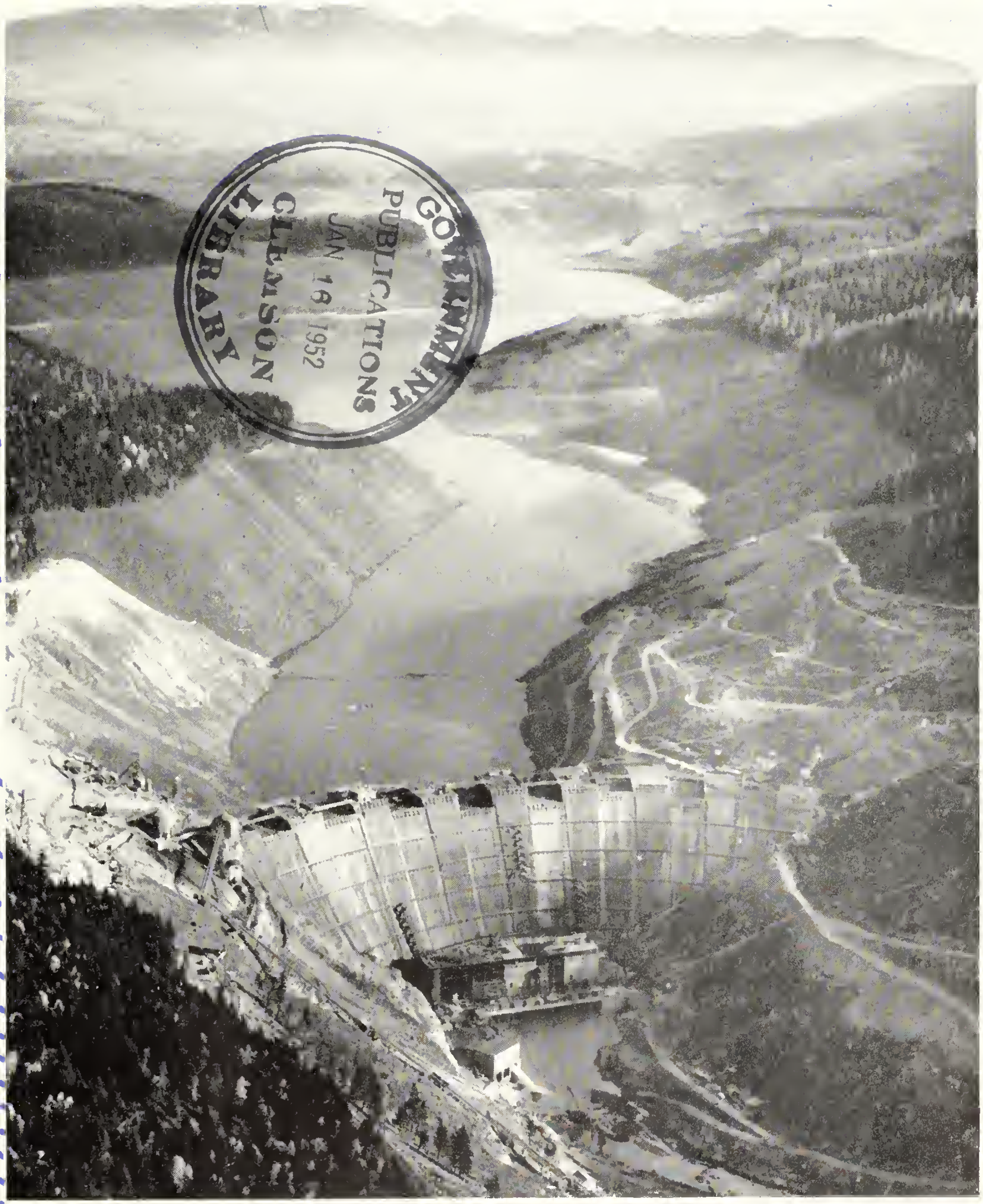
The Reclamation ERA

January

1952



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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

The second largest water hole in the Pacific Northwest began to take shape last September 21 when steel stop logs were dropped into a 12-yard-diameter diversion tunnel to block the flow of the South Fork of the Flathead River near Kalispell, Mont., creating Hungry Horse Reservoir, in back of the Hungry Horse Dam. It will be exceeded in capacity only by the F. D. Roosevelt Lake in Washington. When full the lake will be 3½ miles wide, 34 miles long, and 500 feet deep at its deepest point. Hungry Horse Dam, key feature of the project, now towers 424 feet in the canyon with 140 feet to go by the end of the 1952 construction season. Photo by A. E. McCloud, Hungry Horse Photographer, Region 1.

35 YEARS AGO IN THE ERA

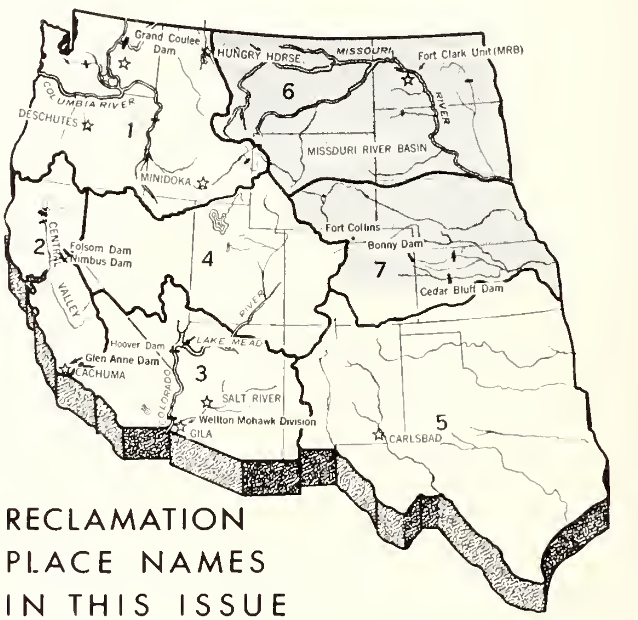
NEW YEAR GREETINGS TO OUR WATER USERS

From Arthur P. Davis, Director and Chief Engineer

The men and women who by toil, privation, and perseverance are creating homes and communities in the desert are adding to the strength and wealth of the Nation, and the most effective cooperation to this end is my highest ambition. I wish the water users for the coming year the great success and increasing prosperity which their heroic efforts have earned.

(From page 2 of the January 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

In 1952—35 years later—Commissioner Michael W. Straus sends his greetings for a Happy, Prosperous and Peaceful New Year to the members of the growing Reclamation family, who live not only in the former western deserts of the United States, but in other parts of this great country and all over the world.



RECLAMATION PLACE NAMES IN THIS ISSUE

FARMS WILL FLOURISH on land like that at left where Ian Briggs, Maurice Langley (Bureau of Reclamation), and C. O. Stanberry (Bureau of Plant Industry, Soils and Agricultural Engineering) plan a development farm next year. Below, the Gila flood of August 29, 1951, after a dry 10 years. *Photos by Samuel B. Watkins, Region 3 photographer.*

WATER for the WELLTON-MOHAWK

PART ONE—PAST AND PRESENT

by A. B. WEST, Supervisor, Operation and Maintenance Division, Region 3 headquarters, Boulder City, Nev.

