Project—Montana.*—Eight-page folder available upon request to the Regional Director, Bureau of Reclamation, Billings, Mont.

Available from the Superintendent of Documents, Washington 25, D. C.

1. *High-Pressure Reservoir Outlets*, by J. M. Gaylord and J. L. Savage—a report (1923) on Bureau installations compiled from correspondence, project histories, feature reports, technical papers, special reports prepared for this purpose, and from personal inspection of the installations described. Obtainable from the Superintendent of Documents.

2. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

3. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest releases are: Problem 10, Pattern of Rural Settlement—25 cents, and Problem 28, Local Governmental Units—70 cents.

Problem 9 (Supplement), Standards and Levels of Living—20 cents.

Problem 14, Financial Aid for Settlers—25 cents.

Problem 23, Rural and Village Electrification—25 cents.

Problem 24, Agricultural Processing Industries—30 cents.

Problem 26, Recreational Development of Roosevelt Lake—75 cents.

4. *Central Valley Project Studies.*—Studies of diversified but interrelated problems affecting the wartime and long-term development of the Central Valley Project in the State of California. Obtainable from the Superintendent of Documents. First released in the series are Problems 1–5, The War Program—45 cents.

5. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

6. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

Reclamation's Construction Program (*Continued from page 194*)

Utah

NEWTON: $50,000; complete Newton Dam and Reservoir.

OGDEN RIVER: $55,000; continue construction on south Ogden district lateral system.

PROVO RIVER: $1,370,000; construction on Salt Lake aqueduct and Jordan Narrows siphon.

SCOFIELD: $40,000; additional work on dam and reservoir.

REGION V (HEADQUARTERS, AMARILLO, TEX.)

Oklahoma

W. C. AUSTIN (formerly Lugert-Altus); $2,960,000; complete main canals and work on laterals and drainage system.

New Mexico

CARLSBAD: $40,000; construction on canal and drainage system.

TUCUMCARI: $1,790,000; complete canal and laterals for first five units; work on drainage.

New Mexico-Texas

RIO GRANDE: $1,480,000; complete Elephant Butte Spillway construction of transmission line and substation.

Colorado

SAN LUIS VALLEY: $240,000; Platoro Dam specifications and investigational and developmental work.

Texas

VALLEY GRAVITY: $250,000; preconstruction surveys and preliminary designs.

MARSHALL FORD DAM: $80,000; minor construction.

BALMORHEA: $70,000; completion of protective works and other construction.

REGION VI (HEADQUARTERS, BILLINGS, MONT.)

Montana

SUN RIVER: $30,000; survey and design studies on drainage facilities.

CANYON FERRY: $600,000; to initiate construction.

FORT PECK: $3,160,000; construction on Glendive-Miles City and Fort Peck-Williston transmission lines, and substations.

MOORHEAD DAM: $900,000; start dam construction.

YELLOWSTONE PUMPING UNIT: $200,000; work on irrigation system.

North Dakota

HEART RIVER: $700,000; including start of construction on Heart Butte Dam and Dickenson Dam.

CANNONBALL DAM: $400,000; start dam construction.

South Dakota

ANGOSTURA DAM: $3,900,000; continue dam construction, and start irrigation construction.

GRAND RIVER including SHADEHILL DAM: $800,000; start dam construction.

BIXBY DAM: $500,000; start dam construction.

Wyoming

BOYSEN DAM: $2,600,000; continue dam construction.

KORTES DAM: $3,400,000; continue dam construction.

KEYHOLE DAM: $200,000; start dam construction.

RIVERTON: $2,185,000; canal system construction and work on drainage system; development of 15,000 acres of irrigable lands for settlement.

SHOSHONE: $3,150,000; canal laterals and transmission line and development of 15,000 acres irrigable public lands on Heart Mountain Division for settlement.

REGION VII (HEADQUARTERS, DENVER, COLO.)

Colorado

COLORADO-BIG THOMPSON: $18,320,000 (including supplemental appropriation needed); continue construction on Granby reservoir and Granby pumping plant, Horsetooth Reservoir and feeder canals, Estes Park aqueduct and power system; Estes Lake; start Olympus Dam; transmission lines.

NARROWS DAM: $300,000; start dam construction.

BONNY DAM: $800,000; start dam construction.

Wyoming

KENDRICK: $1,040,000; continue work on canal and laterals.

Nebraska

ENDERS DAM: $2,400,000; continue dam construction.

CULBERTSON DAM: $300,000; start dam construction.

MEDICINE CREEK DAM: $1,000,000; start dam construction.

MIRAGE FLATS: $190,000; construction Box Butte Dam and canals.

BOSTWICK UNIT: $500,000; for irrigation facilities.

FRENCHMAN-CAMBRIDGE UNIT: $1,700,000; for irrigation facilities.

Kansas

CEDAR BLUFF DAM: $900,000; start dam construction.

U. S. GOVERNMENT PRINTING OFFICE: 1947

NOTES FOR CONTRACTORS

Contracts Awarded During July 1947

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
1670	Colorado River Front Work and Levee System, Colo.	July 24	One 20-inch floating cutter-type hydraulic suction dredge complete with fuel, work and pipe barges, and power attendant plant.	Pacific Coast Engineering Co., Alameda, Calif.	$871,700.00
1727	Colorado-Big Thompson, Colo.	July 25	Four oil-immersed outdoor-type transformers for Granby switchyard.	General Electric Co., Denver, Colo.	111,164.00
1727	do.	July 25	Three transformers and three power circuit-breakers for Granby switchyard.	Westinghouse Electric Corp., Denver, Colo.	112,297.00
1727	do.	July 3	Disconnecting switches for Granby switchyard	Graybar Electric Co., Inc., Denver, Colo.	17,870.54
1773	Shoshone, Wyo.	July 2	One 25-ton traveling crane for Heart Mountain power plant.	Euclid Crane & Hoist Co., Euclid, Ohio	16,885.00
1789	Central Valley, Calif.	July 10	Circuit-breakers for Keswick power plant	General Electric Co., Denver, Colo.	51,139.00
1790	Boulder Canyon, Ariz.	July 24	Transformers, circuit-breakers, disconnecting switches and instrument transformers for Boulder City and No. 2A pumping plant substations.	Westinghouse Electric Corp., Denver, Colo.	39,556.14
1799	Davis Dam, Nev.	July 24	Dismantling, moving and erecting shop building at Government camp.	W. S. Ford, Kingman, Ariz.	24,510.00
1800	Central Valley, Calif.	July 24	One 100-ton gantry crane for Tracy pumping plant	Cyclops Iron Works, San Francisco, Calif.	104,109.00
1804	Colorado-Big Thompson, Colo.	July 16	One 30-inch ring-follower gate with hydraulic hoist for Granby Dam.	Westinghouse Electric Corp., Sunnyvale, Calif.	11,835.00
1804	do.	July 16	One 30-inch hollow jet valve for Granby Dam	Pacific Coast Engineering Co., Alameda, Calif.	10,800.00
1806	Columbia Basin, Wash.	July 7	One transformer for Granby power plant	Westinghouse Electric Corp., Denver, Colo.	38,800.00
1811	W. C. Austin, Okla.	July 11	Construction of earthwork and structures for laterals and sublaterals.	Stigler Construction Co. and Jack Durrett, Stigler, Okla.	349,116.00
1814	Columbia Basin, Wash.	July 11	Construction of six relift pumping plants for laterals.	James Construction Co., Seattle, Wash.	68,016.25
1826	Central Valley, Calif.	July 24	Dismantling, moving and converting buildings for Government camp at Lindsay, Calif.	Paul Spencer Construction Co., Los Angeles, Calif.	153,498.61
1826	do.	July 24	Construction of water and sewerage systems for Government camp at Lindsay, Calif.	Kovick Bros. Construction Co., Fresno, Calif.	11,675.00
1827	do.	July 8	Autotransformers and regulating transformers for Delta substation	Allis-Chalmers Mfg. Co., Denver, Colo.	1,219,380.00
1827	do.	July 8	Transformers and circuit-breakers for Delta and Elverta substations.	Westinghouse Electric Corp., Denver, Colo.	1,272,876.00
1827	do.	July 8	Circuit-breakers for Delta and Elverta substations	Pacific Electric Mfg. Corp., San Francisco, Calif.	192,286.00
1827	do.	July 8	Circuit-breakers for Delta and Elverta substations	General Electric Co., Denver, Colo.	114,864.00
1833	Yakima-Roza, Wash.	July 9	12 sets of motor-control equipment for pumping plants	Allis-Chalmers Mfg. Co., Denver, Colo.	185,891.00
1843	Columbia Basin, Wash.	July 8	Miscellaneous structural steel, railings and gratings for Grand Coulee power plant.	Pacific Car & Foundry Co., Seattle, Wash.	11,952.00
1844	Central Valley, Calif.	July 15	Structural steel, siding, windows and doors for steel warehouse at Tracy pumping plant.	Independent Iron Works, Oakland, Calif.	22,063.00
1847	Colorado-Big Thompson, Colo.	July 23	Discharge valve control system, two hydraulic pumping units, and pressure tanks for Granby Pumping Plant.	Woodward Governor Co., Rockford, Ill.	55,145.00
1858	Shoshone, Wyo.	July 25	Carrier-current coupling apparatus for Heart Mountain power plant and Garland substation.	General Electric Co., Denver, Colo.	21,247.00
1861	Colorado River Front Work and Levee System, Calif.	July 10	Furnishing six 2-bedroom prefabricated houses for Needles, Calif., Government camp.	Green Lumber Co., Laurel, Miss.	16,080.00
1862	Davis Dam, Nev.	July 31	Furnishing 20 prefabricated houses for Davis Dam Government camp.	Green Lumber Co., Laurel, Miss.	49,935.00
1883	Riverton, Wyo.	July 31	Construction of 13.7 miles of the Wyoming Canal	Morrison-Knudsen Co., Boise, Idaho	668,933.00

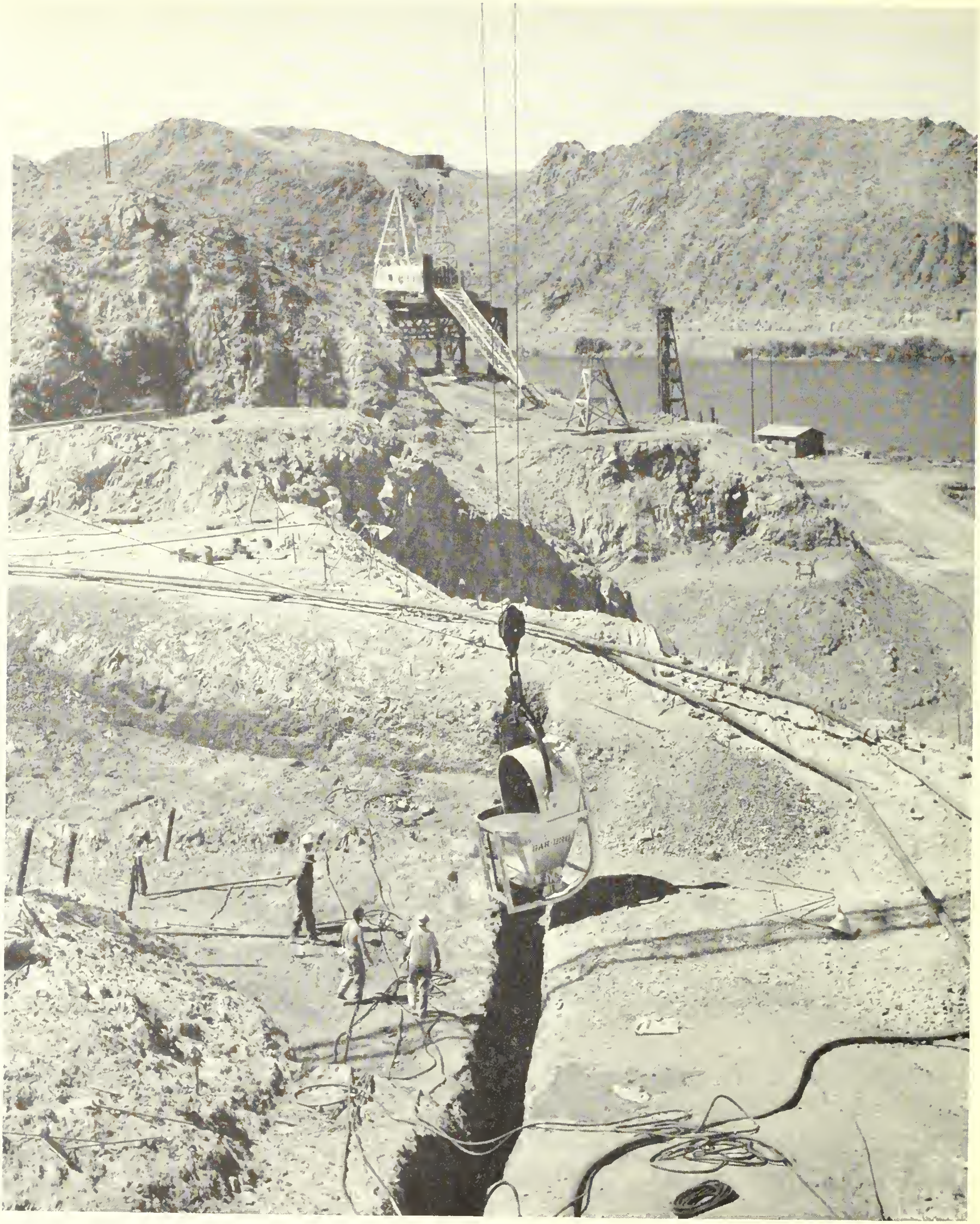
Construction and Supplies for Which Bids Will Be Requested During September 1947

Estimated date bids to be invited	Project	Description of work or material
Sept. 1	Davis Dam, Ariz.-Nev.	Construction of 83 miles of 230-kv. transmission line from Davis Dam to Parker Dam. Steel structures and towers.
Sept. 1	Boulder Canyon, Nev.	Construction of 22 by 55 feet reinforced concrete pump house No. 2A in vicinity of water-treatment plant north of Boulder City, Nev.
Sept. 1	Tucumcari, N. Mex.	Construction of drain inlets and farm and operating bridges, Conchas Canal.
Sept. 1	W. C. Austin, Okla.	Construction of Ozark laterals and structures for irrigation of 9,300 acres of land near Altus, Okla.
Sept. 1	Canyon Ferry Unit, Missouri Basin, Mont.	Construction of 11 miles of relocated road in western Montana.
Sept. 1	Colorado-Big Thompson, Colo.	Construction of 10 miles of Horse Tooth Feeder Canal, including a diversion dam on the Big Thompson River, and concrete and steel siphons, near Loveland, Colo.
Sept. 1	Missouri Basin, Colo.-Nebr.	Construction of 45 miles of 115-kv., wood pole, transmission line from Sidney, Nebr., to Sterling, Colo.
Sept. 1	Colorado-Big Thompson, Colo.	Construction of 20 miles of 115-kv., wood pole, transmission line from Greeley to Loveland, Colo.
Sept. 2	Central Valley, Calif.	Excavation, concrete footings, and gravel surfacing for Keswick switchyard at Keswick Dam, near Redding, Calif.
Sept. 15	Boulder Canyon, Nev.	Laying 6 miles of 12- and 14-inch diameter steel pipe, and erection of 50,000- and 2,000,000-gallon storage tanks at Boulder City, Nev.
Sept. 15	Boise-Payette, Idaho	Construction of earthwork and structures for Sand Hollow Wasteway, near Caldwell, Idaho.
Sept. 15	do.	Construction of earthwork and structures for Willow Creek Wasteway, near Middleton, Idaho.
Sept. 15	Deschutes, Oreg.	Construction of earthwork and structures for lateral system to serve 8,500 acres of land near Madras, Oreg.
Sept. 15	Owyhee, Oreg.	Construction of Locket Gulch Wasteway on North Canal and Owyhee Ditch Crossing near Nyassa, Oreg.

NEXT MONTH

How water is made to run uphill in the Central Valley project of southern California.

ALSO—"The Man Behind the Gun"—describing the latest methods of applying gunite linings to canals.



Progress at Davis Dam

Here is the first bucket of concrete being poured into the gravity wall foundation cut-off trench at Davis Dam in Ariz.-Nev. The main purpose of Davis Dam is to generate electrical energy and to reregulate the Colorado River, below Hoover Dam, through the provision of storage for irrigation and domestic use within the United States and for the delivery of water at the U. S.-Mexico international boundary.

OCTOBER 1947

Harvest Issue

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Featuring:

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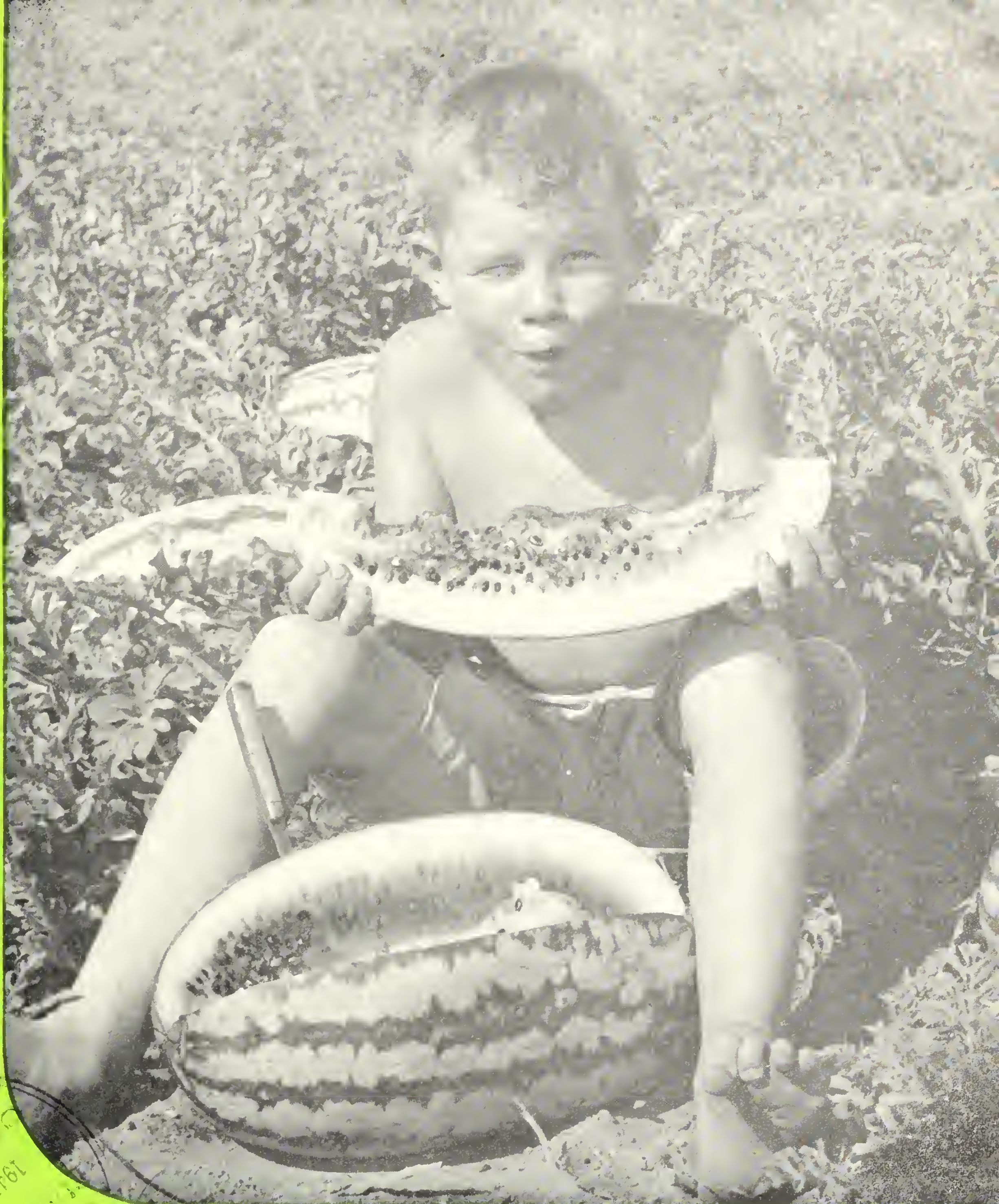
ECLAMATION'S CROP RECORD

●

ATER REPORT



THE *Reclamation* ERA

Corfitzen Goes to Greece

William E. Corfitzen

William E. Corfitzen of the Bureau of Reclamation will become irrigation adviser in the rehabilitation of irrigation works on 800,000 acres in northern Greece, as part of the American mission for aid to that country, Commissioner Straus recently announced. Corfitzen, special representative of the Commissioner, has been loaned to the State Department for 1 year for that purpose.

Mr. Straus, at the time of the announcement said "Rehabilitation of the irrigated areas of Greece will help materially in restoring the food-production capacity of that country." He also pointed out that the war damage in Greece and incidental deterioration of canals, headworks, and turn-out structures had been tremendous, and that restoration of the efficiency of these works will be a distinct boon to Greece's self-support.

Corfitzen's job will be that of expediting the reconstruction with the goal for the completion of this task tentatively set for June 1948.

During the past few years Corfitzen has been principal liaison officer for the Bureau with irrigation officials of 31 foreign nations who have called upon the United States for counsel and aid in developing their own agricultural resources through irrigation. This cooperative program involved the exchange of technical data, receiving foreign officials, providing in-service training for foreign engineers on Bureau of Reclamation projects, and performing irrigation and multiple-purpose investigations and designs for several nations. The outstanding feature of the program was the preliminary design job on the enormous Yangtze Gorge project for China which was supervised by consultant John L. Savage and paid for by the Chinese Government.

"Nations the world over have begun to look to the Bureau of Reclamation for guidance in the development of land and water resource development," Corfitzen said. In commenting on his latest assignment he stated, "The program in Greece is designed to restore to full usefulness the lands in Macedonia and Thrace which have been irrigated for many years, and which supply a principal part of the food grown in Greece."

Corfitzen joined the Bureau in 1933 and has spent considerable time on special research on the problems of sedimentation in canals, and water conservation and utilization, previous to becoming Chief of the Special Assignments Division. He is a graduate of Worcester Polytechnic Institute of Massachusetts and the Denver University Law School. ●

Reclamation ERA

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Ruth F. Sadler, *Editor*

Our Front Cover

Indian Summer in Idaho

Eating 'em right off the vine is a never-to-be-forgotten thrill. And who enjoys it more than a barefoot boy? Jack Massey of Boise, Idaho, illustrates the real way to eat watermelon. Living in the land of irrigation he has an advantage of several additional months for enjoying this luxury. See *Watermelon Time* by Elma Hill Neal on page 226. The photo was taken by Stanley Rasmussen, Region I.

Letters to the Editor

For the People . . . .

The following letter was received from Dr. Charles A. Lory, well-known authority on irrigation, whose comments are greatly appreciated by the editorial staff.

FORT COLLINS, COLO., *August 19, 1947.*

DEAR DIRECTOR LINEWEAVER: Thank you for your letter of July 25 and the return of the photograph used in the July issue of the RECLAMATION ERA to illustrate my article. It was a pleasure to write of my experience as a ditchrider. It recalled many interesting pioneer conditions.

I find the ERA interesting and instructive. For years it was a first class engineering journal on construction of irrigation structures. Now its editors are giving attention to the people who operate these and to the folks on Reclamation project farms. This is proving helpful to the operation and maintenance staffs, and particularly to the farmers.

While methods of irrigation must be adapted to local conditions, beginners in irrigation farming especially, and irrigation farmers generally, would be helped by articles on irrigation methods of growing crops where rainfall is supplemented with "ditch water."

With kindest personal regards,

Cordially,

CHARLES A. LORY,
President, Emeritus, Colorado State College.

Education Via Era

LOGAN, UTAH, *August 12, 1947.*

DEAR EDITOR: Looking toward improvement of irrigation and drainage facilities in Moapa Valley, Nev., the Bureau Region III officials, as you know, are conducting comprehensive and detailed investigations. It is expected that the report of the Bureau's Moapa Valley studies will be ready about July 1, 1948.

The problem of educating farmers and businessmen with respect to Bureau of Reclamation activities, and the value of Bureau projects, is sometimes a perplexing one. It is perhaps more true in outlying valleys long-settled, like Moapa than in some of the valleys more recently settled. I believe that wide circulation of the RECLAMATION ERA in Moapa Valley and in Virgin Valley will contribute substantially to the desired understanding of the Bureau of Reclamation by local people.

Th educational problem in Virgin Valley is more perplexing than in Moapa Valley. In order to meet both needs I would like to send the RECLAMATION ERA to a large number of local people. I am enclosing a list of 28 men—13 of whom are in Moapa Valley and 15 in Virgin Valley to whom I would like to have RECLAMATION ERA mailed for a year or more, beginning with the issue of May 1947. Please advise me if it is consistent with your policies to send the ERA to farmers who are not yet participating in a Bureau program. For the two southern Nevada valleys, Moapa and Virgin, there are three irrigation companies, and about one-half of the men whose names are listed on the attached sheet are directors in an irrigation company. Advise also in connection with a subscription for 28 men—what subscription rate would be in harmony with Bureau practices?

Thank you for an early response.

Yours very truly,

O. W. ISRAELSEN,
Ph. D., Consulting Engineer.

Reader Israelsen was informed that the special 50-cent rate applies to irrigation farmers in the West who are present or potential users of water made available through Bureau of Reclamation projects.—Ed.

Bureau Booster

MINDEN, NEV., *August 16, 1947.*

DEAR MRS. SADLER: For more than 20 years I have made it an absolute rule never to release any material for use in an uncopyrighted publication, but the entire personnel of Region III (and there has never been an exception) have always given me such all-out cooperation, that when Arthur Rydell and William Russell asked for the enclosed article on the Hoover Dam Guide Service for the ERA, I could not say no.

All existing rights in this article are my personal property and you need no authority, other than mine, to use it.

You have my permission to publish it in the ERA and to make any other use of it which will in any way, directly or indirectly, help the Bureau.

Cordially yours,

DONLEY LUKENS,
The Nevada Magazine.

Gratefully and proudly we took Reader Lukens at his word.

SEE NEXT PAGE

Californians, Have Mercy!

SACRAMENTO, CALIF., *August 23, 1947.*

To: Mrs. S.
From: Mr. C.
Subject: Tragic Error in "Next Month" Section of September ERA.

DEAR MADAM: Do you want to get yourself murdered? The Central Valley project in southern California, indeed! Southern California is Los Angeles and surrounding territory south of the Tehachapis which wall off the Central Valley in the south. The Central Valley is northern California, or if anyone prefers, central California. We feel deeply about these things out here.

O. C.

Sorry! We meant to say "sunny" California, of course.—Editor.

United States Department of the Interior
J. A. Krug, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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HOOVER DAM

• • • • • **from the Guide's Viewpoint**

by Donley Lukens

Extracted from ***The Nevada magazine*** *(see Letters to the Editor)*

What is probably one of the most efficient public services in the world is operated by a little group of 22 civil service employees at Hoover (Boulder) Dam. They are the guides who conduct visitors through the dam, and whom Nevadans and tourists alike take for granted.

If there is a similar organization in the world that can equal the safety record of these men, or show a higher percentage of satisfied customers, diligent search has not revealed it.

Up to closing time May 27, 1947, the Hoover Dam Guide Service had conducted 2,200,680 visitors through the dam and directed the movement of twice that number on top of it without a single fatality. The most serious casualty any visitor had suffered on a conducted tour was a badly bruised finger, while a broken leg represented the worst injury on top of the dam.

Add to this safety record the fact that during the 6 years 8 months the dam has been open to the public, allowing for the time it was closed during the war, there have been less than a hundred complaints from all causes.

One of the things which has made this record possible is the type of men the service attracts. Three members of the staff hold master's degrees, three were on the construction job, and a large percentage of them are college men, but all are especially qualified for the work.

A complete list of the qualifications required of a good guide sounds like the curriculum for a Ph. D., but the most important, and the one which they must demonstrate before they are allowed to conduct a party on their own, is a quality of leadership that will enable them to handle a crowd in a closed place, during an emergency, without panic. The importance placed on this requirement undoubtedly accounts for the safety record of the guide service.

The first aid which guides are called upon to give is usually limited to fainting cases, but there is a first-aid man on duty in a special first-aid room at all times and two members of the guide staff are also experts. Jack Arnold was a warrant officer in the Navy Hospital Corps and John Weston was in the Army Medical Corps.

But these things are only the start of the qualifications of a good guide. Besides being capable leaders and first-aid men they must also be teachers and entertainers, capable of answering all manner of questions.

To keep abreast of the questions, not only about Hoover Dam and Lake Mead but other projects of the Bureau of Reclamation they must study continuously.

One of the secrets of their success is that no question is foolish to a good guide, and this is not just a copy book axiom laid down for them to follow. If you get to know the men well enough you will realize that although they see the humor in many questions asked they really take them seriously, because they feel they are serious to the people who ask them. There is one exception to this rule, and that is the tourist who asks the first question that pops into his mind just to start a conversation. Guides soon get to recognize this circumstance and help the conversation along.

The two most frequently asked questions which would bring a snicker from most of us are:

"Is the water good to drink after you have taken the electricity out of it?"

And referring to the high-water mark on the canyon walls left by the waters of Lake Mead, "Why do they paint that white line on the canyon wall?"

Another question which every guide hears almost daily is "How many men are buried in the concrete?" A surprisingly large number of visitors will argue the point with the guides when they are assured that no one was buried in the concrete during the construction period.

Some of the less frequently asked questions which are none the less amusing are:

"Aren't you going to show us any electricity?"

"What kind of fuel do they use to run the hydroelectric turbines?"

"Did the building of the dam increase the size of the lake?"

"Why did they build the dam here instead of in Los Angeles where they use most of the power?"

A feeling of hospitality and the ability to be a gracious host are also among the important qualifications of the guides. They are demonstrated countless times every day by the performance of numerous little courtesies which range all the way from helping a young mother find a place to heat the baby's bottle to helping those who outlasted their luck at the gaming tables hitch-hike rides to practically every part of the United States.

The guides probably find more amusement in listening to the misinformation which some of the tourists volunteer to other members of the party than from any other source.

One self-styled authority pointed out the 150-ton cableway which is used to transport heavy equipment from the canyon rim to the powerhouses below and explained that the cables held the sides of the canyon together so the pressure of the water behind the dam would not push them apart, leaving the dam in the middle of the stream.

Another explained that the reason the water below the dam was green was because the electricity had been removed. To avoid embarrassing him, the guide omitted the usual explanation, which is that the blue of the sky is filtered out of the light when it is reflected from the canyon walls to the water below.

Perhaps it is instances of this kind that help to attract the type of men they have in the Hoover Dam Guide Service and to keep them on the job year after year. Certainly it is not the salaries they receive—for their base pay ranges from \$2,469.24 a year to \$2,895.60 a year for chief guide. With all of the increases possible under civil service, this would still leave them with pay checks of from slightly under \$3,000 a year to less than \$3,500 a year for chief guide, and many of the men in this service could earn half again to twice their present salaries in private industry.

Donald C. Beckord, chief guide, who holds a master of arts degree and served in the late war with the rank of major, thinks the appreciation tourists show for the guide's service helps to keep the men on the job.

"Why," he says, "I get more 'thank you's' in one afternoon on this job than I received in 12 years of school teaching."

The number of people who say, "Thank you" to the guides is one of the remarkable things about the service. An eastern railroad executive who noticed it made three trips through the dam in an effort to learn the secret of the guides, and said:

"There was hardly a person on any of these tours who did not thank the guides either during or after the trip. I have been dealing with the traveling public for more than 30 years and it takes better service to get an American tourist to say 'Thank you' than it does to separate him from a fat tip.

"Any time a tourist appreciates a service enough to say 'Thank you' he will talk about it for at least a year. Money can't buy that kind of advertising, and no other advertising will bring as many tourists."

Just how many of the tourists who visit Hoover Dam come as a direct result of the guide service is anybody's guess, but it can be accurately estimated that those who have visited the dam since it opened have spent at least \$88,027,200 in the southern part of the State and the visitors to the dam this year will spend at least \$16,000,000 in Nevada. ●

ARIZONA ~ Great Outdoor Greenhouse

How farmers cast their seed upon the Yuma and Salt River projects and it returns one-thousandfold

Photo by Ralph E. Johnston

Yuma County Agent Robert J. Moody inspecting a field of Mindo Oats on a farm in the Yuma Valley.

by Ralph E. Johnston

Economist, Project Planning Office, Phoenix, Ariz., Region III

Miracles in the world of agriculture are no longer startling.

Through the use of electrically lighted henhouses, the modern biddy produces two eggs in the time her ancestor produced one. Through the use of water dropped from the heavens upon lush areas or stony mountain sides, and diverted by the ingenuity of man to desert lands, two crops grow where only sagebrush grew before.

But the mind of man, inured as he is to pyramiding production records, cannot contemplate the increase from one bushel of wheat to 60,000 in 2 short years without experiencing something of a shock. Yet exactly that increase is a matter of record—and a matter for rejoicing in Montana where in the early '40s a sawfly infestation threatened one of the Nation's chief wheat-growing areas.

Canadian plant breeders developed a strain which resisted the pest, but the supply of seed was infinitesimal in comparison to the acreage to be seeded. One bushel of wheat under ordinary circumstances would produce approximately 35 bushels in a year's time. At that rate of increase, the farmers would be bankrupt before enough fly-resistant seed could be obtained. The future looked dark. It seemed that only a miracle could save the Montana wheat growers.

Remembering the miracles wrought on the Salt River project in Arizona, where irrigation, plus 310 frost-free days a year, makes the valley a veritable outdoor greenhouse, Montanans sent one bushel of the aptly named Rescue wheat to the Arizona Agricultural Experiment Farm near Mesa. This was in the fall of 1944. The next spring 35 bushels were harvested and shipped back to Montana where a crop was produced in the spring and summer of 1945. That fall 100 bushels from that yield were sent back to Arizona, this time to the Yuma area, where a good crop was produced, resulting in 3,876 bushels being sent to Montana in May 1946. This amount plus that raised in Montana in 1945 was planted immediately. In the fall of that year, just 24 months after the first bushel had been sent to the "outdoor greenhouse," 60,000 bushels of Rescue seed wheat were available to Montana farmers.

Montana's reaction to this cooperation was expressed recently by the Montana Experiment Station and Extension Service in these words:

"The increase of Rescue wheat from one bushel in October 1945 to 60,000 bushels 24 months later sounds like a fairy story, but is nevertheless the true production record accomplished in the race to reduce the huge losses being taken by wheat producers of Montana in the battle against the sawfly.

"It also means that in 1947, instead of 7,000 acres which would have been a maximum number planted under the ordinary method of increase, there will be close to 100,000 acres of Rescue wheat planted in Montana; and this fall (1947), just 36 months after starting the program, there should be harvested enough Rescue wheat to seed every sawfly-infested acre in Montana."

Reducing the benefit to terms of dollars and cents, Montana agricultural authorities estimate that by the use of Arizona's outdoor greenhouses to hasten production of sawfly resistant (Rescue) wheat seed, Montana farmers will gain $4,467,525 during 1947 and 1948.

Montana's experience is not unique.

Other Northern States, from New York to North Dakota, have benefited from use of the irrigated lands of the Salt River and Yuma projects, developed by the Bureau of Reclamation.

New York

In the fall of 1945 small quantities of seed of four different selections of oats were sent to the experiment farm near Mesa, by the agricultural experiment station of Cornell University, Ithaca, N. Y. All of these selections were so new at that time that they were identified only by numbers. In the spring of 1946 a total of 1,325 pounds of seed was sent back to New York. Dr. H. H. Love, professor of plant breeding, New York College of Agriculture, has expressed his appreciation of this type of interstate seed increase cooperation.

North Dakota

A small acreage of a new beardless hard red spring wheat, also a new smooth awned malting barley, was planted in the Salt River Valley in the fall of 1946, by a commercial seed company. An effort is being made to increase the resulting crops in the Red River Valley of North Dakota during 1947.

South Dakota

The spring wheat growing States are constantly confronted with the problem of developing a high quality of bread wheat which has disease-resisting qualities (especially stem rust) and which produces satisfactory yields.

In the fall of 1945 small quantities of new, as yet unnamed, varieties of wheat and barley seed, developed by the South Dakota Agricultural Experiment Station to withstand rust, were sent to the Arizona Agricultural Experiment Farm near Mesa. The wheat is a cross between Rival and Thatcher, so it was designated as Rival X Thatcher, 2280. From a very few pounds planted in the fall of 1945 at Mesa, 278 pounds were shipped back to South Dakota in the spring of 1946.

Fifteen pounds of Peatland X Dryland 252 barley seed were shipped to Mesa in the fall of 1945, and the next spring a crop of 400 pounds was harvested. One hundred pounds were shipped back to South Dakota, and 300 pounds to an irrigated area in Idaho. A crop was produced in South Dakota in 1946, but a larger one was produced in Idaho because of irrigation. Thus starting with 15 pounds in the fall of 1945, because of the cooperation of the irrigated areas, more than 7,000 pounds of seed were available in the fall of 1946.

Dr. J. E. Grafius, associate agronomist, South Dakota Agricultural Experiment Station, recently said of this accomplishment:

"We greatly appreciate the help we have received in this matter. This type of help is of immense value to the northern stations in securing rapid increase of new varieties."

Iowa

The Iowa Agricultural Experiment Station developed the Clinton variety of oats for resistance to helminthosporium, a new oat disease, and other cornbelt oat diseases. Twenty-five pounds of seed were sent to Mesa in the fall of 1943, where it was planted; and in May 1944, 67 bushels (or 2,144 pounds) were shipped back to Iowa. From 25 to over 2,100 pounds in less than a year!

Minnesota

The Mindo and Bonda varieties of rapid-maturing, strong-stemmed and rust-resisting oats, were developed by the Minnesota Agricultural Experiment Station. These varieties are highly recommended for Minnesota and other States with similar oat-growing conditions. A total of 25 acres of each variety were planted in the Yuma Valley in December 1946. These fields are being grown by a Minnesota seed company in order to make available to the farmers of Minnesota larger supply of certified seed of these recommended varieties.

Two Crops Each Year

A year-round growing season plus almost absolute control of water makes possible this cooperation with other areas.

In most of the United States there is only one growing season every 12 months. This is a very definite hindrance to the plant breeders in their efforts to aid agriculture. They do use greenhouses in producing the thousands of individual plants from crosses and selections, which are necessary to obtaining new and improved varieties. Then someone discovered that the two-crops-per-year areas of the Southwest, the great outdoor greenhouses of Arizona, could assist in this work.

The Yuma area averages around 200 feet in elevation, receives a yearly average of less than 4 inches of precipitation, and has 331 days free from frost. The Salt River area averages about 1,000 feet higher than Yuma, has less than 8 inches average yearly precipitation, and 310 days free from frost, thus assuring a year-round growing season.

These normally desert areas have a semitropical climate which is highly advantageous to agriculture on irrigated lands. They can grow, under irrigation, any field crop that can be produced anywhere in the United States. This is possible because of the two growing seasons each year—one for the cooler months, and one for the warmer months; also, because of the more than 80 percent of possible sunshine, which is more than any other area in the United States.

Great Irrigation Systems

To these very important natural field crop growing requirements man has added the great irrigation systems of these two valleys. All crops are produced under irrigation, which means that moisture can be added or withheld as needed, and in the proper amounts. Thus, there virtually is controlled crop production, so essential in speeding up the increase in the scarce seed supplies of the new varieties of field crops. So seed is now shipped to Arizona, where a crop is produced during the noncrop growing season of the Northern States, namely, the late fall, winter, and early spring months.

This "discovery" shortens by years the time when a supply of seed of the new and improved varieties of field crops can be made available.

It is difficult to even imagine the great quantities of seed required to plant the millions of acres of field crops in the United States. Wheat acreage alone in 1944 required 65,684,000 bushels, figured at 1 bushel per acre, for planting.

To this sum must be added the millions of bushels of barley, oats, rye, flax, corn, sorghums, cotton, forage, and pasture crops, most vegetables, and a long list of other crops requiring seed.

When a Northern State has a small quantity of seed of a new variety which it wants to increase in the "great open greenhouses of Arizona," it gets in touch with the Arizona Agricultural Experiment Station.

Dr. Ralph S. Hawkins, formerly head of agronomy department, handled the work when it first started. It is now in charge of Dr. Robert L. Matlock, former extension agronomist and secretary of the Arizona Crop Improvement Association, who recently became head of the agronomy department. After all arrangements have been made, the seed is sent to the experiment farm near Mesa, where D. C. Aepli, superintendent, looks after the planting, harvesting, and return of the crop to the Northern States. The Arizona station has been most cooperative in this work, but it does not have enough land or enough personnel for its own experimental work.

Seed Growers Registered

It now looks like the future seed-increase fields will have to be planted on the farms of registered seed growers approved by the State Crop Improvement Association. This is the method followed in the Yuma area where Robert J. Moody, county agricultural agent, has taken the leadership and rendered very valuable service to this and other seed and crop improvement work.

These seed-increase fields must be grown under conditions which maintain absolutely the varietal purity, as well as all other necessary precautions to assure registered or certified seed. The Arizona Agricultural Experiment Station and the State Crop Improvement Association are cooperating to make this possible.

Thus the Salt River and Yuma projects, besides producing abundantly for their respective areas and the Nation, now render a new kind of very valuable service as outdoor greenhouses for the improvement of the country's crops. •

WATER RUNS UPHILL

(IN CALIFORNIA, OF COURSE)

by Martin H. Blote, *Chief, Irrigation Operations Division, Branch of Operation and Maintenance, Region II, Sacramento, California*

California's rich Central Valley is bone dry all summer and getting dryer as use increases.

Overdrafts on ground water menace hundreds of thousands of valuable acres. But heavy winter rains flash off bare hillsides and floods waste 9,000,000 acre-feet of precious water out to sea. The water supply is geographically all wrong, too. The Sacramento Valley, northern third of the Central Valley, gets two-thirds of the water: the San Joaquin Valley, southern two-thirds, only a third of it.