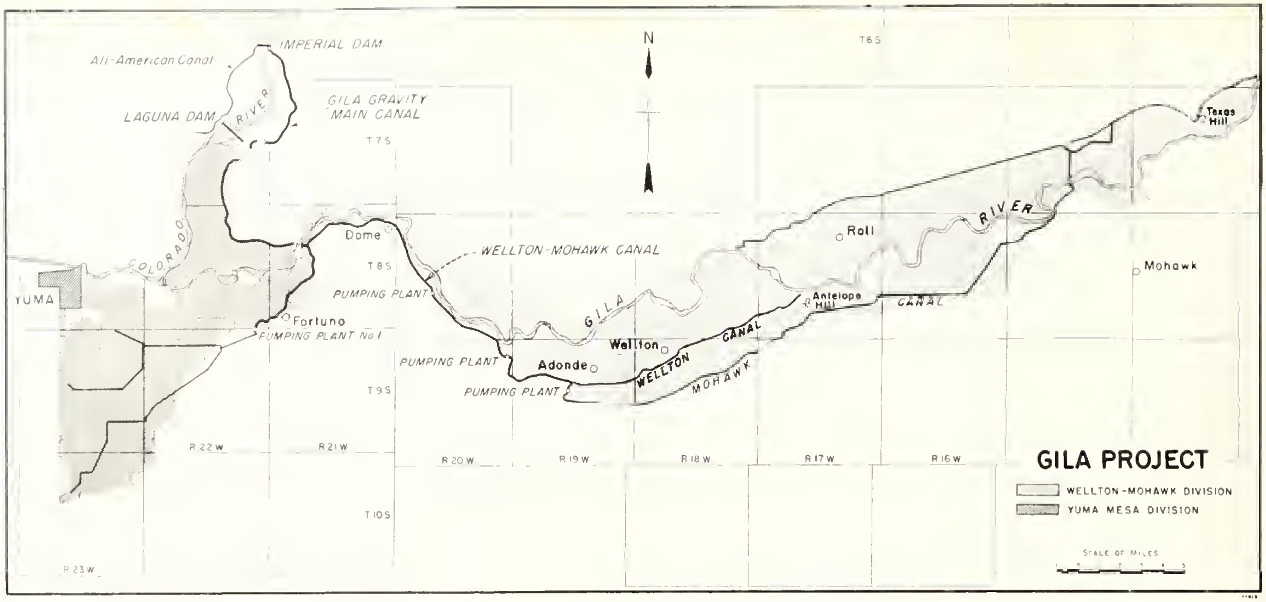
THE WATER WAS GETTING SCARCER every year. And the scarcer it got, the saltier it became. Livestock and people wouldn't drink it—neither would most plants. Farms went out of production. Those that were left narrowed their operations to plants that could subsist on the brackish water.

This describes the situation faced by farmers in southwestern Arizona's Wellton-Mohawk Valley during the past decade. Until last summer's cloudbursts up and down the river, the Gila had carried no water into the valley since the big flood in 1941, and there had been no sweet water to recharge the underground supply and leach the soil. Irrigation from the dams upstream from the Wellton-Mohawk Valley on the Gila and its tributaries and from hundreds of wells has dried up the lower end of the river, which joins the Colorado about 11 miles northeast of Yuma, Ariz.

Except for a few well-kept farms fortunate enough to have usable water, the Wellton-Mohawk Valley presents a lonely scene. There are miles of dried-up ditches with their abandoned concrete box turnouts reminiscent of tombstones. Dead mesquite trees, their roots deserted by the falling water table, add to this oft-repeated drought story of Western agriculture. Where lush fields of alfalfa once thrived, only the hardiest of desert shrubs and weeds remain. White salt deposits, glistening beneath a blistering desert sun, explain all too vividly what has happened.

But only the vegetation is dead on these lands which once were fed with sweeter water. The ditches again will carry water when the Bureau of Reclamation places the Wellton-Mohawk canal system in operation early this year. New lands will be cleared and leveled until within a few years up to 75,000 acres will be in crops, never to be threatened by lack of water or by water too salty for crops or man or beast.

When John C. Fremont visited the area around 1850, on one of his early trips, he reported that the Gila was navigable as far as Antelope Hill, about the middle of the present Wellton-Mohawk development. Establishment of the Butterfield stage line brought the white farmer to the valley in the 1850's, and by 1875 a number of homestead



LIFELINES FOR THE WELLTON-MOHAWK VALLEY—The map shows where the ditches again will carry water when the Bureau of Reclamation places the Wellton-Mohawk canal system in operation early this year. New lands will be cleared and leveled until within a few years up to 75,000 acres will be in crops. ***Map by Drafting Section, Washington, D. C.***

filings had been made on river bottom lands around the present towns of Wellton and Roll, Ariz. During the eighties, gravity canals were built to irrigate several thousand acres. The fertile lands, enriched by centuries of river alluvial deposits, were highly productive and the farmers prospered. Then came the floods in the fall of 1890 and spring of 1891. Diversion works at Texas Hill near the upper end of the area were washed out and the course of the river moved nearly a mile to the south. The Antelope Valley heading further downstream was destroyed, and 31 miles of the Southern Pacific Railroad were washed out. The great Arizona drought from 1898 to 1904 almost dried up the Gila. In 1905 the river again flooded with resulting damage to irrigation works.

The Antelope Valley Irrigation District, organized in 1906, rebuilt the Antelope canal and constructed a wood-burning steam-electric generating plant at Wellton to pump water from the river into the canal near Antelope Hill. The transmission line from the plant to the pumps was the first to be built in Yuma County.

The first wells were drilled around 1915 by several of the settlers who believed that wells would provide a cheaper and more reliable source of water than the river. Successful farming during the years that followed resulted in the drilling of more wells. Increased demand for electricity to drive the well pumps led to the formation in 1921 of the Gila Valley power district, encompassing 97,000 acres of land. Organization within the power district of the Mohawk municipal water conservation district followed in 1923, consisting of approximately 18,500 acres. During this period about 50 large irrigation wells were drilled and about 9,000 acres cleared and leveled. By 1928, over 5,000 acres were in crops and in 1931