To rearrange this scant and poorly distributed water supply, the Bureau's Central Valley project will soon start water running uphill and rivers running backward. Here's how it will work: Circulation of water will begin at Millerton Lake, where the San Joaquin River is pent up behind Friant Dam. A small amount of the San Joaquin water will be allowed to trickle down to its big bend. Somewhat more will go north along the 37-mile Madera Canal. All the rest of the river will be turned south, to flow up to the head of the valley through the Friant-Kern Canal, which will irrigate practically waterless but marvelously fertile lands as far south as Bakersfield, 160 miles away. Gravity will be beaten by a take-off far up the south abutment of the dam and a grade of only 6 inches per mile.

The dry bed of the San Joaquin below its bend must be filled. So Shasta Dam, 350 miles north, at the head of the Sacramento Valley, will release Sacramento River water from its 4,500,000 acre-foot hoard. Pumped out of the Sacramento just below the capital city, 10,000 cubic feet of water per second will shove its way, through natural sloughs and a short canal, across the sluggish currents of the Sacramento-San Joaquin Delta streams.

On the other side of the Delta, a small river will be deepened at the upper end so that it flows backward, drawing most of these "Delta Cross Channel" waters with it into a battery of six great pumps. These pumps, operated by giant 27,000-horse power motors, will lift the water 200 feet into the concrete-lined Delta-Mendota Canal, whose gentle grade of 3 inches to the mile, will carry it 120 miles down to the San Joaquin bend. Here it will empty into Mendota pool, a shallow reservoir from which it will be led all over the countryside formerly served by the San Joaquin.

On its way to the Delta pumps, Shasta water will casually fill up the small Contra Costa Canal. This 48 miles of concrete-lined waterway will serve 20,000 acres of farms, several municipalities, and many great factories along the shoreline of upper San Francisco Bay.

G. V. Gideon's photo with engineers' conception of how the trick is done.

Water rushing out of Shasta Dam will turn five 75,000 kilowatt generators there and three 25,000 kilowatters at Keswick dam—afterbay structure 7 miles downstream—to produce an average annual 1,500,000,000 kilowatt-hours which will supply electrical energy for the Cross Channel, Contra Costa and Delta-Mendota pumps, and lessen municipal and farm power costs throughout northern California. The dam controls floods in the winter. In the summer its valves open wide to deepen the river for navigation and give it enough force to drive out intrusive salt tides from the bay, thus protecting 36,000 fine Delta acres from saline poisoning.

Ultimately—in 25 years, perhaps in 50—if funds are made available, and the Bureau's plans materialize, every little foothill stream worth damming will have been dammed to put every useable drop of water to its fullest use. The Central Valley will be completely ringed by dams and power plants, and webbed with 1,500 miles of interconnected main canals, using water at one time from one river, at another time from another, depending on the season.

When the Central Valley project is fully developed there will be a firm water supply for all needy land now partly irrigated, and enough new water for 3,000,000 more acres perhaps 30,000 new farms. And 8 billion kilowatt-hours of new power will have increased the present northern California supply by 40 percent.

What will vast amounts of new rich land, new low-cost power mean to the economy of the Central Valley? They ought to help make the valley the garden spot of the earth, filled with new prosperous farms, new industry, endless job and business opportunities. The myriad of lakes behind the dams will give every town in the valley a pleasant recreational area at its very doorstep. In brief, all the elements of the good life will be near at hand for 2,000,000 or more people. If they do not make good use of their opportunities, it will not be the fault of the Central Valley project!

The Man Behind the "GUN"

by Gene Nicolai

Region I, Coulee Dam, Wash.

AT LEFT, *mortar being applied pneumatically to a lateral on the 5,400-acre Pasco Unit of the Columbia Basin project in Eastern Washington. This rapidly moving operator manages to keep ahead of the finishing crew, background. Photo by F. B. Pomeroy, Region I.*

On a sagebrush-covered bench of the Columbia Basin project in eastern Washington the Bureau of Reclamation's long-range program in developing less costly canal lining methods is proceeding under a gun—a gun that discharges mortar and leaves a new canal in its wake.

Although still in the experimental stage on the Columbia Basin project, the use of pneumatically applied mortar on the first unit of the Nation's largest irrigation development is particularly significant because it may find extensive application in the thousands of miles of laterals yet to be built before the million-acre expanse can become productive.

The shooting of mortar by compressed air is not new in the industrial field, having been used for years in lining main entries of coal mines, and on many construction jobs. Mortar lining on some Bureau projects also dates back several years. It has been used quite extensively in the Southwest, particularly Arizona and California, but results are not sufficiently conclusive, as far as the Columbia Basin project is concerned, because of the wide variations in temperatures to which linings will be subjected in the Northwest. Winters of eastern Washington generally are longer and more severe than in the Southwest.

In the Pasco unit, the lining experiment also is noteworthy because the mortar is being applied directly to the freshly compacted earth embankments, and without the aid of reinforcing steel wire. This is a simplification of some of the earlier experimental studies. (See RECLAMATION ERA, August 1946.)

Low cost and durability are the chief objectives in the lining test. Only a small crew is required, and the men can be trained rapidly. The key man in the lining cycle is the "man behind the gun." His skill determines how rapidly the work proceeds.

On the Pasco unit, where the test mortar is being applied by J. A. Terteling & Sons, Inc., Boise, Idaho, the procedure follows a routine that appears as simple as spraying a field.

The lining routine begins after the canal has been excavated and shaped. A mobile unit, containing a mixer and compressor, is stationed alongside the cut. The gun operator, working from a movable platform just above the canal bottom, signals for service. A spray of mortar shoots from his gun, and the mixture adheres to the canal as he guides the nozzle along the unfinished section. A 2-inch thickness of mortar builds up rapidly.

Seven men comprise the mortaring crew. Two men operate the combination mixer and compressor; one man feeds cement and sand to the unit; four men work in the canal: The gun operator, his helper, a finisher, and a man who applies filler in expansion joints.

Bureau of Reclamation inspectors check the work. Examinations are made regularly to ascertain if the mortar has been built up to the proper thickness. Other tests are made of the mortar to find out whether it contains the correct materials and in proper proportions. Its composi-

tion is four parts sand to one part cement, by weight, plus necessary water.

The freshly applied mortar is quite stable and requires a minimum of finishing. One finisher, using a trowel and a long-handled brush, can keep apace with the gun operator.

Application of filler to expansion joints is equally simple. Known as "mastic filler," the asphaltic-base material also contains short-fibered asbestos, diatomaceous earth (according to Webster, a fine, variously colored earth sometimes called kieselguhr, used as a dope for dynamite, a polishing powder, etc.), and powdered limestone. It is delivered to the job in powdered form, is mixed speedily in a 5-gallon container by adding an asphaltic flux oil, and is applied with a calking gun.

As mentioned earlier, reinforcing steel wire is not employed in the test section at Pasco. It was, however, employed in a similar experiment recently on two sections of the Roza division of the Bureau's Yakima project, also in eastern Washington. The Roza experiment also differed in that no finisher followed the gun operator.

Further construction on the Pasco unit will find another experiment under way to cut canal-lining costs. Other sublaterals will be finished with bituminous material identical with that used in surfacing highways. In this test, soil sterilant will be applied to halt weed encroachment.

Chief Engineer Walker R. Young of the Bureau of Reclamation reported in the Engineering News-Record (February 6, 1947) that the Bureau's tests of low-cost lining of canals will lean heavily on the know-how of industry.

"Thousands of miles of irrigation canals in the western part of the United States fail to deliver a large proportion of the water turned into them at their intakes because of leakage from unlined sections," Mr. Young said. "To reduce these losses of valuable water, the Bureau of Reclamation is conducting a broad program aimed at the development of lower-cost canal linings. In this program the Bureau, recognizing the

ABOVE, ***over-all "shot" of the job. In this photo the compressor serves the man with the gun, while the boys apply the finishing touches to the groove.*** **AT RIGHT**, ***closeup of the "finishers." Note man on platform spraying two-inch layer of mortar to freshly compacted earth.*** **BELOW**, ***worker with mastic filler plugging expansion joint after mortar has been applied to Pasco lateral. He does the job with ordinary calking gun. All photos by F. B. Pomeroy, Region I.***

past performances of the construction industry in reducing costs and improving workmanship, appeals to the ingenuity of the contractor, the equipment manufacturer, and the materials producer for aid in developing satisfactory linings that can be installed at costs that are economically justified.

"The long-felt need for lining irrigation canals is intensified today by the increased demand for irrigated land in the West and the growing necessities of conserving vital water supplies and of protecting productive lands from seepage. However, with the costs of lining canals by conventional methods and with orthodox materials now at levels that are prohibitive for many distribution systems, the Bureau is looking beyond the precedent of the familiar trapezoidal canal section with its concrete lining and has begun to explore the possibilities of radically different designs, materials, and construction methods," he added.

The Pasco test unit can be cited as a clear-cut example of departure from the traditional. And if the experiment is successful, then construction-cost estimates for laterals on the remainder of the project may drop, with resultant benefits to farmers.

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Next Month—"Try-outs of Precast Canal Linings" by Field Engineer Van E. Nutley—an account of the experiments conducted on the Roza division of the Yakima project, Wash., for lining small canals with precast concrete blocks.

Getting Rid of a Bloomin' Nuisance

by Clayton L. Long,

Former Agronomist, Region I, Boise, Idaho

Weeds are going to take an awful beating in one little 20-acre section of the Pacific Northwest one of these days. They're going to be electrocuted, poisoned, sterilized, dug-up, cut-up, sprayed, trampled on, have their life history exposed, and, in general, be subjected to a thorough going over.

The 20-acre tract will constitute one of the two weed experiment stations involving irrigated agriculture being put in operation in the West for the first time to perfect the best way of putting an end to this "bloomin' nuisance." The Bureau of Reclamation and the Bureau of Plant Industry, Department of Agriculture, are establishing the stations and many other agencies will help to conduct the research work.

One of the two stations will be situated on Hubbard Lake, a few miles south of the town of Meridian, on the Boise project in southwestern Idaho. Clearing and leveling of the land and other preparations were initiated in May.

A series of canals will be created in which water weeds will be encouraged to grow. The established weeds will then be treated with various concentrations of different chemicals and their effect upon the water weeds determined. Below the canals will be situated a series of plots seeded to farm crops. The water from the chemically treated canals will be used for irrigating these crops and the effect of the chemicals upon the crops determined.

Every agency involved in the weed problem is pitching in under a cooperative arrangement. Ada County is furnishing office and laboratory space, with water, heat, and light, in their building located at Meridian. The county is also making available the use of certain weed-fighting equipment and the advice and counsel of their county weed supervisor. The board of control of the Boise project is furnishing land and water to the Bureau of Plant Industry for the station and equipment and technical aid in leveling, grading, and laying out ditches.

The University of Idaho is furnishing the advice and counsel of its weed and other specialists in the weed control research and grass planting program for ditchbanks. Later the university may rent additional weed-infested lands for the work, if necessary. The Idaho Noxious Weed Association is giving its wholehearted moral support together with advice and guidance.

The Regional Office of the Bureau of Reclamation will supply technical aid and the advice of the Chief, Irrigation Operations Division, and the agronomist. They will also conduct large-scale trials of promising methods of control and eradication as they are developed by the weed station.

Weeds account for more than 50 percent of water users' losses from all pests. Moreover they increase the operation and maintenance costs on irrigation systems as well.

The Owyhee project (Oregon-Idaho) reported in 1945 that the cost of the removal of weeds constituted about 14.7 percent of the total cost for operation and maintenance. Removal of weeds as reported amounted to $35,710.38 on this project, which would average $62.76 per mile for all canals and laterals or about $0.47 per irrigable acre of land.

The need for a comprehensive research program for determining ways and means for combatting this most destructive and expensive pest on irrigation lands and water distribution systems has been apparent for some time. The research station under the active management of Jesse M. Hodgson, associate agronomist, has formulated a program which will serve as a logical beginning of the experiments.

A thorough test will be made of the electrovator, which electrocutes weeds, to determine its effectiveness on several of the most noxious land weeds on different soils with different moisture content.

The most effective time and concentration of 2,4-D for the control and eradication of willows will be determined. The effectiveness of 2,4-D in controlling weeds in newly seeded grasses and its effect upon the grasses at different time periods following the germination of the seed, and the effect of this chemical at different concentrations in irrigation water upon crop seeds, will also be studied. Tests will be conducted with combinations of 2,4-D, tillage (shoot cutting), and cropping to determine their effectiveness in weed control.

The research group will also make life history studies of the Potamogetons (pondweeds) and other aquatic weeds, conduct root reserve studies of willows, cattails, Potamogetons, and other water weeds, and determine the effectiveness of chemical treatment for water weed control in dry irrigation ditches. The use of methoxone and other selective herbicides against pre-emergence weeds will be tested.

As the research program develops and matures, and the Bureau follows through with larger trials in the field to adapt the station's findings to field conditions, a general improvement in the economy and effectiveness of the weed control program will, no doubt, result and the Bureau's partner, the water user, will be more confident in his program for control of weeds on his farm.

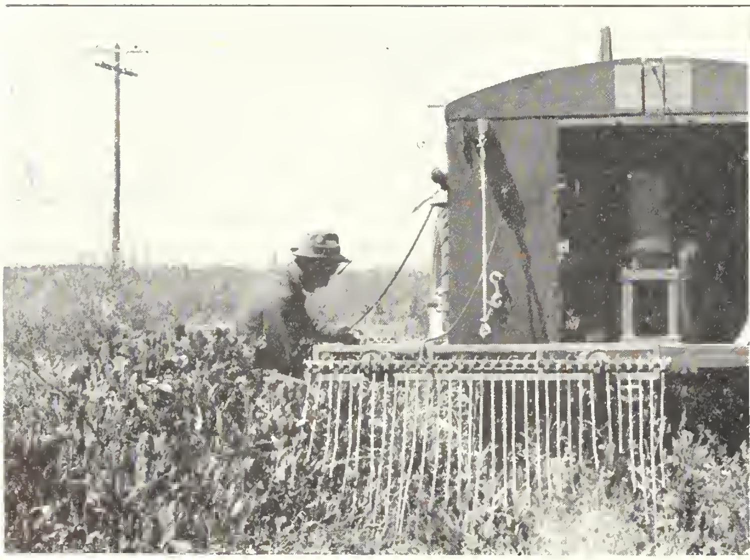


Photo by Philip Merritt, Region I

ELECTROCUTION—*The Electrovator is used to give weeds the "finishing touch."*

Photo by Stanley Rasmussen, Region I

ELOCUTION—*The author cross-examines the "criminal" as a group of Boise farmers weigh the evidence.*

Photo by Ben D. Glaha, Region II

Almost 400 tons of baled hay in these stacks, Minidoka project farm, Idaho, is typical of new record.

Reclamation's Crop Record

For the first time in the 45-year history of the Bureau of Reclamation, the value of crops produced on lands served by project systems in 1946 exceeded half a billion dollars. Compared with 1945 returns, 40 projects showed an increase in total crop values, and 6 projects showed a decrease. Furthermore, the number of projects supplied with irrigation water increased from 46 to 54; the acreage capable of being served a full irrigation supply increased from 2,437,046 to 2,486,793 acres; the area supplied supplemental water and other special contractors increased from 2,576,082 to 2,621,838 acres; and the population on project farms and in cities, towns, and villages dependent on Federal irrigation systems increased from 1,328,411 to 1,398,856.

The benefits derived from the Federal reclamation program are here summarized, based on a comprehensive census of project achievements taken at the close of the year.

For the Nation as a whole, the total output of crops in 1946 was the greatest in history. High yields were primarily responsible, supported by a growing season more favorable than usual. The records for the Federal reclamation projects indicate corresponding excellent production, both in quantity and quality of the crops harvested.

High prices prevailed for farm produce in 1946 and at the same time some of the wartime difficulties as to machinery and labor shortages were alleviated. Farm wage rates reached a record high in the fall, but more labor was available than in the preceding year. The gross values of crops reported for the reclamation projects, therefore, were affected generally by high prices and high yields. This resulted in an upward trend in values, as compared with 1945, and in some cases on individual projects, a sharp increase in the crop values over the preceding year. Increases in crop values generally were accompanied by increases in the cost of production.

The accompanying charts and tabulations show the total achievements under the crop program on Reclamation projects as reported for the calendar year 1946. Crops having a total gross value of $530,623,945 were produced on 4,396,581 acres in cultivation. Of this acreage, 1,990,621 acres received a full supply of water from works constructed by the Bureau of Reclamation, and 2,405,960 acres received a partial or supplemental water supply due to Bureau activities. The average gross value of all crops was $120.69 per acre, as compared to $103.72 in 1945. For lands receiving a full supply of water from the Bureau, the range of gross value was $17.88 to $747.60 per acre. For lands receiving supplemental water from Bureau-constructed systems, the range of value was $16.05 to $245.56 per acre. A wide diversity of crops grown, varying stages of land development, and different types of farming activities caused these variations in returns. Related also is the additional income received from the sale of livestock and livestock products which is not reported.

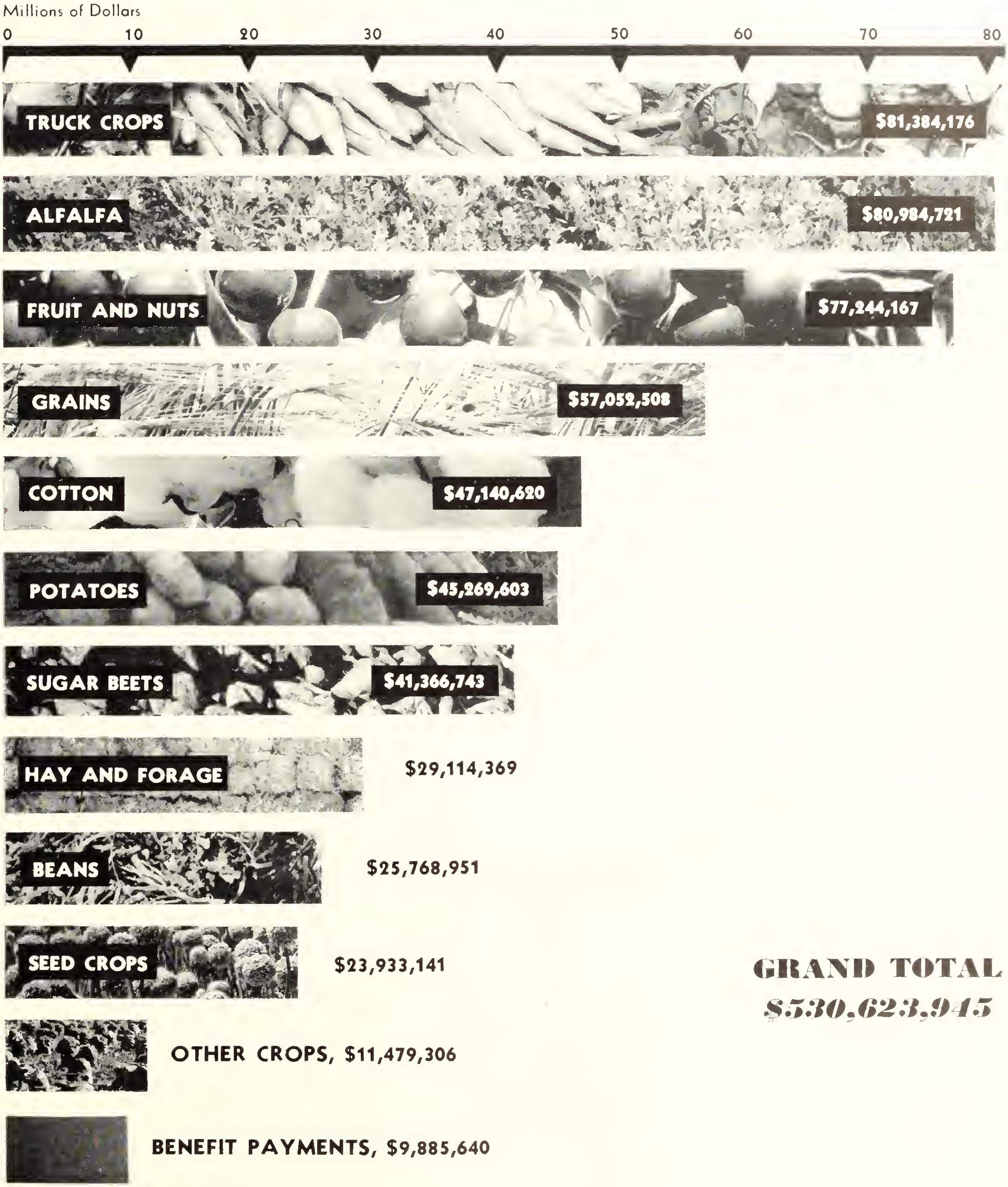
(continued on page 220)

Reclamation's 1946 Harvest

These 54 Irrigation Projects Produced→

reaks 45-Year Record

Crops Worth Over One-half Billion Dollars



CROP RECORD

(continued from page 217)

The 1946 summaries include census reports for 54 projects. On 16 of these projects there were lands outside the regular project areas which received surplus project water under the provisions of the act of February 21, 1911 (36 Stat. 925), known as the Warren Act. In a special category, also, is the Imperial irrigation district, which is included in the total of 54, with 400,000 acres irrigated with water which flowed from the Colorado River through the All-American Canal into Imperial Valley.

The total irrigable land for which the Bureau of Reclamation in 1946 was prepared to supply water was 5,150,831 acres. A total of 4,321,969 acres was actually irrigated, and 4,396,581 acres were in cultivation. The net acreage in cultivation includes some land lying fallow for soil building purposes and not actually irrigated during the year, as well as miscellaneous small tracts from which income was received but to which water was not applied in 1946. Compared with 1945, the acreage increases were as follows:

	1945	1946	Increase	Percent of increase
	Acres	*Acres*	*Acres*	
Total irrigable area	5,030,336	5,150,831	120,195	2.39
Total irrigated area	4,162,588	4,321,969	159,381	3.82
Total net area in cultivation	4,195,732	4,396,581	200,849	4.78

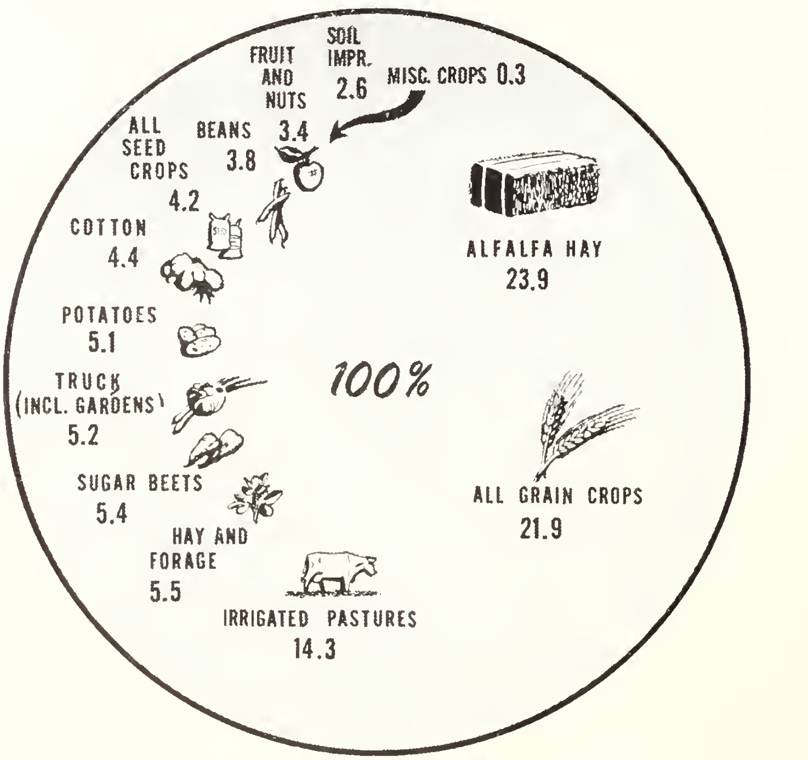
The project area actually irrigated in 1946 (or 4,321,969 acres) was 81.5 percent of the total project irrigable area, or 5,150,831 acres. An analysis of the use of the project land not irrigated shows the following percentages, which are approximately the same as in previous years:

Area actually irrigated	81.5
Land set aside for farm buildings, rights-of-way, and roads	4.0
Class 5 land temporarily suspended from the paying classes and not in cultivation	4.1
Land that was dry farmed	1.6
Land that was idle	8.8
Total irrigable area	100.0

The irrigable lands have been summarized, with a break-down as to the area presently irrigable and additional lands to be served. Furthermore, the acreage has been segregated as to public lands, land in private ownership, and State and Indian lands. Totals are as follows:

Area irrigable in 1946	Acres
Public lands:	
Entered	665,184
Open	2,089
Withdrawn	56,284
Private lands:	
Railroad, unsold	16,851
Other	4,198,637
State lands, unsold	13,650
Indian lands	24,899
Class 5 lands, all categories	172,937
Total	5,150,831

Additional area to be served	Acres
Total irrigable area, end of 1946	5,150,831
Additional land expected to be served irrigation water during 1947:	
Public	45,884
Private	107,449
Total	153,333
Additional irrigable land, to be served irrigation water 1948 or thereafter	9,667,176
Total ultimate irrigable acreage in authorized projects	14,971,340



How Reclamation Land Was Used

Crop Production

The outstanding yields of the 1946 harvest were reflected in the summary of tonnage of food and forage crops. There were 14,439,131 tons reported for reclamation projects in 1946, compared with 11,814,337 tons produced in 1945, an increase of 2,624,794 tons, or 22.2 percent. The increase in acreage harvested was only 4.78 percent, indicating that the higher yield per acre was primarily responsible for the increase in tonnage. The most notable increases were in grains, seed crops, beans, truck, and sugar beets.

Detailed census reports were received for 55.8 percent of the total acreage, as the Warren Act contractors, for the most part, submit summary reports of estimated results only. The diagram on this page shows how the land for which detailed reports were received was utilized.

Crop Values

The total gross crop value for all project areas in 1946 was $530,623,945, or $95,439,550 more than in 1945. This was an increase of 21.9 percent. Prices were high, yields per acre were above previous averages, and new project areas were in cultivation and reported in 1946 for the first time, all contributing to this outstanding increase in gross value. The total gross value is shown on the chart on page 219.

The benefit payments for 1946 crops include Government payments for sugar beets, cotton, soil conservation practices, as well as sugar factory bonus payments which are based on sugar content of the beets. These payments, altogether, amounted to 2.2 percent of the gross income reported.

Miscellaneous Crops

Summaries have been made in connection with the 1946 reports, for the first time, as to some of the more important miscellaneous or specialty crops. In some instances these individual crops account for large segments of project income and are a vital contribution to prosperity in a region.

Crop	Acreage	Production	Gross value
Fruits and nuts:		*Pounds*	
Apricots	3,070	25,068,496	$1,280,795
Cherries	3,982	32,052,259	1,067,529
Grapes	3,896	20,648,906	930,108
Pecans	5,457	2,132,170	823,836
Truck:		*Bushels*	
Asparagus	4,576	851,877	1,767,922
Cantaloupes	18,170	3,072,145	5,535,270
Carrots	4,987	1,932,880	2,343,417
Sweet corn	7,279	1,412,615	558,588
Lettuce	48,422	14,011,872	10,365,668
Melons	5,573	1,402,068	1,346,671
Tomatoes	9,766	3,002,553	2,190,699
Peas	12,456	659,328	1,158,242
Seed:			
Peas	16,291	323,772	1,122,461
Beans	8,496	172,592	866,446
Sweet corn	5,868	261,357	1,011,580
Flax	19,783	445,932	1,661,836
Sugar beets	3,039	449,768	1,117,149
Miscellaneous:		*Pounds*	
Hops	4,240	6,816,282	4,623,859
Mint oil	1,119	55,576	336,846
Nursery	854		538,633

Livestock

The value of livestock on reclamation farms on November 1, 1946, amounted to $74,078,198, or an increase of more than $5,000,000 as compared with the same date in 1945. This amounted to an average value of $1,140 per farm reported. The inventory does not cover the Warren Act contractors.

The summary indicates there were 520,688 cattle valued at $49,718,146, and 1,011,787 sheep valued at $10,864,849. This inventory does not measure the income that is derived through the year by reclamation farmers from the sale of livestock and livestock products.

Area Development

A total of 88,657 irrigated farms was reported in 1946, including those areas served a partial or full water supply under the Warren Act. However, this total did not include the Truckee Storage, Provo River, and Weber River projects for which no reports were received. In 1945 these three projects had 5,530 irrigated farms.

The population for the 88,657 project farms reported totaled 331,435. The population of towns on or adjacent to the projects reported was 1,067,421. The census at the close of 1946 showed 1,057 schools, 1,668 churches, and 149 banks serving the project farms and towns.

Water Deliveries

Information on water diversions, losses in irrigation systems, and the total delivered to farms has been summarized for 36 projects or divisions of projects in 1946. On the basis of these reports a total net supply of 14,551,659 acre-feet was diverted; 5,633,289 acre-feet were lost, principally through seepage from the main canals and laterals; and 8,892,882 acre-feet, or 61.1 percent, were delivered to farms.

Operation and Maintenance

In 1946, revenues to carry on operation and maintenance work on 19 projects, operated in whole or in part by the Bureau, amounted to $2,311,841.67. The total operating expenses totaled $2,254,063.37, leaving an excess of revenues over expenses for the calendar year 1946 of $57,778.30. The largest item of expense was for operation and maintenance of the irrigation canal and lateral systems, and the principal source of revenues was from operation and maintenance charges assessed and paid by the water users. Both revenues and expenses exceeded those recorded for the calendar year 1945.

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The above article was extracted from "Data on Acreages, Crops, Water Deliveries, Costs, Revenues, and Settlement," recent report of the United States Department of the Interior, Bureau of Reclamation, Branch of Operation and Maintenance.

WATER REPORT

This year, most of the Bureau of Reclamation projects, except in the drought-stricken Southwest, have had sufficient irrigation water to mature their crops profitably, and still leave ample hold-over storage for future operations. In the drought-stricken Arizona and New Mexico projects, the situation is critical. Reserves are below normal in all reservoirs of those projects and are near record lows on several. During the month of August, stream flow in the West increased generally, and some of the streams in Arizona and New Mexico showed considerable improvement over the preceding months.

Ground water and stream flow measurements for August, made by the Geological Survey of the Department of the Interior, show a range of from 2,300 percent of normal in southeastern Oklahoma to 0 in south central South Dakota and southern California.

Surface run-off and stream flow were below normal in southern California, Nevada, New Mexico, South Dakota, Nebraska, Kansas, Oklahoma, except for the southeastern corner, and central and western Texas.

Stream flows and well-levels are plotted on the Geological Survey map reproduced below. Small circles with a line drawn from them like the hour hand of a clock, indicate the measurements of well-levels. The hour hand at 12 o'clock means that the wells in that area are full of water. The hand at 3 o'clock denotes normal levels, while low levels are shown by the hand at 6 o'clock. Where wells are heavily pumped, the indicating circle is solid black. The usually heavy August stream flows are shown by cross-hatching, whereas dotted areas indicate unusually low stream flow. The figures represent percentages of normal August stream flow. Thus 110 appearing on the map means that streams in that vicinity were running at 110 percent of August average or 10 percent above normal. The figure 51 on the other hand, denotes that streams are at only 51 percent of normal or 49 percent below median August stream flow.

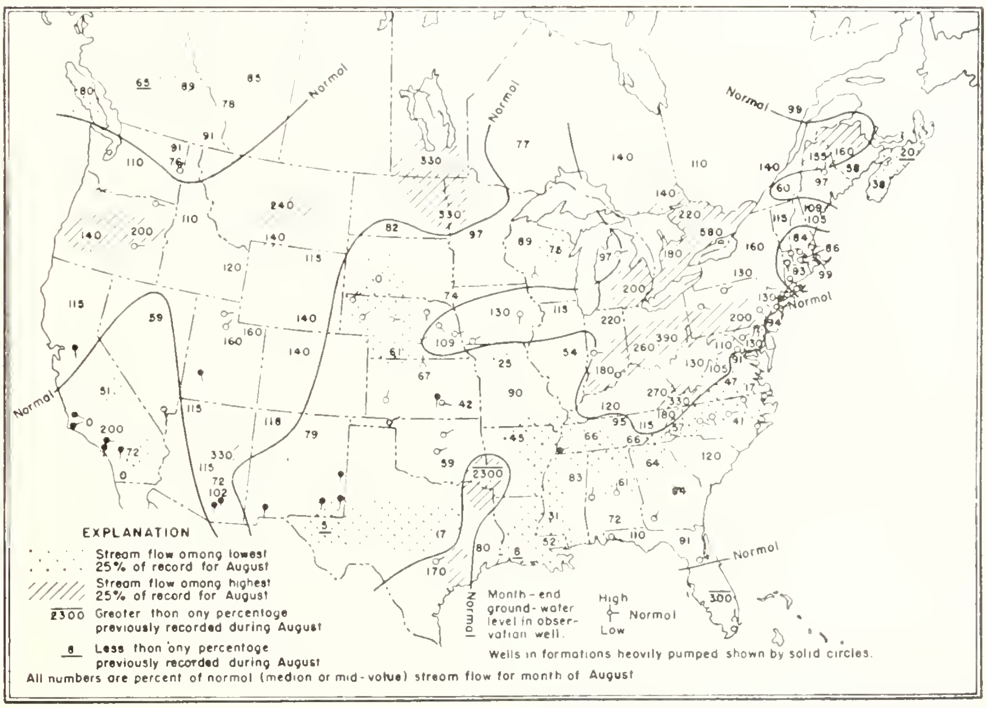
Although run-off in Arizona and New Mexico showed considerable improvement over preceding months, the situation still remains critical. Storage reserves for irrigation and power are generally much below last year.

In New Mexico, the run-off of the Rio Grande increased during the month of August to above the 30-year August average. However, the project's reservoirs contained less than one-fifth of their total active capacities, the lowest August since 1918. In view of the critical condition of the project's reserves, no releases from storage are planned during the fall and winter.

In central Arizona, drought conditions have been so severe that a serious shortage of water for both irrigation and power has resulted. At the end of August the reservoirs of the Salt River project held only about 13 percent of their total active capacity. The 1,398,400 acre-foot Roosevelt Reservoir was empty, and had been empty, or nearly so, since June. While the

(continued on page 228)

Stream Flow and Ground Water in Relation to Normal—August 1947



Map through the courtesy of the Geological Survey

Water Stored in Reclamation Reservoirs

Location	Project and State	Reservoir	Storage (in acre-feet)		
			Active capacity*	Aug. 31, 1946	Aug. 31, 1947
Region 1	Baker, Oreg	Thief Valley	17, 400	6, 600	5, 220
	Bitterroot, Mont	Lake Como	34, 700	12, 900	17, 600
	Boise, Idaho	Anderson Ranch	464, 200	2, 100	2, 000
		Arrowrock	286, 600	134, 000	164, 500
		Deadwood	161, 900	123, 900	93, 900
		Deer Flat	169, 000	41, 600	35, 100
	Burnt River, Oreg	Unity	24, 600	8, 230	4, 600
	Columbia Basin, Wash	F. D. Roosevelt	5, 220, 000	5, 220, 000	5, 196, 000
	Deschutes, Oreg	Crane Prairie	50, 000	40, 000	20, 000
		Wickiup	187, 000	43, 500	61, 000
	Minidoka, Idaho-Wyo	American Falls	1, 700, 000	818, 800	834, 300
		Jackson Lake	847, 000	459, 900	589, 100
		Lake Walcott	95, 200	97, 100	95, 400
		Grassy Lake	15, 200	12, 100	15, 100
		Island Park	127, 300	61, 400	95, 800
	Okanogan, Wash	Conconully	13, 000	6, 000	3, 800
		Salmon Lake	10, 500	10, 000	5, 400
	Owyhee, Oreg.-Idaho	Owyhee	715, 000	454, 900	320, 900
	Umatilla, Oreg	Cold Springs	50, 000	10, 900	4, 800
		McKay	73, 800	26, 500	16, 600
	Vale, Oreg	Agency Valley	60, 000	22, 300	23, 900
		Warm Springs	170, 000	104, 800	35, 900
	Yakima, Wash	Bumping Lake	33, 800	11, 100	12, 000
		Clear Creek	5, 300	5, 300	5, 300
		Cle Elum	435, 700	277, 700	198, 300
		Kachess	239, 000	165, 400	174, 600
		Keechelus	153, 000	109, 200	58, 900
		Tieton	197, 000	160, 000	130, 500
Region 2	Central Valley, Calif	Millerton Lake	503, 100	235, 400	125, 100
		Shasta	4, 389, 100	2, 507, 100	2, 303, 100
	Klamath, Calif.-Oreg	Clear Lake	437, 500	220, 400	154, 200
		Gerber	94, 300	31, 300	16, 700
		Upper Klamath Lake	524, 800	212, 000	189, 600
	Orland, Calif	East Park	47, 900	25, 400	8, 400
		Stony Gorge	50, 000	4, 900	10, 900
Region 3	Boulder Canyon, Ariz.-Nev	Lake Mead	27, 935, 000	19, 454, 000	21, 901, 000
	Parker, Ariz.-Calif	Havasu	688, 000	665, 500	658, 300
	Salt River, Ariz	Bartlett	179, 500	14, 200	10, 400
		Horse Mesa	245, 100	229, 900	176, 900
		Horseshoe	67, 000	8, 400	11, 400
		Mormon Flat	57, 850	54, 500	36, 800
		Roosevelt	1, 398, 400	38, 100	0
		Stewart Mountain	69, 800	43, 100	34, 500
Region 4	Fruit Growers, Colo	Fruit Growers	4, 500	700	1, 400
	Humboldt, Nev	Rye Patch	179, 000	153, 900	119, 000
	Moon Lake, Utah	Moon Lake	35, 800	2, 400	18, 900
		Midview	5, 800	4, 300	5, 400
	Newlands, Calif.-Nev	Lahontan	273, 600	154, 200	93, 300
		Lake Tahoe	732, 000	614, 400	456, 000
	Newton, Utah	Newton	5, 300	2, 000	2, 500
	Ogden River, Utah	Pine View	44, 200	14, 500	18, 600
	Pine River, Colo	Vallecito	126, 300	58, 100	97, 600
	Provo River, Utah	Deer Creek	146, 800	119, 900	130, 100
	Scofield, Utah	Scofield	65, 800	4, 100	18, 400
	Strawberry Valley, Utah	Strawberry	270, 000	111, 500	115, 700
	Truckee River Storage, Calif.-Nev	Boca	40, 900	30, 400	12, 600
	Uncompahgre, Colo	Taylor Park	106, 200	90, 100	106, 700
Region 5	W. C. Austin, Okla	Altus	140, 000	9, 700	65, 800
	Carlsbad, N. Mex	Alamogordo	128, 300	24, 405	9, 300
		Avalon	6, 000	945	500
	Rio Grande, N. Mex.-Tex	Caballo	345, 900	25, 700	36, 200
		Elephant Butte	1, 830, 300	680, 700	324, 800
	Tucumcari, N. Mex	Conchas	300, 000	238, 700	269, 900
Region 6	Belle Fourche, S. Dak	Belle Fourche	177, 500	126, 300	120, 700
	Milk River, Mont	Fresno	127, 200	43, 900	69, 000
		Nelson	66, 800	24, 500	44, 800
		Sherburne Lakes	66, 100	27, 600	25, 200
	Rapid Valley, S. Dak	Deerfield	15, 000	5, 700	12, 400
	Riverton, Wyo	Bull Lake	152, 000	103, 700	122, 000
		Pilot Butte	31, 500	6, 200	7, 900
	Shoshone, Wyo	Buffalo Bill	456, 600	400, 400	434, 900
	Sun River, Mont	Gibson	105, 000	41, 700	39, 700
		Pishkun	32, 050	21, 000	25, 400
		Willow Creek	32, 400	12, 800	14, 600
Region 7	Colorado-Big Thompson, Colo	Green Mountain	146, 900	145, 200	145, 300
	Kendrick, Wyo	Alcova	190, 500	128, 400	185, 200
		Seminoe	970, 000	555, 700	867, 200
	Mirage Flats, Nebr	Box Butte	31, 700	6, 000	20, 400
	North Platte, Nebr.-Wyo	Guernsey	41, 050	13, 000	4, 900
		Lake Alice	11, 000	1, 500	700
		Lake Minatare	57, 000	11, 100	25, 600
		Pathfinder	1, 040, 500	9, 200	195, 900

*Available for irrigation.

Electricity and its FARM CHORES

by
Creighton W. Bicket

*Engineer, Branch of Power Utilization
Region I, Boise, Idaho*

". . . There couldn't possibly be a market for Coulee power."

Before the mammoth Grand Coulee Dam was constructed, and later as it neared completion, doubting Thomases were raising their voices in protest against the enormous electrical installation contemplated. Said they: Since the population growth of Spokane, Seattle, Portland, and other major towns ranged between ½ and 1 percent per year, there could not possibly be a market for Coulee's power for years to come.

During World War II, the tremendous capacity of Grand Coulee generators proved a major cog in the prosecution of the war, making possible the production of aluminum, magnesium, and the atomic bomb at Hanford, Wash. But still the doubters ridiculed. They were sure that once the war was over there would be a large surplus of electric energy in the Pacific Northwest.

Today, instead of a surplus, there is a shortage. The region is figuratively crying for the installation of additional generators at Grand Coulee Dam and for additional dams and powerhouses. Some structures, fortunately, have been approved for early construction.

Basically, there are three major reasons for the power shortage in the Northwest. They are: (1) industrialization of the area, principally in the field of light metals, (2) population influx, and (3) greater use of electricity per customer. It is the latter—greater use per customer—the farm customer, to be specific, who is the subject of this article.

The consumption of electricity on farms in the United States has been growing constantly. In 1923 the average yearly consumption on the farm was 300 kilowatt-hours. As Grand Coulee neared completion, this total had increased 3½ times. The 1946 farm average in the reclamation area was nearly 1,500 kilowatt-hours.

The Pacific Northwest is a pace-setter in use of electricity on the farm. Its consumption is about double the average for the Western States.

Mr. Average Farmer in the region is wisely taking advantage of the low electric rates made possible by Coulee and other dams. He is constantly raising his standard of living, taking the drudgery out of many tasks, and making for himself a richer, fuller life.

A wide field for the use of electric energy is open to farm people in all parts of the West, if it can be made available at reasonable rates. The potentialities are almost unlimited for steadily growing consumption of power and a continued lightening of the work load on our farms and in our farm homes. Here are some of the present and possible future uses.

Household Use

The household use of electricity in rural areas is substantially the same as that in urban centers, except that a pressure water system is necessary before electricity can be put to some other uses. The pressure system makes available running water for drinking and cooking, and emergencies like fighting fires. Installation of the electric hot water heater and the electric range generally completes the more permanent, heavy duty, installations for the house.

The all-electric farm residence likewise will have the radio, vacuum cleaner, refrigerator, washing machine, sewing machine, iron, and a host of other miscellaneous appliances. Of course, provision must be made for adequate lighting in the house and in the yard, in the barn and in the milk house. For those troubled with seepage of water into the basement, a sump pump will undoubtedly help the problem. As conditions permit, many will equip their homes with an electric dishwasher, garbage disposal unit, and electric blanket. And homes may be heated with the new "refrigerator-in-reverse." On many farms the freeze-box, to store meat, fruits, and berries, is considered nearly indispensable.

The introduction of electric lighting into cow barns is said to nearly pay for itself due to less spilling of milk. Ultraviolet rays from electric lamps are being used on cows to produce better milk. Electrically driven animal groomers clean the loose hair and dirt from the udder and flanks of a cow, thus assuring cleaner milk.

Heating of the cow's drinking water is said to increase the yearly average milk production by 5 to 15 percent, the greatest increase being in the colder climates. A higher quality of milk may be maintained by cooling it from 98° F. to 60° F. within an hour and subsequently storing it at 45° F. or below.

Other uses of electricity for dairying include electric milkers, pasteurizers, dairy hot water heaters, germicidal sterilizers for utensils, bottle washers, ventilating units for dairy barn, barn cleaners, electric fly screens, insect sprayers, churns, slippers, separators, and feed grinders and mixers.

Power can save farmers considerable time and effort in handling silage materials, besides giving a better quality of feed. Ensilage is said to be sour or sweet depending upon whether it is made below or above approximately 117° F. Experiments show that it may possibly be worth while to heat the fodder artificially by passing an electric current through the silo. Silage handling equipment includes the silo filler, unloader, and ensilage cutter.

Many farmers have eliminated weather risk at haying time by installing hay driers in their barn, where all curing beyond the first four hours in the sun takes place. Hay cured in this manner is reported positively superior to the completely sun-cured product. Moreover, electric hay driers give the next crops more than a week's growing start. Other forage handling uses for electricity include balers, shredders, and grain grinders.

Perhaps one of the earliest applications of electricity to poultry was that of using artificial lighting to increase egg production. Annually, artificial lighting does not increase production, but the benefit accrues from heavier production at those times when prices are highest. Production during light laying periods has been increased 10 to 30 percent. For maximum effectiveness a 15-minute dimming period is given to provide "dusk," which provides the chickens sufficient time to "go to roost." Clocks are available which turn the lights on and off at the proper time.

Egg production may also be increased by electrically warming the drinking water for the chickens. In below freezing temperatures, chickens drink about 25 percent more water if heated, and in above freezing temperatures about 5 percent more. The extra water consumption increases their appetites and results in greater egg production. Egg production may be increased in summer by providing coolers for the hen house.

Ultraviolet light in 10-minute doses, morning and evening from December to March, is said to speed development of chickens and produce more fertile eggs. Ultraviolet light used continually helps prevent the spreading of colds throughout the flock. Other equipment, using electricity in connection with poultry, includes brooders, incubators, heaters, ventilating equipment, electrically operated dropping boards, poultry pickers, and egg cleaners.

Crop Production

Electric plowing, in which the ground is tilled by a plow suspended from motor driven cables, is practiced in Europe. This method is generally used on larger farms, and done by contract. Usual rate of tillage is one-third to 1 acre per hour, with an average of 5 acres per day. Some large plows, however, will handle up to 30 acres per day. In contrast to plowing by tractor, with electric plowing there is no packing of soil. While one might think a large maze of wires would be required, such is not the case, since the electric plow can operate anywhere within a quarter of a mile from its source of supply through long extension cords.

Electric power for pumping is important on farms. Orchardists, lettuce growers, and other types of farmers, are making more and more use of the pressure sprinkling systems. These are of either the overhead or surface variety. With the ultimate of installations, time clocks, together with electrically operated valves, enable one to irrigate in the cool of the night or very early morning without the accompanying loss of sleep. One lift-type installation in the Pacific Northwest contemplates the use of clock-operated electrical valves to provide water at the desired times, thus saving labor costs.

Some experimentation is being carried out to determine the effect of electricity on plant growth. Tests indicate that the growth of plants is stimulated by a network of overhead wires, kept at a potential of 25,000 to 50,000 volts. By using the network up to one-fourth of the time during the early stages of growth of certain cereals, an increase in yield of up to 20 percent has been realized. Wheat, for example, has been entirely grown to maturity in 3 months by the use of electric light, the grain being put into water along with the necessary nutrients. Many more experiments will have to be made before the relative overall benefits of such methods can be definitely established. Since the voltages used are dangerously high, the development and

Photo by Stanley Rasmussen, Region I

Once-revolutionary milking machine—today commonplace—is one of farmer James Allen's many electrical appliances.

projection of such methods must be left to properly equipped research organizations.

Insects are being trapped (including apple bud moths and coddling moths) by means of an electric lamp, of about 100 watts, suspended over a pan partly filled with oil, or a pan of oil-covered water. Electric lights of specific colors may be used to attract pests of different sorts in orchards and gardens.

Also worthy of mention are the experiments with electricity for killing weeds. Here again, high voltages are required, so the development of such processes will, of necessity, be left to research organizations.

The all electric farm will have an electrically powered sprayer to cope with spraying problems.

Crop Processing

The electric threshing machine is coming into prominence. The chief merit lies in the greater amount of grain (5 percent more) reportedly obtainable due to the steady speed of the motors. Other crop processing equipment includes grain elevators, corn shellers, corn shredders, grain seed cleaners, and straw cutters.

Cold storage for fruits, vegetables, and berries at the proper temperature enables farmers to hold their produce until the price is right. Experiments seem to indicate that a very high frequency radio wave has a preserving effect upon produce, and may therefore some day be employed to achieve the same results.

Related uses for electricity in crop processing include dehydration of fruits, vegetables, hops, nuts, etc., and cider mills.

Early Gardens

To provide an early start for vegetables or flowers, soil-heating cables are now being widely used. These consume, on an average, only 1 kilowatt-hour per day for each square foot of hotbed heated.

Some people are now putting a greenhouse in their basements. In this way, with the right application of electricity, the proper "length of day," the proper amount of heat, and the proper amount of infra-red and ultra-violet rays may be provided. Authorities, however, differ as to the degree of benefits of ultra-violet rays on some types of plant life. Experiments show that electric light in greenhouses has an accelerating effect upon the germination of seeds and hastens the growth of certain vegetables, the effect depending somewhat upon the color of the light.

Very intensive light on budding plants brings them quickly into bloom, and it is said that seedlings subjected to very strong light will not wilt.

In some places sterilization of soil is being practiced, to rid the soil of fungi and pests.

In the garden, too, the ultimate development might be time-governed, electrically operated valves for controlling irrigation water. A device has been perfected which will turn on the valve according to the dryness of the earth instead of by clock. This must be used, however, in conjunction with a timer or be turned off by hand, since no provision is made to shut off the water according to the saturation of the soil.

Miscellaneous Farm Uses

Electricity might possibly be used on the farm for branding irons, meat processing equipment, clippers, livestock sprayers, paint sprayers, sheep shears, electric fences, tool grinders, wood saws, concrete mixers, and lawn mowers. Ultra-violet light used in pig brooders is said to be of considerable help in preventing rickets.

Large Bureau of Reclamation hydroelectric plants, such as Grand Coulee, are enabling the farmer to use more and more and more power for a smaller and smaller cost per kilowatt-hour. Research is constantly developing new applications to make farm tasks easier and to enable the farmer to realize a higher net profit. Possibilities are unlimited. Day by day more power is sent to the farm. ●

Tumbling Tumbleweeds

by

William H. Mercer

Weed Control Specialist, Region V, Amarillo, Tex.

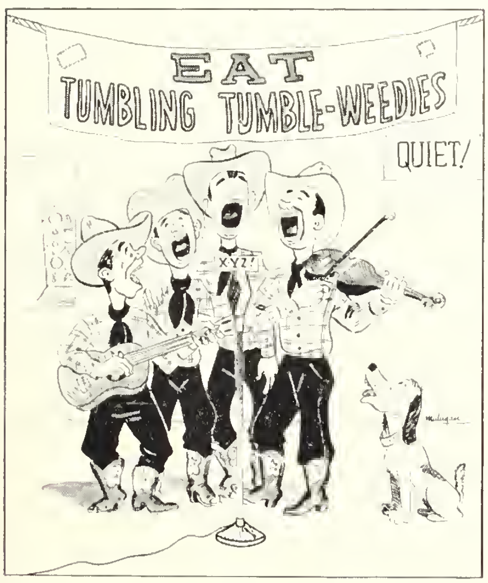
When the voice of a "Maitre de Cowboy Krooners" bursts through the radio of a western ranch or farm house to announce that the next number to be rendered by the quartet is entitled, "The Tumbleweed Song," you can bet your last irrigation ditch that listeners would like to stuff a five-string banjo down the collective throats of the singers.

The less western ranchers and farmers hear about tumbleweeds is all for the best, unless it should be a new wrinkle for eradicating them from fields and pastures.

The word "tumbleweed" may apply to any one of several itinerant weeds which are equipped by Nature to distribute their progeny over the landscape when propelled by wind power. The genuine tumbleweed, however, is the Russian Thistle, which holds all world records for long distance, high speed, broad jump, high hurdle, wide-sweep locomotion. It travels farther, faster, and in wider circles than any other weed on earth.

Each fall the Russian Thistles (tumbling tumbleweeds), which grow along highways and in fields and pastures, get the urge to go places and see things. Away they go, first one way and then another, all according to which way the wind blows.

The Russian Thistle began its gyrations and tumbling exercises on the Steppes of Siberia where it impoverished and crowded out multitudes of farmers before it started its round-the-world tour. Since leaving Siberia, its travels make the journeys of Genghis Khan appear as insignificant as a Sunday School excursion to the city park.



From Siberia the weed gained entrance into South Dakota at a time when neither plant nor human immigrants were required to have inspection passports or character recommendations. In the years since it first slipped into this country in 1874, mixed with seeds of grain, the weed has "naturalized" itself in practically every one of the States, in most Canadian provinces, and in Mexico.

A Russian farmer is said to have brought some crop seed with him when he migrated from Siberia to South Dakota. Mixed with the crop seed were seeds of the Russian Thistle. The farmer sold some of his first harvest of field seed to neighbors. The neighbors, who had never heard of Russian Thistles, planted the infested field crop seed without first cleaning it in a fanning mill. From that day to this, the offspring of the imported thistle have continued to plague the countryside, and the tumblers now exact a higher total tax from more farmers than any other weed.

No completely successful method to eradicate tumbleweeds has been developed to date and since the task appears to be hopeless, control plans are largely disregarded by a majority of farmers and ranchers. However, only recently some weapons for control have begun to be viewed with favor. It appears reasonable to hope that flame throwers and chemical formulas can and will be employed to an extent that tumbleweed populations will be reduced along highways, fence lines, ditch banks, on waste land, and around vacant lots in towns and cities.

Any successful control program, however, will require organized effort and cooperation between farmers and their town neighbors. In the beginning, the people must become more weed-conscious and gain a determination to study and apply every successful method and device developed up to the present time. Perhaps, in the near future, science can give them even better weapons than any now available.

Tall Tale by Mercer

Mercer is gaining wide recognition for his tall tales about weeds. Fact is, his extra-vocational talk has labeled him a foremost braggart in Texas, which is no small distinction. At last February's Western States Weed Control Conference in Portland, Oreg., Mr. Mercer, hard-pressed by other western weed men, had this tale to recall on the subject of Texas tumbleweeds:

"Knowing that a 25-mile travel limit would be an insult to any self-respecting Texas tumbleweed, my experiments started in the very tip of Texas. (Mr. Mercer's western colleagues had mentioned that some Texas tumbleweeds had been known to travel 25 miles in irrigation districts.)

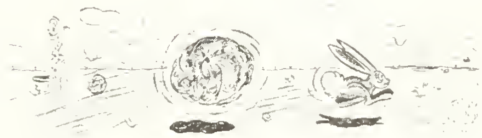
"Tumbleweeds, equipped with speedometers, were released in a stiff breeze between Port Isabel and Boca Chica. We timed them as they passed the Bureau's regional

Bill Mercer, admiring his certificate

office in Amarillo and succeeded in catching a few to read the speedometers. This proved difficult despite the fact that we used veteran cowpunchers who had experience in roping V-bombs directed over London in the late war. The elapsed time for the 900-mile run showed an average speed of 101.475 miles per hour, with short runs exceeding 151 miles per hour. The tumbleweeds were further shown to have planted 12,000 seeds per mile over the distance."

Other western weed specialists pulled in their yarns and quietly retired from the field. No western tumbleweed could match the Texas record. Mr. Mercer's tale knocked about among weed men over the Nation. And he was generally conceded to be a top-knocker among experts. Eventually the story reached John Randolph of Houston, Tex., who published a little book, "Texas Brags." So impressed was he by Mr. Mercer's account that Mr. Randolph wrote and asked permission to incorporate the story in a revised edition of the book.

Mr. Mercer was awarded the number one membership in the Solemn Order of Texas Braggarts, an organization reserved for true tellers of tall Texas tales. A fully embossed certificate was sent to Mr. Mercer at the Bureau of Reclamation office in Amarillo. It was complete, even with a seal of the Republic of Texas. Now Mr. Mercer, who started out simply as one of the world's great weed men, can "sit on the top rail" of any fence when he is telling a Texas brag. He is even bragging about being a Texan, having lived in the State off and on only since 1917 when he landed in San Antonio and was forced to write back home to North Dakota. "I have met the Texans and I am theirs."



Watermelon Time

by Elma Hill Neal

Photo by Stanley Rasmussen, Region 1

Lou Obermeyer, Emmett, Idaho, thumps a likely specimen from his eight-acre melon patch.

Songs have been sung and poems have been written about the beauties and fragrances and pure delights of apple blossom time, or the time when roses bloom or perhaps cider-making time. It is high time someone gave a little more credit to watermelon time.

The Englishman has his tea at 4 o'clock in the afternoon but the native Missourian reserved that hour for the soul-satisfying rite of cutting a ripe watermelon.

On a hot, humid afternoon when Grandpa came in from the timber, back of the barn, where he had been hewing out fence posts, he stopped by the cistern, quaffed a long drink, and with me by his side, started around the house for the cellar.

Lifting the trap door, we descended the steep steps. Grandpa slowly unlatched the thick inner door. There in the dark, damp insides, lined and floored with rock, were the fruits of the vine—watermelon and cantaloup. Almost tenderly, he picked up the long Klondike, whose zigzag stripes had been worn to a creamy yellow on the undersides, where it had wallowed in sandy soil through the long summer. Cautioned to be careful, I was allowed to carry a fragrant "mushmelon" that was golden plump and heavily ridged. Grandpa never plugged a melon. Years of experience, first gained, no doubt, in someone else's patch, enabled him, by scrutiny and by scarifying and through the deep hollow sound given off by an energetic thump, to tell the exact moment for plucking.

By the time we got safely around the house with our armloads, Grandma was there with butcher knife and salt box. The ripe melon popped and then was ripped its entire length with the first plunge of the knife. Jolted gently, it fell apart and lay in two dewy, luscious halves. To each of us was dealt a ruby wedge, rimmed with emerald and dotted with a mesh of black seeds. Without thought of cost or waste, we broke out the brittle hearts and threw the end pieces to the expectant Plymouth Rocks standing by.

Grandpa always had a melon patch somewhere on a sunny slope or rich piece of bottom land and in seasonable years it bore profusely. Along the last of August when the "dog days" were at their worst and the "snake doctors" hung flutteringly over the muddy ponds and the goldenrod grew gray and dusty by the roadsides, Grandpa would load up the wagon bed with some of the bigger ones and head for town. The trifling sum that he received for them was beside the point. It was size and quality of fruit that he wished to display to old neighbors and friends whom he chanced to meet in town or along the way. Each of them raised watermelons, too, of course, but it was a great subject for bragging and boasting.

Today, watermelons have a new place in the sun. Every State (and there are few out of the 48 who don't raise them) takes an inordinate pride in its melons. Watermelon raising is not the haphazard byproduct of a piece of ground left over from other more important crops. It is a scientific bit of agriculture that meets a definite market need. There are fine points to be observed, shape, size, sweetness of flavor, texture of meat, thinness of rind. Melons have had their seeds bred out and a wilt resistance bred in. Their keeping qualities are an essential consideration. No longer is the watermelon season confined to August and September. Now from early June to late November, trucks are on the road, hurrying their sweet burdens to a never satisfied market.

Practically anybody can guess that there is a definite affinity between water and watermelons, and so, those raised on irrigated projects are the "patches" to be depended on commercially. It was on irrigated tracts that experiments could be made to improve varieties and build up new strains, for water, climate, and soil were constant. Poor old Grandpa had to take a disappointment every few years, for droughts were a known and feared factor in all of his agricultural operations. During such seasons, the creek bottoms dried and cracked open in criss-cross lines, the level of the water in the cistern dropped lower and lower, and the vines turned yellow and the baby melons withered on the stems.

In the old days, melons were seldom served at the table, but today, melons are served at any meal, from breakfast to midnight snack. Cut in fancy shapes, chilled melons and cantaloupes are combined with other fruits or served separately as cocktail, salad, or dessert. On airlines, high in the sky, or on streamliners, hurtling across the continent, melons are a favorite delicacy to add color and zip to the traveler's plate. A busy housewife finds a melon saves times and is often more welcome at the end of a meal than a heavier dessert. Reducing diets, in this era of fads and fancies, allow for melons because of their low caloric content.

And so, thanks to irrigation and modern transportation, that hallowed season known as watermelon time has been extended and intensified and given an atmosphere of permanence and dignity that it has so rightly deserved. •

NEWS ROUND-UP

Force Account Work Limited

Under a provision of the 1948 Interior Appropriation Act a limitation is placed on the amount of force account work (that done by hired labor). This will mean the virtual elimination of certain work for the fiscal year on projects where available funds are not sufficient to let additional contracts, or where normal contracts cannot be readily awarded.

Among the works to be affected by this limitation are the extensive irrigation construction and power development on the Columbia Basin project in the State of Washington, and the land levelling program on the Gila project in Arizona.

Yuma Homestead Opening Set

Twenty-eight family-sized farms on the Yuma project in Arizona were opened to homestead entry on September 9. This marks the seventh homestead opening by the Bureau of Reclamation within the past year and is expected to be followed in the near future by an announcement of the eighth—the opening of 4,941 acres of the Gila project, consisting of 54 farm units.

The Yuma area comprises 1,439 acres of land with farm units ranging in size from 28 to 82 acres. Veterans of World War II will have a 90-day preference period in which to file for homesteads (from the opening date, September 9, until December 8, 2 p. m., 1947).

For applications and additional details, interested persons should write to the Gila project office of the Bureau of Reclamation at Yuma, Ariz.; the Regional Director of the Bureau of Reclamation at Boulder City, Nev.; or the Washington office of the Bureau at Washington, D. C.

A settlement office to advise prospective settlers has been established at the Gila project at Yuma Army Air Base, 7 miles east of Yuma, Ariz.

Design Work Decentralized

In order to comply with appropriation limitations for the Denver engineering offices of the Bureau of Reclamation, and to relieve the overload of designing work scheduled for the fiscal year of 1948, 25 field design offices are being organized.

Heretofore, all of the Bureau's designing work was done in the Denver Office. While the Denver Office will continue to be the focal point for the design of dams and major structures, the field offices will be responsible for detailed designs on minor structures. Included in these will be the works appurtenant to dams, camps, roads, design of transmission lines and irrigation distribution systems. This procedure will place detailed design operation closer to the site of the many Reclamation projects. The basic technical control over these operations will continue to be exercised by the Chief Engineer, who will assign experts from his staff to head each office. In addition to this he will utilize a small group of traveling specialists to effect supervision and coordination.

While the financial limitation on the amount which can be spent for engineering services in Denver will provide 40 percent less than was spent during the fiscal year of 1947, the Bureau is committed to start construction on a greater number of dams this year than ever before. As a result the establishment of the field offices near work centers has become a mandate in order to meet this requirement.

The tentative locations of the design offices are as follows:

- Arizona—Phoenix and Yuma.
- California—Friant Dam, Sacramento (transmission lines), Antioch, Redding, and Coachella Valley (site not determined).
- Colorado—Grand Junction and Estes Park.
- Idaho—Boise and Lewiston Orchards.
- Montana—Great Falls and Miles City.
- Nebraska—Indianola.
- Nevada—Boulder City.
- North Dakota—Bismarck.
- Oregon—Klamath Falls.
- South Dakota—Pierre.
- Texas—Amarillo.
- Utah—Provo and Salt Lake.
- Washington—Coulee Dam and Ephrata.
- Wyoming—Heart Mountain and Casper.

NRA to Meet at Phoenix

The sixteenth Annual Convention of the National Reclamation Association will be held at Phoenix, Ariz., on October 29, 30, and 31. Among those who have been invited to attend are Secretary of the Interior J. A. Krug and Assistant Secretary William E. Warne, Secretary of Agriculture Clinton P. Anderson, Reclamation Commissioner Michael W. Straus, and other officials of the Interior Department, Bureau of Reclamation, Federal Power Commission, and the War Department. In addition, invitations have been extended to Senators Carl Hayden and Ernest W. McFarland of Arizona, Hugh Butler of Nebraska; Representative Ben Jensen of Iowa, and many others. The Era will carry a full account of the meeting as soon as possible.

Markwell at Western State Engineers

Assistant Commissioner Kenneth Markwell represented the Bureau of Reclamation at the annual meeting of the Association of Western State Engineers held in Boise, Idaho, September 9–12. In addressing the meeting Mr. Markwell stressed the need for liberalization of Reclamation laws and their relation to the accelerated construction program planned by the Bureau over the coming 7-year period.

W. C. Austin Project Dedicated

In memory of the man who said, "The State should mark the way and bring her people to a point of understanding the value of controlling, using, and preserving the water as it falls upon our soil and as it passes into, through, and across the border," Oklahoma's first Reclamation project, the W. C. Austin, was dedicated on September 5 at the close of a three-day celebration.

The dedication was attended by many notables, including Secretary of the Interior J. A. Krug, Governor Roy J. Turner, Assistant Commissioner of Reclamation Wesley R. Nelson, Former Governor Robert S. Kerr, and Don McBride of the National Reclamation Association, all of whom were active participants in the dedication. Robert B. Harbison, former associate of the late Judge Austin, presided as chairman of the steering committee for the dedication. During the three days leading up to the celebration, the Ground Forces and the Army Air Corps of the United States Army presented a colorful show for the benefit of the thousands on hand.

President Joe B. Zinn of the Lugert-Altus irrigation district was cosponsor of the dedication and Harold Pease, president of the Altus Chamber of Commerce, extended full cooperation to make the occasion a success.

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Christmas Gift Suggestion:

A subscription to the Reclamation Era

(Continued from page 221)

run-off has increased in some areas and served to alleviate the effects of the current drought, the ground and surface storage reserves are so depleted that many months of excess rainfall will be required to break the drought.

Thunderstorms and heavy rains occurred at several locations in the Colorado River Basin during August. The flow of the river was increased from 129 to 195 percent of normal. The active storage in Lake Mead, over 21,900,000 acre-feet, was the highest since 1945 and is sufficient to furnish adequately the irrigation needs of the Gila and Yuma projects and the Imperial Irrigation District.

In general, the outlook for a favorable hold-over storage is good for projects in the Columbia, Missouri, and Colorado River Basins. Heavy rains, flash floods, and early snow in the mountains have caused a run-off of normal or above in most of these basins. In some cases the daily run-off was near the spring flow. Soil moisture is in good to excellent condition for this time of year.

To compare the amount of water in storage in the Bureau of Reclamation reservoirs on the same date last year with this year's storage, see table on page 222. ●

RECLAMATION READING

Bureau Publications

Available from the Bureau of Reclamation

1. *Landownership Survey on Federal Reclamation Projects.*—Available upon request to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

2. *A Study of the Effect of Silt on Absorbing Light Which Promotes the Growth of Algae and Moss in Canals,* by W. E. Corfitzen, assistant engineer, under direction of C. P. Vetter, engineer, Bureau of Reclamation, Denver, Colo., October 30, 1939, 7-page mimeographed study with graphs.

3. *Questions and Answers About Forming an Irrigation District to Further Irrigation Under the Missouri Basin Development Project—Montana.*—Eight-page folder available upon request to the Regional Director, Bureau of Reclamation, Billings, Mont.

Available from the Superintendent of Documents, Washington 25, D. C.

1. *High-Pressure Reservoir Outlets,* by J. M. Gaylord and J. L. Savage—a report (1923) on Bureau installations compiled from correspondence, project histories, feature reports, technical papers, special reports prepared for this purpose, and from personal inspection of the installations described. Obtainable from the Superintendent of Documents.

2. *Putting the Missouri to Work.*—Illustrated summary of the unified plan for development of the Missouri River System. Fifteen cents a copy.

3. *Columbia Basin Joint Investigations.*—Advance studies of problems arising in connection with settlement of the million-acre Columbia Basin project in the State of Washington. Obtainable from the Superintendent of Documents. Latest releases are: Problem 10, Pattern of Rural Settlement—25 cents, and Problem 28, Local Governmental Units—70 cents.

Problem 9 (Supplement), Standards and Levels of Living—20 cents.

Problem 14, Financial Aid for Settlers—25 cents.

Problem 23, Rural and Village Electrification—25 cents.

Problem 24, Agricultural Processing Industries—30 cents.

Problem 26, Recreational Development of Roosevelt Lake—75 cents.

4. *Central Valley Project Studies.*—Studies of diversified but interrelated problems affecting the wartime and long-term development of the Central Valley project in the State of California. Obtainable from the Superintendent of Documents. First released in the series are Problems 1–5, The War Program—45 cents.

5. *Columbia Basin Reclamation Project—East Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the east Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Forty-five cents a copy.

6. *Columbia Basin Reclamation Project—South Irrigation District Appraisals.*—Report on the appraisal of lands and improvements in the south Columbia Basin irrigation district—one of three irrigation districts of the Columbia Basin project in Washington State. Tables showing the amount of land in each class, the appraised value of land and improvements, and the total sums for each subdivision appraised. Appendix contains classifications and appraisal of lands excluded from the south Columbia Basin irrigation district. Fifty-five cents a copy.

Miscellaneous Publications

"Man as a Geological Force," by Paul Cohen, in *The Technology Review*, June 1947, page 469. Illustrated. According to the author, "At his current rate of engineering and agricultural operations, man is reshaping the earth's surface vastly more quickly than nature." (*The Technology Review* is a monthly publication of the Massachusetts Institute of Technology, Cambridge, Mass.)

Landscape Gardening for the Rural Community in the United States, a list of references on such subjects as lawns, rock gardens, roadside improvement, and so forth, compiled by Cora L. Feldkamp, Library, United States Department of Agriculture. 46-page mimeographed Library List No. 35, April 1947. This compilation contains author and subject indexes.

"Veterans May Get Preference in Coulee Area," by J. W. Granberg, in *Evergreen*, May 1947, page 10. Illustrated. Concerning preference of World War II veterans in acquiring family-size farms on the Bureau of Reclamation's Columbia Basin project (Wash.). Goodrich W. Lineweaver, Director, Bureau's Branch of Operation and Maintenance, has commented, "Settlement opportunities for veterans while they are young and vigorous is our major goal. We want to give them a chance to carve their future out of these fertile lands, go into the business or professions that will be made possible, and participate fully in the establishment of a new empire." (*Evergreen* is published monthly by Wilbur J. Granberg, Seattle, Wash.)

U. S. GOVERNMENT PRINTING OFFICE 1947

NOTES FOR CONTRACTORS

CONTRACTS AWARDED DURING AUGUST 1947

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
1768	Rio Grande, N. Mex.-Tex	Aug. 8	Electrical equipment for Socorro substation	General Electric Co., Denver, Colo	$51,817.27
1802	Deschutes, Oreg	Aug. 5	Sand and coarse aggregate for concrete structures	Prineville Sand and Gravel Co., Prineville, Oreg	52,121.25
1820	Davis Dam, Ariz.-Nev	Aug. 13	Oil circuit breakers, disconnecting switches and lightning arresters for Davis switchyard.	General Electric Co., Denver, Colo	975,716.20
1820	Davis Dam, Ariz.-Nev	do	Current transformers for Davis switchyard	Westinghouse Electric Corporation, Denver, Colo	70,226.10
1823	Rio Grande, N. Mex.-Tex	Aug. 20	Construction of Elephant Butte-Socorro 115-kilovolt transmission line.	Reynolds Elect. and Engr. Co., El Paso, Tex	356,859.33
1839	Columbia Basin, Wash	Aug. 13	Neutral-grounding reactors and circuit breakers for station service units Grand Coulee power plant.	Westinghouse Electric Corporation, Denver, Colo	11,399.00
1840	Columbia Basin, Wash	Aug. 15	Structural steel for pumping plant building—Pasco pumping plant	Pacific Coast and Foundry Co., Seattle, Wash	13,716.00
1846	Hungry Horse, Mont	Aug. 6	Construction earthwork and structures for relocation of forest service road.	F. R. Hewitt Co., Spokane, Wash	632,128.00
1859	Davis Dam, Ariz.-Nev	Aug. 1	Erecting 20 prefabricated houses at Davis Dam Government camp	John Bohaman, Pacific Palisades, Calif	101,100.00
1860	Klamath, Oreg.-Calif	Aug. 13	Ten vertical-shaft pumping units for pumping plants—Tule Lake division.	Crane O'Fallon Co., Denver, Colo	20,687.00
1863	Missouri Basin, Nebr	Aug. 5	Electrical equipment for Gering, Bridgeport and Sidney substations.	General Electric Co., Denver, Colo	22,360.00
1865	Deschutes, Oreg	Aug. 7	Construction earthwork and structures for 10 miles of North unit Main Canal.	Adler Construction Co., Redmond, Oreg	219,355.00
1867	Provo River, Utah	Aug. 5	Two bypass valves for Jordan Narrows pumping plant	Pacific Coast Engineering Co., Alameda, Calif	12,150.00
1871	Deschutes, Oreg	Aug. 18	Construction earthwork and structures laterals M 57 to M 61A	W. C. Bauman Co., Portland, Oreg	299,301.00
1876	Provo River, Utah	Aug. 14	Construction Jordan Narrows pumping plant, siphon, penstock discharge pipes and wasteway.	Carl B. Warren, Pleasant Grove, Utah	519,299.10
1890	Missouri Basin-Boysen, Wyo.	Aug. 29	Construction of Boysen Dam, power plant, and relocation of Chicago, Burlington & Quincy R. R.	Morrison-Knudsen Co., Inc., Boise, Idaho	13,899,999.30
R-2-10	Region 2, California	Aug. 7	Erecting 12 prefabricated houses at Tracy Government camp	Wallace D. Harkins, Inc., San Francisco, Calif	66,930.00
R-2-10	do	Aug. 12	Erecting 8 prefabricated houses and constructing water systems, driveways and sidewalks at Antioch Government camp.	O. C. Fursman, Antioch, Calif	26,931.32
R-2-10	do	do	Construction of water systems, streets and walks at Tracy Government camp.	Karl C. Harmeling, Stockton, Calif	30,618.28
B-139	Central Valley, Calif	Aug. 8	Reinforcing steel for Delta-Mendota Canal	Bethlehem Pacific Coast Steel Corporation, San Francisco, Calif.	95,675.85
34	Missouri Basin, Mont	Aug. 7	Photo-index maps	Fairchild Aerial Surveys, Inc., Los Angeles, Calif	15,712.00

CONSTRUCTION AND SUPPLIES FOR WHICH BIDS WILL BE REQUESTED DURING OCTOBER 1947

Estimated date bids to be invited	Project	Description of work or material
Oct. 1	Davis Dam, Ariz.-Nev	Erection of 10 two-car garages at Davis Dam Government camp.
Do	do	Erection of 20 prefabricated houses at Davis Dam Government camp.
Oct. 15	do	Construction of 83 miles of 230-kilovolt transmission line from Davis Dam to Parker Dam. Steel structures and towers.
Do	Tucumcari, N. Mex	Construction of earthwork and structures for Saxon lateral to irrigate 150 acres of land near Tucumcari, N. Mex.
Do	W. C. Austin, Okla	Construction of Ozark laterals and structures for irrigation of 9,300 acres of land near Altus, Okla.
Do	Missouri Basin, Colo.-Nebr	Construction of 45 miles of 115-kilovolt transmission line from Sterling, Colo., to Sidney, Nebr. Wood poles.
Oct. 1	Missouri Basin-Canyon Ferry, Mont	Construction of Canyon Ferry government camp electrical distribution system.
Do	Owyhee, Oreg	Construction of Locket Gulch Wasteway on North Canal and Owyhee ditch crossing near Nyssa, Oreg.
Oct. 7	Central Valley, Calif	Construction of earthwork, lining and structures for 11.5 miles of Friant Kern Canal near Visalia, Calif.
Oct. 15	Missouri Basin, Nebr	Construction of Medicine Creek Dam, an earthfill structure approximately 107 feet in height and 3,600 feet long near Cambridge, Nebr.
Do	Missouri Basin, N. Dak	Construction of Heart Butte Dam, an earthfill structure approximately 125 feet in height and 1,850 feet long and relocation of State Highway 49, approximately 50 miles southwest of Bismarck, N. Dak.
Do	Missouri Basin-Canyon Ferry, Mont	Construction of office, dormitory, garage and shop; 8 four-room, 1 five-room, and 3 six-room residences for government camp.
Oct. 10	Colorado-Big Thompson, Colorado	Construction of 20 miles of 115-kilovolt transmission line from Greeley to Loveland, Colo. Wood poles.
Oct. 15	Central Valley, Calif	Construction of earthwork, lining and structures for 13.6 miles of Delta-Mendota Canal near Fresno, Calif.
Do	Klamath, Oreg.-Calif	Construction of Adams 60 c. f. s. concrete pumping plant near Merrill, Oreg.
Do	Boulder Canyon, Nev	Laying 6 miles of 12- and 14-inch diameter high-pressure steel pipe and erection of 50,000 and 2,000,000 gallon storage tanks at Boulder City, Nev.
Do	Boise, Idaho	Construction of earthwork and structures for Sand Hollow Wasteway near Caldwell, Idaho.
Do	do	Construction of earthwork and structures for Willow Creek Wasteway near Middleton, Idaho.
Do	Deschutes, Oreg	Construction of earthwork and structures for Mud Springs Creek lateral to serve 8,500 acres of land near Madras, Oreg.
Oct. 24	Colorado-Big Thompson, Colo.	Construction of earthwork, lining and structures for 10 miles of Horsetooth Feeder Canal including a diversion dam, a 1-mile tunnel, 12 concrete siphons, and 1 steel siphon near Loveland, Colo.
Oct. 30	Davis Dam, Ariz.-Nev	70-ton governor gallery crane for Davis Dam.
Oct. 31	All-American Canal, Calif	Construction of flood protection dikes No. 1 and No. 2, Coachella division.

NEXT MONTH

***SPOTLIGHT ON THE PIONEERS*—What the Tule Lake settlers, one of the most widely publicized groups of veterans in the West, have accomplished in less than a year of homesteading.**

Also

***UTAH'S WATER COURTS*—Colorful anecdotes illustrating how the early Mormons settled their difficulties in Church Courts over the distribution of irrigation water.**

Harvest Time ~ *Then and Now*

This rare photo, taken around 1912 or 1915 and made available by the family of the late Judge Austin (see page 227), shows a sweetpotato harvest on Mr. Fullerton's irrigated farm at Olustee, Okla. The modern harvest scene below (San Luis Valley, Colo.) shows trucks and machinery replacing horse-drawn equipment of earlier days.

OVEMBER
1947

Featuring:

**Take
ECLAMATION
off the**
erry-Go-Round
**by
ommissioner Straus**

**THE POWER
SHORTAGE
by
rthur Goldschmidt**

SPOTLIGHT
on the
PIONEERS

THE *Reclamation* ERA

Cause for Thanksgiving

Photo by F. B. Pomeroy, Region I

New Forage for Dairy Cattle

Three-year-old Kathleen Hampton reaches upward for the head of 10-foot feeder corn being grown on the Bureau of Reclamation's Development Farm No. 1, near Moses Lake, Wash., on the Columbia Basin project of Washington. Holding her is her father, Kenneth Hampton, wounded veteran of World War II, who grew up on irrigated farms of Washington and Idaho and was selected to operate the farm for the Bureau. The corn, representing the first test planting by the Bureau of Reclamation in the project, is Hybrid 939 and will be used as forage for dairy cattle. Because of delays in completing an irrigation well, Hybrid 939 got a late start in the 1947 season. The Moses Lake farm, one of several planned on the Nation's biggest reclamation project, is a joint undertaking of the Bureau of Reclamation, Bureau of Plant Industry, and Washington State College.

Reclamation ERA

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Ruth F. Sadler, *Editor*

Next Month

How the Boise and Owhyee projects in southwestern and eastern Oregon produced 60 percent of the Nation's sweet corn seed supply in 1947. Also the story of hybrid sweet corn seed production (of which 80 percent of the entire country's requirements are grown on these two projects).

Our Front Cover

Pioneer Woman of 1947

Eleanor Jane Bolesta (pronounced Bo-*leh*-sta), ex-WAVE, lady homesteader in action on her modern irrigation farm, typifies the spirit of the new settlers on the Tule Lake division of the Klamath project in Washington-Oregon. Eleanor and her husband Charles, a marine who is recuperating from injuries received at Guam, have already made themselves a home and this fall will reap their first harvest. They feel they are the luckiest couple on earth—the land is wonderful, the neighbors are congenial, and the climate is exactly what the doctor ordered.

See page 237 for more data on Reclamation's first postwar group of settlers.

THE WHITE HOUSE

WASHINGTON

MY DEAR JUDGE SAWYER: I regret not being able to attend your annual convention in Phoenix this year, but I am confident that my representatives from the Department of the Interior and you leaders in the national reclamation movement will work out a basis for successfully extending the program of water conservation and utilization in the Western States.

In the past 45 years reclamation development has been proven as a means of attaining better living in the 17 Western States. Over 4 million acres of land have been irrigated, more than 2 million kilowatts of hydroelectric capacity have been installed, and flood waters have been held back and utilized. These achievements, great as they are, are not great enough to meet the problems facing us today. The conservation and wise use of our natural resources are essential to our existence as a Nation.

In my messages to the Congress this year, I stressed that the major opportunity of our generation to increase the wealth of the Nation lies in the development of great river basins. To fulfill that opportunity, an orderly program of appropriations is needed. Development plans of the required magnitude can be executed efficiently only if the responsible agencies have knowledge of the funds they may expect over a period of years. Efficiency and economy in our major domestic productive expenditures demand a long-range appropriation program.

Adoption of such a program now would reaffirm our democratic processes. It would extend in practice the principle of family-size farms for our citizens and would be evidence to the truth that effective utilization of our national resources lies in their development for the benefit of the greatest number of people.

I hope your association and other western groups can work out the means for providing that the reclamation structures already begun are completed soon, and for developing our western river basins on a scale which will meet the requirements of the Nation.

Sincerely yours,

Harry Truman

Hon. Robert W. Sawyer,
President, National Reclamation Association,
c/o Westward Ho Hotel,
Phoenix, Ariz.

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Letters to the Editor

Contrast Apparent

WILLISTON, N. DAK.,
August 2, 1947.

DEAR EDITOR: I am highly appreciative of your letter of July 15 concerning the information which I submitted on the home of Mr. Joseph Paulson for publication in the June issue of the RECLAMATION ERA.

At present, the small grain crops both on dryland and irrigation in this part of North Dakota are approaching the harvest stage. We anticipate a good crop in both cases, but it appears that the dryland crops may be somewhat shriveled due to lack of rainfall and exceptionally high temperatures. For this reason there is a very high contrast apparent even to the casual observer between the dryland and irrigated crops.

No doubt you have seen this many times, but the people in this area are constantly becoming more and more impressed with this difference, and of course with the proposed operations of your Department the interest and stimulation here is very keen.

Sincerely,

ARLON G. HAZEN,
Associate Agricultural Engineering Superintendent, North Dakota Agricultural Experiment Station., Williston, N. Dak.

Editors, Please Copy

PORTLAND, OREG.,
September 18, 1947.

DEAR EDITOR: We refer now to your volume 33, number 9, September 1947, of RECLAMATION ERA, and the article on pages 192 and 193, by K. W. Sawyer, manager of the agricultural department of the Portland Chamber of Commerce, entitled "Sprinkler Irrigation in the Willamette Valley."

We have been particularly impressed by this article, and, of course, knowing Mr. Sawyer well through his activities in our local agriculture, are quite anxious to have 1,000 reprints of the article just as it is laid out in your magazine.

We would appreciate hearing from you as to the proper procedure for obtaining these reprints, and, of course, if it is at all possible, would prefer to have the 1,000 copies from your publishing department. In the event that it is not possible for you to furnish the reprints, we, of course, would then like to have permission to reproduce our own photostatic copies locally.

We of the Northwest are, of course, indebted to you for your decision to run such an article concerning a subject of such vital importance to our national agriculture, and will certainly look forward to additional material of this type as time goes along.

Looking forward to hearing from you regarding the above, we remain,

Very truly yours,

ROBERT M. MORGAN,
Sales Manager, Irrigation Division, R. M. Wade & Co.

Many thanks to reader Morgan. Our readers are freely permitted to reproduce articles and photographs which appear in the RECLAMATION ERA. Credit lines and copies of material reproduced are always greatly appreciated.—Ed.

Voice of a Veteran

CRAWFORDSVILLE, IND., *August 16, 1947.*

RECLAMATION ERA,
Bureau of Reclamation, Department of the Interior, Washington 25, D. C.

DEAR SIRS: Inclosed find check for $1 covering a 1-year subscription to your publication, RECLAMATION ERA, to be sent to the above address.