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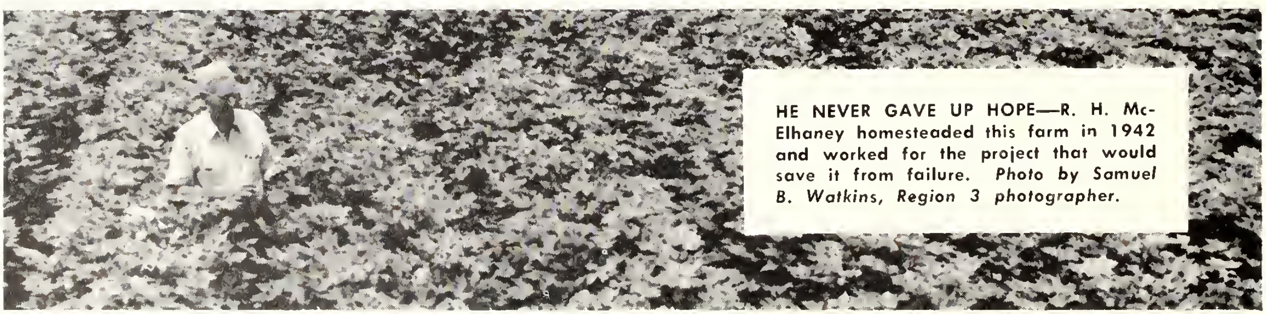
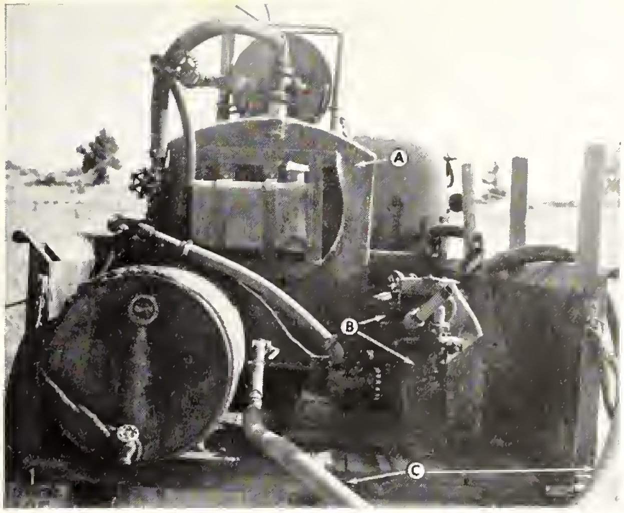
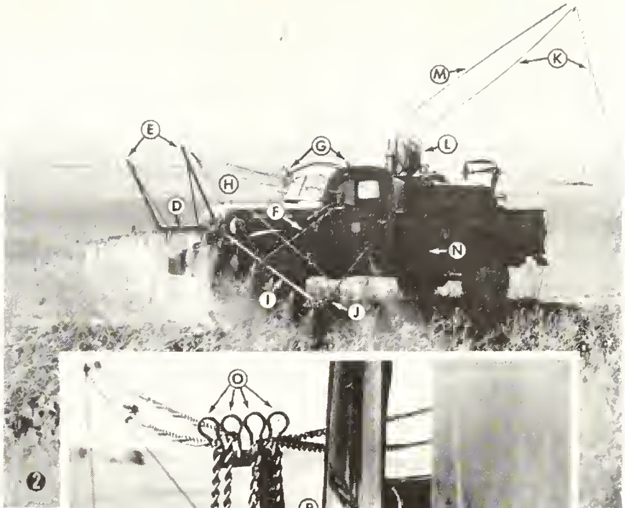


HE NEVER GAVE UP HOPE—R. H. McElhaney homesteaded this farm in 1942 and worked for the project that would save it from failure. ***Photo by Samuel B. Watkins, Region 3 photographer.***



REAR VIEW—Just behind the cab is a 200-gallon tank for the spray solution (A). The 25-gpm pump and air-cooled engine are at lower right (B). The 2-inch diameter suction hose (C) for quickly refilling the spray tank with water from a ditch can be handled simply by the operator who turns two valves, and the pump either refills the tank or forces the mixed spray solution to the boom line. At left, with the spigot over the tail of the truck bed, is a 50-gallon drum of concentrated chemicals. *All photos on this page by Phil Merritt, Region 1 photographer.*



DESCHUTES' "WEEDMOBILE"

A HOME-MADE ADJUSTABLE, ADAPTABLE, FREE-WHEELING, DRIVER-OPERATED ditchbank weed spraying machine has joined the artillery against weeds on the 50,000 acre North Unit of the Deschutes project in Oregon.

This new machine was developed by members of Jefferson County, the Extension Service, the Jefferson County Seed Growers Association (representing the Deschutes farmers), the Soil Conservation Service and the Bureau of Reclamation. People from these groups joined forces to wipe out the weeds before they got a chance to harm the world-famous certified Ladino Clover seed crop (see article entitled, "Deschutes Does It Again," on page 92 of the May 1951 Reclamation Era.)

Their four-point weed eradication campaign includes (1) seeding canal and lateral rights-of-way with desirable pasture grasses, (2) installing stock guards to encourage fencing and pasturing, (3) treating patches of noxious weeds like Canadian Thistle, Morning Glory and White Top with sodium chlorate, and (4) applying 2,4–D to stub-

IN ACTION (top of page)—The 32-foot, five-section spray boom is supported by a steel frame (D), attached to the front bumper. Uprights (E) support the pulleys for the ropes which raise or lower the side sections of the boom. Guy ropes (F) from each side of the cab hold the boom at right angles to the truck so that if the side sections bump against a fence post, high bank, or other obstruction they can swing backward without damage, the tension from the supports, ropes, and pulleys permitting the boom to brush past the obstacles and resume their former position. A steel rack (G) supports the spray boom when not in use. Swivel connections (H) for the side sections (I) permit them to swing from the carrying to an operating position and to be raised or lowered as needed when spraying. Wing sections (J) are hinged so they can be tipped up or down to conform to the contour of the ground or side slopes of ditchbanks. The hand boom has a 150-foot-long ⅜-inch hose line (K), wound on a reel (L), and supported by a 10-foot swivel mast (M), to keep it clear of the rig when in use. A 50-mesh line screen (N) prevents clogging of spray nozzle from the main supply line. From the supply line there is also a hose bypass back to the supply tank to regulate pressure at the control manifold which also acts as an agitator to maintain constant mixing of the spray solution.

DRIVER'S CONTROLS (inset)—The four ropes which raise and lower each section of the boom are attached to short sections of chains to allow quick adjustment by means of metal clips (O) which hold the chain links firmly in place. The clips are supported by a metal frame (P) mounted on the cab. To control the spray solution to each section of the boom (including the hand boom), valves (Q) are mounted in a manifold, connected by ⅜-inch hose lines to the separate boom sections. A 1-inch hose (R) is the main supply line from the pump to the manifold.

born weeds which appear year after year—willows, sweet clover, sour dock and scattered noxious plants.

It is a big job, particularly when you realize that there are 300 miles of canals and laterals on 1,550 acres of rights-of-way in the distribution system of the North Unit. However, the farmers figure that in two or three years the pasture grasses in the "Point One" program will crowd out most of the troublesome annual weeds like Russian thistle and mustard, thus making their "Point Four" program easier—although some spraying will still be necessary to control the sweet clover, willows and other ditchbank weeds.

Giving the weeds a good spray of 2,4–D at the right time stops them in their tracks, cuts out the costly job of removing dried up weeds before the irrigation season, and saves money. During 1949 and 1950 annual weed costs at Deschutes' North Unit dropped 25 percent for the sections sprayed with 2,4–D. Thus the importance to the weed eradication campaign of the new machine for spraying ditchbanks.

In 1949 the men in the Bureau's project shop constructed a spray unit which they mounted on an army-type 4-wheel-drive pickup truck. They hooked up the unit with a fire pump of 50 gallons per minute capacity, powered by a 5 horsepower air-cooled gasoline engine to furnish the pressure.

The spray solution was carried in a 100-gallon tank mounted on the truck bed. Making the unit even more compact, the truck also carried a 20-gallon drum of concentrated chemicals which could be mixed with water and fed into the spray tank when the crew ran out of spray solution while on the job.

The workmen constructed a 36-foot spray boom in three sections, so that the two outer sections could pivot vertically and horizontally. They then mounted the middle section on the truck's bumper. To make certain that no weeds escaped in spite of the mobility of the "side arms" of the bumper spray boom, the crew added a hand boom with a hose line 150 feet long for sharp-shooting, or scouting weeds beyond the range of the bumper-mounted boom. They constructed special valve controls on the truck cab so the driver could spray from any one, or all sections, at the same time.

But the one unit was not enough to allow the crews to cover all the weeds at the proper stage of growth to prevent their spread and to eliminate the necessity of clearing away dry weeds. So, early in 1951, under the supervision of the project manager and the irrigation supervisor, the shop foreman went to work again, this time making several improvements over the first rig.

The second unit was mounted on a 4-wheel drive, 1-ton "power wagon" to assure plenty of traction and power when needed, and had a 25-gallon-per-minute bronze gear pump (which experience had shown to be adequate for the job) instead of the 50 gpm pump on the first unit. This pump, like the first one, was run by a 5-horsepower motor. However, the capacity of the spray tank was doubled—a 200-gallon tank being used, and a 50-

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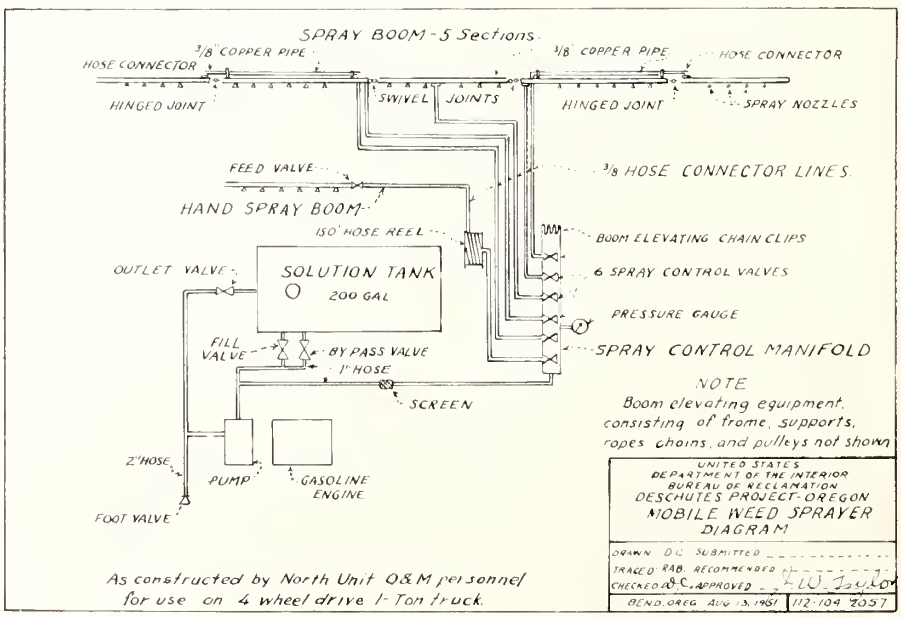
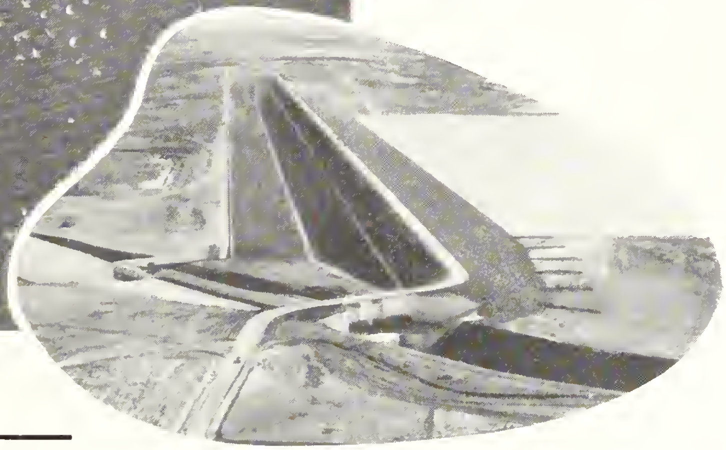
MAKE YOUR OWN "WEEDMOBILE". If your fields are level, you could build your own mobile weed sprayer from the diagram at right. You could even use this rig for treating your crops for weed, insect, and disease control. If your fields are bumpy or irregular, however, write to the Construction Engineer, Deschutes project, at Bend, Oreg., for information on the boom-elevating equipment to make your rig flexible and damage-proof.





A "BONNY" REFUGE for waterfowl has been created in Colorado. At left, part of the estimated 13,000 ducks which made Bonny reservoir their home last November. Below, a bird's-eye view of the dam, looking south. *Photo at left by John N. Berg, Region 7 photographer. Photo below by the Utah Construction Company.*

BONNY DAM— A BARGAIN

by N. BETH WOODIN

Kansas River District, Indianola, Nebr.
Region 7 (Headquarters at Denver, Colo.)

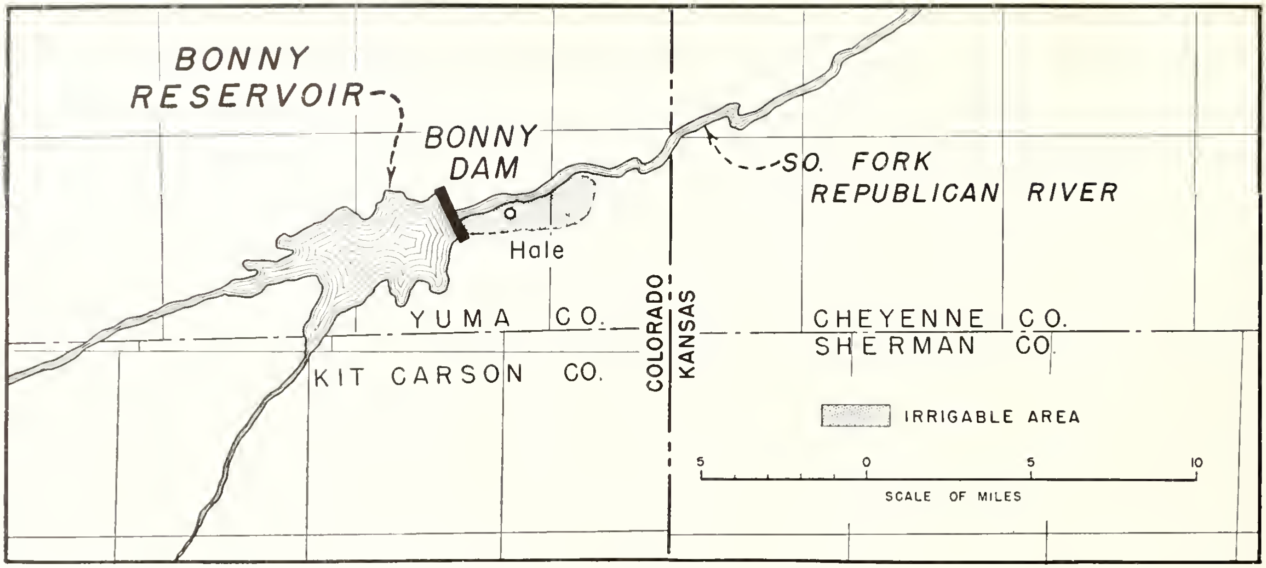
This is the story of a bargain—the story of how four million dollars and a year and a half of time were saved in building a dam for the people of the United States.