If possible, start my subscription with the August issue. I have the July issue. It is a wonderful piece of work. I am especially interested in this publication because I am a veteran intending to homestead on a Reclamation project.

Thanks for the July issue and congratulations to you on being able to put out such an informing and practical publication for the would-be homesteader.

Yours very truly,

L. L. PATTON,
113 E. College St.

FIELD DAY IN THE FALL

by Wynne Rowlands
Delta District, Region II, Sacramento, Calif.

Two crops of wheat a year, new marketing developments for ramie and the castor bean, added poundage for stock pastured on an improved ladino clover, and progress in reducing the amount of damage by the corn earworm were the highlights of the first fall field day to be held by the agronomy division of the University of California at its Davis, Calif., experimental grounds on September 5, 1947.

Twice as many people as were expected turned out for this all-day review of the experimental crops of today which may become the cash crops of tomorrow.

Among the crops made possible through California's long growing season was a plot of green wheat, nicely headed out and about to mature. At the Davis fields two crops of grain a year are grown to speed up plant-breeding work. The 12-month program for grain production consists of sowing in November, harvesting by June, planting again before July and harvesting in late October. The July-October crop, like the irrigated pastures in the area, must be irrigated about once a week.

An improved ladino plot added 600 pounds of mutton per acre of pasture last year. This improved ladino consists of common ladino mixture from which the inferior types were eliminated and has carried from two to three times the usual number of animals. Although pasture management seems to be the more important factor in weight gains, visitors could plainly see a very marked difference in the growth between the improved and common ladino plots with the same treatment.

From the response and keen interest shown, the fall meet will be a regular function. In the past the agronomy division has held a spring field day only.

The program was arranged by the acting chairman of the division of agronomy at Davis, Calif., Mr. F. N. Briggs. Lectures at the various plots were made over an efficient portable public address system as the visitors looked over plots including field corn investigations, summer legumes, lima beans, mung beans, blackeye beans, cereal rust nursery, sweet corn improvement (to reduce the amount of damage by the corn earworm), dry and snap bean varieties, pasture plants, castor bean trials (to develop a nonshattering type of bean suitable for commercial production), irrigated pasture legumes, ramie, alfalfa improvement, and alfalfa seed production. •

The POWER *Shortage*

by Arthur Goldschmidt

Former Director, Division of Power, United States Department of the Interior*

THE Department of the Interior, through its various agencies, is engaged in marketing power from existing dams and projects under construction in States comprising more than four-fifths of the Nation's area.

The Department's combined power wholesaling job already involves more kilowatt-hours than that of any other agency, public or private. Power demands throughout the areas in which the Department operates are forcing tremendous increases in this capacity.

Reclamation's Power Plans

Throughout the 17 Western States, the Bureau of Reclamation is working on a program of multiple-purpose water developments that will more than double its existing two-million-odd kilowatts of capacity within the next 6 years. In these States and eastward to the Atlantic, the Corps of Engineers is undertaking construction on water-control programs that will develop another million and a quarter kilowatts of power, or twice the capacity already installed in its dams. In the Southwest the Corps of Engineers is doubling the capacity of the existing dams and has additional projects under construction. In the Northwest, scheduled additions to the Columbia River development required by the Bonneville Power Administration look to making available another 745,000 kilowatts of capacity, and requirements indicate that another 1½ million will be needed by 1953.

The Corps of Engineers and the Bureau of Reclamation are continuing their surveys for the multiple-purpose developments of the rivers of America, and tremendous additions to the power capacity figures already mentioned are in the making. Although these figures seem large, we can today, without fear of the ridicule of the past, ask: Will this be enough? Will these plans and projects, even if brought into production at the earliest possible moment, catch up with the tremendous power demands that are currently swamping us? Are our sights high enough?

The answer is simply that this is not enough. Neither our present nor our prospective power supply is adequate to maintain full production and full employment.

Photo by Ray L. Wiggins, Region III

THE FUTURE LOOKS BLACK—*even with work going on night and day at such potential power-makers as Davis Dam on the Colorado River.*

In this Nation, power supply has become a basic factor in our way of life and in our ways of making a living. When we plan, authorize, and budget additional power capacity in the power business, we must take into account the planning, authorizing, and budgeting of our consumers. The millions of farmers, the householders, shopkeepers, businessmen, and industrialists are planning, authorizing, and budgeting for power consuming appliances and equipment. The result is that we have outgrown our plants. We threaten to outgrow our plans.

The total number of consumers of the electric industry has risen to over 36 million. The average annual residential use of power has increased to 1,296 kilowatt hours from 735 kilowatt hours 10 years ago, an increase of 76 percent. We know that this figure is not a stopping point, for in the State of Washington where abundant low-cost power has been available, the annual residential use is now about 3,000 kilowatt hours.

Business and industry are using more power than ever before. The Nation's primary aluminum load alone has increased from about 4 billion kilowatt hours in 1940 to the rate of about 10 billion annually today. This spring the Nation consumed over 4½ billion kilowatt hours each week compared to 2 billion weekly 10 years ago.

These figures did not just happen. They are not an accident. The tremendous increase in the use of electricity in our Nation has come about as a result of definite programs and policies intended to bring it about. We as a Nation set out to make power widely available to the people under programs and policies designed for that purpose. The Congress undertook to encourage multiple-purpose water conservation and development programs that would make large power supplies available at low cost. We undertook as a matter of national policy to get those power supplies to the people. We undertook to encourage wider rural electrification for the Nation's benefit. These policies have been consistent and interdependent. Low-cost hydro power has made many Rural Electrification projects feasible, and low rates to consumers have made Interior Department projects pay out.

The power policies and programs thus undertaken in the past few years reflect the best of our American tradition in business, finance, and government. They were not particularly new when they were reenacted in the Bonneville and TVA Acts, the Rural Electrification Act, and the Flood Control Act of 1944. But in these and other acts, the Congress supplied the missing ingredient: action.

Congress authorized the jobs to be done and made the funds available to do them. Sound policies were backed up by concrete and steel, copper and aluminum, in dams and transmission lines. These policies and programs are a part of progressive Ameri-

**Recently appointed executive vice chairman of the interdepartmental technical committee which will plan the International Scientific Conference on the Conservation and Utilization of Natural Resources.*

can thinking, our desire to develop and grow, to build bigger and better and to greater purpose. The same policies that have brought about our greater use of power have been tested in business as well as Government with the same result. They constitute the dynamics of the American economy.

This policy of not selling short on America's capacity for continued growth has also been the basis of the Government's program of placing generators in dams it was building for other purposes, and of carrying the power to prospective markets. Those generators and transmission facilities were ordered ahead of the market demand—and they created that demand.

We are today selling all of the power that we can produce and are returning the cost of its production to the Government. We see no let-up in this demand.

Let us draw one further analogy. The Ford policy of mass production for mass consumption did not injure the automobile industry. He made the country car-conscious and the spur of his competition was a driving force in the industry. Whether they derided his efforts or feared them, his competitors were benefited by Ford's policies.

Today the public power capacity of the Nation is larger than ever before and represents about one-fifth of the national capacity.

Private Power Profits

According to the Edison Institute the profits of the private utility industry in 1946 rose to 685 million dollars, increasing more than 20 percent over 1945. Never had publicly owned power been a larger percentage of the total power available in America—and yet never have the profits of the private industry been higher.

The fact is that the bold development of power resources and the sound mass consumption pricing policies of public agencies have started a chain reaction in the development of the American power market. The current sharp upward trend in power demand is creating our most immediately pressing problem. Today, we can no longer build ahead of demand. Even if all agencies, public and private, got together with the greatest combined effort, we could not meet present demands for power. To be sure, the shortage of material supplies to add new customers is in many cases putting off the day of reckoning on power supply. But the Nation as a whole is today operating its power system by heavy encroachments on its reserves.

The combined national peak was 93 percent of the total dependable capacity of class-I utilities in January. This means we had an average of only 7 percent reserves. Many important power areas are operating well above their net assured capacity. We are relying on luck. England's power experience last spring with unusual weather provides us with an example of the dangers and hardships that can result from relying upon inadequate power supplies.

We must as a Nation do everything possible to catch up with ourselves and get on a sound basis of power supply. This country cannot defend itself without adequate power. We cannot, moreover, maintain a sound level of employment or business activity or even our standard of living without adequate power. We must not cynically rely upon the inevitability of recessions.

Indeed, nothing short of a depression, with its toll of national insecurity and individual hardships can prevent us from hitting the ceiling of our power supply with serious repercussions, unless public and private agencies both buckle down to the task of getting every available kilowatt on the line as quickly as possible.

A short recession cannot solve our problem even if it were sound to count on it.

Our three generator manufacturers can put out only equipment capable of generating about 12.5 million kilowatts in the next 3 years. Increases in plant capacity, if they can be completed, may bring this up another 1½ millions by 1949. This must take care of all electrical capacity, including foreign orders. The excessively long delivery time of 27 to 39 months for power transformers and the shortage in distribution transformer manufacturing capacity and the difficulties of getting other materials add to our problem. It is evident that manufacturing capability must be increased.

Let us look down the next 10 years.

Assuming the 4½ percent rate of growth in peaks that was experienced by our power systems from 1930 to 1939, a period that included a major depression, we will need 26 million kilowatts of additions to our installed capacity to meet our peaks in 1957 without reserves. We are not using the so-called "abnormal" increase of more than 12 percent in the peak in the last year because we are developing a very conservative estimate.

Assume only 15 percent as average national reserve, and our total requirements for 1957 will be 84 million kilowatts. We have allowed for no retirements nor for the rate of growth we have experienced since the war. This must be our minimum target.

The growths of this year and next cannot be met with adequate reserves—but we must plan to get upon at least this footing before our 10 years are up.

This means that every kilowatt of Federal capacity now on order and every project having power potentialities must be hastened to completion as rapidly as possible.

For American industry cannot operate its electrical equipment on excuses—or even on reasons for power deficiencies. American farmers cannot electrify their farms on promises of more capacity.

Just what constitutes a shortage?

There is never a meat shortage among vegetarians. Doubtless there are large areas in the world with a fraction of our own electrical capacity, where there is no bottleneck in power or transformers or consumers' equipment. But we cannot compare the power requirements of our highly complex economy with those of any other nation in the world.

When we ushered in the age of electricity we moved down a road from which there is no turning back. Some people may prefer the good old days of the smoky lamp and the old oaken bucket, but there are not enough such lamps and buckets to go around, and there are not adequate means of keeping them in use today.

This Nation needs and will continue to need more electric power than any comparable nation on earth for its day-to-day living. It needs more power for its day-to-day production. Coulee kilowatts are used in the Northwest instead of coolie labor, and there is no way to reverse this process of substitution. All the manpower in the region cannot replace electricity in the production of aluminum. Nor can manpower replace electrical power in the tremendous pumping operations on the irrigated lands in this area.

We cannot replace machines with men and maintain our level of living or our national security.

Almost everyone is aware that we have greater electrical capacity than any other nation in the world. But to a large degree our kilowatt strength is a measure of our weakness. A knight in full armour may have been able to win over a group of unprotected fighters. But he must depend upon the Percheron that was bred to carry him. We, too, are dependent upon our horsepowers, and cannot maintain our production, our health, or our national security without them.

We cannot take electricity from our homes, shops, and factories and switch it to other uses at a moment's notice or at all.

Our food habits, for instance, are based upon ample refrigeration in the home, in the markets, and in transportation—all requiring electricity. Our sanitary facilities are dependent upon electrically driven pumps for which there is now no substitute in most of our crowded urban areas.

This requirement that we have power for our national health and security is not only true of our cities, although here it is a fact to an absolute degree.

On the farm, the introduction of electricity has increased our capacity to produce manyfold—and we are dependent upon this increased capacity to produce. Moreover, any effort to move backward, even temporarily, to the use of other than electrical means of refrigeration, heating, cooling, water pumping, cooking would require equipment that no longer exists or makeshifts for which there is not the manpower on our farms to operate.

So it is safe to assume that electric power is here to stay. But if it is to do the job that only it can do, in providing the basis for a strong national economy, we must move ahead to install additional capacity as rapidly as it can be fabricated.

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Utah's "Water Courts"

How the Law of Riparian Rights Was Discarded and the Mormons Settled Their Disputes Over Water

by William R. Palmer

Chairman, Iron City Centennial Committee

As the people of Utah celebrate their centennial this year, they are also celebrating a century of progress in irrigation law.

When the Mormons arrived in the Great Salt Lake Basin in 1847, it was Mexican territory inhabited only by roving bands of Indians and an occasional white trapper.

Among the problems which confronted the settlers was that of distribution of the meager water supply for irrigation purposes. There was no water law in the eastern States or in England applicable to controversies over irrigation water, and the Mormons had no precedent to follow.

Under the English common law of riparian rights, a man could impound the water, divert it from its natural channel, pollute it, or do anything he pleased so long as it was on his property.

The Mormons have been called "the fathers of irrigation." They were not, however, the first to irrigate land in the West.

There is ample evidence that Indian tribes in the arid regions of the West practiced irrigation long before the first white man visited the area. And it is well known that the Catholic missionaries in California and along the Rio Grande River in New Mexico had been irrigating their vineyards before the Mormons came to Utah.

Brigham Young and his people were, however, the first to stake their all on artificial application of moisture to the soil. To them belongs the credit for first developing and reducing irrigation to something of a science.

The Missions had abundant water supply, comparatively small tracts of land under cultivation, and ownership of the property was all in one holder.

The Mormons had wide deserts of thirsty land and small, varying, and uncertain mountain streams which, to the end that "every man might raise his own bread" had to be divided equitably among many inexperienced users. The law of riparian rights was exactly opposite from the thing these people needed.

The common-law doctrine of riparian rights, under which only the owners of land adjacent to natural streams had correlative rights in the water, was not appropriate for conditions existing in the arid Salt Lake Valley. It was promptly repudiated and a new law had to be devised. It is interesting to note that the water law based on custom and justice which developed in the isolated Utah communities, and elsewhere in the West, had one thing in common which was foreign to the common law. Beneficial use was declared to be the basis, the measure, and the limit of a water right.

The Author

William R. Palmer was born at Cedar City, Utah, on May 7, 1877, and has lived there all his life.

During the years of his business life (banking, merchandising, and livestock), Mr. Palmer was active also in his church. For 12 years he was clerk and historian for the Parowan Stake of Zion (compares with a county in area and population).

For 4 years he was a bishop and presided over a bishop's court. Later, for 15 years, he was president over this same Stake and, as such, presided over its high council court. These offices gave him access to all the earlier church records for his region, including the water adjudication trials.

For over 20 years Mr. Palmer has been a member of the board of control of the Utah State Historical Society and is now State archivist for Utah. He is the author of many published articles on Utah Indians, western pioneering, and a recent book, *Pahute Indian Legends*.

After being driven from Missouri and Illinois, Brigham Young had said, "If there is a place so utterly forbidding and undesirable that no one else will want to live there, that is where we will go," and, "If our enemies will leave us alone for 10 years we will ask no odds of anyone." The Great Basin, according to trapper tradition, was just such a place, and here Brigham Young had led his impoverished people.

But of all the pioneering in America, the Mormons in the Great Basin had the least right to expect to succeed. They had chosen the toughest country of all to conquer and they were the least prepared with material resources and experience. Almost every card in the reclamation pack was stacked against them. For them, in the most literal sense, it was a case of "root hog or die."

The Mormons, however, did have one intangible asset which other more favored pioneers lacked and which counterbalanced all their handicaps. They had a vital unity of purpose and a constructive philosophy of life under which they could focus their meager resources on a common cause. "The earth is the Lord's and the mission of man is to subdue it and make it fruitful." To them, the reclaiming of a desert was "building up the Kingdom of God on earth" as much as proselyting for converts. This materialistic spirituality kept them united and happy and enabled them always to set community interest above individual gain. It enabled them also to set up their own courts—church courts—to adjudicate the ever-insistent problems which arose between members of the church and to harmonize their disagreements. Among these, of course, included disputes as to the use of water.

Every Mormon town was settled by a group of people who had been selected, organized, and sent there to found a settlement. They first surveyed their townsite, drew for lots, built a fort and a meeting house which served also for school and recreation center. The fields, close to town, were divided into 5- and 10-acre plots, and these were allotted to heads of families according to the size of their families. These small fields were all enclosed in a common fence and drew irrigation water through a common canal.

As already noted, the Mormons set themselves at once against the doctrine of riparian rights. They substituted the principle of "beneficial use of water." Brigham Young said, "No man has a right to waste one drop of water that another man can turn into bread." The principle was laid down that water belongs to the people and no man can gain title to more than he can use in a beneficial manner.

That question of beneficial use of water posed an endless lot of experimentation and adjudication to clarify its meaning. What constituted beneficial use of water? How much water would a given crop require? How often should it be applied? Could a man help himself to the stream

(Continued on page 240)

Try-Outs for Precast Canal Linings

by Van E. Nutley

Field Engineer, Roza Division, Yakima Project, Wash., Region I

ABOVE: *precasting 2′ by 2′ blocks.* AT RIGHT: *easy-to-handle 8″ by 2′ size demonstrates interlocking feature.*

Photos by Claude Studebaker, Region I

Photos by K. W. Casper, Region I

AT LEFT: *hand-placing 2′ by 2′ blocks.* ABOVE: *completing weed-resistant and erosion proof 8″ by 2′ lined lateral.*

One of the more interesting experiments in the Bureau's low-cost canal lining program for small canals was conducted on the Roza Division of the Yakima project late in the fall of 1945 and 1946. These experimental linings involved the placing of concrete—first, by the gunite method and then by the use of precast blocks.

Concrete linings placed by the gunite method are not unusual, but the section lined with interlocking precast concrete blocks may lead to more widespread use of this type of material. The Portland Cement Association participated with the Bureau in the design and construction of both of the sections of experimental canal lining mentioned. Two types of precast concrete blocks were used, one having been suggested by the Portland Cement Association and the other designed by the Bureau of Reclamation. The Portland Cement Association type block measured 8 by 24 by 2 inches, while the Bureau-designed block measured 24 by 24 by 2 inches or $2\frac{1}{2}$ inches. The thicker Bureau-designed block was used for the canal bottom.

The east turbine lateral at mile 3 was chosen for the experiment because excessive seepage had been experienced on this section, which had been placed in service during the 1945 irrigation season. The precast blocks were used only in the straight or tangent section of the canal without attempting to adapt their usage for a curved section which was lined with gunite. The straight section of canal has a 4-foot base and one to one side slopes.

The Yakima Cement Products Co. manufactured all the blocks used in this experiment, using demountable steel forms which were removed while the concrete was green. Blocks themselves were hand-finished with a steel trowel and cured with Hunt-clear curing compound. The batch for all precast blocks consisted of one part of cement to $2\frac{1}{2}$ parts of sand and $3\frac{1}{2}$ parts of gravel.

Because of the requirement for carefully prepared and aligned subgrade upon which to lay the precast blocks through this section of the canal and the unstable sandy soil, it was found necessary to shape the canal by hand-tamping methods immediately ahead of the crew placing the blocks. All of the interlocking blocks were laid with an internal setup mastic consisting of 8 percent fibered asbestos, 4 percent diatomaceous earth, 45 percent dry asbestos, 35 percent liquid asphalt, and 8 percent impregnator "D". It was found that while this mastic has very desirable characteristics for this type of use, it had to be applied to the interlocking edges of the blocks with a hand trowel. The 2-foot square Bureau-designed blocks weighed between 100 and 150 pounds and were laid in rows lengthwise of the canal section beginning with the base blocks. The smaller cement association blocks weighed only 34 pounds and

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Take RECLAMATION off the *MERRY-GO-ROUND*

Extracts from the address of United States Commissioner of Reclamation Michael W. Straus before the sixteenth annual convention of the National Reclamation Association at Phoenix, Ariz., on October 30, 1947.

For the second time, as Commissioner of Reclamation, I have an opportunity to present my annual report to the advocates of reclamation and western resource development, and want particularly to plead for united action to achieve a firm, continuing, and steadily progressive national program for reclamation.

To attain its destiny, the arid West must, as a prerequisite, take its basic reclamation program off the merry-go-round of circumstance. It must put it on an orderly basis and keep it there with a clear and ratified program looking forward at least 7 years, planned and scheduled in advance so that the West and its responsible officials can hope to plan their development on solid foundations and carry out their plans immune from the vagaries of happenstance.

In the past decades, reclamation programs have, by various and sometimes temporary jurisdictions, been alternately cleared and blocked, speeded and slowed down, frozen and thawed, and commanded to "Giddap" and then "Whoa."

As one of the great construction programs of the world, reclamation requires better treatment.

This country cannot accomplish a multiple-billion-dollar complex program by alternately squeezing it fat and then stretching it thin as if it were an accordion—at least, it cannot be done on an economical and rational basis.

That is why we must achieve the orderly security of a basic continuing program, on which the country can rely, looking a reasonable span of years into the future.

This has been a crowded and adventurous year for reclamation. The past 12 months have witnessed the greatest volume of reclamation work in the history of the West. Many difficulties were surmounted.

The year was marked by reclamation's greatest construction program, the greatest amount of water being spread on the greatest number of acres, the greatest irrigated crop production with the first half-billion-dollar Federal crop value, and the greatest power generation.

At the time of the greatest need, reclamation produced the greatest amount of food while irrigationists enjoyed the greatest prosperity with the highest produce markets ever known.

The needs of the world, the Nation and the West for reclamation are increasing. A lot of people are getting hungry in this world. The United States, in some fashion, is going to feed a lot of them. Reclamation is going to do its share. Every area of the country, and particularly of the 17 Western reclamation States, daily demands more electrical energy at reasonable rates. Reclamation is going to provide its share. If we do not, the West will suffer for the simple reason that its growing population must have these necessary services.

On the question of population, the Bureau of the Census started its last report by saying, "A great westward movement of civilian population in the United States took place between the last census (1940) and 1946."

Western Population Booms

In what the Census calls "the West," which are the Mountain and Pacific States, population increased 28.3 percent with the highest increases in Washington, Oregon, California, and Arizona. In the remainder of the United States, increases were only 3 percent.

And when we compare new acreages brought under irrigation with this growth in population, we find that between 1940 and 1946 Reclamation increased new lands made productive for the first time by a full supply of project water by 5.3 percent in all the 17 reclamation States. Those same States reported an over-all gain in population of more than double the gain in new irrigated acreages—a gain of 12.7 percent in population.

Now, that is your problem, my problem, the Nation's problem. We are going to have to see those people get watered and fed as they can be watered and fed only on irrigated land, and that their new industries are sparked as they can be sparked only by new low-cost electrical energy.

That is why we say without qualification that, as the national debate goes forward on economy and budget, the one extravagance too vast to be reckoned by any bookkeeper's columns of dollars and cents is the mad extravagance of water wasting unused to the sea in a land that cries for water and food and power.

Economy is a word that means a lot of different things to a lot of different people. One thing it meant to some people was economy concentrated on the western reclamation program.

This is attributed to the fact that sincere and honest men were required for the first time to deal with a subject with which they were not familiar.

The new majority in the House of Representatives, principally from a humid area of the country where water generally and actually is a surplus—and frequently damaging—resource, had to have an opportunity to study the subject.

For 6 months a bright, white, and searching light played on reclamation. Those who challenged this program were only performing their duties according to their own true beliefs. It was a good thing that reclamation had to meet that challenge.

When the searchlight had concluded its swing over the West, the result was appropriations of about 100 million dollars of new money, which with funds heretofore made available made possible for you a sizable reclamation program of approximately 200 million dollars for this fiscal year. It is overwhelmingly construction.

That is not as large a program as the President asked for, or the Bureau of Reclamation reported was required, and it provides for fewer investigations. Mathematically, the new money is just a shade under the previous year's appropriations. It also happens to be approximately double the average annual appropriation for the past 10 years. The size and scope of the Reclamation Program today defies comparison with yesterday.

In other words, the Congress not only last year, but again this year, made the largest reclamation appropriations in history. By any interpretation, Congress affirmed its appreciation, support, and confidence in the West's reclamation program. And we might add that Congress did that in the face of a lot of divided counsel from the West itself.

The Congress, as a whole, seems to be ahead of some self-anointed spokesmen or any pleaders amongst us for special interests.

Just remember these facts when any prophets of doom or corporals of disaster tell you that the Congress does not support reclamation, or that it will not unless we junk this traditional policy or throw that policy in the ashcan.

Such advice completely and conveniently ignores the obvious fact that the time-tested policies some people now want exterminated are those that sprang from the West itself, were adopted by the Congress, ratified by legislation, and are mandatory upon Reclamation.

And that covers quite a few items—some highly controversial. It even covers some that are occasionally miscalled "novel social theories," such as the family-sized farm and the low-cost reclamation power requirements—both of which happen to be principles written into the law by the Congress many years ago and, when attacked, confirmed by the Congress over and over again.

Reclamation has the funds. The Congress and the country have told us to roll the construction program. This we must do despite any legislative novelties that appeared in the guise of appropriation actions.

One was a limitation placed, without warning, on the amount of essential engineering and design work that the Bureau was permitted to do in Denver, Colo., the world headquarters of heavy construction engineering talent.

Another restriction was a prohibition against the Government doing work itself that was authorized and appropriated for in the reclamation program.

Both of these riders slow construction and increase costs ultimately to be met by water and power users. Reclamation will ask the Congress next session to knock off both of these handcuffs.

A basketful of Reclamation bills were enacted during the year, but the chief interest revolves around two measures. These were the Reclamation power rate bill and the bill to end acreage restriction.

The first power rate bill was, in my opinion, a conglomeration of assorted views going far beyond anything I ever heard discussed before this Association. Instead of liberalizing reclamation law, it would have made it harder for a reclamation project to win through.

Long hearings ensued in which the country was treated to the spectacle of the West divided against itself. But from this performance there emerged an entirely different bill.

Rockwell Bill Summarized

This bill, known as the "Rockwell Bill," would do a number of things of vital importance.

- It would reduce the interest rate on the investment in power facilities on Reclamation projects from 3 to $2\frac{1}{2}$ percent.
- It would settle the technical controversy over application of the interest component, and, by statutory action, would ratify application of not more than one-fifth of the interest component as a direct aid to irrigation on the project.
- It would fix the amortization period on power investment at 78 years or the useful life of the facilities, whichever is the shorter.

These sections of the bill alone have the effect of making more reclamation projects feasible by getting the West much needed lower-cost power while widening the power markets which reclamation can both serve and draw upon for revenues to support its multiple-purpose projects and give the required assistance, beyond irrigators' ability to pay, to irrigation works.

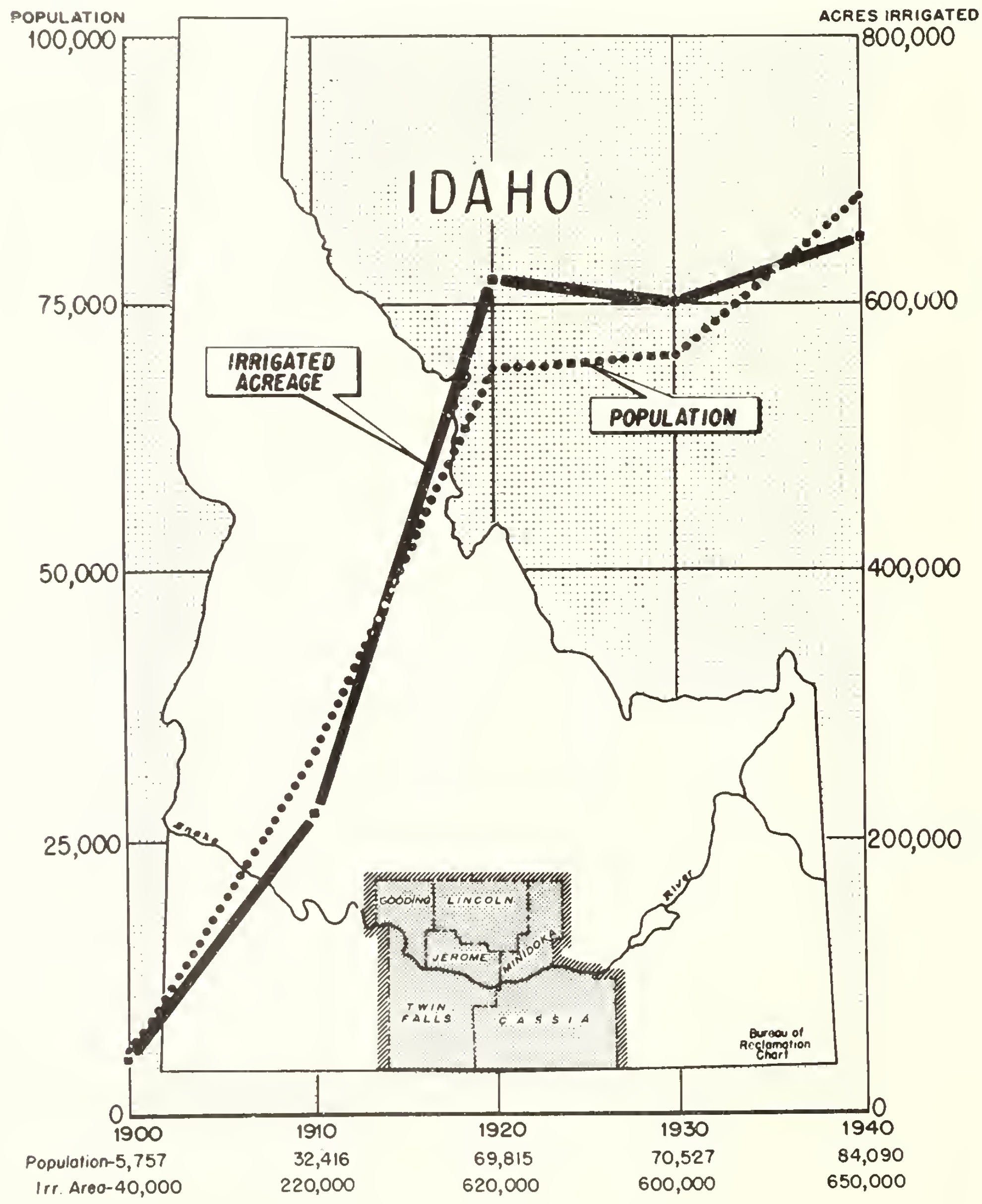
But, more important, provisions would be added by the legislation which would make nonreimbursable by water or power users those portions of the investments in features of multiple-purpose projects which might properly be allocated to development of recreation and fish and wildlife protection (which are common to most projects in the West), and, in addition, making nonreimbursable allocations for silt control (which is of vital importance particularly in the Southwest) and to general salinity control.

That bill, the "Rockwell Bill," House bill 2873, has been reported to the House of Representatives unanimously by its Public Lands Committee, and is also before the Senate as Senate bill 1608, introduced by Senator Butler, to be acted upon at the next session. It probably is not perfect. But, nevertheless, in its entirety it benefits the West's program and terminates controversies that have set Reclamationists against

(Continued on page 246)

IRRIGATION INCREASES POPULATION

Six Idaho Counties Which Without Irrigation Would Have Remained Desert



How the growth of population parallels the expansion of irrigated agriculture is graphically shown by this Bureau of Reclamation chart covering a 40-year period in six counties in southeastern Idaho. The 1940 population of the area was nearly 15 times greater than that of 1900 and the irrigated area slightly more than 16 times greater. The irrigation expansion has created more than $130,000,000 in property values, an annual pay roll of $63,000,000, 1,600 business enterprises, and jobs for 26,000 persons. Without irrigation this Twin Falls-Minidoka-Gooding section of the Snake River Valley would have remained as unproductive as the surrounding desert.

SPOTLIGHT on the PIONEERS

by Orin Cassmore
Region II, Sacramento, Calif.

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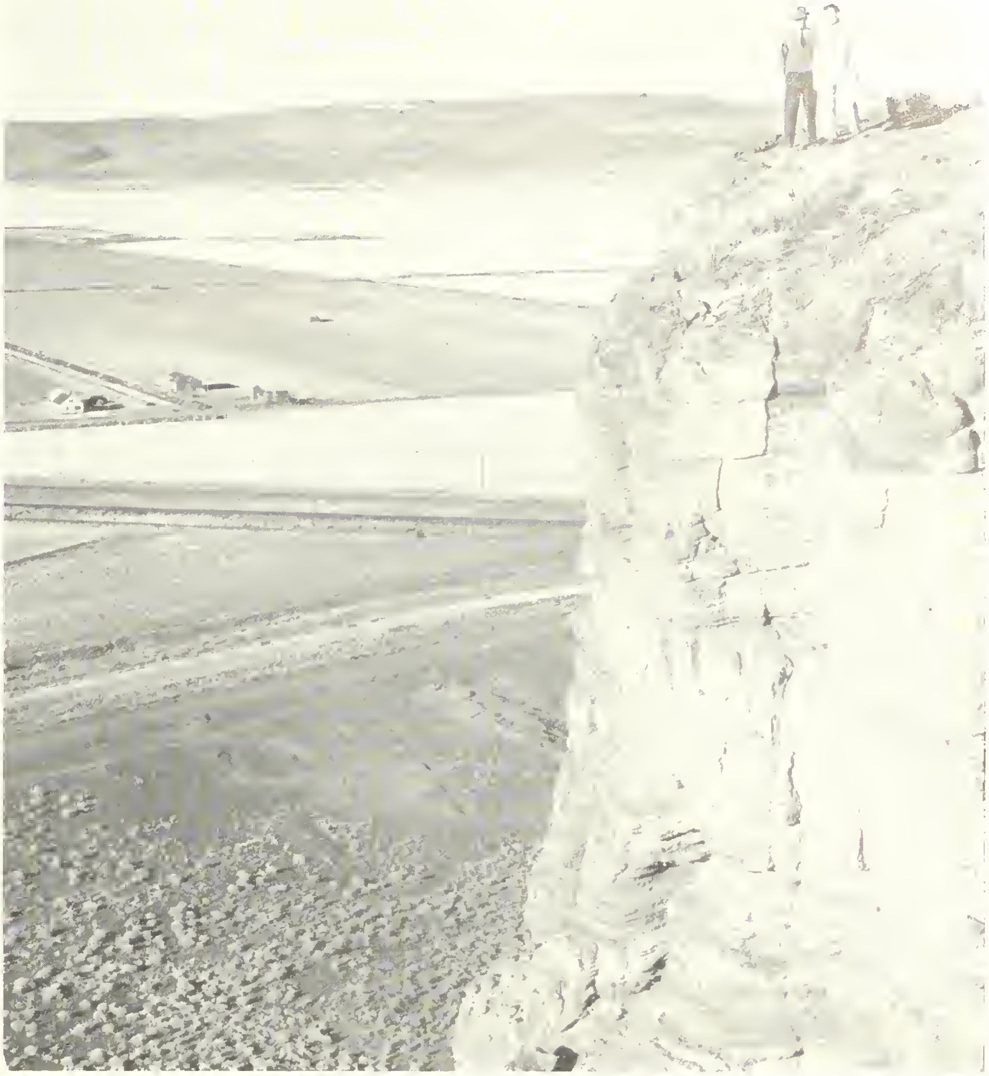


J. E. Flaharty, Region II

SKYLINE SURVEY *of his new homestead conducted by Walter Buchanan (right) with the aid of his father, Walter D. Buchanan, from a bluff overlooking the Klamath project.*

Latest reports from the Klamath project show that our present-day pioneers will have plenty of reasons for giving thanks this season.

It has been a hard year, but it has been a good year.

Something has been going on almost every week since March, when we went up to report on the choosing of farms by the 86 entrymen who were selected from the group of 172 whose names were drawn last December. The farm selection scene, as you might expect, continued the high level of drama that had started with the drawing.

This business was completed in January. Two months more were allowed for the settlers to pull stakes elsewhere and to look over the homestead lands so they could list the plots that were their first choices. Almost every veteran, usually with a coterie of advisers from the locality, tramped over the whole 7,500 acres, consulted with county agents and Bureau people. On March 13 everyone was at the project office bright and early.

Then E. L. Stephens, project superintendent, stepped to the big map at the front of the room and called up Robert L. Smith, of Banks, Oreg., first man. Mr. Smith got his first choice, of course. Then up came Gewin McCracken, of Arlington, Va. He got his, too. Then 3, 4, 5, and so on up to 86. Almost everybody was delighted, for almost all of them seemed to have gotten their first, second, or third choices. So nearly alike in productivity were the farm plots they laid out that almost every experienced farmer in the area evidently had a different idea as to which farm was the best.

The only unhappy man was one lad way down at the bottom of the list who was so sure the piece of land he wanted most would be taken that he did not write its number down. It turned out that no land in that area had been taken when he was called up, but he had forgotten the number, so had to be content with a random choice.

The only disagreement on the worth of any of the land came from Leland Cheyne, who had been farming in the Basin. Number 85, he declined to take either of the two pieces left, saying he believed that it would take too long to get either of them into profitable production. Eldred Charley, of Medford, did not think so, and accepted the last piece over the telephone while sick in bed at home.

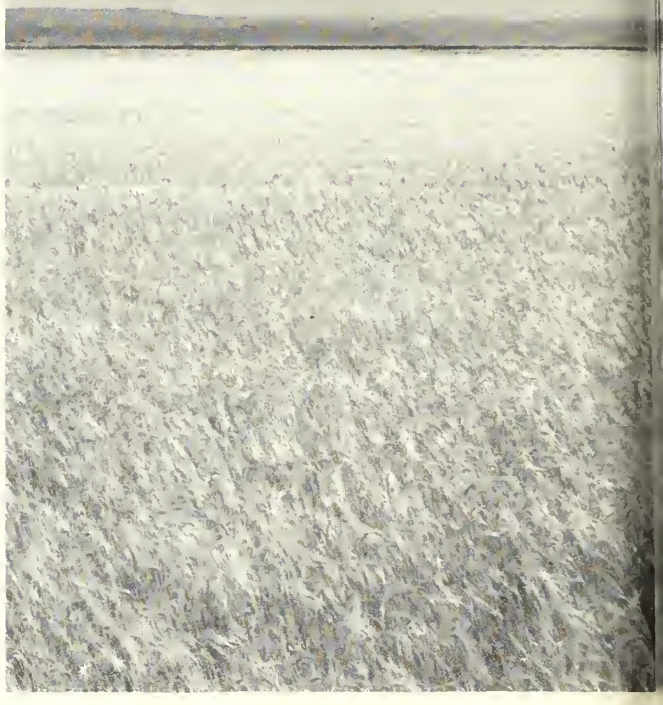
Then came the mechanics of becoming a homesteader on an assembly line of desks stretching half way around the room: first the water-rental application for a particular piece of ground; then a desk to pay the water rental a year in advance; then presentation of the receipt and getting a certificate from the examining board as an eligible entryman; then to the Bureau of Land Management representative to fill out homestead entry forms and to be certified as indeed the operator and potential patentee of homestead number so and so. No gunplay; no surreys and buckboards dashing madly for a choice piece of property; no "Sooners," but the end of long months of an exhausting nervous grind that began when, rather hopelessly, the entryman had trudged about getting papers together last September, only hoping that he would be one of the lucky few in the group of 15,000 who requested application blanks.

Getting the farm was not, however, the end of frenzied activity, as we have noted before. There were celebrations and picnics and lunches and dinners and dancing in the project towns to greet the new homesteaders. There were homesteaders' meetings initiated by the Bureau in which the various problems—getting a postal route, water, electricity, roads, how to get barracks moved onto the lands—were discussed. There were a million things to do; planting time was breathing down their necks; every homesteader had from 4 or 5 to 14 letters from established farmers offering to lease his land for as high as $65 an acre for the 1947 season, a price which would give the

Thanksgiving—1947

Photo by J. E. Fluharty, Region II

PIONEERS *turn down the lure of easy "land lease" money and with teamwork and streamlined equipment make possible the center scene.*



"Amber W

operator a good profit and the homesteader a chance to get his house up, his well dug and his yard and some shade trees planted, plus a sure and substantial income while doing so.

This seemed to be a very sound and intelligent program, the old slow-but-sure stuff, and we expected to find that most of the homesteaders were handling their land that way for the 1947 season.

Not so. When we took our first look at the previously bare plain from the bluff high above it in mid-May, we saw it dotted with houses; here and there a tree which could not have grown up in two months (Modoc County Agent Jack Hayes is dealing out the Chinese elms and Siberian peas) and everywhere the green of barley. Later we found that almost to a man they had broken and plowed and disked and seeded their own land in between trips to town to buy tractors with the funds the banks were willing to advance. And they and their wives had planted kitchen gardens and flower gardens and trees and seeded patches of lawn at the same time.

There was the Bolesta place, with iris growing in a garden patch at the edge of a nice stand of barley, even though no house had been brought in yet. Next day the house was there, and we found Charles Bolesta planting a strawberry patch alongside it to surprise Eleanor Jane when she came back from a visit to town.

There was Charles Stiles, long, lean, black-haired ex-MP sergeant, fortyish, who already had two 12-foot poplars, pruned down from full-sized trees, growing to shade the house he hadn't had time to start on yet. It was 7 in the morning and he was milking a brindle cow, apologizing for doing this chore where the living room will be. "Those fine trees? One of the old settlers gave them to me; helped haul 'em over. People around here sure are nice and cooperative."

Cooperation—yes, that was what struck you when you saw the full-steam-ahead way the new homesteaders were going—Mr. Stiles' daughter and son-in-law were helping him and Mrs. Stiles get the grassland in shape, a low place filled in, and the house built. Then they in turn would take over Mr. Stiles' dry farm across the hills in Lake County.

Mrs. Lena Johnson had come out from Minnesota to help her son and daughter-in-law get started. She was busy in overalls, calcimining the beaverboard walls of the barracks.

There were five pieces of machinery at work on Gerald Corcoran's place. (See photo on this page.) New homesteaders Bill Crawford, Robert Anderson, and Eldred Charley, brother Myron Corcoran, friend Ed Jones, home on furlough—these five were operating the battery in a coordinated sweep that looked like a California corporate farm instead of 80 acres up at Klamath.

"Everybody trades work and equipment," Mr. Corcoran said. "We figure that if somebody is willing to rent our land for \$50–\$60 an acre that means he figures he can add that amount to his costs and still make a good profit. Why shouldn't we get that extra money ourselves? All it takes is a little cooperation and we can get the crops in and still get our houses fixed up and everything going fine by the end of the year."