Bonny Dam, located on the South Fork of the Republican River near the little town of Hale, Colo., was completed and accepted by the Bureau of Reclamation on May 4, 1951, 521 days ahead of schedule, at a cost of $13,000,000. The estimated cost prior to the opening of bids was $17,047,000.

Much of the credit for this phenomenal accomplishment is due the principal contractor, the Utah Construction Company of San Francisco, Calif., with its staff of highly efficient, energetic, and resourceful key personnel. During the first full year (1949) of construction, the Utah Construction Company accomplished 43 percent of the contract work on what was scheduled to be a 4-year job. In so doing, they established several new records for earth work on Bureau of Reclamation projects, excavating over 1,000,000 cubic yards of material a month for 4 consecutive months, with a maximum of 1,334,000 cubic yards in November, and placing over 1,043,000 cubic yards of embankment material the same month.

There were two principal reasons for the saving accruing to the United States in the construction of Bonny Dam. One was the unique methods developed by the contractor which enabled him to submit an extremely favorable bid for the job. The other was that the completion of the work almost a year and a half ahead of schedule substantially reduced the administrative cost to the Government.

Bonny Dam, the principal feature of the St. Francis Unit of the Missouri River Basin project, is situated about six miles west of the Colorado-Kansas State line. It was designed by the Bureau as a multiple-purpose structure providing for irrigation, flood control, silt storage, and other benefits. Although the irrigation phase of the project was determined to be in conflict with existing agreements between the States of Colorado, Kansas, and Nebraska covering the distribution and utilization of the water of the Republican River and its tributaries, Congress appropriated funds in 1948 for the construction of Bonny Dam primarily for flood control. Studies are now essentially completed to determine the most practicable plan for development of the irrigation potentialities without violating existing agreements between the three States.



WAITING FOR A TRI-STATE AGREEMENT covering the distribution and use of Republican River's water is the shaded area around Hale, Colo. In the meantime Bonny Dam, principal feature of the St. Francis Unit of the Missouri River Basin, provides flood control, fish and wildlife, and recreation benefits. *Map by Drafting Section, Washington, D. C.*

Storage of the runoff of the South Fork of the Republican River in Bonny Reservoir will ultimately provide irrigation for 7,000 acres, of which 5,200 acres will be in Colorado, and 1,800 acres in Kansas. The major portion of the area to be irrigated in Colorado is located on a high terrace and will require a pump lift of about 150 feet to divert water to these lands. The lands to be irrigated in Kansas, however, will be mainly valley lands that can be reached with a gravity flow canal.

Bonny Dam is situated in a semi-arid region of the Great Plains normally deficient in precipitation and subject to recurring drought and hot, dry summer winds. The area is also subject to occasional storms of great intensity which transform its normally quiescent streams into raging torrents of destruction. Of the 175,000 acre-feet of storage capacity in the reservoir, 132,000 are allocated to flood control, with the remaining 43,000 reserved for irrigation and silt retention.

The dam is a rolled earthfill structure rising 128 feet above the river bed. It is aproximately 3,200 feet long and over 8,554,000 cubic yards of embankment material were used in its construction. A roadway 30 feet wide was constructed along the dam crest, with a bridge spanning the concrete spillway opening at the north abutment. Rock riprap was used for the protection of the upstream face of the dam, and the downstream slope was protected by seeding the enbankment with a mixture of crested and western wheatgrass, biennial yellow sweet clover, and barley. A gravel-surfaced road three miles long was constructed to provide access to the dam from the north.

Bonny Dam was selected by the Bureau as the site of an upstream embankment protection experiment designed to lower costs for this type of work. A test embankment section was constructed on the south shore of the reservoir about two-thirds of a mile upstream from the dam. Because of the high cost of rock suitable for riprap ordinarily used in upstream embankment protection, Bureau engineers had been experimenting for over two years with a number of substitutes for rock. The results of this research indicated that the two most promising materials were standard (compacted) soil-cement and hot-mix asphaltic-concrete. These materials were used in the test section. It is too early at this date to predict the success of the experiment: it will take years of exposure to freezing and thawing, wind and wave action, and other adverse conditions before its success can be determined.

Reservoir clearing operations were completed in April 1950 and storage of water in the reservoir was begun in July of that year. The reservoir now forms a lake more than three miles long and a mile wide and covers 1,620 acres. It has a shoreline of 10½ miles. When the lake is filled to normal capacity, it will be about 3½ miles long and 1¼ miles wide and will cover 2,042 acres. The shoreline will be 14 miles and the lake will be about 55 feet deep at its deepest point.

Bonny Reservoir is 75 miles from the nearest body of water of comparable size, and it is expected that the area will be used extensively for recreational purposes. Approximately 27,000 people live within the area the reservoir is expected to serve. Already large flocks of ducks and geese have stopped at the reservoir in the fall and spring and the area gives evidence of becoming a hunter's paradise. Recreational and wildlife development is under way and additional work is planned for the future. A swimming beach and a boat launching ramp have been completed, and access roads to the public recreational area have been gravelled. Trees and shrubs have been planted in the recreational area and seedling trees in the sites selected for wildlife habitat development. Construction of facilities for the public recreational area were completed in December 1951. The Colorado State Game and Fish Department has stocked the reservoir with about 100,000 fish, principally bluegills, bass, and drum.

A memorandum of understanding between the Bureau of Reclamation, the Fish and Wildlife Service, and the National Park Service of the Department of the Interior and the Colorado State Game and Fish Department is being negotiated, under the terms of which the land and water surface of the reservoir area will be administered, operated, and maintained by the Colorado Game Department. Operation of the reservoir area by the Game Department will start in the spring of 1952. This will be the first area in the Missouri River Basin on which such a coordinated reservoir management plan has been developed and an agreement has been worked out whereby a State game commission has administrative control over the management of the land and water-surface area of an entire federally owned reservoir.