"That's right," said Mrs. Jennie Oman,

Tulelake pioneers live their new lives according to the best traditions of our hard-working, home-loving, community-conscious forefathers.

Photo by Ben D. Glaha, Region II

Photo by J. E. Fluharty, Region II

PINT-SIZED *Dennis Oman, whose mother, Mrs. Jennie Oman, with the rest of the settlers is building a community for this and future generations.*

Grain"

looking up from where she was tucking hot caps around her melons. "We can do anything. The oldtimers around here said you can't grow melons. I'll show 'em." The Omans will show 'em, too. They're here to stay. Mr. Oman was tacking up a "For Sale" sign on the house trailer because their place was already liveable. Within a day or two a substantial 30-foot chicken coop, built with salvaged lumber, would be ready to care for a big brood. In addition to the kitchen garden, there was grass and a big plot of flowers.

"Sure we'll show 'em," said Walter Hulse. He had alfalfa in, and a plot ready for potatoes. His barracks had the beginnings of a solid foundation and he was putting in a big picture window to get the fine view south and west. "We have a chance to make it while the making is good. You can do it and still have time to make yourself a nice place to live."

More than likely this bunch will show everybody. Two months after they got their homesteads there were crops growing on every place. Only 15 percent are leasing their land. Nobody is trying to make a million dollars the first year by plunging into potatoes, which take so much work that he wouldn't have time to make a home: but 33 have planted their 17-acre potato allotments. Two-thirds have their whole places in Hannchen, the premium malter's barley that is a profitable Klamath specialty. Perhaps a quarter of this group has clover, grown here for its valuable seed, mixed in with the barley. Twenty-five percent have their land in alfalfa and clover. One or two are raising flax, which looks good this year. When we last saw the project all the crops were up and looked well. In addition, half the homesteaders had their barracks on the land and were ready to move in; almost all the rest had made arrangements to move theirs. About 50 had bought some power farm equipment. This first season there is plenty of work for every piece in the area.

And they are already beginning to form a solid, public-spirited community. The monthly project meetings are teaching them the possibilities for civic action lying in the old New England town meeting. With the help of Paul Braunig, Bureau settlement specialist, the power company was induced to build lines in on a subdivision basis, instead of to individual settlers as they applied—a quicker and cheaper method of getting electricity. They were discussing a bond issue for a water system. Plans were afoot to move a school to a more convenient location. Some were talking of a vocational agricultural school in Tule Lake, using surplus buildings and equipment for classrooms and shops. A committee headed by homesteader Paul Rogers is making Modoc County aware that there are a couple of hundred vigorous young voting citizens up in its northwest corner. The county claims it has no money to build roads on the project; the homesteaders are demanding either roads or the loan of equipment to build roads themselves.

Yes, this is a community that ought to be a successful one. It is carrying on in the best traditions of America's pioneers.

•

NEXT MONTH—the story of what is happening in the way of assistance to new veteran settlers on the Minidoka project in Idaho.

Power Shortage

(Continued from page 232)

It is sound national policy to increase the production of public power in connection with Federal multiple purpose water developments because those projects are conservative of our energy resources and provide other lasting and essential benefits to our people.

It is sound national policy to increase the ratio of these public power installations to the total capacity of the country because under the policies that have been laid down by the Congress for their handling they provide an opportunity to develop undeveloped areas and afford a means for consumer protection on price and availability of power.

But as much as we favor the continued development of publicly produced power for the long run, we believe even more strongly that our present task is to add kilowatts to our national capacity and would not think of discouraging any development of additional electrical energy at this time—whether by steam, hydro, or diesel; by cooperatives, private utilities, or by public agencies.

We have reached a point where the necessity for more power production facilities overrides any other consideration.

We hope that the utilities will bend every effort to increase their capacity. At the same time, the work of the Bureau of Reclamation, the Army Corps of Engineers, of Bonneville, of Southwestern, and of TVA is vital to supply the power requirements of our Nation.

We assume that the agreement reached by public and private utilities alike in the Northwest, calling for more and faster Federal power facilities was motivated by a knowledge that this power is essential to the development of this region and the maintenance of its agricultural, commercial, and industrial strength and is basic to the defense of our Nation.

The time has come for others in the utility business, public and private and cooperative, to take a similar responsibility for the economic welfare and the security of our country and its people. •

The above article was adapted from an address by Mr. Goldschmidt, before the Fifth Annual Convention of the National Rural Electrification Cooperative Association at Spokane, Wash., Wednesday afternoon, April 23, 1947.

UTAH'S "Water Courts"

(Continued from page 233)

whenever he thought his crops needed it? At what point did *use* become *waste?* Out of these and other serious and honest attempts to solve such questions was coined the phrase "duty of water."

It was providential that this experimentation fell to the lot of a cooperatively minded and homogeneous people. In Mormon hands those small 5- and 10-acre fields became in reality experimental farms on which the intricacies of irrigation practice were painstakingly worked out. It simplified the problems to have all families owning about the same amount of land and having, therefore, about the same needs.

Because all of these settlers had minds of their own which they were using, there were many controversies. The ecclesiastical "courts" were frequently called upon to settle some dispute over water. There were no legal precedents applicable to such disputes in this arid region. But the Utah settlers were of the same faith and they respected and obeyed church laws. Church "courts" ruled that taking irrigation water when it was another's turn was an un-Christian act for which one could be tried for his fellowship in the society.

There were two such church tribunals which heard all these grievances, and all of this service was rendered without cost to the parties to the controversy. The bishop's "court" was the "court" of primary jurisdiction. It was composed of a bishop and two counsellors. They heard each case with patience and forbearance and rendered a decision. The decision did not legally bind the parties, but its practical effect was to settle the controversy in a large percentage of the cases. If either party was dissatisfied with the decision, he could appeal to a high council "court" which was composed of a president and 12 high priests chosen for their mature experience, sound judgment, and for their high standing in the confidence of the people. This court had both original and appellate jurisdiction. It heard all the evidence on both sides and sustained the bishop's decision if they thought it just, or modified it if they thought it unjust. Those old trial records shed an illuminating light on the struggles to reduce the practice of irrigation to a workable system. In their broader aspects, the courts were seeking always to discover and lay down rules of general equity that would apply in all cases rather than just the settling of a dispute between this man and that.

Perhaps an actual case or two may be of interest. There was, for example, the case of *Edwards v. The People of Paragonah.* William Edwards had a full-day water right in the Paragonah field. He acquired a piece of dry land a mile away from the field and he wanted to transfer his water right to it. He made a ditch and when his water turn came he took the stream away from the field and diverted it to his new farm. He argued that the water was his on that day and he could use it where he pleased.

The farmer whose turn followed Edwards protested. He said it always cost him an hour of his water turn to run the stream down through a dry ditch and the dry ditch also soaked up a lot of his water. Other farmers said they depended on the field ditch to water their work animals and Edwards was, therefore, causing them great inconvenience and loss of time.

The bishop's court decision was that Edwards could not take the water from the field in which it was allocated without injury and loss to all water users in the same canal. Nor could he do so without loss of water to himself since he, too, had to run the stream each week through a dry ditch. Moreover, if Edwards could divert his water, then every other field owner could do the same and soon the value of the old established field would be depreciated. On appeal, the high council confirmed the bishop's decision. Many years later Edwards took his troubles to the civil county court which applied the same reasoning as the church "courts," and rendered a similar decision.

Perhaps the most noteworthy case of all was that of a man we shall call Brother A who went out at night and stole the water off Brother B's grain and put it on his own. In the morning B discovered the theft, followed the stream down, and found it on A's grain. Brother A was convicted of stealing water and the bishop's decision was, "You shall appear next Sunday in church before all your brothers and sisters, confess your sin and ask their forgiveness. Then in the fall the threshers shall measure your grain and determine your yield per acre. They shall do the same also on the field you robbed. Then you shall deliver into Brother B's bin an amount of grain that will make his land yield as much per acre as your land yielded. That will be the amount of grain that the water you stole produced." The culprit proposed instead that he would give Brother B his next full turn of water and that would be double the amount he had stolen. The bishop said, "No, that will not answer the ends of justice. Damage has already been done to Brother B's crop and a belated application of water now will not help that. Then, taking the water off your grain at this time might injure it and both of you will be the losers." "But," reasoned the thief, "your decision puts on me the labor and expense of harvesting his grain and that is not fair." The bishop's reply was worthy of a Solomon. "You borrowed his grain without his consent and now you must return it without his assistance."

How did it all come out? Because the sentence was so unusual, it was on the tongues of everyone throughout the summer and when threshing time came curiosity could scarcely be restrained. To the surprise of all, Brother B's land yielded more grain than Brother A's and the credulous said, "The Lord never prospers a thief." But in the minds of the thinkers the incident stirred a suspicion that possibly they were watering their crops too much. Subsequent experience confirmed that suspicion and the field fence was pushed out to enclose more land which the same stream was made to cover. The average yield per acre under the old system of frequent watering was 25 bushels per acre. When the amount of water was cut, the yield was built up subsequently to double that amount. That one eye-opening case led not only to the doubling of the yield per acre but also to the doubling of the acres farmed under the old canal.

(Concluded on page 246)

The Huggins Check Plat

by John K. Black
Shoshone Project, Wyo., Region VI

Photo by Joe W. Butler, Region VI

The author, inspecting pea plants on Huggins plat. Inoculated plants at left. Compare pea pods.

Mother nature gives up her secrets very reluctantly but usually provides a handsome reward to anyone who diligently sets out to improve her domain.

It was general knowledge that Heart Mountain Division lands are deficient in nitrogen, but the extent of this deficiency was not fully appreciated until Alvin J. Huggins, a World War II veteran, on Unit No. 62, set up a check plat in his pea field.

This enterprising homesteader picked out 10 acres of his most level land and seeded it to seed peas for which he had contracted. The field man for the seed company with whom he was dealing advised that the pea seed should be inoculated with nitrogen-fixing bacteria to make sure these necessary little organisms would be there to gather the free nitrogen from the soil air and concentrate it in nodules on the roots of the plants where it could be used in the plant diet.

Huggins, being of a scientific turn of mind, left a check plat about 75 feet wide where no inoculum was used. The results were apparent almost from the day the first plants came up. The check plat produced pale green plants that barely covered the ground. It was easy to see where the seed had been treated. Healthy rugged plants followed the drill marks and showed up in stark contrast to the dwarfed growth in the check plat alongside. And all it cost him was 30 cents per acre for the inoculum.

Now that the peas have been harvested, the results are even more apparent. The check plat was barely worth harvesting. The plants were so short that it was difficult for the combine to pick them up. The acreage treated with bacterial culture produced at the rate of 2,000 pounds of clean peas per acre, while the untreated plat yielded 200 pounds per acre. At the contract price of 7 cents per pound, it is simple arithmetic to figure the reward this veteran received for giving mother nature a helping hand by turning loose in the soil the all-important bacteria.

Land Use Specialist Robert M. Fagerberg prepared a full report on the subject which was given at one of the meetings. The local newspaper also took up the subject in one of its issues. The lesson has been well learned and all will benefit by it another year.

As the settlers began to arrive in March and April of this year, project personnel were called upon to answer a great many questions:

- What crops should we plant?
- When should we plant?
- Where can we get seed?
- Where can we get machinery?

In order that only the soundest advice would be given these young men eager to succeed on their pioneering venture as homesteaders, the county agent, representatives of other agricultural agencies, successful farmers, representatives from seed houses, the canning company, the sugar beet fieldman, machinery dealers, and others who could contribute sound advice, were consulted and invited to attend the settler's meetings held each Thursday evening.

These men would sit together, each explaining his own experiences and inviting questions from the new settlers and other members of the panel.

It was obvious from the first meeting that the experts had the interest of the veterans at heart and were not necessarily trying to promote their own businesses.

A representative from one of the bean elevators advised the boys not to try producing beans until the lands had been built up by applications of barnyard manure or green manure, even though this meant he would get no beans from Heart Mountain this year.

The same was true with the field man from the sugar-beet company.

All of those who were called in drove home the point that it was important to plant sweet clover or alfalfa on the land the first year and to make wise use of irrigation water. These meetings laid the foundation for sound farming practices on Heart Mountain homesteads and can prove equally effective with other groups of settlers.

As a rule, the modern homesteader of today, a veteran of World War II, is young and energetic. He is usually well informed, but more important than this, he has his eyes and ears open and is receptive to suggestions. It is the responsibility of the members of the project settlement and development staff, the county agricultural agent, and other agricultural leaders to see to it that he gets the best possible information, but they too must learn as they go along.

Every new division opened for settlement has its own individuality, and therefore, experimentation must be encouraged. Huggins' experience will certainly encourage other settlers to set aside check plats each year which will assist all the farmers in the area in developing improved agricultural practices. •

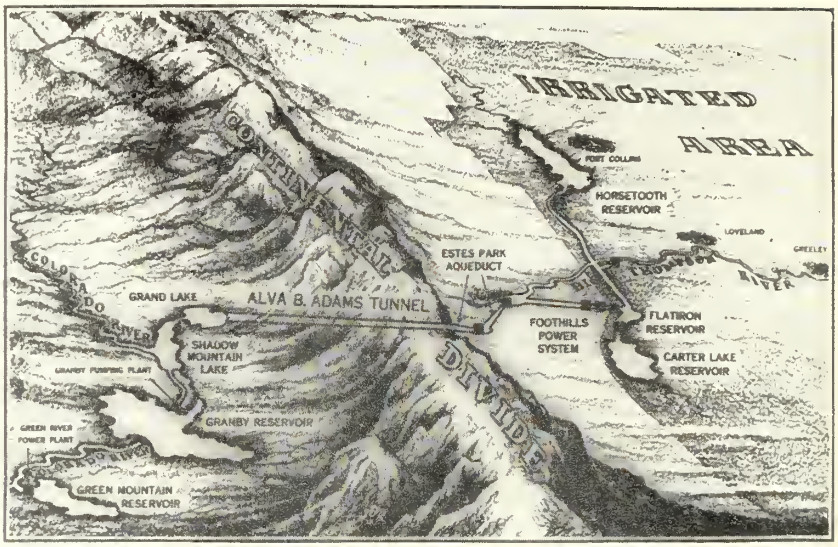
Trans-Mountain Water—

A Blessing and Challenge

First flow through Adams Tunnel starts era of higher yields of surer crops if water is applied wisely

by N. R. McCreery

Consulting Agriculturist, The Great Western Sugar Co.



Drawing by Jas. D. Richardson

Alva B. Adams Tunnel, June 23, 1947, after 14 years of planning and work.

When water flowed through the Alva B. Adams Tunnel to the eastern slope on June 23, 1947, nearly 14 years after the first meeting of the project sponsors in Greeley, August 17, 1933, we could see the first tangible evidence of the fulfillment of a dream of a few far-sighted men.

It was truly a historic event when eastern Colorado was given the opportunity of securing for the present generation the benefits of this increased water supply and, what is of even more importance, the preservation for posterity of the rights to this water in the Colorado River that could only be assured by actually putting the water to beneficial use. Too much credit cannot be given to Mr. Charles Hansen of Greenley, who has been the guiding spirit, the wise counsellor, the persevering genius of conciliation in the face of many perplexing and recurring problems through all these years.

At this time the project is only partially completed, but the additional 40,000 acre-feet of water available to the irrigated land under the Big Thompson Irrigation District and the land tributary to the South Platte River east of the confluence of these two rivers will mean much as a supplemental supply and a veritable godsend in years of deficiency.

Power To Aid Marketing

A few years hence, when the entire project is completed and the total 310,000 acre-feet become available, we can look forward to northern Colorado becoming an even more outstanding agricultural region than it is today. This will mean an increase in the created wealth of the region that will draw and sustain an increased population.

Increased output of farms will bring marketing problems. To some extent these will be solved by new processing plants drawn to the area by more than one hundred thousand kilowatts of electrical energy to be generated annually by the power plants of the project.

In some of the recent dry years our rejoicing would have been more enthusiastic than in this year of more than normal rainfall. But to those who have had the frequent experience of no water for the second and third cuttings of alfalfa or the last two applications for their sugar beets and have seen the yields reduced in both of these crops by several tons per acre, the knowledge of this ample supply of water available for the future will bring pleasant anticipation of increased yields and more stability of income because they can now plan any diversification of crops that offers them the highest return from their land.

We in the beet-sugar industry who have seen the fields drying up after the August 15 irrigation and have known there was no more water in sight will now know that we need not fear the recurrence of this deficiency but instead may expect an increase of several tons per acre through the continued growth of the crop to the harvest time as the result of this late irrigation.

This is certainly a rosy picture and can mean the beginning of a new era in the agriculture of northern Colorado if a careful use is made of the additional water, but an increased water supply is not always on the credit side of the ledger. It is possible that this water can be the cause of reduced yields if it is not used judiciously. In other words, it is possible that an ample supply can prove a detriment rather than a blessing. If too much water is used on the fields, not only do the crops not produce their maximum growth for the current year, but plant food for future crops is dissolved and carried away through leaching, and the crops of future years may suffer.

A reasonably moist condition of the soil is desirable during the growing period of most crops, and especially sugar beets, to keep the plants drawing their maximum supply of the plant food from the soil which is only available to the plant in liquid form.

For sugar beets, frequent light irrigation during the entire growing period will produce more tons per acre than infrequent heavy irrigations. This is not just a case of someone's theory but a proven fact demonstrated many times by experiment stations. The excess water from a heavy irrigation creates a saturated condition that is not conducive to maximum growth during the time that the excess water remains around the plant.

Bad Use of Ample Water Reduces Yields

In addition to the loss caused by retarding the growth of the crop, there may also be a slowing of the bacterial action in the soil due to the cold, damp condition maintained over substantial periods of time while the excess water is percolating out of the soil. The maintenance of this cold, damp condition due to over-saturation also tends toward a compacting of the soil and a certain loss of the tilth that is necessary to encourage maximum plant growth.

Further, some areas will become seeped from the surplus water, increasing the necessity of drainage installations to bring the land back to a usable condition. Harmful effects from too much water are multiplied with the years and it is well to be aware of the problems which may arise from the increased water supply in order to avoid the damages that will surely follow its excessive use.

(Continued on page 218)

Ditchbank Weed Control in the Southwest

by Curtis Bowser

Region III, Boulder City, Nevada

Weeds long have been recognized as one of the important forces responsible for serious losses in the production and marketing of crops.

It is known that infestations may be started from weed seeds maturing on ditchbanks and carried to farms by the irrigation water. Also weed growth on the ditches create one of the major operating problems for irrigation districts because they impede the flow of water, cause seepage, and transpire enormous quantities of water.

The Bureau of Reclamation has realized the seriousness of these problems and has instigated a weed control program designed to help prevent this source of infestation to crop land and to reduce operation problems and maintenance costs created by weeds growing on ditchbanks. (See March 1947, Reclamation Era, p. 55, for the story on ditchbank pasturing.)

The favorable growing conditions in the Southwest which are well known for year-round production of fruits and vegetables are equally as favorable for the growth of weeds. Irrigation projects in this area are plagued with a year-round problem of controlling undesirable plants along the irrigation systems.

The recent strides in chemical weed-control research have shown that weeds no longer need be regarded as a necessary nuisance. Now many effective methods can be economically employed to reduce the heavy tax which these pests impose upon agriculture.

In the Salt River Valley, Ariz., the most troublesome weed is Johnson grass, a rank-growing, comparatively shallow-rooted perennial plant, often attaining the height of five or more feet and sometimes completely covering a ditchbank and right-of-way.

Up until 1945, the weed-conscious water users in the Salt River area employed mobile weed burning units to control the ditchbank plants. However, the success of this operation was generally poor as some ditches did not have operating roads, and the fire hazard to the many haystacks, buildings, trees, grain fields, and telephone and power poles near the canal right-of-ways was not conducive to the use of large, high-pressure weed burner units which are necessary if efficient and economical burning is to be accomplished. Neither was it possible always to perform the burning operations as frequently as is necessary to eradicate Johnson grass.

Consequently, experiments with oil spraying were made, and it was found that Diesel fuel oil, when applied in quantity to cover the vegetation, would control the Johnson Grass and the noxious broad-leaved plants, yet not seriously retard the growth and spread of the lower growing Bermuda grass which is important as a soil stabilizing and weed competing sod cover in the Southwest.

Photo By C. W. Bowser, Region III

OIL SPRAYING *in Salt River Valley to control Johnson grass on irrigation ditchbanks. Fences, power lines, etc., prohibit use of large weed burners.*

In 1946, the 12 spray units operated by the Salt River Valley Water Users' Association, were used to apply oil to some 3,200 miles of ditch at an average cost of $20.70 per mile. Approximately 125 gallons of oil per mile were applied, that is, for a strip 8 to 10 feet in width. The costs of application and volume of oil applied are less this season and will be further reduced as the grass and weed infestations are diminished in size and growing-vigor.

The increased cost of Diesel oil and the recent practice of removing more of the aromatic compounds—the most toxic factions to plants—in order to make it a more efficient engine fuel have forced investigators to seek cheaper and move toxic oil substitutes to control grassy vegetation.

Mr. L. S. Evans, associate agronomist of the Bureau of Plant Industry, Soils, and Agricultural Engineering, in charge of the Southwestern Federal Weed Research Station at Phoenix, Ariz., has been working on irrigation weed problems in cooperation with the Bureau of Reclamation and the Salt River Project.

He has investigated a mixture of fortified oils and water, i. e., 70 gallons of water, 30 gallons of oil, and 1 quart of phenol fortifier (Dow General, Sinox General, or Chipman General) on ditchbank weeds.

Initial results indicate this nonselective spray will destroy very rapidly the parts of the plants above ground and that the regrowth will be slower and have less vigor than when the weeds are sprayed with straight undiluted oil.

In addition to being more toxic, the fortified oil and water mix is less than one-half as expensive as the 27°+gravity oil commonly used for ditchbank weed spraying. Test applications of high aromatic unsaturated oil compounds (Shell Weed Killer No. 20 and Standard Weed Killer No. 2) on Johnson grass and Carrizo cane also have proved highly successful.

The weed-control problems confronting the operation and maintenance forces of the Yuma and All-American Canal projects in southwestern Arizona and the Imperial Irrigation District in Southern California present different aspects than those in the Salt River Valley.

There the objectionable ditchbank weeds are predominantly shrubby species, arrow-weeds, salt cedars, and willows. Also, the ditchbanks have different characteristics from those in the Salt River Valley—they are wide with operating roads on both sides and few houses, fences, or haystacks near the right-of-ways. These are ideal operating conditions for large-size, truck-mounted weed-burning equipment.

The Imperial irrigation district, which incidentally is at present the largest irrigated area under one district in the United States, practices a successful weed control program and other weed preventative measures on its 3,000 miles of irrigation waterways.

In 1946, with 11 weed burners, the District covered a total of 23,779 miles of ditchbank, some sections of the 3,000 miles receiving several applications, consuming 2,059,244 gallons of burner fuel. The average cost per mile for all weed burning was $10.59.

There are now but few large weeds growing along the inside ditchbank slope. The secret of the Imperial irrigation district's economical weed burning is the far-sighted scheduling and timely execution of the weed-burning operations so that the plant

Photo by Samuel B. Watkins

TRUCK-MOUNTED WEED BURNER *operating along Gila Gravity Main Canal in Arizona.*

Photo by Harry W. Myers, Region III

WEED BURNING UNIT *operated by Imperial irrigation district in area free of fire hazards.*

growth never gets out of control.

To remove the water-line weed infestation from the All-American Canal, it was necessary for the Bureau of Reclamation maintenance force to resort to equipment that could approach the weed growth from the water surface, as in many places ditchbank operating roads are not provided and in other sections of this giant-sized canal the banks are of such height that a 45-foot boom on a truck-mounted burner could not reach the water line.

Consequently, a weed-burner unit was mounted upon an amphibious DUKW, 2½-ton GMC vehicle, and canal bank ramps were constructed to provide means for entry and exit for the equipment.

The flame sweeping up and through the vegetation on the ditchbank slopes was so effective and the operation with the amphibious unit so successful that the Bureau since has obtained several DUKW vehicles to be used in those waterways of sufficient depth and size to allow free movement of the machine.

(EDITOR'S NOTE: Construction details of the amphibious weed burner were featured in the October 1946 issue of the RECLAMATION ERA. Complete detail design drawings of either the truck or amphibious mounted weed burners will be furnished on request from regional director, Region 3, Boulder City, Nev.)

More economical and efficient measures to eradicate the undesirable ditchbank weeds now are being investigated.

Trials in 1946 indicated that 2,4-Dichlorophenoxyacetic acid possibly could be used to control the broad-leaved plants, including among others the willows, salt cedars, and arrow-weeds.

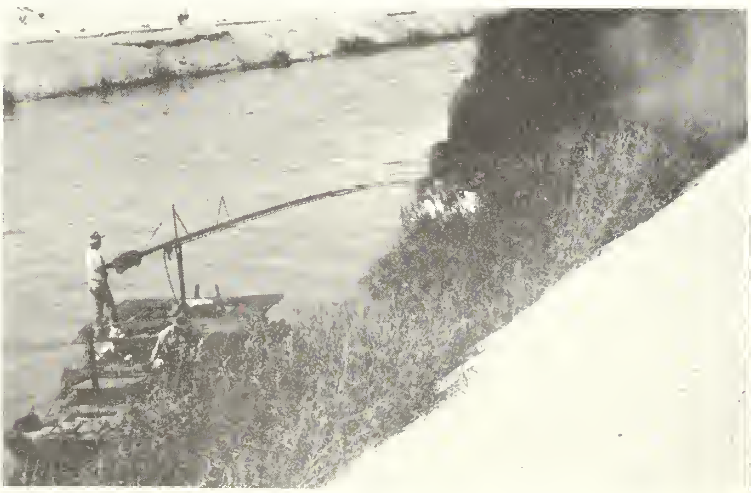
The results of the 2,4-D applications this season to some 250 miles of canal bank vegetation by the Bureau of Reclamation and the imperial irrigation district have been 100 percent satisfactory, and no harmful effect to field crops has resulted.

Care and caution are exercised when applying 2,4-D to ditchbank weeds and the practice is followed of not spraying in areas where possible harmful effects to susceptible crops, including cotton and tomatoes, could result. Note picture below showing the application of 2,4-D to a heavily weed-infested outside ditchbank slope.

Cost of the 2,4–D applications compares favorably with the cost of burning; also the spraying is preferred, as the workmen are not exposed to the uncomfortable heat and smoke nor is there a fire hazard. Further, the 2,4–D eradicates the weeds in a comparatively short time while burning may require many operations over a period of several years to effect a kill.

The grassy weeds, however, are not affected by the 2,4–D. For these plants other means such as frequent burning, the use of fortified and aromatic unsaturated oils, and improved herbicides must be used.

The 1947 season has been most successful in the history of weed control on irrigation ditches. The new and more scientific methods introduced show promise of saving irrigation districts hundreds of thousands of dollars annually in addition to more effectively preventing weed infestations on farm lands. However, many other methods are being investigated to obtain even greater efficiency in ditchbank weed control in the Southwest and other regions in the reclamation area. ●



AMPHIBIOUS TACTICS *are employed in All-American Canal area where it is impossible to get at weeds by land. This DUKW will "smoke 'em out."*

Photos by Harry W. Myers, Region III

APPLYING 2,4–D *to vegetation on outside of ditchbank in Southern California. Spray is applied under high pressure but is controlled and directed to give full plant coverage.*

Getting the Sub Up

Subirrigation in the San Luis Valley of Colorado dominates the agriculture, the social life, and the vernacular of the region

by Frank A. Brookshier

Former Project Economist, San Luis Valley Project, Colorado

The "sub" was just right and resulted in this big potato harvest.

"I've sure got the sub up!"

A son of the soil pulls out his bandanna, wipes his brow, and with these words identifies himself as a practitioner of the agricultural art known as "sub culture" or "subirrigation," a dominating characteristic of the fertile San Luis Valley of Colorado.

This unique, practically level valley plain, averaging a mile and a half above sea level, is virtually a closed basin, surrounded by colorful mountain ranges. To the south and southwest are the San Luis hills. The San Juan, in the west, merges in the north with the lofty, legendary Sangre de Cristo Range which, pushing up from the south, ushers the blood-red sun into the enclosed valley.

The valley is traversed by the historic, winding Rio Grande that meanders on through New Mexico to draw an irregular line between Texas and Mexico before mixing its waters with the Gulf, 1,800 miles from its source.

At one time the valley was covered by a huge lake supplied with water from the Rio Grande River. But as the channel of the river cut deeper and deeper into the rocky canyon to the south of the valley, the lake was eventually drained, leaving an underground basin of water that stands at a level of approximately three feet under the surface. This underground lake, below the roots of the growing plants, makes subirrigation possible. The water table is raised or lowered by diverting waters from the Rio Grande river out over the smooth surface of the valley floor.

"Can't get the sub up," is an expression heard on farms during a dry spring or summer. It means the water table is too low, that is, too far below the surface of the ground, and even though an effort has made to recharge the ground-water area, the moisture is not moving by capillary action into the root zone.

The water table rarely exceeds 10 feet except on steep, alluvial slopes, and fans near the outer edge of the valley. This shallow ground water is stored in a porous fill ranging in depth from 10 to 90 feet over a floor composed mainly of silts, clays, sands, and gravel.

Whether the farmer can get the "sub up" may and often does determine the difference between a successful and an unsuccessful farming season. This factor is important in an area where the annual rainfall averages only 6 to 9 inches, and the growing period is short. However, once in a great while the amount of rainfall exceeds the normal, and then one will hear the complaint: "Can't get the sub down." Even though the season is dry, a few sudden rains, supplementing the irrigation water, will get the sub up too high in some areas and this condition may prevail during potato spraying. If so, the tractor-sprayer may bog and give the potato bugs a chance for a Roman holiday. Not only tractors, but wagons, automobiles, and all vehicles bog down to their hub-caps while the "sub is up."

The sub culture in the San Luis Valley dates from the middle of the nineteenth century when the first permanent agricultural settlements were established in the lower section. The soil structure, grade, and water table encouraged the practice of subirrigation.

The common method of subirrigating is by cutting small ditches through a field, the direction corresponding with the slope or grade of the land. The distance between these laterals varies from 100 to 300 feet, depending on the structure of the soil, water available, crop grown, and similar factors. Normally about one-fourth to one-half cubic foot of water per second is run down the ditches. Checks of dirt, which serve to retard the flow down the laterals and cause the water to seep out below the surface of the field to build up the sub, are placed at frequent intervals in the ditches. A network of covered and open drains prevents accumulation of excessive salts in the soil. These drains serve a dual purpose during dry periods: farmers place checks in them to hold up the sub, and recharge the ground water areas. Eventually some of the water returns to the river, or as in the farming area north of Monte Vista, the drains terminate in the closed basin where the San Luis lakes are replenished. Unless neighboring farms correlate their operations, some clashes may result, for the water table is unconfined, and when one man wants the sub up, another may want it down.

Efficient farmers often maintain test holes on their farms to detect quickly the rise and fall of this pulse of the soil's life blood, producing crops to sustain the valley's economy.

A new device known as the piezometer is being perfected, which can be thrust into the ground to measure the moisture content of the soil. It should be popular with valley farmers seeking the "sub."

About 456,000 or 70 percent of the total irrigated acreage of the valley lies in the project area of the Bureau of Reclamation which plans to provide supplemental irrigation water to stabilize its agricultural economy.

Subirrigation is practiced on about half of the farming area each year. This does not necessarily mean that the same plot on a farm is irrigated each year. The crop grown, depth of water table, amount of rainfall, soil structure—all affect the farmer's decision as to his choice of row, corrugated, flood, or subirrigation method for his land. The latter method of applying water to the land has been known for centuries. However, it has been practiced in only a relatively few areas in the United States other than in the San Luis Valley.

Advocates of subirrigation say this method possesses several advantages over

(Continued on page 248)

RECLAMATION MERRY-GO-ROUND

(Continued from page 236)

Reclamationists. The Bureau has advised the chairman of the Public Lands Committee that its passage would advance reclamation.

Family-Sized Farms

The other major legislative controversy in the past session was over an attempt to repeal for three projects the so-called 160-acre law and family-sized farm principle, which has been a cornerstone of reclamation policy since reclamation became a Federal function nearly half a century ago.

That bill was not reported out of committee.

While differences of opinion may be inherent to our democratic process, on these two subjects we are reaching a point where it appears to the detriment of our common interest that so many people spend so much effort and money on these two endeavors each year. They have not succeeded, but they have exhausted a lot of Reclamation's time which could be better spent in driving forward the work you want done and which needs to be done.

Construction Hurdles Ahead

And that leads us to immediate major problems with which we are today confronted. Most of you have had some personal experience in the last couple of years in some type of construction, building a barn or remodeling a house or trying to buy and install a piece of machinery. You know what you were up against. Multiply it a few million-fold and then add all the actions required of irrigation districts, States, and courts that precede irrigation construction, and you know somewhat of Reclamation's task.

Within two days after appropriations were passed in July, Reclamation forces gathered in Salt Lake City to program our work in accordance with the expressed policy of Congress, namely to drive its construction on an all-out basis, giving that requirement the priority over all other endeavor. We are going to use the Nation's money just as economically, effectively, and efficiently as we can for the purposes that you and the Congress provided it. To achieve this end requires a minimum economical rate of construction and not dragging out jobs without finishing them.

To achieve the construction program we will have to surmount a thousand difficulties in a thousand places. In just a few instances it will bring a problem back before you and the Congress. An economical construction program will probably mean, for example, that the great Grand Coulee-Columbia Basin project, the Colorado-Big Thompson project, and the Davis Dam project will go broke, as far as available construction funds are concerned, well before the end of the fiscal year. Some other projects may come into the same dilemma if contractors meet their schedules. Before that time comes we will report the situation to Congress and ask for such appropriations as may be required. Congress will then have before it the question of closing down those approved projects or continuing their construction without interruption.

We believe that is the intent of the Congress and just what it wants us to do. No deficiencies have or will be made by the Congress. We know the cost of closing projects because we were required to do so in war years. But it is unjustifiable waste that increases total costs eventually to be repaid by water users to deliberately slow down construction so that it drags on with continuing nonproductive overhead. The benefits in the form of water and power would be denied to the extent of such a willful slowdown just as repayment would also be denied the Government.

Year's Record Decisive

This has been a decisive year for Reclamation. We have opened 40,607 acres of irrigated public land on 10 projects for settlement by veterans.

Our projects with good times have done better than in the past in meeting their financial obligations. Some delinquencies have been cured, and the record today shows that 97.6 percent of payments due have been made on time. The Bureau honors the good faith of the number of communities which voluntarily increased their payment contracts to accord with increased costs. But, as a practical point, Congress honors that type of partnership when project appropriation time comes around.

The present law requires full repayment without interest of the Federal investment in irrigation within 40 years with a discretionary additional 10-year development period.

The general practice in both private and public financing since the 40-year limitation was written has been to allow longer periods of repayment with full repayment still required but smaller annual payments, within the irrigators' ability to earn, stretched out over a lengthier period.

The Congress itself has been recognizing this situation with increasing frequency in the past few years, and in the last few months has passed individual acts approving specific Reclamation projects with up to 68- and 69-year interest-free repayment periods. A proposal certainly will be made in the next session of Congress to extend the repayment period up to 70 years without a development period. The Bureau will favor that proposal. If Congress approves, this will be another stride forward in our program of liberalization of the reclamation laws and bringing them up to date.

Those are our hopes. But to achieve all these things, reclamation must get off the merry-go-round of a "giddap and whoa" schedule.

While it is inevitable that each shift in the world kaleidoscope reflects on Reclamation and that each Congress, by appropriate action, refixes Reclamation schedules in the light of its latest estimate of comparative needs, reclamation must win for itself a minimum firm program base that the West can rely upon in scheduling its work intelligently at least 6 years in advance.

Precast Canal Linings

(Continued from page 234)

were placed in transverse rows along the length of the canal. In placing the smaller blocks it was found more desirable to round the canal bottom to obtain the optimum support for the interlocking joints of these blocks.

The conclusions reached as a result of this experiment in the lower cost canal-lining program may be summed up as follows:

1. Precast blocks of these types require a much more exact subgrade than some other types of linings.
2. It will be necessary to use special curved blocks or some other type of lining in curved sections of canals.
3. The precast block lining presents a firm surface of suitable hydraulic properties and is apparently resistant to weed damage and erosion.
4. The scale of this experiment did not permit satisfactory cost conclusions to be drawn.

Twenty-Three Years Ago . . .

FACT FINDERS SAID: The Reclamation Record, now the New Reclamation Era, should adopt a more definite policy of being a practical aid to the farmer and should be made the most attractive and valuable journal entering the homes of the water users.

From A Report submitted to the Secretary of the Interior by the Committee of Special Advisers on Reclamation, April 21, 1924.

Fort Peck Generator

The Office of the Commissioner of Reclamation is making a strong justification to the Chief of Engineers to support the installation of the third generating unit in the Fort Peck power plant. The additional power is required to meet both present and immediate future power needs of the area.

UTAH'S "Water Courts"

(Continued from page 240)

It was as late as 1880 before Utah passed a general territorial irrigation statute. The principle of beneficial use and other fundamental principles of water law which developed from custom and necessity in the Mormon communities and elsewhere in the arid West were included in the early statutes, and are still the basis of the State law.

NEWS ROUND-UP

Coachella Contract Draft OK'd

On September 5, Assistant Secretary Warne approved the draft of the Coachella Valley County water district repayment contract for the distribution system and appurtenant flood-protective works. The draft has now been returned to the district for execution. The contract will provide for carrying to completion the Main (All-American) Canal to the Coachella Valley which will result in the total irrigation of 75,000 acres of land instead of 20,000 now irrigated by a pumping system.

Large Dams Conference Papers Requested

The United States Committee on Large Dams, of which Commissioner Michael W. Straus is Chairman, has announced the subjects of the technical papers for discussion at the Third International Conference on Large Dams, to be held at Stockholm, Sweden, from June 10 through 17, 1948. The following papers were announced during the executive meeting of the International Commission at the Hague early in September:

- Uplift on dams and uplift stresses.
- Research instrumentation and results in measuring stresses and strains in concrete and earth dams.
- Methods of controlling piping in earth dams.
- Experience resulting from the testing and use of special cements in large structures.

Engineers are requested to submit their papers through Chairman Straus and are urged to do so by the earliest possible date, but in no instance later than December 1, 1947.

John C. Page Retires From Reclamation Duty

After 36 years of western reclamation service, John C. Page, 60, engineer and onetime Commissioner of Reclamation, will retire from the Federal service on October 31.

In approving the request for retirement, Commissioner of Reclamation Michael W. Straus asked Mr. Page to serve as consultant from time to time on reclamation problems, and added: "It will be most gratifying to me and to other members of the staff to be able to profit from your counsel."

Mr. Page indicated that he would serve when called upon as consultant. Since August 1943, he has been a full-time consulting engineer at Denver, and has worked in part on completion of the Colorado River Basin Report and on preliminary studies of the Central Arizona project.

He served as Commissioner of Reclamation from January 1937 until June 1943, when he resigned upon advice of his physician because of ill health. After a rest, he resumed active duty as consulting engineer.

"The service Mr. Page has given to Reclamation has been marked by a deep love of the West and conscientious interest in development and reclamation of land and water resources there," Mr. Straus said. "His career, which took Mr. Page from surveyman to Commissioner, coincides with all but the first 9 years of the history of Federal reclamation. He has grown with the Bureau of Reclamation, and has contributed in a conspicuous way to the development of our western resources. I am happy that we will not completely lose his experience and knowledge by his retirement from active service."

During his term as Commissioner, the Bureau of Reclamation was engaged in a large construction and development program which added thousands of acres to irrigated farm lands and witnessed the construction of some of the largest reclamation hydroelectric power plants. Among important construction was the construction of Grand Coulee Dam in the Columbia Basin, which during the war was a fundamental factor in the Pacific Northwest's war production, the completion of Imperial and Parker Dams on the Colorado River, the Bartlett Dam in Arizona, the Seminoe and Alcova Dams in Wyoming, Alamogordo and Caballo Dams in New Mexico, and Marshall Ford Dam in Texas. Studies which ultimately led to congressional authorization of the Missouri Basin project were started.

During the early war years, he was engaged in accelerating the aspects of reclamation projects vital to munitions production and maintenance of the food supply. The strain was such that with health impaired, he felt compelled to resign.

Basic Magnesium Power Supply

The Senate War Investigating Committee held hearings at Las Vegas, Nev., on August 21 and 22 to attempt to develop a power supply to keep the facilities in operation.

It was pointed out that the Boulder Canyon power contracts contained restrictions that made delivery from the Hoover Dam power plant exceedingly difficult. Senator George W. Malone of Nevada suggested installation of an extra generator at Hoover Dam and use of the Davis Dam power plant.

The State of Nevada has proposed taking over the facilities at Basic Magnesium including 230-kilovolt transmission and bus structures and three banks of 75,000-kilovolt-ampere transformers. Senator Malone urged that the facilities be turned over to the Bureau of Reclamation instead and all power-supply arrangements made with that agency.

Intensified Canal-Lining Program

Procedures for an energetic attack on canal-lining problems over a broader front, were approved by Commissioner Straus, September 17.

The Bureau of Reclamation has been conducting surveys and research as to low-cost canal linings, and during fiscal year 1948 greater emphasis will be placed on the problems of the smaller canals and laterals with more test sections on operating projects and greater participation by field personnel.

The regional programs and the recommendations of the Chief Engineer provide for an estimated expenditure totalling $355,600. The 1947 allotments for canal-lining work amounted to $650,000 but less than $250,000 of these funds were obligated by the end of the fiscal year.

The program will be coordinated by the Branch of Operation and Maintenance in cooperation with the Chief Engineer.

An intensified approach to many of the problems encountered on the older operating projects is growing in importance in view of the anticipated rise of similar problems on many new projects, particularly in the Missouri Basin. During fiscal year 1947 noteworthy equipment for placing sections of plastic soil cement lining was developed on the W. C. Austin project, and a rotary packer on the Gila project.

It is expected that fiscal year 1948 will see study and testing of vibratory impact equipment, seepage measurement devices, Bentonites and soils, asphalt membranes and asphaltic concrete, soil cement, pneumatically applied mortars, nonreinforced Portland cement concrete, hydraulic lime concrete, precast concrete blocks, and various plastics.

Engineers Needed!

In order to keep western reclamation work rolling at the pace prescribed by the Congress, the Bureau of Reclamation needs more engineers.

Men who are trained and experienced in the design of dams, irrigation canals, powerplants, transmission lines and equipment, roads, railroads, bridges, steel and concrete structures and drainage works, are urged to submit applications for Federal employment (Form 57) to the Chief, Personnel Field Office, Bureau of Reclamation, Denver Federal Center, Denver, Colo.

Engineers are needed in the office of the Chief Engineer in Denver and in 29 field design offices throughout the 17 Western States. Chief Engineer Walker R. Young states that through the facilities of the Branch of Design and Construction at Denver he can offer young engineers an opportunity to learn the principles and practices of reclamation engineering and a chance for a worthwhile career in the Federal Government.

These engineering positions pay from $2,644.80 to $4,149.60 to start. While working and contributing to the success of the current program, each engineer is given the opportunity to specialize and to learn the broad objectives of reclamation work for future promotion.

Throughout the Missouri River Basin field engineers are needed. Thirteen new dams are now being started, 4 others are under construction. On these projects, located in the States of Montana, Wyoming, North Dakota, South Dakota, Colorado, Nebraska, and Kansas, field engineers can apply their theory and knowledge to actual construction. The work is hard and the living conditions for families are temporary in some cases, but there is opportunity for engineers to get the practical experience they need in order to qualify for the better positions that lie ahead for those who win their way up the ladder of success.

Those desiring to work on the Missouri River Basin project should send their applications directly to the Regional Director, Region 6, Billings, Mont., and to the Regional Director, Region 7, Customhouse, Denver, Colo.

People who possess civil service status and are eligible for reinstatement may be given permanent appointments. Those who are presently employed by the Federal Government may be transferred at Government expense, provided the transfer is not for the convenience of the employee. Those who do not possess civil service status should apply to the Central Board of United States Civil Service Examiners, Bureau of Reclamation, Denver Federal Center, Denver, Colo., for information concerning civil service examinations. At the present time, temporary appointments pending establishment of civil service registers, are being given to engineers who will have to pass civil service examinations subsequently.

If you are an engineer and you would like to take part in the design and construction of western reclamation projects, send your application for Federal employment to the above-mentioned officials or to the Personnel Field Office, Bureau of Reclamation, Denver Federal Center, Denver, Colo.

Transmountain Water

(Continued from page 242)

With this increased amount of water becoming available, the principle limiting factor in maximum crop production will be the fertility of the soil. The present generation will be judged not so much by the construction of this project as by the use that is made of the water and the condition of the land we hand on to posterity.

This increased supply of water from the western slope was intended to supplement the limited quantity from the regular stream flow. If this conception of its use is carried out, it will fulfill the hopes of its sponsors and bring the returns necessary for the liquidation of its enormous cost. Only by such intelligent use can we keep faith with those who have conceived this gigantic enterprise and carried it through successfully.

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The above article was reprinted from the July–August issue of "Through the Leaves" with the kind permission of the publishers, the Great Western Sugar Co., Denver, Colo.

The largest hydroelectric generators in the world are located in the Bureau's power-house at Grand Coulee Dam, Wash. These generators have a capacity of 108,000 kilowatts.

Getting the Sub Up

(Continued from page 245)

the other practices because there is less water lost by evaporation, there is relatively no loss of plant nutrients such as occurs in the more pervious soils when flooded, and labor costs are lower.

The sub culture permeates all phases of valley life, even that gala event, the Ski-Hi Stampede, held annually at Monte Vista. During 3 crowded days of festivities, highlighted by a rodeo, the sub really rises! "My hoss shore's got the sub up!" says a cowboy as he swings off his sweating horse.

A farmer meets his neighbor and asks "How's the sub this morning?" The reply may be, "Well, I'm having trouble with that south eighty. I have been pourin' water into it but don't seem able to get the sub up."

It is a common topic around the dinner table, on country roads, along streets in towns, during farm meetings, and at social affairs. The use of this word (it is no longer just a prefix in this locality), with all of its attendant significance, has produced a common denominator in the lives, speech, and thinking of the valley farmers.

Thus the subirrigation practice is carried over into the various aspects of life in the San Luis Valley and has become a definite part of its cultural pattern. •

OKLAHOMA

Short-Grass Salvation

In the short-grass country of southwest Oklahoma, the normal pattern of weather is a cruel one for farmers: too much rain at spring-planting time, drought in the growing season, rain again for the harvest. Year after year, cotton, maize and alfalfa crops have either been washed out by floods or ruinously parched.

This year's weather was as bad as any since the Dust Bowl days of the '30s. No rain had fallen, to speak of, all summer. But last week, instead of gloom, there was jubilation in the short-grass country. A $12,000,000 Federal Reclamation project was formally opened, promising an end, at last, to floods and drought for 50,000 acres of prairie farmland.

At Altus (population 8,593), the seat of Jackson County, there were 3 days of festivities—a banquet, parades, fireworks. The big event was dedication of a new 100-foot dam across the North Fork of the famed Red River.

On Dedication Day the temperature stood at 110° in the shade—and all the shade the crowd had was a few parasols and newspapers. Visiting bigwigs—including Interior Secretary "Cap" Krug and Gov. Roy Turner—were little better off under the sheet-iron roofing of their bunting-decked stand.

But to short-grass farmers, enduring the heat and 2 hours of speechmaking was no great price to pay for the spectacle before their eyes. Above the dam lay a turquoise lake. Below it, through a creek-bed ordinarily dry at this time of year, tumbled a stream of water, enough to feed 340 miles of irrigation canals and ditches.

What this water meant, the farmers had already learned. Last year, 510 acres on 11 farms were irrigated. Their average return, mainly from cotton, was $130 an acre, versus $22 an acre for nonirrigated land. This year, 3,200 acres on 60 farms have been irrigated. On these lands, cotton now stood 5 feet high and loaded with bolls. On nonirrigated land, it was only 2 feet high and barely worth picking.

Secretary Krug voiced the obvious moral: a nation which is endeavoring to rehabilitate the world could use more reclamation projects like the one at Altus.

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The above article was reprinted from Time *magazine, September 15, 1947, with the kind permission of the publishers.*

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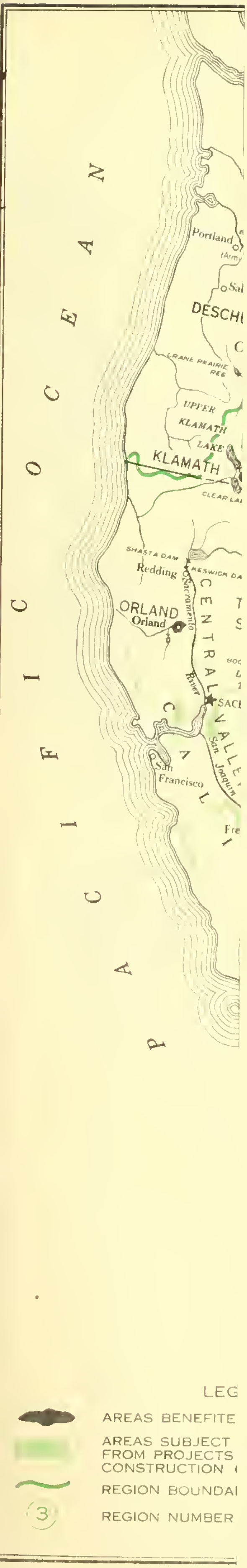
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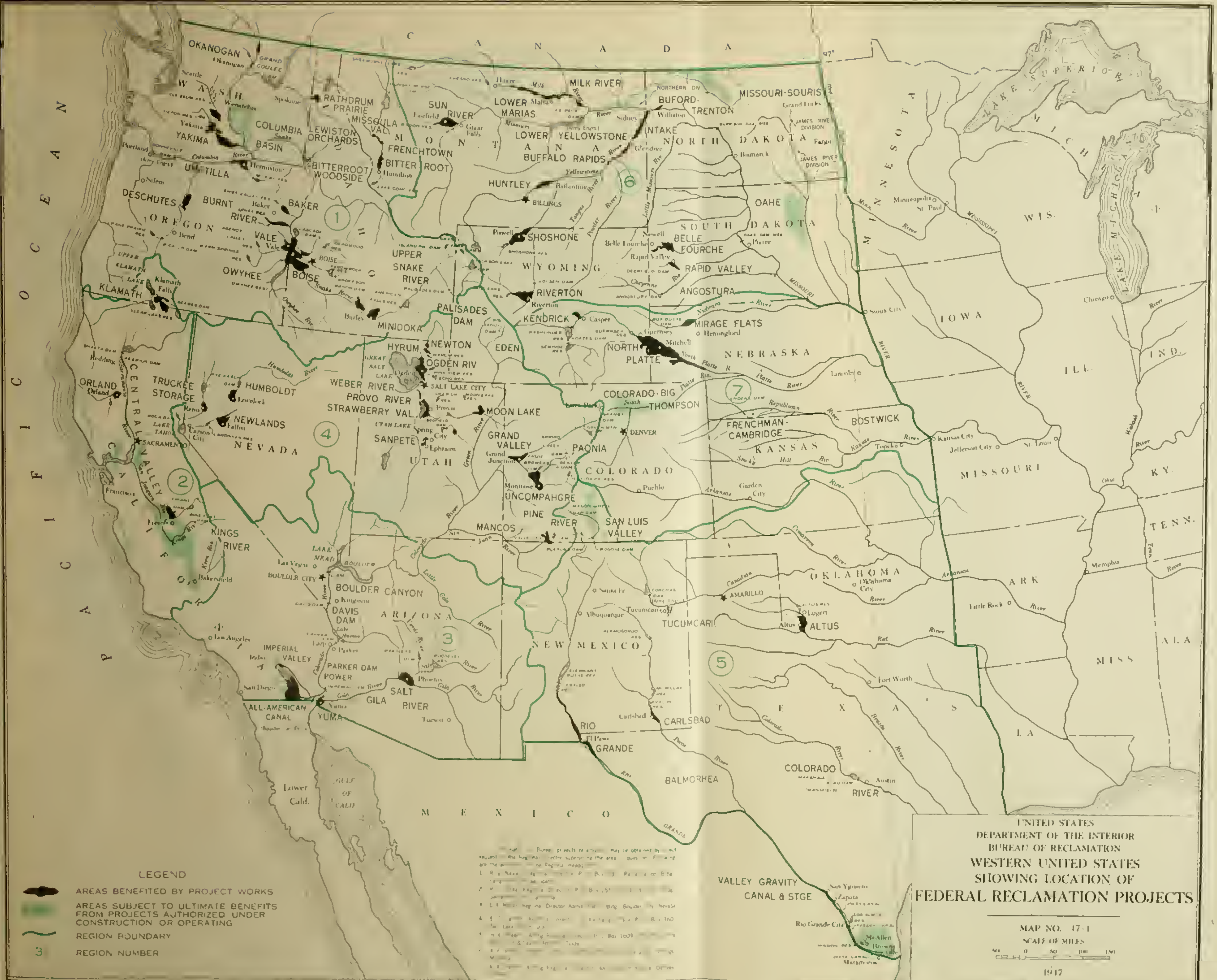
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DEPARTMENT OF THE INTERIOR
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DESCHUTES
BURNT RIVER
BAKER
VALE
OWYHEE
BOISE
KLAMATH
RATHDRUM PRAIRIE
LEWISTON ORCHARDS
MISSOULA VAL.
FRENCHTOWN
BITTERROOT
WOODSIDE
BITTER ROOT
SUN RIVER
LOWER MARIAS
MILK RIVER
LOWER YELLOWSTONE
BUFFALO RAPIDS
HUNTLEY
BUFORD-TRENTON
INTAKE
MISSOURI-SOURIS
OAHE
SHOSHONE
UPPER SNAKE RIVER
MINIDOKA
PALISADES DAM
RIVERTON
KENDRICK
BELLE FOURCHE
RAPID VALLEY
ANGOSTURA
MIRAGE FLATS
NORTH PLATTE
HYRUM
NEWTON
OGDEN RIV
EDEN
WEBER RIVER
PROVO RIVER
STRAWBERRY VAL.
MOON LAKE
SANPETE
GRAND VALLEY
COLORADO-BIG THOMPSON
FRENCHMAN-CAMBRIDGE
BOSTWICK
PAONIA
UNCOMPAHGRE
PINE RIVER
MANCOS
SAN LUIS VALLEY
ORLAND
TRUCKEE STORAGE
HUMBOLDT
NEWLANDS
CENTRAL VALLEY
KINGS RIVER
BOULDER CANYON
DAVIS DAM
PARKER DAM POWER
IMPERIAL VALLEY
ALL-AMERICAN CANAL
YUMA
GILA
SALT RIVER
TUCUMCARI
ALTUS
CARLSBAD
RIO GRANDE
BALMORHEA
COLORADO RIVER
VALLEY GRAVITY CANAL & STGE
WASH.
OREGON
IDAHO
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
NEBRASKA
NEVADA
UTAH
COLORADO
KANSAS
CALIFORNIA
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OKLAHOMA
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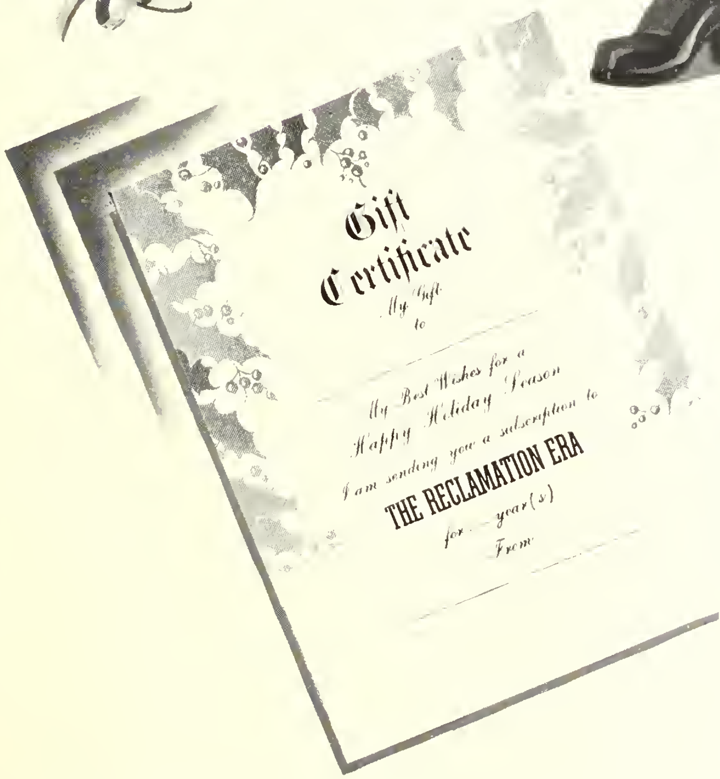
Santa Says: *Solve your gift problems this easy way!*



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NOTES FOR CONTRACTORS

Contracts Awarded During September 1947

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
1812	Missouri Basin-Kortes, Wyo	Sept. 4	Control board for Kortes power plant, schedule 1	General Electric Co., Denver, Colo	$34,964.00
1812	do	Sept. 5	One a. c. distribution board, 1 d. c. control and distribution board, and 2 motor-generator sets for Kortes power plant, schedule 2.	Zinsco Electrical Products, Los Angeles, Calif	17,089.00
1812	do	Sept. 12	Two 750/935 kilovolt-ampere transformers for Kortes power plant	Standard Transformer Co., Warren, Ohio	13,614.00
1848	Columbia Basin, Wash	Sept. 19	One 6,000 7,500 kilovolt-ampere transformer for Grand Coulee power plant.	do	23,624.00
1854	Boise, Idaho	Sept. 15	Two butterfly valves for Anderson ranch power plant	Baldwin Locomotive Works, Eddystone, Pa	94,400.00
1866	Missouri Basin—Kortes, Wyo	Sept. 2	Three ring-follower gates with hydraulic hoists, gate hangers for Kortes power plant, item 1.	Willamette Iron & Steel Co., Portland, Oreg	131,066.00
1866	do	Sept. 2	Three controls for ring-follower gates for Kortes power plant, item 2	Vickers, Inc., Detroit, Mich	11,472.00
1868	Columbia Basin, Wash	Sept. 15	Nine 43,000 kilovolt-ampere transformers for Grand Coulee power plant, units R1, R2, and R3, schedule 1.	Westinghouse Electric Corp., Denver, Colo	931,970.00
1872	Deschutes, Oreg	do	One 15-ton revolving crane for Wickiup Dam outlet works	Maris Crane & Hoist Co., Philadelphia, Pa	10,116.00
1875	Columbia Basin, Wash	Sept. 8	Replacement parts for circuit breakers, and current transformers for Grand Coulee switchyard.	General Electric Co., Denver, Colo	89,700.00
1879	Davis Dam, Ariz. Nev	Sept. 22	Transformers and circuit breakers for Phoenix substation, schedules 1 and 3.	do	297,726.00
1879	do	do	Disconnecting switches and lightning arresters for Phoenix substation, schedules 1 and 5.	Westinghouse Electric Corp., Denver, Colo	20,300.41
1881	Missouri Basin—power transmission lines unit, Nebraska.	Sept. 12	Three 3,333 kilovolt-ampere transformers for Gering substation, schedule 1.	do	59,468.00
1881	do	do	Circuit breakers and current transformers for Gering substation, schedules 2 and 4.	Allis-Chalmers Mfg. Co., Denver, Colo	66,375.80
1881	do	do	Disconnecting switches for Gering substation, schedule 3	Electric Power Equipment	31,737.63
1888	Boulder Canyon, Nev	Sept. 2	Construction of streets, sidewalks, curbs, and gutters for Boulder City	Queen & Queen and J. E. Roberts, San Bernardino, Calif.	51,731.00
1889	Kendrick, Wyo	Sept. 17	Four 5,000 kilovolt-ampere transformers for Cheyenne substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo	86,872.00
1889	do	do	One 15,000 kilovolt-ampere transformer, 15 current and 2 potential transformers, for Cheyenne substation, schedules 2 and 7.	Allis-Chalmers Mfg. Co., Denver, Colo	29,755.28
1889	do	Sept. 10	Circuit breaker for Cheyenne substation, schedule 3	General Electric Co., Denver, Colo	22,818.00
1889	do	Sept. 26	Disconnecting switches for Cheyenne and Casper substations, schedules 4, 5, and 6.	Railway & Industrial Engineering Co., Greensburg, Pa.	12,712.48
1893	Davis Dam, Ariz. Nev	Sept. 4	Disconnecting switches for Tucson and Phoenix substations, schedules 1, 2, and 3.	General Electric Co., Denver, Colo	41,739.19
1894	Boise-Payette, Idaho	Sept. 15	Outlet pipe for Cascade Dam outlet works	Independent Iron Works, Oakland, Calif	11,391.00
1895	Rio Grande, N. Mex	Sept. 17	Lightning arresters, demand meters, watt-hour meters for Alamogordo and Hollywood substations, schedules 1, 3, and 5.	General Electric Co., Denver, Colo	84,196.00
1899	W. C. Austin, Okla	Sept. 16	Construction of earthwork and structures for Altus laterals 21.5 and 21.7 and sublaterals.	Stamey Construction Co., Altus, Okla	430,165.00
1904	Davis Dam, Ariz.-Nev	Sept. 17	30,000 tons of calcined, reactive, siliceous material for use in concrete	California Portland Cement Co., Los Angeles	330,000.00
1906	Provo River Utah	Sept. 26	Welded-plate-steel siphon, pen stock, discharge pipe and blow-off pipe for Jordan Narrows pumping plant and siphons.	Provo Foundry and Machine Co., Provo, Utah	117,712.25
1907	Shoshone Heart Mountain, Wyo.	do	Construction of earthwork and structures for Ralston lateral, station 231+25.02 to 413+69.25, laterals R1 to R-15 11 and R-26 to R-41 and sublaterals; north alkali drain.	Knowlton and Jensen, Salt Lake City, Utah	351,978.00
1919	do	Sept. 30	Steel structures for switchyard at Heart Mountain power plant	Independent Iron Works, Oakland, Calif	10,134.00
1920	Missouri Basin-Canyon Ferry, Mont.	Sept. 16	Construction of earthwork, structures, and surfacing for relocation of county roads at Canyon Ferry Dam.	Union Construction Co., Great Falls, Mont	202,039.50
1925	Missouri Basin-Kortes, Wyo	Sept. 19	Electrical equipment for Kortes power plant	General Electric Co., Denver, Colo	11,593.50

Construction and Supplies for Which Bids Will Be Invited During November 1947

Project	Description of work or material
Boise-Payette, Idaho	Construction of earthwork and structures for Sand Hollow wasteway.
Do	Construction of earthwork and structures for Willow Creek wasteway.
Boise, Idaho	Generator protective equipment for Anderson Ranch Dam power plant.
Boulder Canyon, Nev	Furnishing and installing 6 miles of 12- and 14-inch diameter high-pressure steel pipe, and erection of 50,000 and 2,000,000-gallon storage tanks near Boulder City.
Central Valley, Calif	Construction of earthwork, lining, and structures for 14.5 miles of Friant-Kern Canal.
Do	Construction of earthwork, lining, and structures for 13.6 miles of Delta-Mendota Canal.
Do	Construction of earthwork, lining, and structures for 17.2 miles of Friant-Kern Canal.
Do	Oil circuit breakers, disconnecting switches, instrument transformers, lightning arresters for Tracy switchyard and Elverta substation.
Boulder Canyon-All-American Canal, Calif	Construction of structures for distribution systems in East Thermal and North Indio areas, Coachella Division.
Do	Construction of wasteways Nos. 2 and 3 for flood protective works, Coachella Division.
Colorado-Big Thompson, Colo	Construction of 20 miles of 115-kilovolt transmission line from Greeley to Loveland, Colo.
Do	Construction of earthwork, lining, and structures for 10 miles of Horsetooth Feeder Canal, including a diversion dam on Big Thompson River, a 1-mile tunnel, 12 concrete siphons, 1 steel siphon.
Do	Switchgear for Granby pumping plant.
Columbia Basin, Wash	Dispatchers board and desk for Grand Coulee left powerhouse.
Do	Main control board and terminal board extension, graphic board, and unmounted switchboard equipment for left powerhouse, Grand Coulee.
Do	Station service auxiliary equipment for Grand Coulee right power plant.
Do	Cable for tie circuits for the Grand Coulee power plant 230-kilovolt switchyards.
Do	Deicing motor-generator sets for Grand Coulee power plant.
Do	Generators for units R4, R5, and R6, Grand Coulee power plant.
Davis Dam, Ariz.-Nev	Construction of 83 miles of 230-kilovolt transmission line from Davis Dam to Parker Dam; steel structures and towers.
Do	Construction of five 22-foot diameter, welded-plate-steel penstocks.
Klamath, Oreg.-Calif	Construction of Adams 60 cubic-feet-per-second concrete pumping plant.
Klamath-Tule Lake, Oreg.-Calif	Pumping units and motor control equipment for pumping plants E and F.
Missouri Basin—Frenchman-Cambridge, Nebr	Construction of earthwork and structures for 12.5 miles of Cambridge Canal.
Do	Construction of Medicine Creek Dam, earthfill, approximately 107 feet high, 3,600 feet long.
Missouri Basin—Power transmission lines unit, Nebr	Transformers, reactor, oil circuit breakers, disconnecting switches, fuses, instrument transformers, lightning arresters, for Bridgeport substation.
Do	Transformers, oil circuit breakers, disconnecting switches, fuses, instrument transformers, lightning arresters for Sidney substation.
Shoshone, Wyo	Control and relay board for Garland substation No. 2.

DECEMBER 1947

Featuring:

**Highlights of the
RA Convention**

**ARIZONA'S
500 YEARS OF
rigation History**
by
Odd S. Halseth

**Australian
agebusting Plow**
by A. C. Hull, Jr.

THE Reclamation ERA

Photo by Norton T. Novitt, Region VII

Tree-Trimming Tots

These youngsters are getting all set for Santa Claus' visit to their home in the "Government Village" at Estes Park, Colo. The one at the extreme right is "looking for reindeer tracks."

Estes Park, where the children reside, is headquarters for the Bureau of Reclamation's Colorado-Big Thompson project, on which the Alva B. Adams 13-mile tunnel was recently dedicated. It is the longest irrigation tunnel in the world, slightly in excess of 13 miles from portal to portal. Its purpose is to divert water from the western to the eastern slope of the Rocky Mountains to supplement the irrigation supply for more than approximately 615,000 acres of inadequately watered lands.

Season's Greetings

To Our Readers

Reclamation ERA

Vol. 33 **December 1947** **No. 12**

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Ruth F. Sadler, *Editor*

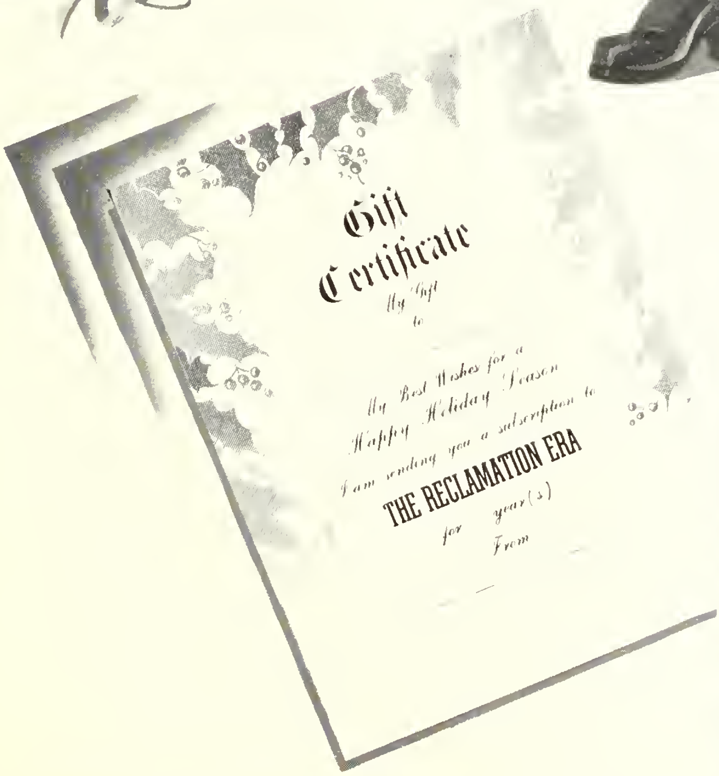
Our Front Cover

Peace on Earth

A light in the window, a star in the East, and a child in the West hears the story of Christmas as Rachel listens to her father, Roy Dement, explain the significance of the Yuletide display which won for him the first prize in the small homes division of the contest sponsored during the 1946 Christmas celebration by Plainview, Tex., businessmen.

This photograph was taken by A. E. McCloud, when in Region V.

Santa Says: *Solve your gift problems this easy way!*



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Washington 25, D. C.

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• HIGHLIGHTS of the NRA Convention •

National figures of both major political parties attending the sixteenth annual convention of the National Reclamation Association at Phoenix, Ariz., October 29-31, demonstrated the nonpartisan character of Reclamation as a national policy, as attested by the support which was given irrigation expansion to conserve water and land resources in order to provide for increased food demands at home and abroad, as well as settlement opportunities for veterans and others in the West.

Senator Hugh Butler of Nebraska, chairman of the Senate Public Lands Committee, at the annual banquet told the convention he favored speedy completion of authorized Reclamation projects and was supporting supplemental appropriations for this fiscal year for such projects as Columbia Basin where irrigated land is needed for veteran settlement.

Representative Ben Jensen of Iowa, chairman of the House Interior Appropriations Subcommittee, who, like Senator Butler, visited many Reclamation projects this fall, gave assurance additional construction funds would be forthcoming to keep work going on Columbia Basin and several other projects.

Wherry Urges Unanimity

Senator Kenneth S. Wherry, of Nebraska, chairman of the Senate Interior Appropriations Subcommittee, called for western unanimity for Reclamation as an indispensable aid in securing congressional appropriations. He likewise called for expediting construction. He cited the great progress made in western Nebraska through Reclamation's North Platte project as an example of what Federal irrigation would do in other sections of Nebraska and the West.

Secretary of the Interior J. A. Krug, in his prepared address, proposed a 7-year Reclamation program to bring 4,000,000 additional acres under irrigation, and double the capacity of Reclamation power installation at an outlay of more than 2 billion dollars.

Secretary of Agriculture Clinton P. Anderson told of the world need for food and of his department's interest in and support of irrigation.

Lt. Gen. R. A. Wheeler, Chief of Engineers, War Department, hailed the coordinated program of the Bureau of Reclamation and Corps of Engineers in the Missouri River Basin as paving the way for even greater cooperation among these agencies.

Assistant Interior Secretary William E. Warne warned of the inroads of soil erosion on the agricultural future of the Nation and urged constructive measures to combat this maiming of the Nation's wealth.

Among the proposals of particular interest in many Western States was the unqualified endorsement by Senator Butler of a pending Senate bill directing the transfer to the Bureau of Reclamation of all irrigation activities now under the Bureau of Indian Affairs.

Other national figures at the convention included United States Senators Hayden and McFarland of Arizona, Watkins of Utah, and Murray of Montana; Representatives Edward H. Jenison of Illinois, Lemke of North Dakota, D'Ewart of Montana, Fernandez of New Mexico, and Murdock of Arizona. Next year's convention will be held at Oklahoma City, Okla.

The following officers were elected: Harry E. Polk of North Dakota, president, succeeding Judge Robert W. Sawyer of Oregon, who was again nominated for the office but declined to serve; Clifford H. Stone, of Colorado, first vice president, J. E. Sturrock of Texas, second vice president; H. M. Ahlquist of Washington, treasurer, and Don McBride of Oklahoma, secretary-manager.

Resolutions adopted by the convention are summarized as follows:

- Urged and recommended that the Congress adequately support a snow survey program to meet the needs of the various water users in the Western States.
- Eliminating Interior Department appropriation act limitations for transfer of work to be performed by the Chief Engineer of the Bureau of Reclamation at Denver.
- Recommending that force account work be permitted on reclamation projects.
- Supporting congressional legislation assuring water user organizations "the right to acquire permanent water rights and control of their distribution facilities."
- That Congress appropriate sufficient funds for revegetation and fire control of watersheds.
- Urging the appropriation by Congress of sufficient funds for the United States Geological Survey.
- Asking for a long-range program by the Federal Government by which Congress can set up funds in adequate amounts to carry through construction work on Reclamation projects at the most efficient and economical pace.
- That uses of water in non-navigable streams be subject by Federal statute to State law.
- Expressing appreciation to members of Congress for their interest in the National Reclamation Association.
- Commending the Department of Agriculture and urging the Bureau of Reclamation to seek cooperation of its agencies and the State colleges.
- Urging enactment of House bill 2873 by Congress which will aid in the promotion of reclamation projects and to relieve water users on existing projects from costs at-

(*Continued on page 264*)

Letters to the Editor

We Started Something

WASHINGTON, D. C., *August 6, 1947.*

DEAR EDITOR: In the June issue of the RECLAMATION ERA I found on page 128 an article entitled "Who Started It?" having reference to the initiation of the first irrigation works in our country. I read this with a great deal of interest and then took the liberty of asking my good friend, Mr. Odd Halseth, archaeologist of the city of Phoenix, Ariz., and superintendent of the Pueblo Grande Ruins near that city to supply me with some authoritative information relative to irrigated farming practices of our Indian tribes of many hundreds of years ago who lived in the Salt River Valley area of my State.

It seems to me that it might be well to call to the attention of the many readers of the RECLAMATION ERA the fact that efficient and worthwhile irrigated agriculture flourished in Arizona long before the first white man set eyes upon that wonderful country. With kindest regards, I am,

Yours very sincerely,

CARL HAYDEN,
United States Senate.

As a result of Senator Hayden's interest, we are privileged to publish the article on the opposite page written by Archeologist Odd Halseth especially for the RECLAMATION ERA.

The Bureau has always made a slight distinction in definition regarding the "first" irrigation—considering Utah's claim valid as the first large-scale Anglo-Saxon irrigation in this country. However, the study of pre-historic and pre-White Man irrigation methods teaches many lessons of an agricultural as well as archeological nature.—Ed.

Seed . . . . .

ZURICH, MONT., *October 7, 1947.*

Dear Editor: . . . The ERA is better all the time. Success to it.

Yours very truly,

J. F. SHARPLES & SON,
Bliss Triumph Potatoes,
Seed and Table Stock.

The Era Goes to the Fair

PUEBLO, COLO., *August 18, 1947.*

DEAR EDITOR: In regard to your letter of August 15, 1947, replying to our request, in which you offer us past issues of the RECLAMATION ERA, we will be very happy to have a number of copies for distribution from our booth at the Colorado State Fair during the week of August 25. The number of copies will be left to your discretion. I will guarantee that any number that we might have left at the close of the fair will be distributed personally by me in the 12 counties of the Arkansas Valley.

We appreciate very much your generous offer, and I trust the people of the Arkansas Valley will provide quite a number of subscriptions for the ERA in the near future.

Very truly yours,

ROGER ERNST,
Executive Secretary, Water Development
Association of South-eastern Colorado.

Do You Belong to a Club?

Are all the members subscribers to the *Reclamation Era?* This is your magazine; you can make it grow. Only 50 cents a year to water users.

Arizona's 1500 YEARS of Irrigation History

White dotted line in this aerial photo shows remains of Hohokam hand-constructed diversion ditch for early irrigation. Square-shaped mound below modern irrigation system (upper right) marks Pueblo Grande ruins which hold many secrets of an ancient civilization.

by Odd S. Halseth

City Archaeologist and Director, Pueblo Grande Museum and Laboratory Phoenix, Ariz.

WITHOUT AGRICULTURE there would be no civilization as we now know it. Man would still be roaming the earth in quest for food, without a chance to settle down to a sedentary form of society and with little or no energy left over for the so-called civilized pursuits of life.

Civilization, or culture of today, is largely a result of man's liberation from spending all his energy in the search for edible plants—and this liberation was brought about by agriculture, or domesticated crop production.

We therefore speak of the "germ of civilization" as wheat in Egypt and Europe, rice in Asia, and—at a much later date—maize, or corn, in the Western Hemisphere.

Much of the early history of agriculture is a matter of written records, except for the Americas, where no phonetic system of writing was in use prior to Columbus. For this reason archaeology plays an important role in unfolding the pre-Columbian chapters of American history.

After the American Indians had learned to cultivate corn and could settle down to sedentary living, they left an accumulation of material remains which have become a great aid to archaeological investigations.

Culture history and chronology are inherent in human refuse deposits, so archaeology must deal with pots and skulls and other material evidence. But it must also deal with the reason for man's behavior and act as the historical detective branch of anthropology, which includes all the branches of the study of man. Archaeology alone cannot solve all the mysteries of human behavior, and often the most careful field work and laboratory studies only produce new problems without solving old ones.

The history of prehistoric farming in Arizona is based on a number of archaeological facts which are coordinated and interpreted according to prevailing evidence and logic, always subject to new information and revision.

The Pueblo Grande Laboratory

This presentation of desert agriculture and irrigation is based on work and studies conducted at Pueblo Grande, a Municipal Prehistoric Monument, established by the City of Phoenix, Ariz., in 1924, and operated as a museum and laboratory of human research since 1929. The interpretation, of course, is that of the writer's.

Corn found its way into Arizona some time about the beginning of our Christian era, and has been grown continuously since that time in both the northern and southern parts of the State.

In the northern part, and the adjoining areas of New Mexico, Colorado, and Utah, are found a number of ruins of former Indian farming communities, known as Pueblos. This is plateau country and agriculture is based on dry-farming methods. The present Indians devote most of their ceremonial calendar to prayers for rain, much as their ancestors did centuries ago.

Archaeological study of accumulated culture deposits has helped to establish a continuous chronology for these ruins, from the earliest up to the present time and through the presence of timbers with dated tree-rings, accurate dates in our own chronology have been established for many buildings and associated culture material. Where no timber is found to furnish a clue, a relative chronology can be established with fair accuracy through study of such material as trade-ware (pottery, shell, or other objects traded between tribes). This cross-dating is used for ruins found in the desert region, where corn was also grown by irrigation methods.

In the Valley of the Sun (the Salt River Valley) where the city of Phoenix has "arisen from the ashes of the past," like its mythical namesake, and in the nearby Gila Valley, on most of the Pima Indian Reservation, we find evidence of a prehistoric agriculture which was contemporaneous with most of the Pueblo culture on the plateau.

Whereas the Pueblo culture survives to this day, the desert culture seems to have closed its final chapter around 1400 A. D., with what appears to have been a wholesale abandonment of both the Salt River and the Gila Valleys. So far, neither archaeology nor ethnology can prove where the people went or if they have any descendants among any existing Indian tribe.

FROM POST HOLES—and other ruins of dwellings and storage houses—archaeologists find clues to the existence of the Hohokam.

The Pima Indians, who have occupied the same area along the Gila River for about four centuries, speak of the ancients as "Hohokam," a term used to designate the dead, or "those who have vanished." Early investigators report that Pima informers consistently claimed that the ruins of the Hohokam had looked the same "in the memory of all their fathers." However, if one wants to place the Pima in the Hohokam geneology, it can easily be done with a little wishful thinking.

Whereas the Pima Indians occupied the Gila Valley when first encountered by the Spanish explorers, the Valley of the Sun was not resettled until the arrival of American pioneers in 1867. The reason for this may be found to be a study of hydraulic conditions rather than a matter of cultural archaeology.

History Repeats Itself

A study of an irrigation farming culture must include a study of irrigation technology, and, as engineers remind us, all the laws of nature are not operating on the surface, but underground as well, often in a vital, and even fatal, form.

With all the engineering knowledge now available, farmers in this area are at the present time in desperate need of more water, while several conditions indicate that the prehistoric farmers were greatly troubled by too much of the same commodity. A brief survey of recent irrigation history will help to clarify some points in question.

The Valley of the Sun, also known as the Salt River Valley and the Salado Valley, from the name of its river, was first farmed by whites in 1867. The river was then a deep and narrow stream with a permanent flow, far in excess of needs, particularly during the winter months. But with the expansion of farming activities in the valley and, what is far more important, with the destruction of the watershed by cattle, lumber, and mining industries, things began to happen with an alarming speed. The Salado became an erratic stream. Within a few years it left its narrow bed and cut new ones with increasing force of floods from the watershed.

One flood might leave a new channel a mile from the previous one and farmers were kept so busy repairing intake dams that by the time repairs were made, the flood was over and little or no water was left for irrigation of summer crops.

With the passing of the Reclamation Act in 1902, and the subsequent construction of Roosevelt Dam, storage was provided for the floodwaters and the farmers were happy in the belief that their troubles were over. But they figured without the underground activities of Mother Nature, and it wasn't long before another problem reared its head, or at least came to the surface.

This was a rising water table, a condition brought on by the lack of sufficient underground drainage. An estimated one-fifth of the water used for irrigation goes into the ground. Where the natural equilibrium is as sensitive as it seems to be in this valley, it is only a matter of time and irrigation before the table starts rising and the only method of control is drainage by pumping.

By 1918 one-third of productive land was waterlogged in the Salt River Valley. The water table was within a few feet of the surface of some 80,000 acres, and actually covered the surface in some places. During some years the water table rose as much as 5 feet in places measured, but, with the aid of about two million dollars to purchase and install about 200 deep-well pumps, the farmers were saved again.

After the water table had been lowered to a safe depth, pumping continued for irrigation purposes. This, in turn, helped to create a problem which at the present time concerns desert farmers everywhere. The laws of Mother Nature cannot be settled in the legal courts, it seems, and man is slow in realizing that she will not be violated without penalties.

The Hohokam did not suffer any such manmade destruction of the watershed as the rugged Americans did; but, unless Mother Nature inflicted her vagaries only upon the white man, we must assume that the Hohokam farmers also were subject to having their lands water-logged. They spread irrigation water over their lands and sent that fatal one-fifth as an addition to the natural water table for a matter of some 700 years.

The chronology obtained from a large number of undisturbed Hohokam trash mounds reveals an occupation beginning some time before 700 A. D. Many of these trash mounds date from about 1400 A. D. in the top level and go back to the earlier date in the bottom level.

In some trash mounds examined in the Gila valley, the top level *ends* with material from the 700 A. D. period, thus indicating an abandonment of some villages in the Gila Valley at the time the Salado (or Salt River) valley was first settled.

Origins in the Gila Valley

The beginning of the Gila Valley trash mounds starts several centuries earlier, though no accurate date can be given as yet, but it is obvious that irrigation originated in this valley, perhaps by direct flooding from the river and later by canal construction.

The Gila River, unlike the Salado, runs in a bed which is cut through a series of terraces which, in turn, lie several feet below the upper desert level. During high stages of the river, these bottom lands could easily be inundated and covered with rich silt, thus affording an ideal place for flood irrigation and farming on a small scale. It would be an inviting place for any band of Indians looking for a location to plant whatever domesticated seeds they had.

The areas subject to flood irrigation could not have been very extensive, however. As late as a century ago the Gila was described as a comparatively narrow stream, about 75 feet wide in some places, with bottom lands extending for about one-quarter of a mile in both directions. Since both the human and the environmental factors would be closer between Hohokam and Pima history than with our own, it might be well to look at the Hohokam through some of the known Pima experiences.

Before the white intrusion, the Pima Indians lived in about a dozen separate villages, each with its own canal, or ditch.

The total population was about 4,000, divided into some 800 to 900 households, each farming an average of 10 acres. They did most of their work with hand tools made from ironwood, mesquite and cottonwood.

Ditches averaged about 3 miles in length and were dug by the shareholders of each, sometimes within 1 year, depending on the manpower situation. Apache wars, hunting expeditions, saguaro and mescal gatherings and other distractions made some projects last 3 years, or more. The ditches were planned to irrigate the first land about a mile below intakes, which were constructed of "logs, poles, and brush." Except for periodic cleaning, water ran in the ditches "most of the year" and no head gates were used. Water was abundant. Some informants describe the older ditches as about 10 feet wide at the intakes, tapering to from 3 to 5 feet at the terminals. The sides were dug almost straight down with a taper of only about 1 foot, and water usually ran "knee-deep."