Under the terms of the memorandum of understanding and a specific lease, the Colorado Game Department will administer the recreational area, the private cabin site area, the organized club camp area, and all agricultural and grazing lands in the reservoir area. Also under the terms of the agreement, the Game Department is charged with the enforcement of Federal and State game and fish laws in the area. Cleland N. Feast, director, Colorado State Game and Fish Department, 1530 Sherman Street, Denver, Colo., and Robert Poley, Wildlife Technician, Bonny Dam, Burlington, Colo., can be contacted regarding any phase of the management of the reservoir area. THE END.

Deschutes' "Weedmobile"

(Continued from page 4)

gallon supply barrel made it possible to carry more than twice the amount of concentrated chemicals than the first unit. The business end of the rig—the spray boom—was 4 inches shorter than the first one, and had five sections, instead of 3, making it more flexible and adjustable. This unit, as can be seen in the accompanying photos and drawing, retained the hand boom with 150-foot-long hose, and valve controls for the truck driver. Other features of the "homemade" spray rig are indicated in the illustrations.

The pump and gasoline motor mounted on one base, and the tank with valves and fittings are all connected with hose lines, so the equipment can be quickly removed and stored and the vehicle can be used for other purposes during the nonspraying season.

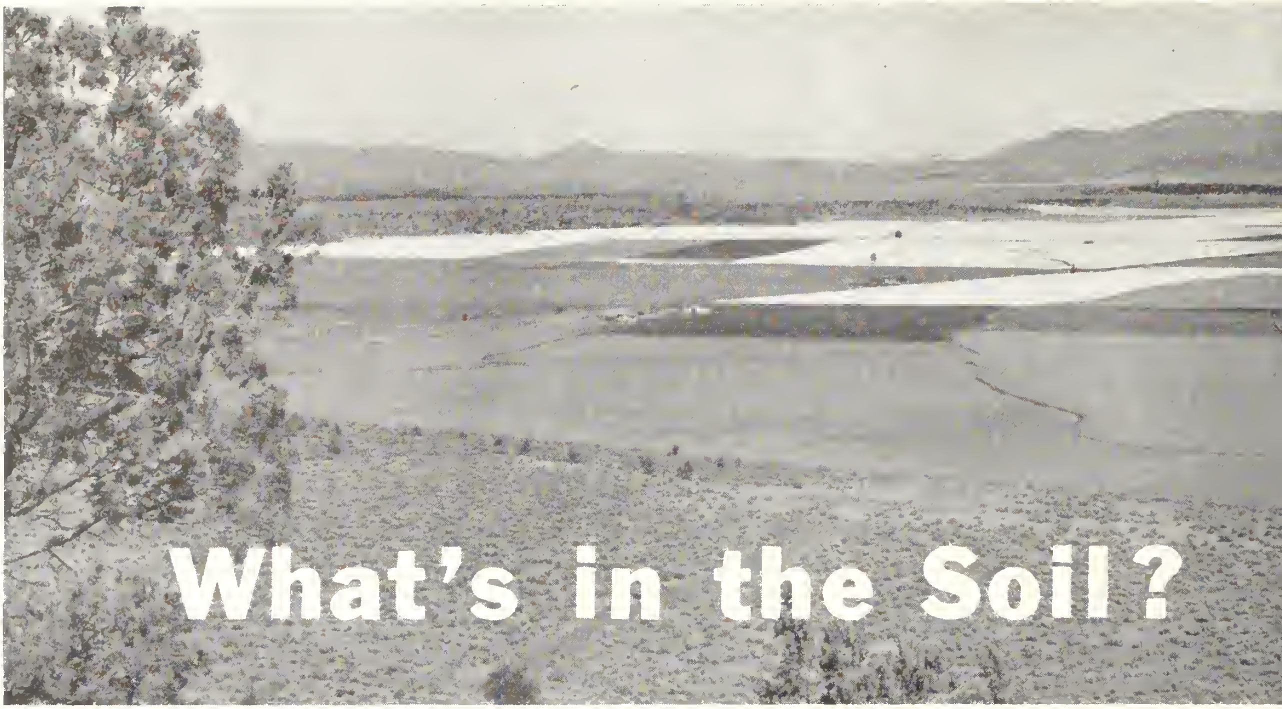
Much of the material used in the construction of these two units was on hand in the project warehouse. The estimated cost of the second unit was $450 plus the vehicle. It is believed that a similar unit could be built in a shop using new materials for no more than $650. THE END.

Glen Anne Dam Scheduled for Construction

Secretary of the Interior Oscar L. Chapman announced on October 31 that a contract for construction of the Glen Anne Dam on the Cachuma project in California had been awarded to L. A. and R. S. Crow of El Monte, Calif.

The 250-foot-long and 102-foot-high earth-fill structure will provide a regulating reservoir for Santa Ynez River water to be brought from Cachuma Dam and Reservoir through the 6.4-mile Tecolote Tunnel to irrigate almost 30,000 acres of land near Santa Barbara and furnish 10,300 acre-feet of municipal water to the City of Santa Barbara annually. The distribution will be made via a 28-mile South Coast Conduit.

The primary purpose of the Cachuma project is to provide additional irrigation water for the Goleta, Montecito, Summerland and Carpinteria water districts where the present drain on the underground water supply threatens salt water intrusion which may cause one-third of the irrigated land to revert to dry-land status. The project is also designed to provide a municipal water supply which will permit the orderly expansion of the City of Santa Barbara. •



What's in the Soil?

by E. N. POULSON, Soil Scientist, and
L. R. SWARNER, Irrigation Engineer,
Boise, Idaho, Region 1 headquarters

(Part one in a series of articles on soils and land classification.)

MUCH OF WHAT WE KNOW about the management of soils was known long ago. It was acquired little by little and handed down through the years from father to son, from man to man, and from nation to nation. But only in the last hundred years have people made a concerted effort to delve into the science of that thin layer of the earth's crust that supports life almost endlessly. Progressively, and especially in the last few decades, as has been true of all sciences, soil science has engaged the attention of an increasing number of researchers and a vast amount of knowledge is being accumulated.

A productive soil is not a haphazard mass of mineral particles, such as sand, silt, and clay. It consists of both organic and mineral matter more or less orderly arranged—structurally organized particles between which are cavities and channels filled with organic matter, air and moisture. The latter are necessary for the microscopic and other life which inhabits the organic and mineral matter and performs an essential function in the link

"THAT THIN LAYER OF THE EARTH'S CRUST" . . . must be kept in gaad conditian ta produce crops. Inset ot right, undergraund wealth in the farm of bacterio-inoculoted cowpeos with nitragen-packed raat nadules—necessary far lush, deep-green plont growth. At lawer left, on opposite poge, a patentiolly praductive soil "with orgonic ond minerol motter mare or less arderly orranged." Note crumblike structure at tap, and blocklike orrangement belaw. *Scenic phato by Phil Merrit; soil photo by Stan Rasmussen, bath Regian 1 photographers. Drawing by Llayd Chellmon, Graphics Sectian, Washingtan, D. C.*

between the soil and the vegetation that lives upon it.