With the white man came better tools and implements as well as a demand for farm produce, so after 1860 the Pima Indians expanded their subsistence farming into business production and enjoyed a period of real prosperity.

But not for long. A ruthless civilization was on the march, Mother Nature reacted in her customary manner, and as the water supply gradually diminished, more and more farm land went back to brush and mesquite, and many Indians took up wood cutting and went to work for their neighbors.

After much legal dispute the Coolidge Dam was built and to the detriment of both Pima and archaeology the several floods coming down the Gila, after the destruction of the watershed, washed away much of the bottom land and covered up some areas with many feet of silt. We shall never know how much evidence of early Hohokam occupation has been lost by this change of the valley.

We may safely say, however, that when the time came for the Hohokam to expand their farming to the desert level, their only alternative was to build canals long enough and big enough to carry water to the higher level, which they eventually did.

First "True Irrigation Culture" Along Salt River

This marks the birth of the only "true irrigation culture" in prehistoric North America, and it made it possible for the Hohokam to utilize for the first time the rich lands along the Salado River.

By 700 A. D. a number of settlements were established in the area where Phoenix, Tempe, and Mesa are now located, and during the next 500 years more than 20 villages were occupied, and at least 10 separate canal systems had been constructed.

The construction size of some of these canals was enormous. Some measure over

FROM PIMA INDIANS—who were using Hohokam irrigation systems when found by the Spaniards—come legends of the ancients.

30 feet from crown to crown and 10 feet in depth. A total of about 125 miles of canal construction has been surveyed in the Salado valley.

How much water they carried is, of course, unknown and it may not even be of great importance to the history of what followed. What counts mostly is the amount actually used for irrigation and that fatal one-fifth which goes into the ground to build up the local water table. As yet, no fair estimate can be made of this amount, either. We have to rely mostly on the time element in considering waterlogging of Hohokam lands. Although some village areas are known to have covered from 50 to 75 acres, like that of Pueblo Grande, we cannot use this for a population estimate.

Hohokam dwellings were flimsy structures with no lasting quality. The custom of burning a home where death occurred was, and still is, common among desert tribes and probably was practiced by the Hohokam. If so, one single generation would be responsible for the building of several houses in different parts of the village.

Towards the end of the occupation we find another form of architecture in Hohokam villages and it is here that evidence of waterlogging shows most strongly at Pueblo Grande. A huge mound-like structure, common to all late village sites, was constructed at Pueblo Grande during the last centuries of Hohokam history. The mound itself covers an area of about 300 by 150 feet and stands to a height of more than 20 feet above the desert level.

Superficially the mound resembles the caved-in ruins of a multi-storied Pueblo type of dwelling, which is the main reason for the early archaeological designation of the Hohokam ruins as Pueblos.

Some archaeologists still refer to these mounds as ruins of multi-storied dwellings, although only one such ruin has been found so far in the Hohokam area. This is the "Big House" at Casa Grande National Monument, which is the only one of its kind and unlike the typical Hohokam mounds, although it was also used as a granary.

Excavations of the Pueblo Grande mound show that it was built up by a series of purpose fills and that on the top of each fill a single-storied structure was erected for storage purposes.

On the bottom levels floors are found with storage pits and storage bins, with evidence of much decayed vegetable material. One room on an upper level produced a large number of storage ollas (earthenware jars), many of which were filled with charred corn. So far there is no evidence of any domestic use of the filled areas, so we may reason that each floor level, of which there are eight, represents a granary structure.

Floor plans vary with each level, showing both masonry and wattle wall construction. No large roof timbers, such as those used in Pueblo construction, are in evidence and roofs appear to have been of typical desert materials and style—the forked post with poles and brush covering. The fills consist of materials from gravel, loam and old trashmound deposits and were carried in by the basket load. After the first two fills a masonry wall was built around the mound to retain the dirt on each extended platform level. Rooms were later built against the outside of this retaining wall and another separate wall enclosed the whole unit, forming a compound not unlike the arrangement of the "blockhouse" built for protection against the Indians on the Plains.

(*Continued on next page*)

FLAX—Newcomer to Klamath

by A. D. Harvey

Klamath Falls, Oreg., Region II

Test planting of flax varieties at Tule Lake Demonstration Farm, Tule Lake, Calif. The farm was established by the University of California, in cooperation with the Bureau of Reclamation and the Tule Lake Growers' Association.

Interest in the growing of flax has been on the upswing in the Klamath Basin of Oregon and California since 1939 when the first field plantings were made for the production of seed.

Cool weather prevalent in the basin favors the growth of flax. The occurrence of frost during the growing season, however, has to some extent discouraged a more rapid development of flax raising as a permanent enterprise.

Plantings made during the latter part of April and the early part of May successfully develop and mature a seed crop in four and a half months so that by early September, although the plants are not quite dry enough to cut, the seed crop is ready for harvest.

Today, the Klamath Experiment Station, located near the Municipal Airport at Klamath Falls, Oreg., continues its research on flax started as far back as 1938.

Varietal plantings to test their reaction and adaptability to local conditions are being made with the view toward obtaining high yielding varieties or strains favoring local conditions.

The Tule Lake Demonstration Farm, located at Tule Lake in the California portion of the basin, has also undertaken the observation of varietal plantings suited to the area comprising lands reclaimed from the bottom of Tule Lake.

Flax does well under irrigation in the better soils of the basin. It is a plant which demands only slightly more water than the small grains for its development but tolerates amounts sufficient for the growth of legumes. This capability makes flax an excellent nurse crop for leguminous plants without entering into competition with the requirements of such crops.

Plantings at the rate of from 40 to 50 pounds of seed to the acre have produced, on good soils, yields of as high as 25 bushels of seed per acre.

Present market prices of slightly above the support price of $6 per bushel result in a gross revenue of over $150 per acre. The cost of raising flax compares closely with that of raising grain. The cost of harvesting, however, sometimes includes the expenditure incurred in windrowing or in topping when the crop is either too weedy or not quite dry enough to combine.

Some of the better known varieties, such as the Bison, the Midland or the Redwing, have been grown in the basin and have produced good yields. Frosthardy varieties, such as the Crystal variety which is now being tested at the Klamath Experiment Station and others which may produce seed high in oil content, will, no doubt, eventually find their way into the field of commercial production.

It is estimated that in 1947 approximately 1,000 acres of basin land were devoted to the production of flax for seed.

Continued interest in the growing of flax, and in the maintenance of a stable market for flax seed, bids well for this crop to become a permanent member of the family of crops composing the pattern of agricultural enterprise of the Klamath Basin in Oregon and California. •

1500 Years

(Continued from page 253)

Therefore, we have evidence pointing to the use of these structures for both food storage and protection. Farmers always have gone to greater effort in building safe storage for their crops than in making their own dwellings, and no effort is too great for protection against marauding enemies.

But why the fills? Of the many possible answers, the most logical seems to be waterlogging. With a rising water table and the capillarity of desert soil, moisture easily could have found its way to the granary floors during late Hohokam times, and every farmer knows what that means. With no facilities for pumping, the Hohokam probably hoped to escape the moisture by elevating their granary floors and kept on filling until they finally decided to leave the valley.

When they left, there must have been some who could not be taken along, or refused to leave for other reasons. This remnant seems to have built their dwellings on the highest available ground and we find their remains on the last level of the abandoned granary mounds.

Within a little more than two centuries the Hohokam compounds and granaries had been built, filled in and rebuilt several times, and finally abandoned. Even the Casa Grande compound and village were abandoned, probably last of all.

About 1500 years of irrigation history has shown that many irrigation problems are common to the past and the present and that it pays to correct past mistakes before making new ones.

In one way our society differs from that of the Indians. With them, responsibility was to the family and tribe only; ours is to the whole world, as well as to the Nation, the State and the community. •

(Photographs used with this article were kindly submitted by Mr. Halseth from his personal files.)

Perplexities Unlimited

by Raymond J. Lund,

Agricultural Agent, Chicago and North Western Railroad

Editor's Note: Although a year has passed since Mr. Lund presented this symposium of perplexities to the Wyoming Reclamation Association (at a meeting held November 7, 1946, at Thermopolis, Wyo.) this paper is presented here as a matter of wide—and still current—interest to those concerned with the complex problems of reclamation.

It seems to me that the field of reclamation is fraught with "Perplexities Unlimited."

Let me call attention first to some of the more common problems leading to unlimited perplexities; second, to the necessity of facing the issues; and third, to our responsibility in accepting the challenge.

My first contact with irrigation was about 22 years ago at Billings, Mont., the center of a large irrigation project. Later during the drought years I saw numerous attempts at irrigation in the eastern part of South Dakota in an area where it had little or no application prior to 1933 and 1934. I became actively interested in the Rapid Valley project at the time I assumed the Pennington County extension duties, which work brought me in close touch with Reclamation activities in western South Dakota. Subsequently early in 1940, upon becoming identified with what was then known as the Wheeler-Case program, as project supervisor of the Rapid Valley and Angostura projects, it was my privilege to visit many Reclamation projects in the West, for making observations and studies concerning their desirable features as well as noting their limitations.

A few ditches to water some land for pasture and a number of wooden flumes to carry a little water to a "miner's diggings" were the small beginnings of that great job of conserving and using the most important resource of our Western States—water. Today great projects as well as small are built to conserve the water.

With the passage of the Reclamation Act of 1902, a new era was ushered in. Prior to this time, irrigation enterprises had been undertaken through private initiative, as in those days it was a comparatively simple matter to divert water from streams onto adjacent land. However, as it became necessary to divert and carry water by canal to more distant lands, projects became too costly for a local group to undertake. In many instances, large and costly storage reservoirs became necessary. The Federal Government entered the field to finance the building of projects with a period of years provided for the repayment of construction costs without interest.

People flocked to those early reclamation projects, settling thereon as if through a wave of the magic wand, water would flow and the desert bloom as a rose. Disappointments followed. New problems unknown to earlier irrigation projects arose. In some instances, the water supply was found to be inadequate to meet the needs of the project as previously contemplated. This may be attributed to the fact that complete rainfall and run-off data were lacking at the time early construction was undertaken.

With a limited knowledge of water requirements for the various crops, many farmers had to work out their own methods of application of water to the land. Sometimes more water was used than necessary, which resulted in the leaching and erosion of soil and the seepage of lands. In most instances farmers without knowledge of the area, without information, without guidance, and some without even a background in farming methods set out to develop their respective farms to which water was delivered at the high point.

It required skill and adaptation then, as it does now, to grow crops on arid land under irrigation. Many farmers have had to learn by trial and error. Many found that crops best adapted to soil and climate do not always bring the greatest financial returns. Changing crops to meet changing market demands is costly.

Early Speculation and Tenantry

Individuals invested in land, some for speculation, others to reap the anticipated "great" return that was to be forthcoming from the various crops to be grown. It was natural that tenantry should follow, varying of course to the degree that potential investors became interested in acquiring land on the project which gave promise of outstanding returns on the investment. Now, tenantry is a problem that we find everywhere, which we cannot do much about. We know from past experience however that many tenants let buildings, ditches, and other property deteriorate until conditions become so bad that they seek another farm. Irrigation farming, it seems to me, is a business for landowners.

Taxes are generally high, and become practically impossible to meet during a period of depression such as we experienced in the early 30's. During a period of economic stress the farmer will make an attempt to pay State, county, and local taxes first, to avoid penalties for delinquency, and if he has not enough money, the annual construction payment is deferred. When the going is real tough the land goes for taxes and tenantry increases. Would it not be wise and expedient for local taxing agencies to consider the policy of basing assessment values upon the equity of the water user rather than on full land and water valuation?

The mortgage debt has been a problem. It is unnecessary perhaps to elaborate upon the experiences in the early 20's and even more so in the early 30's when project farmers in general found it extremely difficult to adjust themselves to the rapid decline in farm prices. In this respect their position was no different than that of the dry-land farmer. However, construction costs remained on the same basis during periods of low prices as during the periods of high prices.

Let me refer to one of the early reclamation projects with which I am familiar—the Belle Fourche project in South Dakota. Following the first world war many farmers left that project for reasons which cannot be attributed to reclamation. They were simply broke and disgusted and could not blame anyone but themselves. However, early in the history of that project, we find that there was too much optimism and speculation. Some men went into this section with $100,000 or more, and left with little or nothing. They learned from experience that irrigated land is worth per acre only what it can be made to produce. For instance, back in 1912 a piece of raw gumbo land sold for the price of $100 per acre. It is not surprising that the county later acquired that unit. About one-half the homesteads were taken by nonfarmer elements such as clerks, school teachers, lawyers, and businessmen who expected to make irrigation farming a side line.

Pitfalls of Farming

Insect pests cause occasional heavy losses. Grasshoppers in particular have brought devastation to some projects. Control of the coddling moth has been undertaken at great expense to the apple growers. On a few projects hail storms have inflicted heavy losses. Others have experienced destructive late spring or early fall frosts. Floods have caused damage to crops and canals. Wind erosion has become a factor to be reckoned with on some projects. While these factors are beyond the full control of the farmer, they seriously affect his crop production and his ability to pay his construction costs and other financial obligations. On some projects heavy losses are sustained from noxious weeds.

These and other problems parade in review. Appeals to Congress for extension of time for repayment, for changes in repayment of construction costs, become counterparts among farmers who find themselves in distress, confronted with changing conditions in a changing world. While these are among some of the problems that may be with us always, let us meet them squarely. These may provide the cornerstone, or even the foundation upon which we hope to build for success. What about the design or the pattern by which we proceed to erect the framework of that structure on the foundation so carefully laid? Does it fit? We have used that pattern before, some may say. But times have changed, we are told. Then we must face the facts. Some features of that pattern may have become antiquated.

Results of "Joint Liability"

Joint liability is required in all contracts that have been executed under the provisions of the Adjustment Act. This was intended to provide security for the Government investment and to insure the payment of construction costs. And what was the result? Under joint liability many agencies refused to make loans on project lands even if the individual were a first-class risk. Joint liability theoretically was to provide security for Uncle Sam's investment, but in reality it has created among many farmers a psychological antipayment complex which has been detrimental to the project as well as to the individual. True, that actually no one has been required to assume an obligation other than that undertaken by the individual land owner; however, many farmers have stated that even though they were able to do so, they would not pay, if they could avoid doing so by postponement or moratorium of one kind or another.

In many instances farmers are asking for the establishment of a definite repayment policy. They ask for the elimination of an obsolete requirement, theoretical in its application, that serves to antagonize rather than to encourage the payment of annual construction charges. It seems to me that the leaders of reclamation have a responsibility to assume in helping to devise some sound, practical approach to this feature so as to encourage a wholesome attitude among all irrigators of any project regardless of what their annual charges may be.

The Reclamation Act stipulated that water could not be delivered to more than 160 acres under one ownership. There were good reasons for this provision. Although the basic principle underlying that requirement perhaps has not changed altogether in this day, it seems that some modification would be in order to meet certain conditions which we now observe on some new projects in the process of development.

For example, a study of the Kendrick project in Wyoming indicates that the soil texture, coupled with the average wind velocity for that area, makes it necessary under practical sound farm management to recommend the growing of closely drilled crops and alfalfa rather than the planting of highly specialized row crops which would tend to increase wind erosion hazards. In December 1945 the average wind velocity in that area was 19 miles plus per hour. I have been informed that the average annual wind velocity there has been 13 miles plus per hour. In consideration of the type of agricultural economy that should be recommended for that project, the average operator will be able and should handle more than 160 acres if his operation is to be considered practical and sound from the economic point of view.

I have talked with farmers on some projects who said that they were handicapped because their respective farms were too small to be operated economically. At the time of the passage of the original Reclamation Act, farmers possessed relatively few and simple tools. Motor power as generally accepted today was then unknown. Now with modern machinery of all kinds and descriptions which the farmer has acquired or seeks at the earliest opportunity, his operating cost becomes higher, but he is capable of handling more land and often needs a larger unit if he is to carry forward a successful economical operation of his farm. The farmers of today are not going back to the horse and buggy days of yesterday. While experience has shown that in some sections 40 acres may be ample for a highly specialized operation, in other areas under different conditions, 80 acres, 100 acres, and even 160 acres of irrigable land may not be enough for one unit under one ownership. Let us face the issue as we keep constantly alert concerning the developments of new methods, new operations, new types of equipment with which a farm may become equipped in a progressive, modern changing world. We must be ready to accept change in our pattern and modification of our regulations if we are to meet these changing conditions.

Government a "Liberal Partner"

The original Reclamation Act provided for the payment of construction costs in ten annual installments. Rising costs of construction made it necessary to extend the time of payment. This was authorized by the act of August 13, 1914. The passage of special relief acts was followed by the Fact Finders Act of December 5, 1924. This was then repealed by the passage of the Adjustment Act of May 15, 1926, which authorized the execution of repayment contracts extending over a period not to exceed 40 years. Thus we see that the Government has been a very liberal partner in this irrigation business. Whereas the debt was first to be paid in 10 years, it was later changed to 20 years, then to 40 years. The Reclamation Act of 1939 as amended provides for a repayment period of 40 years with an additional 10 years given to development. Under that act the authority to adjust contracts to extend the repayment period beyond 40 years was left to Congress. As of the present time it appears that about 40 percent of the districts having repayment contracts are requesting amendatory contracts. This neither implies nor means that all of the operators on those districts are in financial difficulty nor in arrears on their payments. Enough operators are apparently in distress, however, on those projects to prompt these districts to request either an adjustment or an amendatory contract.

Facing the Facts

We recognize reclamation's accomplishments—the conservation of water and land resources; the creation of 50,000 or more irrigated farms within Federal projects and the providing of a supplemental water supply for 35,000 or more farms under various acts covering non-project land; the stabilizing of agricultural conditions on many irrigated farms; the providing of a market for midwestern products, both agricultural and industrial; and the increasing of the valuation of land and property.

Forty years of experience has taught that the construction of project works does not complete the work of the project.

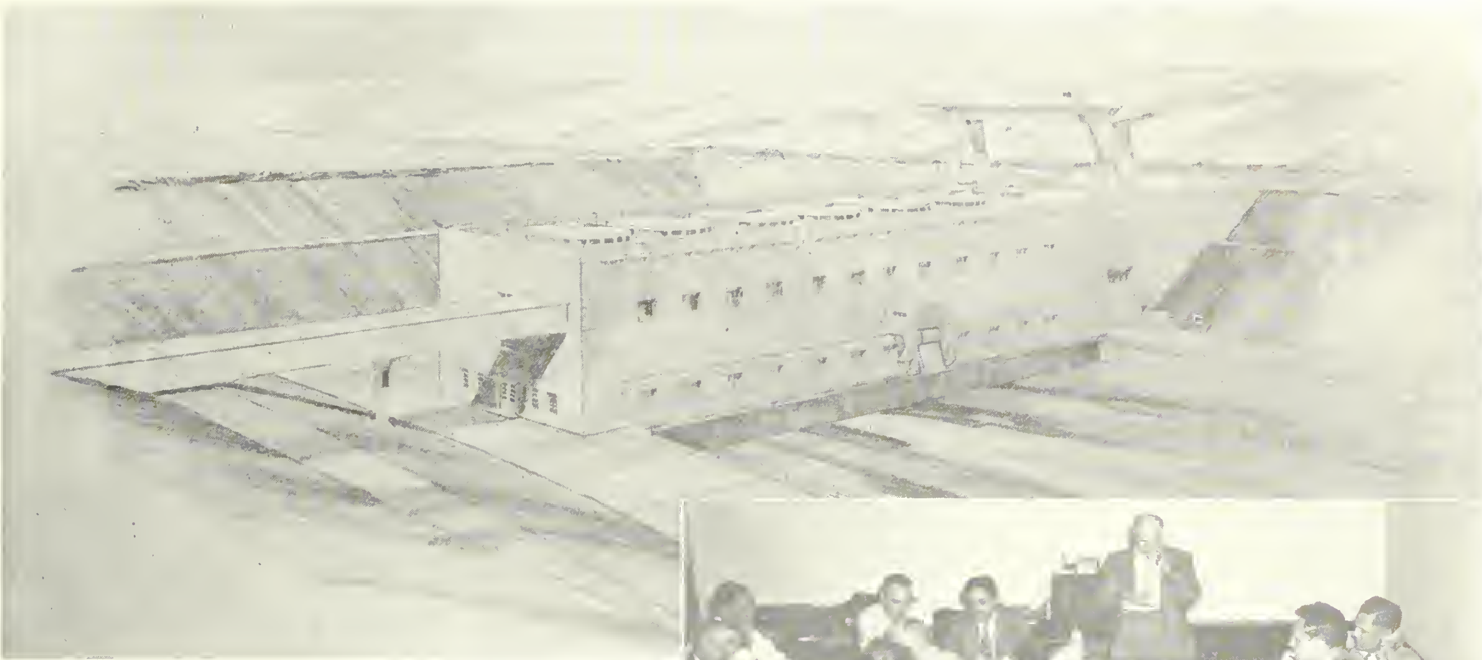
In 1926, the irrigable areas on many of the projects were classified as productive or marginal and nonproductive lands. Land classification was sometimes made by those not appreciating the full importance of the work to be done. Land classification is still being carried forward on some projects. Years of cultivation or tillage of the soil makes for changes in soil characteristics to the end that certain lands that might be classified as nonproductive this year will be found in another category 5 or 10 years hence. On the other hand, some lands that are today considered good production land may be unfit for tillage and the production of crops a few years later. Drainage may then enter the picture to become a costly major undertaking—an additional burden for the project to bear.

The Federal Bureau of Reclamation has never lost a dam. Its engineering has been superb. It is not from the standpoint of engineering that I view this subject, but from the social and economic aspect. After many years of experience some projects are now operating on a sound financial basis, while others are struggling with a financial overhead that threatens to tear down the very structure upon which the project has been built.

The Reclamation Act of 1902 was perhaps the best that could be devised at that time. It has amendments, perhaps others are needed in order to provide the flexibility desired to meet the various conditions on existing projects as well as those in the making.

It seems to me that the time has come for us to accept the challenge of meeting the problems that stalk many of our reclamation projects. It is only by recognizing

(*Continued on Page 260*)



The Drama of a Big Bid Opening

By William T. Easterday, *Engineer,*

Branch of Design and Construction Region II, Sacramento, Calif.

Tension at its highest *as A. G. Boden, Bureau Engineer, Central Valley Project, announces successful bidder for Tracy Pumping Plant. Above is architect's drawing of structure.*

Everybody has seen the great dams, canals and public buildings which represent an expenditure of Federal money in local construction to increase the Nation's wealth. Almost everybody has joined the "curbstone engineers" to watch some of these structures under construction. But to most people, the process by which the big job gets started remains forever mysterious, and all the dramatic events which lead up to construction are passed off with the comment, "Oh, the Government built that!"

Actually, the Government itself seldom constructs, almost never in peace-time. The Government agency designs the structure, buys the materials to be used, and supervises the actual building to make sure that the designs are faithfully executed. But in almost all cases the construction itself is carried forward by private contracting firms, whose own engineers and skilled laborers are equally responsible to the Government and its people for doing a good job.

Since public works very often are public for the very reason that they're too big and costly for private undertaking, these public projects are a large item in the contractor's repertory and competition is keen for Government contracts. Here are the steps whereby a contractor gets signed up for a Government job:

1. The Government draws up specifications, outlining the engineering job in great detail. These specifications are weighty volumes, sometimes running to hundreds of pages. They are distributed to interested contractors without charge for use in preparing bids, and are sold to others requesting them for information purposes at a price usually under $5. This price is less than cost, and in conformance with general contracting practices is charged primarily to keep down the demand and cost which would be involved if wide free distribution were made.

2. The private firm's technical experts study the specifications very carefully from all standpoints and finally arrive at an estimate as to the lowest amount for which it can execute the designs and still make a reasonable profit. A young firm, seeking to become established, sometimes cuts its profit down to almost nothing in order to get the contract and show what it can do.

3. The Government announces a date and place for opening of bids. At a certain hour, usually 10 a. m., all bids must have been submitted in sealed envelopes and the opening proceeds. Often the bids are received at the very last minute, since the firms' representatives gather together before the opening and try to find out what the others are bidding, scaling their own bids down to a minimum just before the deadline.

4. At the precise hour announced, the bids are opened and read aloud by a Government official. Representatives of the construction trade press are on hand, because the name of the low bidder is big news to them. Usually, the contract goes to the lowest bidder, but the Government may find the low bid unacceptable because of some stipulation in the bid or because of the firm's record. Award of the contract is not announced until the Government has studied the bids carefully, usually not until a month after the opening.

Here is the picture of a recent big bid opening for a giant structure in Alameda County—the Tracy pumping plant of the Central Valley project. Region II, which is building the Central Valley project, conducted this opening in its office at Antioch. ●

Hybrid Sweet-Corn-Seed Center of

by Merle L. Tillery
Region 1, Boise, Idaho

SIXTY PERCENT OF THE NATION'S SWEET-CORN SEED SUPPLY IN 1947 . . . .

EIGHTY PERCENT OF THE ENTIRE COUNTRY'S REQUIREMENTS FOR HYBRID SWEET-CORN SEED . . . .

These are the results of ideal growing conditions and fertile desert soil irrigated through dependable Bureau of Reclamation facilities on the Boise and Owyhee projects in southwestern Idaho and eastern Oregon.

Aerial view showing hybrid sweet corn seed sou

This year's crop was produced on 6,200 acres planted to sweet corn seed, 5,000 acres of which produced the hybrid variety.

These two Reclamation areas are also excellent for the production of open pollinated sweet corn seed. This is the type of sweet corn used by everyone before the introduction of hybrids. Approximately 30 percent of the open pollinated sweet corn seed used in the United States is produced here, where 1,200 acres is devoted to its production.

The story of hybrid sweet corn seed production is a most intriguing one. At present there are about a hundred varieties. Private seed companies and State and Federal experiment stations are continually working to improve these varieties and to develop new ones.

Golden Cross Bantam a Favorite

Golden Cross Bantam was one of the first varieties to be developed. It is this type that is grown in huge quantities in the Boise and Owyhee areas. It is a yellow corn used for home and commercial gardens, as well as by the canning and quick-freeze industries, and is by far the most popular hybrid, outselling all other varieties.

The principal processes necessary to produce Golden Cross Bantam are interesting. Golden Cross Bantam is the product of two inbred lines of corn. Inbred lines are produced by transferring the pollen, by hand, from the tassel of a corn plant to the silk of an ear of corn on that same plant. Corn is normally produced by cross pollinization, that is, pollen from one or more plants, disseminated by wind, may fall on the silk of an ear of corn to fertilize the kernels on that ear.

The seed companies maintain two inbred lines for each hybrid corn produced for commercial planting. This year (1947) the inbred lines were grown in isolated plots and were pollinated by hand. This consisted of taking the pollen from a corn plant and transferring it to the silk of an ear of corn on that same plant and then covering with a paper bag to prevent other pollen from falling on the silk.

In 1948 the resultant inbred, or hand-pollinated, corn seed will be grown in increased plots under isolated conditions. The following year the two inbred lines required to produce Golden Cross Bantam sweet corn seed will be grown under contract by farmers on the Federal Reclamation projects. Then, in 1950, this hybrid Golden Cross Bantam sweet corn seed will be planted in home gardens, commercial gardens, and grown under contract for the canning and quick-freeze industries. Corn produced at this stage cannot be used again for seed. It will not reproduce true to type. New seed must be purchased for each crop of hybrid corn.

Farmers who produce Golden Cross Bantam sweet corn seed on the Owyhee and Boise projects assume certain responsibilities and follow prescribed practices specified by the contracting seed company. The most important of these are:

- the land selected must be isolated from other corn fields,
- the land must have a high level of available plant food,
- four rows of female (seed ear producing plants) must be planted to one row of male (pollen producing) plants,
- the female rows must be detasseled as soon as tassels appear (this requires going over the field every day for 14 days),
- the farmers must give careful attention to irrigation, particularly at the critical water requirement period (which is during and immediately following the development of the tassel),
- the ear on male plants must be picked and disposed of before harvest (these ears are not Golden Cross Bantam),
- the Golden Cross Bantam must be harvested before frost (because frosted seed is low in germination).

e Nation

Photo Courtesy Crookham Seed Co., Caldwell, Idaho.

a, Idaho (Boise project). Rows of male corn are denoted by white lines, while female corn is denoted by darker lines.

About 50 percent of hybrid sweet corn seed is harvested with mechanical pickers, while the remainder is shucked by hand.

In this area seed corn at harvest has a moisture content of about 35 percent. To dry the corn in cribs would require too much time, so large artificial drying plants have been provided at Caldwell and Nampa, Idaho, and Ontario, Oreg., to dry the sweet corn seed as soon after harvest as possible. This artificial drying process reduces the moisture content to about 12 percent. As the corn is taken from the dryers it is run through a sheller and sacked for storage to await further processing. Each grower's lot is tagged for identification until final weights are determined and germination tests made.

From storage the corn seed is taken to the cleaning plant where it is run over cleaning machines to remove chaff, husks, pieces of cob, and cracked kernels. Then it goes to the hand-grading room. Here girls and women remove by hand all cracked, dwarfed, undersized, or misshapen kernels. The seed is then sacked and labeled for shipment.

Yields of hybrid sweet corn seed average about 2,000 pounds of marketable seed per acre. However, Mr. C. J. Shellenberger of Melba, Idaho, considered to be one of the best growers in the area, has a 3-year average per-acre yield of 4,300 pounds of marketable seed on a 10-acre contract.

Contract Prices for Hybrid Seed

Contract prices for producing hybrid sweet corn seed vary from 8 to 19½ cents per pound, depending upon the variety produced. These prices are reduced 1½ cents per pound if the seed company does the detasseling. Experienced growers usually detassel their own corn with family or community labor.

The 1947 contract price for Golden Cross Bantam is 9 cents per pound if the farmer does the detasseling, and 7½ cents per pound if the seed company does the detasseling. This gives the average grower a gross per-acre return of \$150 to \$180, depending on whether he does the detasseling. Mr. Shellenberger with his record yield of 4,300 pounds per acre at 9 cents per pound (he does his own detasseling) has a gross per-acre return of \$387.

The acreage devoted to sweet corn seed production grew tremendously on the two developments during the war because of the demand for the production of more food. The acreage rose from 2,500 in 1940 to a peak of 8,000 in 1944.

A large part of the increased production of vegetable and garden seed in the United States during World War II was earmarked and stock-piled for foreign countries.

This was not true in the case of sweet corn seed. Most of this seed was used in home gardens and commercial farms for the canning and quickfreeze industries. A small amount was shipped to Southern Russia. The Army and Navy used sizable quantities of Golden Cross Bantam sweet corn for green corn production in tropical and semitropical areas. It was found that this hybrid sweet corn variety was one of the few vegetables that could be produced under tropical conditions. Three and four crops of Golden Cross Bantam sweet corn were produced each year in some areas.

Experimental work was started on the Golden Cross Bantam in 1922 by Glenn M. Smith, Agronomist of the Bureau of Plant Industry, stationed at Purdue University, Lafayette, Ind. Selection and improvement work continued until 1931 when the first seed was released for trials under field conditions. There has been a great improvement in Golden Cross Bantam since this initial release due to Mr. Smith's efforts and those of the seed trade, and other research scientists in the hybrid sweet corn field.

Other research scientists prominent in the development and improvement of hybrid sweet corn seed are Dr. W. A. Huelsen, University of Illinois, Urbana, Ill., Dr. E. S. Haber, Iowa State College, Ames, Iowa; and Dr. W. R. Singleton, Connecticut Agricultural Experiment Station. In addition to developing and improving hybrid sweet corn varieties, these research scientists also supply the seed companies and growers with information on methods, technique, and "know-how," so necessary in the production of this type of seed. •

Perplexities Unlimited

(Continued from Page 256)

the realities of the situation and then by proceeding to do something about them that we will regain the confidence of those among us who question the feasibility of increasing or enlarging reclamation projects by the Federal Government. Too often we have been guilty of promoting or accepting some enterprises from an idealistic viewpoint, unmindful of the realism to follow. With our feet firmly implanted in the soil, with a grim determination to go forward with plans that recognize the realities of the problem approached, we can then perhaps eliminate the necessity and the practice of recurrent appeals to Congress for moratoriums, for deferment, for write-offs, for adjustments in the construction cost, or for other palliates which but stave off the day of reckoning.

Last Year's Resolves

What are some of the phases of the unfinished task which deserve our considered judgment? Here is the gist of some of the resolutions adopted at the 15th annual convention of the National Reclamation Association in 1946, showing what is needed.

- The release of impounded funds.
- Additional legislation to protect the beneficial consumptive use of water in the west.
- Coordination of activities of Federal map-making agencies to complete all the essential topographic mapping of the United States.
- Amendment of the Reclamation Project Act of 1939 so as to recognize the district as to the amount paid for construction costs, the rights of the district in the water rights it has been using, the right to renew contracts, and the need for termination of control when construction costs are fully paid.
- Further study of the fixed acreage limitation provision now required by the Act of 1902, to be given by special committee.
- Compliance with State laws in the development of projects on the part of any Federal agency dealing with water.
- Utilization of power revenues, without discrimination as to types of operating organizations whether such projects are operated by the United States, by irrigation districts, or by water users' associations.
- Modified contracts with respect to existing provisions concerning the revenues derived from the sale of land on some projects.
- The need of a small projects division in the Bureau with a simplified procedure to handle the small projects seeking equal opportunities with large ones in participating in the Federal Reclamation program.
- The enactment of a Federal stream abatement pollution law to protect and preserve States' interests.
- Legislation to clarify and elaborate the factors to be used in the determination of economic justification of reclamation projects in view of the Department of Interior Solicitor's opinion respecting the application of power revenues on Reclamation projects.
- Additional research in the field of irrigation and drainage.
- Coordinating the efforts of all Federal agencies concerned with the development of our natural resources by the legislative and executive branches of the Government.

These are among the 24 resolutions adopted at Omaha last year.

By directing the energies of research to the entire field of reclamation with all of its ramifications, we shall be taking some of the necessary steps toward answering many of the pertinent questions raised. However, studies alone will not do the job. Hearings, investigations, and reports are not enough. We need action now!

If a mistake has been made, let us not continue that mistake. Rather, let us proceed to rectify an error, whether it was made yesterday or has the slightest indication of reappearing tomorrow. By first recognizing our mistakes, then facing the issue, we shall be able to accept the challenge for completing the task remaining before us.

Perplexities Unlimited? Yes! But these provide us with the challenge that should spur us onward toward the achievement of our ultimate objectives, as we proceed to do the things "that couldn't be done."

We know from past experience that agricultural development has preceded industrial development. Speaking for the carriers in this program of carrying reclamation forward, our interest is so obvious as to seem not even necessary to require a statement.

There can be no separation of the interest of this western country from the interest of companies which provide transportation facilities. We advance or we retrogress in the same direction and at the same ratio as the territory we serve. We dedicate ourselves to the purpose of bringing an adequate, sound agriculture in this country. Maintenance and support of the present reclamation policy is the means of achieving that goal in the arid regions. We have supported and will continue to support Reclamation Associations. What we have done in the past we will continue to do in the future. We hope to do our part to help spread community prosperity just as far as it can be spread by the practical use of water that falls in the entire water shed. ●

Do You Plan To Move?

If so, please notify the *Reclamation Era* so that you may continue to receive your copy regularly.

Water for the Asking

From Nampa, Idaho, comes the story of a Kansas farmer, a Nampa businessman, and a Nampa farmer.

While the farmer from Kansas was visiting the businessman, in walked the Nampa farmer, who ran a farm owned by the businessman.

"I need some additional water for my beet field," he told the owner. The latter called the irrigation district office, reported what was needed, nodded, said "Okay" as he was told the price and that delivery of the water would be made as requested, and hung up.

The Kansan listened with rapt interest. "Just what did you do?" he asked.

"Oh, I just ordered three rains 10 days apart," was the answer.

"Gawd," responded the amazed Kansan. "Can you do that out here?"

New Maps Available

The following recent project maps have been prepared by the Washington, D. C., office of the Bureau of Reclamation:

Shoshone project, Wyo.-Mont., map No. 47–57, four colors, red, green, blue, and black, size approximately 10½ by 16″, price 15 cents.

Same map numbered 47–54, three colors, blue, green, and black. Size approximately 10½ by 17″, price 15 cents.

Minidoka project, Idaho, map No. 47–55, three colors, blue, red and black, size approximately 8½ by 11″, price 15 cents.

Same map numbered 47–55A, approximate size 19½ by 26″, price 25 cents.

1946 Index and Bound Volumes of Era Available

A limited supply of bound volumes of the May through December 1946 issues of the Reclamation Era are now available at $2 a volume. Separate copies of the Index to these numbers are free upon request.

Make check or money order payable to Treasurer of the United States. Postage stamps are not accepted. Address order to the Commissioner, Bureau of Reclamation, Washington 25, D. C.

OPENING DAY at Model Farm

"Unusual weather" fails to dampen enthusiasm for the first field day at Columbia Basin Project's Development Farm

by Gene Nicolai, *Coulee Dam, Wash., Reg. I*

Photos by Harold Foss, Region I

Seventeen thousand farms like this one will eventually dot the Columbia Basin Project landscape.

Farm houses of this type will constitute the nucleus of the future communities which will cover a million acres.

It was a cold, drizzly October day at the Bureau of Reclamation's Development Farm on the Columbia Basin project of eastern Washington.

Kenneth Hampton, wounded veteran of World War II and operator of the 80-acre demonstration plot, frowned at the dismal sky. Then he looked thoughtfully at the smoothly graveled driveways, the maturing corn and potatoes, the sprouting alfalfa and clover, the newly painted machine shed converted from a war-surplus airplane hangar.

"Doesn't look like much of a crowd," he told his young wife.

Out near the machinery shed, John L. Toevs, land-development director of the project, which is headed by project development supervisor W. W. Johnston, pulled out his watch. It was 1:05, five minutes past the time set for beginning the first field day on the farm, two miles east of Moses Lake.

A flat-bed truck, carrying a man, wife, and baby turned down the side road, rattled by the almost-four-room farm home and stopped near Toevs.

"We've come to look over the farm."

"Glad to see you," Toevs answered. "Just park over there. The meeting will be in the machinery shed at two."

And then, streaming from Moses Lake and from roads channeling from other parts of the million-acre expanse, came a steady flow of cars and trucks. Toevs lighted his pipe and grinned. Hampton hurried out to direct traffic while his wife hustled their 3-year old daughter into a new dress.

They kept coming—school buses, new sedans, old coupes, even a motor scooter. And by 1:30 o'clock, the crowd, swelled to more than 400, began a tour of the farm dwelling designed at Washington State College. Others ignored the chilling rain and wandered through the fields, exchanging views about the 10-foot hybrid feeder corn, examining the Netted Gems, asking questions about the milking parlor, the machinery, and the well which will serve the farm irrigation system until water from the project's main network reaches the Basin.

By 2 o'clock they had filled all seats in the machinery shed and were perched on cement sacks, empty boxes, potato diggers, and oil drums.

The first field day at the first development farm on the Columbia Basin project was a success.

Toevs opened the meeting with the greeting: "Well, folks, we're glad to see you here."

He was speaking to prospective settlers waiting for water to reach the parched lands in the basin, to agricultural agents of railroads, Chambers of Commerce, the Grange, Washington State College Extension Service representatives, the Bureau of Plant Industry, the Columbia Basin Commission. He made a plea for weed control to his listeners, many of whom operate farms served by private irrigation in the Basin. He explained the cooperation of the State College and the Prosser (Wash.) Agricultural Experiment Station in the development farm program.

Congressman Hal Holmes from Washington's fourth district was principal speaker. He commended the development farm plan as a guide for future settlers.

"Farms like this, using poorer type soils as well as the better soils, show the transformation of sagebrush to crops," Congressman Holmes said. "Here they will practice rotation of crops, carry on scientific research, and study planting of various crops to help those who will farm in the Basin. Here a vision has been transformed into cold reality.

"Irrigated farms like this show what happens when life, in the form of irrigation water, reaches this arid region. Your presence here proves you are people of vision. Men without vision are lost; men with vision can do wonders."

Ned Thomas, president of the Moses Lake Chamber of Commerce, which long had planned the initial field day, introduced

(Continued on Page 266)

Veteran Assistance at Minidoka

In the aptly named "Magic Valley" of southeastern Idaho new settlers will have help in building self-supporting farms

by **Ernest J. Palmer**
Hunt, Idaho, Region I

Veteran Glenn A. Parsons, (left) receiving advice from Harold L. Harris, Work Unit Conservationist of the Soil Conservation Service, Jerome, Idaho.

←*Photo by Phil Merritt, Region I*

The mere drawing of a name from a bowl is but a small beginning in the building of a fertile irrigated farm on a patch of public land now barren desert. The actual transformation of sagebrush land into a productive unit is a major job, one that taxes the best of the men who undertake it.

To many of the veterans who won a piece of the 3,226 acres of public land opened to homestead entry on the Gooding Division of the Minidoka project, in Idaho, where the Japanese evacuee camp was situated, it is a particularly new adventure. One said:

"Why, I've farmed all my life but I don't even know how to walk up to an irrigation shovel. Can I get help from someone who can show me how to irrigate?" "Where do we get our water?" "What's a lateral?" "What's a sub lateral?" "What's a corrugation?" "How much water do you run down the ditch?" "Can I get help in laying out my irrigation ditches?" "How do I get the sagebrush off the land?" "Are schools available?" "How can I get water for my household use?" "Can I get electricity?"

While all of the men have had three years of full-time farming experience after reaching the age of 15, as required in qualifying for the drawing, many never irrigated before, and about half came from outside the State of Idaho and thus are unfamiliar with local conditions. That the winners would need advice and other assistance in bringing their land to the productive stage was evident long before the first name was drawn from the bowl.

Although some old-timers may say that the new settlers should not be "wet nursed," that they should have to dig for themselves, the more thinking person will agree that the new farmers will have plenty of trials and tribulations despite all the help they will get. They'll need courage, ambition, and must put in long hours and plenty of hard work to make a success in their undertaking.

Then, too, times have changed. The new settlers must develop their farm units quickly and efficiently because of high living costs and lack of capital. Otherwise, they'll surely lose out.