It is obvious that without plant life there would be no animal life. But it may be more difficult to realize that the soil which supports the plant life depends upon climate, vegetation, the lay of the land, parent rock, and time. These factors determine the makeup of the soil and how much plant life it is able to sustain. It takes ages for nature to sculpture mountains or hills, build plains and valleys. In the same way nature slowly but thoroughly molds or conditions geologically weathered mineral fragments of sand, silt, and clay into a dynamic, natural body capable of providing a constant supply of life-sustaining nutrients for plant growth from its mineral and organic makeup. Certain features of this natural body are most significant in producing crops, yet are the most difficult to recognize and evaluate. For instance, a handful of soil teems with millions of beneficial bacteria and molds which live on organic matter. They play an important part in producing compounds that contain the elements needed by plants in such a form that they can be taken into the plants by the roots. If this surprises you, remember that many of our modern wonder drugs come from the soil. Molds taken from the soil produce commercial quantities of penicillin, streptomycin, and other wonder drugs, not yet too well known, that daily save hundreds of lives.

Soil Nitrogen and Organic Matter

The progressive farmer is well aware that lush, deep-green plant growth means plenty of nitrogen in his soil, but he may not know how closely this supply is linked with the activity of the soil's micro-organisms, or minute animal life. Many farmers would be astounded—and who wouldn't be—to know that agricultural chemists have estimated by computation that the air above every acre of land contains about 35,000 tons of nitrogen, which would, if converted into commercial fertilizers, have a value as high as 5 million dollars or more. Although people have learned how to transform gaseous nitrogen into forms useful for

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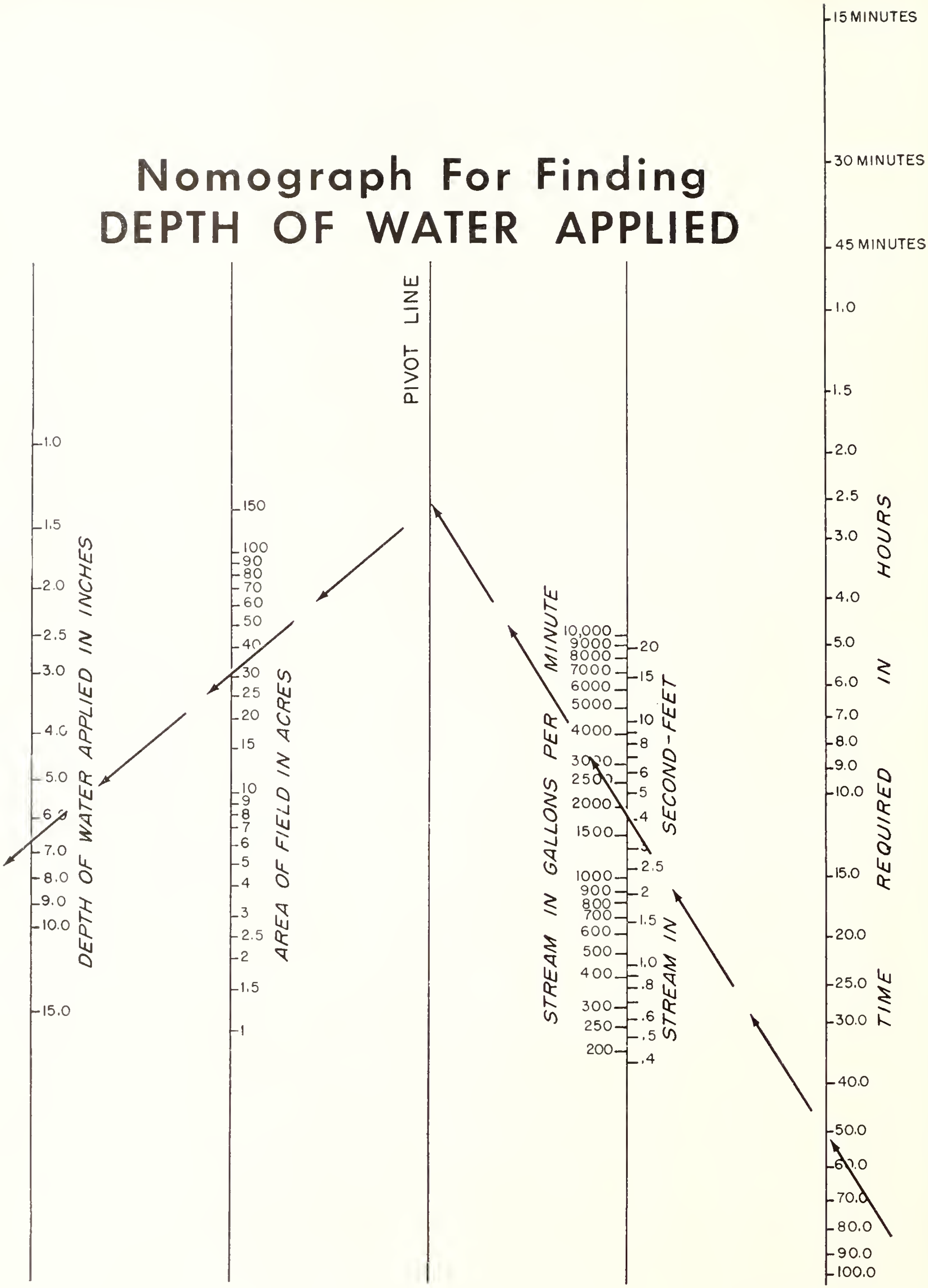
Nomograph For Finding
DEPTH OF WATER APPLIED



OF TIME AND WATER

by JAMES GARTON, Assistant Professor, Oklahoma Agricultural Experiment Station; and JIM HOWELL, Associate Agricultural Agent, Jackson County, Oklahoma

How often have you asked yourself, "Am I using the right amount of irrigation water for my crop? Am I running the water too long? Am I wasting water or time?"

Every irrigation farmer knows that when too much water is applied, some will either move downward through the root zone, leaching out valuable plant food on the way or cause too much surface run-off, or do both. He also knows that if he does not apply enough water to thoroughly wet the root zone of his plants, the crop will suffer before the next irrigation.

Here is a nomograph which can give you the answers to these questions, and help you to find out whether you are using too much or too little water on each field and thereby control your irrigation deliveries so that you will use only the amount of water required for a good job.

The nomograph has four scales. Reading from left to right they are: (1) depth of water applied in inches, (2) size of field in acres, (3) rate of water delivered in gallons per minute or second-feet, and (4) time required in hours. If you know three of these quantities, you can determine the fourth. In the example shown, the farmer wants to know how much water he is applying to his field—how many acre-inches of water per acre his crop is getting.

He has ordered water for 50 hours at a rate of 4 second-feet for his 31-acre field. (Technically, a second-foot of water means one cubic foot of water per second. In round numbers this is equal to about 450 gallons a minute. It is a rule of thumb that a stream of one second-foot is equal to one acre-inch of water per hour.) This hypothetical farmer locates 50 hours on the time scale on the far right, and 4 second-feet on the second-feet scale. He places a straight edge through these points, and marks where it crosses the pivot line. From this point on the pivot line, he places the straight edge through 31 on the acres scale and finds that it cuts the inches scale at about 6.5 inches. Therefore, he is applying an average depth of approximately 6.5 inches to the 31 acres.