In January 1947 the Bureau of Reclamation stepped out and squarely faced the problem of how best to provide settler assistance on the Minidoka project. Through its land use specialist it conferred with local representatives of other agencies who had a service to offer rural folks. It was readily agreed by all that the best way to provide the aid was to form a committee, an Inter-Agency Committee as it were, consisting of representatives of all the organizations involved, which would plan, coordinate, and carry forward the most helpful program possible for the settlers. The committee should be ready for action when the first settler arrived.

The first meeting of the new group was held on January 15, 1947, and meetings have been held regularly ever since. The land use specialist was elected Agency committee coordinator and the county extension agent was elected secretary. Represented on the committee are: University of Idaho extension division, Idaho State Board of Education, Idaho Employment Service, Farm Home Administration, Production and Marketing Administration, Soil Conservation Service, and Bureau of Reclamation.

The settlers who have taken up residence on the project are appreciative of the help they are receiving through this group. Under the plan a definite delineation of responsibilities has been outlined for each agency. The activity of each is outlined below:

Bureau of Reclamation

The Bureau laid out farm units according to the topography of the land and the acreage required to support an average family at a suitable standard of living.

Under Public Law 478, Seventy-ninth Congress, second session, buildings and certain personal property used at the War Relocation Camp, such as bathtubs, blankets, rubber boots, shovels, sewing machines, chairs, and kitchen utensils, were transferred to the Bureau of Reclamation. A great deal of this property has been allocated to the veteran homesteaders and many of them are actually removing these materials to their farm units.

Electricity for the farms was made available through the efforts of the land-use specialist and the project superintendent, working with power company officials. As a result, homesteaders can obtain electric power within a few days after they request the service.

Veterans need schools for their children, too. The Inter-Agency Committee can take credit for having the Hunt unit taken into the Eden School District, and having the district provide busses to transport the youngsters to and from classrooms. The Bureau assisted the district by giving it a school bus and two barrack-type buildings.

Where could veterans live while building their homes? That question was quickly answered by the Bureau by providing them with temporary housing in two blocks in the former Japanese evacuee camp. A laundry building, with showers, toilets, and wash basins, is available nearby. The settlers appreciate these accommodations. As one said, "This certainly beats living in a tent, such as my dad had to do when he was homesteading."

The Bureau extends settlers a warm welcome through the land use specialist. The "welcome" includes giving them information on how the unit might best be irrigated and on the assistance that is obtainable and showing them the buildings and personal property and temporary housing that is available. The veteran also gets information such as how to file his homestead entry or contact building movers.

One of the main jobs that the land-use specialist is doing—and the one that is probably appreciated most by the settlers—is to assist them in laying out farm fields, irrigation systems, and locating farmsteads and to provide accurate information on the leveling that is necessary. This work is done out in the field with the specialist operating the level and the farmer the rod.

University of Idaho Extension Division

Briefs containing reliable information on the types and kinds of farm equipment necessary to grow various crops are being provided by Virgil Cross, Jerome County Extension Agent. Another brief, called "Recommended Seeding and Crop Table, Hunt project," is also available. It gives the planting time, rate of seeding, best source of seed, and varieties of seeds adaptable in the Hunt area. The county agent will also provide briefs on farmstead location and on the selection of livestock breeding stock and such others as the veterans may need. In addition to giving individual assistance, the county agent holds educational meetings with the Hunt settlers during the winter months, when the extension specialist can assist him.

Agent Cross is not only able to assist the settlers with the above educational program, but he also knows the best fishing streams in Idaho. Several of the settlers seem to be very interested in this phase of the settler assistance program.

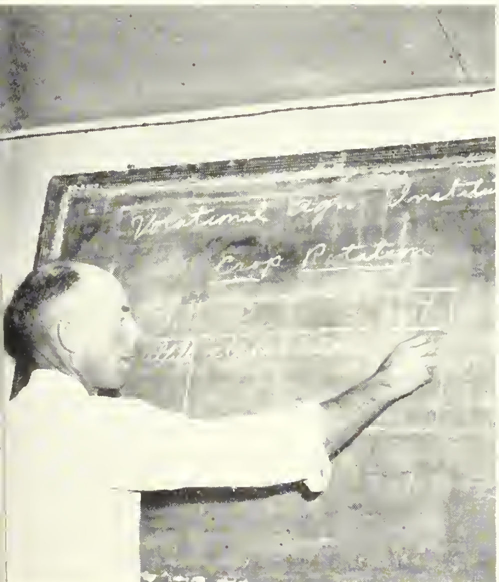
Idaho State Board of Education

Under Public Law 346, Seventy-eighth Congress, second session (commonly known as the GI Bill of Rights), qualified veterans are entitled to take institutional on-the-farm training. The new farmers are eligible for a 1-year training program, plus one additional month of training for each month spent in the armed forces, but not to exceed four calendar years. During this training period, the Veterans' Administration will make subsistence payments to veterans enrolled in the agricultural courses.

The State department of vocational education, through its agricultural education branch, will establish this training program for the veterans at Hunt. Clare Hunt, assistant in charge of veteran training and on-the-farm training, and Henry Schodde, district supervisor, department of vocational education, have prepared the program. The class will be held in one of the warehouses at the Hunt camp with Bart Gardner as agricultural instructor. Courses will be offered in crop and livestock production, marketing, farm management, and irrigation practices, as well as any other training which will be of specific value to the ex-soldier settlers on this project. For practical illustration as part of the course in agricultural engineering, Gardner will work with the settlers in remodeling their barracks into farm homes, assist them in preparing equipment to move their buildings, etc. The course will be part individual instruction and part classroom work.

Production and Marketing Administration

Major benefits are to be gained under the Production and Marketing Administration program. Practice D-15, for instance, will allow the settler $6 per acre for preparation of land for irrigation. Through L. E. Pool, chairman of the Jerome County Agricultural Conservation Association Committee, the closing date for signing plan sheets was extended from



Photos by Phil Merritt, Region I

The three "R's" (especially Rotation) will play an important role in the program as shown by Henry Schodde at the blackboard. At center, County Supervisor Verl Unander of FHA discusses with Veteran William R. Niedrick the possibility of using the water tower for domestic supply, and at right, the Bureau's land specialist helps veteran Carl Blanford survey for a main ditch location.

Photo by Phil Merritt, Region I

Hunt Inter-Agency Committee swings into action mapping plans which will help shape the destiny of lucky veteran homesteaders on the Minidoka Project, Gooding Division.

May 1, 1947, to September 1, 1947, for the special benefit of the Hunt homesteaders. The Inter-Agency Committee has mailed briefs to the new settlers giving them information on how to take advantage of the program and listing the practices that would benefit them most.

FARM HOME ADMINISTRATION

This agency, represented at Hunt by County Supervisor Verl Unander, will, as far as congressional appropriations allow, make production and subsistence loans to purchase livestock, farm equipment, seed, feed, and other farm supplies and to pay for necessary hired labor, erect necessary minor buildings or make minor repairs. The latter may not exceed more than $100 for a 10-month period.

Loans will also be made by the FHA to purchase essential home equipment, to meet subsistence and medical care of the family, and to individuals or groups to buy sires, equipment, etc.

The agency may also extend credit assistance and technical advice and service for the development of domestic water. It is making a survey of the domestic water requirements of the Hunt settlers. If the existing large wells for the Japanese camp cannot be used to provide water to the 43 homesteaders, it is hoped the FHA will recommend and assist the settler in developing individual wells.

SOIL CONSERVATION SERVICE

The Soil Conservation Service will aid the settler in developing individual or group conservation plans, make recommendations on proper land use according to capability classes and assist with other technical surveys. Harold L. Harris, work unit conservationist, represents the SCS on the Inter-Agency Committee.

IDAHO EMPLOYMENT SERVICE

Assistance to the veteran in finding outside work during slack periods on the farm and in obtaining hired help during busy seasons will be offered by this agency. Its office is in Jerome and Ronald S. Cutler in charge, will act as veteran information officer. The organization is also the claims-taking agency for the servicemen's readjustment allowance.

In summarizing the settler assistance program on the Minidoka project, it can be said that each and every veteran will find friendly assistance available from every member of the Inter-Agency Committee, which is determined to help the veterans to the fullest extent of the authority of its members. In the last analysis, however, it will be up to each settler to make his own success. Under our democracy, that is as it should be. ●

* Seated left to right: Clare Hunt, assistant supervisor, agricultural education; Henry Schodde, district agriculture education supervisor; Ronald S. Cutler, manager, Jerome County Employment Service; Verl Unander, county FHA supervisor; O. V. Chenoweth who will replace the present land use specialist; L. E. Pool, Jerome County chairman of PMA; Harold L. Harris, work unit conservationist (SCS); Ernest J. Palmer, present Minidoka land use specialist, and W. Dean Boyle, regional land use specialist.

Correction: Our Front Cover for last month carried the startling news that the Klamath project was located in Washington-Oregon. There is no change—it is still in California-Oregon. The photograph was taken by J. E. Fluharty of Region II.

NRA Convention

(Continued from page 250)

tributable to purposes other than irrigation or municipal water supply.

- Permitting the contracting for surplus waters for irrigation purposes.
- Asking the Bureau of Reclamation to establish a Small Projects Division.
- Proposing that the States own title to all lands beneath the navigable water within their boundaries, which, as to coastal States, includes the marginal shelf, subject to regulatory powers of the Federal Government.
- Opposition to creation of any regional authority.
- Opposing continuation of the Southwestern Power Administration (in Arkansas).
- Urging Congress to follow an annual program of appropriations which will complete currently authorized flood control projects.
- Memorializing Congress to enact Senate bill 912 to remove land limitations from the San Luis Valley project in Colorado, Valley Gravity Canal project in Texas, and the Central Valley project in California.
- Naming of a committee by the association president to draft a Federal law extending the period for repayment of water users' obligations.
- Urged and recommended that no income-tax liability based on power revenues be imposed on water users; and that all net revenues derived from power facilities included in the construction cost of a project be applied to the aid of the irrigation system, such application to be made in manner fair and appropriate to project division involved; it was further urged that an equitable allocation of net revenue from power facilities not subject to repayment by water users shall forever be applied as an aid to the irrigation system.
- That Congress and the Bureau of Reclamation should strictly adhere to the principle of providing adequate, economical supply of supplemental water for existing projects.
- Expressing opposition to the Bureau of Reclamation retaining control, operation and maintenance of projects after water users' organizations have become legally entitled to take such control.
- Pledging association cooperation with the Bureau of Reclamation and the Corps of Engineers.
- Requesting the association's secretary-manager to send the resolutions adopted to the Congress, governors and attorneys general of the 17 Western States.
- Expressing thanks to the city of Phoenix "for the excellent manner in which all matters pertaining to the meeting have been handled."
- Asking for modification of law to permit the War Department to sell water for irrigation purposes from Army dams without regard to Reclamation law. # # #

Australian Sagebusting Plow

by A. C. Hull, Jr.

Forest Ecologist, Intermountain Forest and Range Experiment Station, Ogden, Utah

EDITOR'S NOTE: As part of a range improvement program, the Forest Service has been conducting tests in Idaho and nearby States in removing sagebrush with a new type of disk plow. Because clearing of sagebrush is a major activity on nearly all new Federal Reclamation projects, we are grateful for this opportunity to publish the latest developments for the benefit of our readers.

Below, the man in charge of the experiments, tells the story.

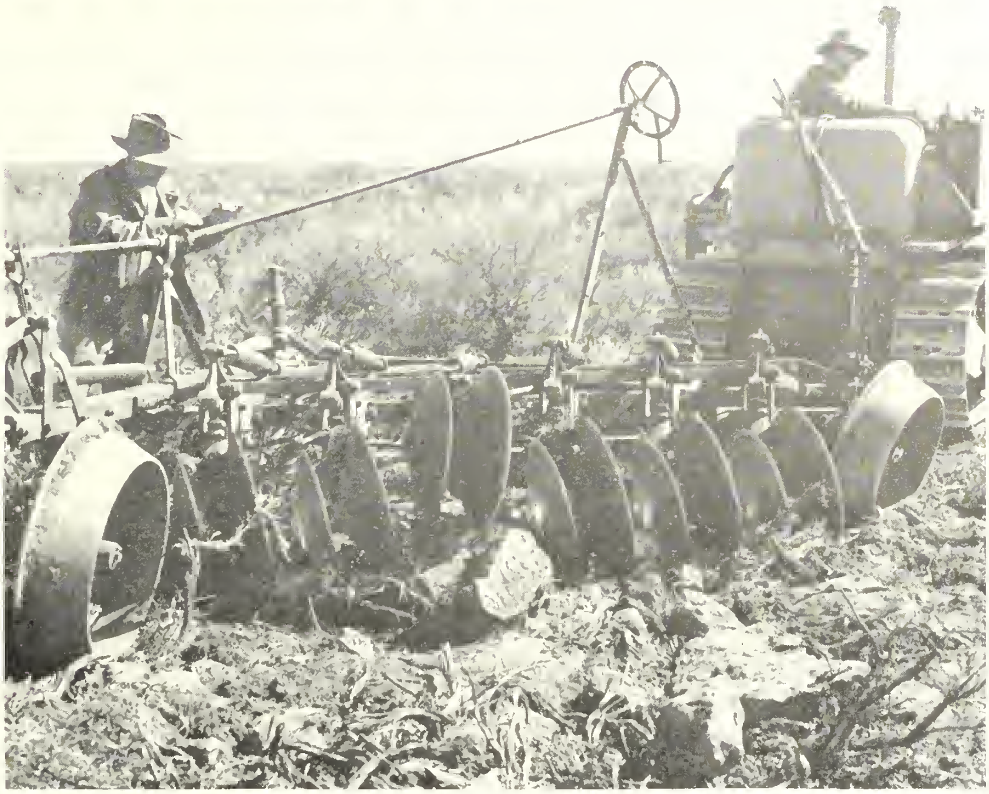


Photo by Stanley Rasmussen, Region I

Sagebusting Plow in Action—*Because of unique spring action, each pair of disks can roll over obstacles such as rocks, or brush piles up to 12 inches in height, without supporting any weight of the plow.*

From "Down Under" has come a machine for "plowing under" sagebrush—a major undertaking on great stretches of lands used for range or watersheds or to be cleared for farming.

Until recently, removing sagebrush with the wheatland-type plow has given the best results obtained by mechanical means. This summer some tests have been conducted with a new type disk plow that is promising in several respects.

The Sungeneral stump-jump disk plow has completed three tests near Boise, Idaho, in which plowing and killing of sagebrush on 325 acres of land was accomplished with a high degree of success. This machine was imported from Australia by the Forest Service as part of its research program in developing better machines and cheaper methods for clearing sagebrush and reseeding western ranges.

Present plows used for sagebrush removal are rigid, and when one disk hits a rock or a stump the entire weight of the plow, plus the forward momentum, is thrown on the one disk and breakage often results.

The Australians, who had similar problems, overcame them by mounting disks in pairs on independent arms controlled by springs. The plow was developed to plow saplings and shrubs on land being brought under cultivation. As the tree- or shrub-covered areas of Australia were cut or burned over, the tough roots and stumps were left in the ground. A machine was needed which would tear up the ground, kill the young saplings and brush, and plow through stump, roots and rocks without breaking and clogging. The stump-jump plow did this job well, and in addition it was found to be excellent for plowing good farm land.

The first American test of the stump-jump plow was made in March 1947 on a 20-acre area in the proposed Mountain Home Federal Reclamation project near Boise, Idaho. Most of the area was rock-free, but one corner had loose lava rocks ranging from pebble size to angular rocks 16 inches in diameter. The soil was silt loam and the area was covered with sagebrush which averaged 10 plants per 100 square feet, exclusive of seedlings. Plants varied from less than 1 inch to more than 6 feet in height. Brush kill was very high and is representative of what the plow can do on sagebrush lands. At this location, 40 plots were marked and counted before and immediately after plowing. Sagebrush kill was as follows:

Age groups of sagebrush	Sagebrush plants per 100 square feet before treatment	Percent kill by plowing
Mature	6.2	89
Young	3.8	91
Seedlings	15.6	100
Total	25.6	
Average		93

It takes great care with the wheatland plow to obtain as effective removal as this.

The next test was on a 260-acre area where a regular wheatland-type plow had commenced plowing in the fall of 1946. After plowing 100 acres and having many break-downs, the wheatland plow, in good working condition when the plowing commenced, was wrecked and had to be rebuilt. During April 1947 the stump-jump plow covered the remaining 160 acres. Upon completing this tract, an additional 60 acres, which because of rocks had been skipped the previous fall, was plowed. The 220 acres comprised abandoned and waste land supporting weeds and some large brush. The soil was fine-textured and very sticky when wet. Just beneath the soil surface were numerous lava reefs. Striking these hidden rocks caused the regular wheatland-type plow to break. On the other hand, when the stump-jump plow struck these rocks, the individual disks would ride up over them without breakage. A single disk drill was pulled behind the plow on this area and a very good grass-seeding job was accomplished.

The plow was then moved to a heavy sagebrush area with some mountain brush, native grass, and weeds. This area had some rocks and was badly cut up by gullies and ravines with steep slopes. The plow went on any slope where the tractor could go, with 35 percent slope being the maximum at which much work was done. The plow did an excellent job of killing sagebrush and effectively uprooted and killed brush species such as bitterbrush, serviceberry, snowberry, and young ponderosa pine. It sliced off the thick, tough roots of arrowleaf balsamroot, and killed all other perennial weeds and bunchgrasses.

Uphill Tests Made

However, on hillsides where the disks threw uphill, the rear end of the plow slipped downhill and young brush and tough weeds slipped between the disks. Because of the dishing action of the disks and the better steering of the wheels, it was superior to a wheatland-type plow on sloping land.

The spring action of the disks caused the stump-jump plow to clog less and to break less than wheatland-type plows. The stump-jump plow cleared itself of brush, rocks, weeds, and mud. The only breakage on these severe tests was cracking of the spring lever arms and cracking of the rear wheel, which was chipped during the shipment.

When the plow was ordered from Australia, extra parts were requested to replace those parts which most frequently broke or wore out. The only parts sent were new boxings, indicating that wear and not breakage was the major problem in the rocks and stumps of Australia. The greater ruggedness of the Sungencral plow is a strong point in its favor.

The plow was pulled by an old HD 7 (60 h. p.) crawler-type tractor. On level land it easily pulled the plow and the drill in third gear at the rate of 3 m. p. h. The operator estimated that the tractor could pull two plows in third gear. On level land it was possible to plow almost 2 acres an hour while on the steeper land it was barely possible to plow 1 acre per hour.

The most distinctive feature of the stump-jump plow is the independent swinging disks mounted with a pitch on jump arms in sets of two. Spring tension holds the disks in the ground when cutting, but when the disks encounter rocks or brush, the spring allows each pair of disks to ride over rocks, or brush piles, up to 12 inches high independent of the other disks. The disks are alternately 20 and 23 inches in diameter, but are mounted on the hump arm with a pitch so that both disks touch the ground at the same time. The pitch of the disks gives them a dishing or sliding action which helps them to maintain a digging depth and kill brush without a corresponding spring tension or heavy weight. The jump arm is in line with the direction of travel. This angle combined with the pitch of the disks allows the disks to release themselves easily when striking rocks.

The depth of cut can be adjusted up to 7 inches. The tests indicated that about 2 inches was most effective when a moderate rate of travel was maintained. The width of cut of the plow is easily adjustable from 6 feet 4 inches to 7 feet 6 inches by changing the steerage of the two rear wheels with a hand lever. The plow was tested at all widths within this range. As the width of cut is decreased, disks acquire more of a slide-under cutting action which is best for removal of sagebrush. The wider cut is good on weeds and on farm land.

This plow is made by the H. V. McKay Massey Harris Co. in Australia, but because of industrial difficulty the plow is not now available. Plows are made in 8-, 12-, and 16-disk sizes. The plow tested was the 12-disk size and weighed 3,000 pounds. Cost in Australia was $413, f. o. b. Melbourne, and shipping and handling charges made the plow cost $601 in Ogden, Utah. Because the plow was an experimental model, import duty was only $6.

The stump-jump plow is a step forward in sagebrush removal. It probably is not the final answer to the mechanical eradication of sagebrush under American conditions. Anticipating the need for improved machinery and methods for reseeding range land, the Forest Service has set up an equipment development program. This plow test is therefore just one of the many methods being tested, and the plow is only one of the many machines being developed for reseeding of range lands. Other parts of the program include the use of sagebrush rails, pipe harrows, broadcasters, brush burners, and other methods.

The stump-jump plow has outstanding features, some of which are now being incorporated into a trial model brushland plow built especially for eradication of sagebrush and similar shrubby species. This work is under the direction of Mr. Ted Flynn at the Forest Service Equipment Laboratory in Portland, Oreg. After thorough testing, this brushland plow will be turned over for commercial manufacture and will be available on the market. It is hoped that this brushland plow will give even better results in the difficult but important job of killing sagebrush. ●

Big Coulee Generator Starts

Helping to alleviate the threatened power shortage in the Northwest the L–7 108,000 kw generator was put on the line in the Grand Coulee powerhouse the latter part of October.

This brings the actual installed capacity of the power plant up to 776,000 kilowatts with a "peaking capacity" in the neighborhood of 920,000 kilowatts, or greater than the combined power-generating facilities of all plants in North and South Dakota, Delaware, Mississippi, Wyoming, Utah, and Arkansas.

Because of the growing demand for power in the Northwest area the assembly of L–7, first postwar generator to go into service, was accomplished on an around-the-clock schedule. Two more generators of 108,000 kw capacity remain to be installed in the left powerhouse by the close of 1948.

Opening Day at Model Farm

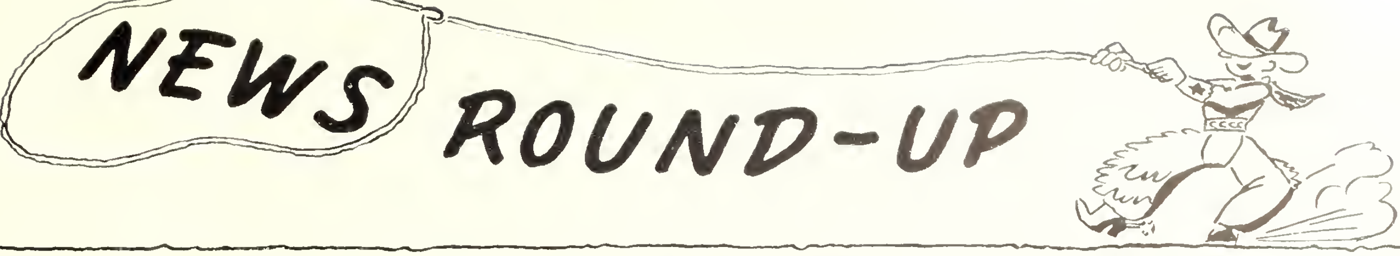
(Continued from Page 261)

others on the speakers' platform, including Miss Helen Noyes, extension economist in home management, Washington State College; H. E. Wichers, extension specialist in rural architecture, Washington State College; District Manager Frank A. Banks of the Bureau of Reclamation; H. P. Singleton, head of the Prosser Experiment Station; James O'Sullivan, whom Thomas called "the Grand Old Man of the Grand Coulee Dam;" J. A. Weber, chairman of the joint board of the three irrigation districts in the project; and J. P. Simpson, member of the State Legislature.

The speeches were short and to the point. The crowd was attentive, but anxious to see more of the crops, to ask more questions about the alfalfa, clover, vetch, and pasture. When the meeting ended, the men started for the fields. The women looked enviously at the modest farm home and read Extension Service circulars describing its plans.

Dusk came early and the families reassembled. Cars and trucks coughed into action and windshield wipers began flicking away at the seldom-experienced rain.

And down to the south the sky began to glow from the lights of the Potholes Dam, where the Nation's fourth longest barrier is being built to impound some of the great volumes of water needed for an irrigation system designed to serve 15,000 family-size farms in the Nation's biggest reclamation project. ●



Taft Visits Reclamation Areas

Senator Robert A. Taft of Ohio, who returned from a Western tour which included visits to the Bureau of Reclamation's Hoover Dam, Imperial Valley, and other Reclamation areas, said during the trip "we certainly must proceed with a public works program, and reclamation in particular has the appealing claim that all of the projects undertaken up to this time are self supporting, so that we can afford to be more generous than with regard to other public works." He concluded by urging "preparation of plans for practicable new projects so they may be available as soon as more funds can be found."

Second Klamath Opening

Secretary of the Interior J. A. Krug recently announced the opening for settlement of the second group of public land farms in the Tule Lake division of the Klamath project, Oregon-California. There will be 44 farm units embracing an area of 3,522 acres. The farms are located in the Coppeck Bay area. Applications for filing will close at 2 P. M. on January 20, 1948.

All applications received during the filing period which began October 22 will be considered simultaneously filed and a public drawing from those who qualify will be held to determine eligibles to enter the farm lands.

Details of the opening and application forms may be obtained by writing to the Bureau of Reclamation, Klamath Falls, Oreg.; Bureau of Reclamation, Sacramento, Calif., or Bureau of Reclamation, Washington, D. C.

Commissioner of Reclamation Michael W. Straus explained that the general regulations under the Homestead and Reclamation laws which have governed previous openings will apply. First opportunity for homesteading, according to law, is given to veterans of World War II who apply before the closing date.

Homestead laws require filing of entry notice and actual residence on the lands within 6 months after date of entry. To get full rights to the land, three years' residence is required. However, credit for military service up to two years may be substituted for a like period of residence.

Each successful applicant in the drawing will be given, free of charge, two barrack-type buildings of the type used for War Relocation Centers, or their equivalent, Secretary Krug added, and certain other property acquired by the Bureau of Reclamation from war surpluses for distribution to homesteaders under Public Law 478, Seventy-ninth Congress. The barracks may be converted into various farm buildings and plans for such conversion have been made by the Bureau.

Entrymen will be required to pay a water rental charge during a predevelopment period of 4 years, after which the irrigation construction charges, under Reclamation law, must be repaid by water users through their organization within 40 years.

Almost all of the homesteaders who received farm lands in 1946 have advanced in their settlement to the point where they now have substantial permanent dwellings and are cropping the lands, the Bureau of Reclamation reported. Mr. Straus added that the record of this area, with no serious crop failure in 25 years, would indicate a good chance for any qualified settler to farm the land successfully.

Platoro Reservoir Approved For San Luis Valley

Secretary of the Interior J. A. Krug recently announced approval of a Bureau of Reclamation recommendation to start construction of Platoro Reservoir on the Conejos River in southern Colorado as soon as repayment contracts are completed by water users in accordance with Reclamation law, as the first stage of a two-reservoir plan to regulate the river.

The Conejos River, a tributary of the Rio Grande, would be developed within terms of the Rio Grande Interstate Compact. Storage on the Conejos is needed, the Bureau of Reclamation reported, to regulate the local water supply seasonally to improve crop production.

Primarily a producer of livestock, with locally raised forage crops used to support the stock, and of potatoes, green peas and other vegetables, the Conejos division comprises 116,200 acres in Conejos County, with average elevation of 7,800 feet above sea level. About 74,000 acres are now irrigated with simple diversion systems, some dating back to 1855, but since no storage is provided, acute water shortages occur both in early spring and late in the growing season. The reservoir will trap floodwaters for use during these periods, and at the same time reduce overflow from stream banks at times when mountain snows are melting.

It is estimated that reservoir storage will make it possible for farmers to double their crop production value per acre.

The two-stage development was recommended by Commissioner of Reclamation Michael W. Straus as the result of additional investigations authorized by the Congress in 1941. The study was to determine whether one or two reservoirs would provide better regulation. Commissioner Straus reported that "storage in Platoro Reservoir will provide adequate regulation for the immediate water needs of the area and will reduce flood damages." The Platoro dam will create a reservoir of 60,000 acre-feet capacity. The Mogote reservoir, with tentative capacity of 30,000 acre-feet, would be constructed later under the two-stage plan, "after the agricultural economy of the area has improved to the extent necessary to justify the need for an additinoal late-season irrigation supply."

Forty percent of the Platoro Reservoir construction and operation costs would be allocated to flood control, and 60 percent to irrigation, as provided when the project was authorized. The Commissioner reported that the Directors of the Conejos Water Conservancy District, representing the farm owners, have approved the plan. The water users would repay irrigation construction costs in 40 years without interest, and pay irrigation operation and maintenance charges annually. The reservoir is expected to reduce the annual flood damages by about 75 percent.

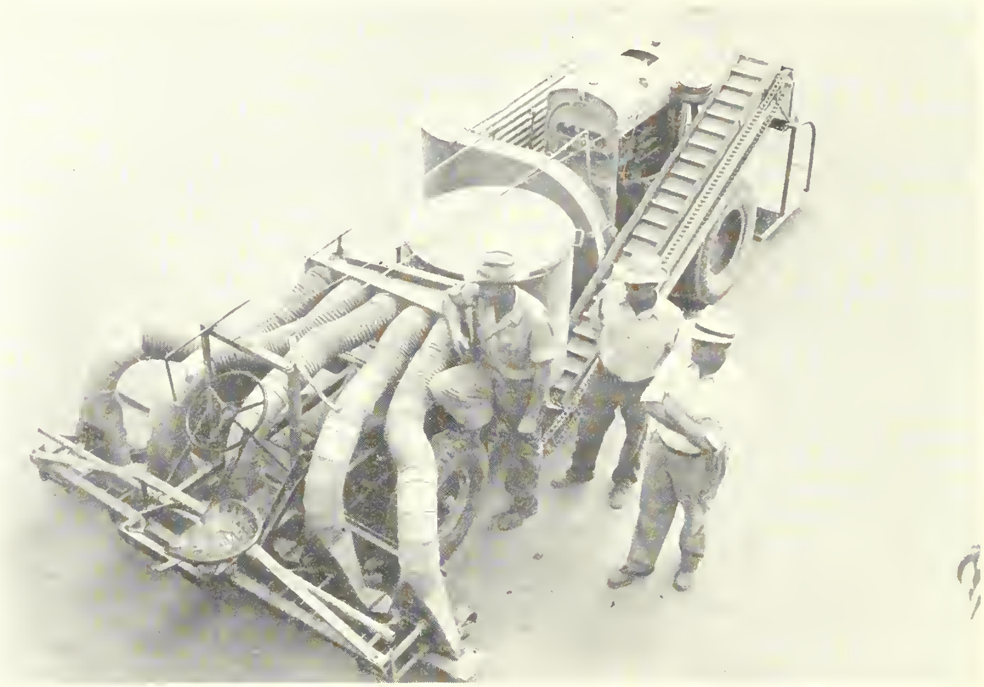
Barbecue Celebration Marks Gila Project

To celebrate the realization of many a pioneer's dream (passage of the Gila project act), some 1,500 persons gathered at the Mohawk Valley schoolhouse in Roll, Ariz., for a good old-fashioned barbecue on November 1.

The enactment of the Gila project bill last July will provide for delivery of water to 75,000 acres of irrigable land in the Mohawk Valley where the communities of Wellton and Roll are located approximately 50 miles east of Yuma.

The celebration was marked by the attendance of many notables including Senators Hayden and McFarland of Arizona, Butler of Nebraska, and Murray of Montana. Also present were Representatives Harless and Murdock of Arizona and Fernandez of New Mexico, Assistant Secretary of the Interior William E. Warne, Commissioner of Reclamation Michael W. Strauss, many other Reclamation officials including Yuma District Manager John K. Roher, and a large NRA delegation.

More Profits for the Almond Producer through *Mechanization*



H. E. Van Till, extreme right, poses with his vacuum almond harvester. With him, left to right, are driver Ivan Bowen, and sacker William Hankins. →

Photo by A. E. McCloud, Region II

No more tedious hand-gleaning of almonds for California's commercial growers of this popular delicacy—a vacuum harvester makes a clean and easy sweep.

Mr. H. E. Van Till, an almond grower on the Bureau of Reclamation's Orland project in California, recently put into operation a suction-type harvester, the latest in a series of continuous attempts to improve the methods of harvesting this crop.

Early in almond harvesting history, the nuts were knocked from the trees and picked from the ground by hand—an unsatisfactory and expensive method. Soon growers began to invent various conveniences. One of these is the widely used almond sled, a long box-like arrangement with attached sheets, similar in operation to firemen's nets. The horse-drawn sled proceeds from tree to tree where the sheets are carefully spread out beneath the branches to catch the almonds as they are jarred or knocked to the ground. They can then be easily gathered up, shoveled into bags, and later hauled to the huller.

Because not all almonds ripen at the same time, growers are faced with problems caused by unripened nuts clinging too tenaciously to the trees, or overripe nuts being blown to the ground by light winds. The new almond gatherer has solved many of these problems and does the job at a reduced cost to the grower.

The mechanical harvester of Mr. Van Till is nothing more than a large vacuum cleaner. It is powered by a 45 h. p. Hercules engine, which provides the mobile power and also drives the large fan which creates the suction. Five suction boxes cut a swath of 117 inches, picking up all loose material from the ground. Behind the fan is a large bin in which the leaves and other debris are separated from the nuts. The unhulled almonds then pass to a conveyer belt which carries them to a platform on the rear of the harvester where they are sacked very similarly to the way grain is handled on a combine harvester.

The driver, who operates the machine, and the sacker are the only crew required. As in the old method of harvesting, the land beneath the trees must be smoothed prior to knocking the almonds.

The harvester of Mr. Van Till at present picks up 300 sacks a day, and after some improvements, it is estimated that it will be able to handle 500 sacks daily. There are several other harvesters similar to this in the process of being manufactured, which will soon be available. •

Salvage Speeds Schedules at Shasta

by Irving C. Harris, *Construction Engineer,*
Region II, Sacramento, Calif.

More than 375,000 board feet of lumber, made available by using war-surplus equipment and logs salvaged in clearing the Shasta reservoir area, kept the Bureau's Central Valley project construction program on schedule in northern California despite a critical lumber shortage.

In the fall of 1946, construction progress on Shasta and Keswick power plants, tower footings for the Oroville-Sacramento transmission line and other major construction features was threatened by lack of lumber and heavy timber for concrete forms, stringers, caps and other construction requirements until Bureau forces at Shasta dam started pulling rabbits out of their hats.

(*The activities described in this article took place prior to July 1, 1947.*—Ed.)

An ideal sawmill site was found at the old aggregate storage bins a mile downstream from the dam. One bin was converted into a millpond and the first task of a war-surplus Seabee sawmill unit was to draw logs out of it to make the lumber for the 35 by 120 foot structure that was to house it. A locally designed 21 by 35 foot pontoon barge, equipped with a loading and unloading winch, a hoist rig, and driven by a "Sea Mule" propulsion unit, was constructed from Navy surplus pontoons. Logs which would have normally been burned in clearing operations on the Pit River arm of Shasta Lake were then salvaged, loaded aboard, and barged 20 miles down to the dam. Removed from the barge at the dam site, they were trucked to the mill, a mile and a half away. Operated by a small crew of 8 to 10 men, the mill had a capacity of about 10,000 board feet per shift. It was equipped with a 60-inch main saw capable of handling 42-inch logs, a 3-

(*Continued on next page*)

NOTES FOR CONTRACTORS

CONTRACTS AWARDED DURING OCTOBER 1947

Specification No.	Project and State	Award date	Description of work or material	Contractor's name and address	Contract amount
1901	Missouri Basin, Wyo.	Oct. 1	Construction of superstructures for bridges, relocation of C. B. & Q. R. R., Boysen unit.	American Bridge Co., Denver, Colo	$528,785.00
1905	Missouri Basin, N. Dak	do	Furnishing electrical equipment for Beulah and Garrison substations	General Electric Co., Denver, Colo	16,276.00
1909	Missouri Basin, Mont.	do	Furnishing 20 two-bedroom prefabricated or precut residences for Government Camp, Canyon Ferry Dam.	Green Lumber Co., Laurel, Miss	53,600.00
1912	Columbia Basin, Wash	Oct. 7	Furnishing four 1,000 kilovolt-ampere outdoor transformers for Pasco 115-kilovolt substation.	Westinghouse Electric Corp., Denver, Colo	10,511.00
1913	Missouri Basin, S. Dak	Oct. 21	Furnishing one 72-inch diameter and one 54-inch diameter outlet pipe, Angostura Dam.	Pacific Coast Engineering Co., Alameda, Calif	55,100.00
1914	Missouri Basin—power transmission lines, Nebr.	Oct. 31	Construction of Gering-Sidney 115-kilovolt transmission line	R. N. Campsey Construction Co., Denver, Colo	210,697.05
1915	Central Valley, Calif	Oct. 1	Furnishing electrical equipment for Shasta and Keswick Switchyards	Westinghouse Electric Corp., Denver, Colo	193,306.80
1917	Missouri Basin, Nebr.	Oct. 15	Construction of Cambridge Diversion Dam, Frenchman-Cambridge unit.	J. A. Terteling & Sons, Inc., Boise, Idaho	367,683.50
1926	Columbia Basin, Wash	Oct. 3	Furnishing circuit breakers and lightning arresters for right and left switchyards, Grand Coulee power plant.	General Electric Co., Denver, Colo	1,520,208.00
1928	Colorado-Big Thompson, Colo.	Oct. 28	Furnishing one 50-ton and one 25-ton traveling cranes for Granby pumping plant.	Cyclops Iron Works, San Francisco, Calif	75,066.00
1930	Boise, Idaho	Oct. 27	Construction of concrete check, Black Canyon Canal	Vernon Brothers Co., Boise, Idaho	28,118.50
1941	Lewiston Orchards, Idaho	Oct. 10	Construction of Webb Creek Diversion Dam and concrete diversion pipe.	Hansen and Parr Construction Co., Spokane, Wash.	50,011.75
1942	Missouri Basin, Mont	Oct. 13	Furnishing structural steel, siding, doors, windows, etc., for warehouse, Canyon Ferry Government camp.	Caird Engineering Works, Helena, Mont	18,196.56
1951	Hungry Horse, Mont.	Oct. 30	Excavation for diversion tunnel, Hungry Horse Dam	Guy F. Atkinson Co., South San Francisco, Calif	613,400.00
1967	Central Valley, Calif	Oct. 21	Construction of 230-kilovolt transmission lines, Shasta to Cottonwood-Gas Point Road and Keswick tap lines.	Abbott Electric Co., San Francisco, Calif	587,383.00
2-R1	Minidoka, Idaho	Oct. 11	Earthwork, lateral lining, and structures for laterals	Duffy-Reed Construction Co., Twin Falls, Idaho	91,670.50
3-R1	Deschutes, Oreg.	Oct. 22	Construction of Cove Power Plant diversion dam	Alder Construction Co., Madras, Oreg	24,120.00
A 7091-A	Davis Dam, Ariz.-Nev.	Oct. 20	Furnishing aluminum conductor for Davis-Hoover and Davis Prescott-Phoenix 230-kilovolt transmission line.	General Cable Corp., Kansas City, Mo	803,014.37

CONSTRUCTION FOR WHICH BIDS WILL BE INVITED DURING DECEMBER 1947

Project	Description of work or material
Boise-Payette, Idaho.	Construction of earthwork and structures for Sand Hollow wasteway.
Do	Construction of earthwork and structures for Willow Creek wasteway.
Boulder Canyon—All-American Canal, Calif.	Construction of structures for distribution systems in East Thermal and North Indio areas, Coachella division.
Do	Construction of Wasteways Nos. 2 and 3 for flood protective works, Coachella division.
Central Valley, Calif.	Construction of earthwork, lining, and structures for 14.5 miles of Friant-Kern Canal.
Do	Construction of earthwork, lining, and structures for 13.6 miles of Delta-Mendota Canal.
Do	Construction of earthwork, lining, and structures for 17.2 miles of Friant-Kern Canal.
Colorado-Big Thompson, Colo.	Construction of earthwork, lining, and structures for 10 miles of Horsetooth Feeder Canal, including a diversion dam on Big Thompson River, a 1-mile tunnel, 12 concrete siphons, and 1 steel siphon.
Missouri Basin—Frenchman-Cambridge, Nebr	Construction of earthwork and structures for 12.5 miles of Cambridge Canal.

NEXT MONTH

What Causes Gullies? **Is man responsible for the vast eroded badlands of the West, or is Mother Nature to blame? Geologist H. V. Peterson of the Geological Survey presents the latest findings on these and other pertinent questions.**

ALSO ***How To Conserve Irrigation Water Supplies,*** **by L. R. Fiock, Superintendent of the Rio Grande project in New Mexico-Texas.**

Our Back Cover

Cottonwood Creek, Idaho

Today's snow—next season's irrigation water supply. This scene of the Boise National Park area shows Cottonwood Creek on its way to Arrowrock Reservoir which stores irrigation water for the Bureau of Reclamation's Boise, Idaho, project.

The photo was taken by Phil Merritt, Region 1

(Continued from page 268)

saw edger, a cut-off saw, and a 30-foot set of live rolls.

The need for the mill can best be realized when you consider the vast quantity of heavy timber and lumber required in framing, sheathing and shoring concrete forms and in providing walers, segments, etc., illustrated by the requirements for the three draft-tube forms for Keswick Power Plant. Each draft-tube form required 30,000 board feet of lumber—a whole carload. In embedding these forms, and in subsequent concrete operations, more than 2,500 cubic yards of second-stage concrete for Keswick Power Plant have been placed according to schedule.

Likewise in Shasta power plant, where two 75,000 kilowatt generators, loaned to Grand Coulee for 33 months during the war, are being installed, large quantities of lumber are required. For instance, unit No. 5 alone took more than 55,000 board feet of timber and lumber. Similarly, work on Unit No. 2, the other installation being made at the present time, requires large quantities of lumber, much of it in large dimensions. Despite these heavy demands, work is proceeding in an orderly and scheduled manner although lumber shortages in the market still continue.

These major construction features can move along only if a host of minor related features are completed according to schedule. For example, the lack of the relatively small quantity of 30,000 board-feet of lumber would have delayed the building of Shasta switchyard footings or steel tower footings on the Oroville-Sacramento 230-kv transmission line now under construction by the Bureau. In addition, lack of lumber for bridges, access roads, scaffolding, ladders, etc., would have made smooth coordination and integration of over-all construction progress quite difficult.

But once again, "Joe McGee" did the job.

In the final month of operations the sawmill produced 116,330 board feet of lumber and timbers of various dimensions for use on the project. ●

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ottonwood Creek, Idaho

Bureau of Reclamation Photo