Now, supposing this farmer is irrigating sugar beets. Like all irrigation farmers he knows the depth of his crop's root zone, which is about 3 feet. From his county agent he learns that the type of soil on his 31 acres will hold water at the rate of 1 inch for every foot of depth. He should, therefore, apply a depth of 3 inches or 3 acre-inches of irrigation water per acre. Now he finds out he has been applying 6.5 inches—more than twice as much water as he needs!

To learn how much to cut down on water delivery, he turns to the nomograph again, working it the other way, from left to right, instead of from right to left. Placing the straight edge at 3, sliding it over to 31, and drawing a line through both, he finds the point on the pivot line. Shifting his straight edge to run from this point on the pivot line through the 4 on the "stream" line, he finds that it crosses the time scale at 22. Accordingly, he can shorten his time of water delivery to 22 hours.

Assuming uniform application of water, these scales on the nomograph will work the same for any field, irrigation stream and time period. It can be used for surface or sprinkler irrigation. Give it a chance to serve you. It may save you time, water, and money. The End.

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THE SALT LAKE AQUEDUCT

TWIN TERMINALS (1). Chlorination and control house (2), the Alp
Draper tunnel (3), Olmstead Tunnel (4), Deer Creek Dam (5), where
Salt Lake Aqueduct begins, the Weber-Provo canal (6), and the Duch
tunnel (7) are major features of this project, which more than doubles
water supply for the capital of Utah. Below, a high-pressure, plate-s
section of the Salt Lake Aqueduct. *Photograph of relief model of*
United States by Raisz and Brown, used by permission of the copyr
owners, Kittredge and Coolidge. Art work by Shirley Briggs, Grap
Section, Washington, D. C.

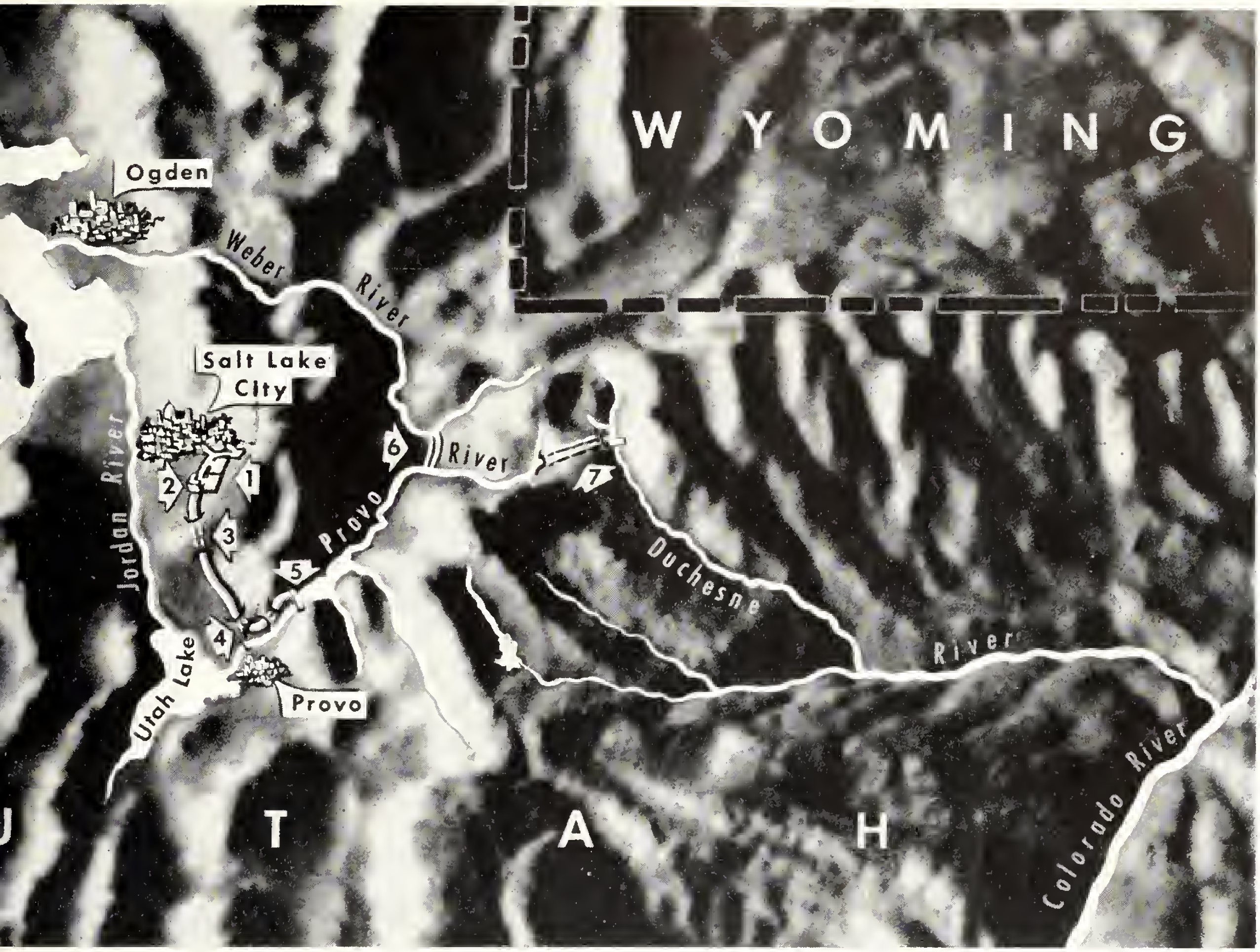
SALT LAKE CITY NOW HAS ALMOST TWICE AS MUCH WATER on tap as it has had during its 105 years of existence.

This water flows from two rivers beyond the Salt Lake Valley, even from the other side of the Continental Divide, merges at Deer Creek reservoir and takes off for a 41-mile journey through a "double jointed" pipeline called the Salt Lake Aqueduct to terminate in twin reservoirs near the southeast city limits of Salt Lake City.

Now the people of Salt Lake City and its suburbs, the farmers in the outlying districts, can turn on their faucets, sprinklers, or other water outlets with confidence, knowing that the water will gush forth when needed.

It was not always thus. Eighty-six years ago (on August 9, 1864 to be exact) Alderman Sheets stood before the Board of Aldermen of "Great Salt Lake City" and asked that artesian wells be bored "to meet the pressing wants of the citizens in watering their lots." This was done. But the "pressing wants of the citizens" grew as more and more people entered the historic valley settled by Brigham Young and his followers, commencing July 24, 1847. And the water supply did not increase. In fact, during the severe drought of 1934 it dwindled to alarming portions. At that time the mountain streams ran dry, and Utah Lake, which was supposed to hold water under exchange agreements from these self-same streams, shrank from 850,000 to 20,000 acre feet—less than one-fortieth its normal size.

The city fathers decided then and there that if there was not enough water in the valley, and never would be enough to meet the needs of the growing city, then water would have to be imported from the outside.



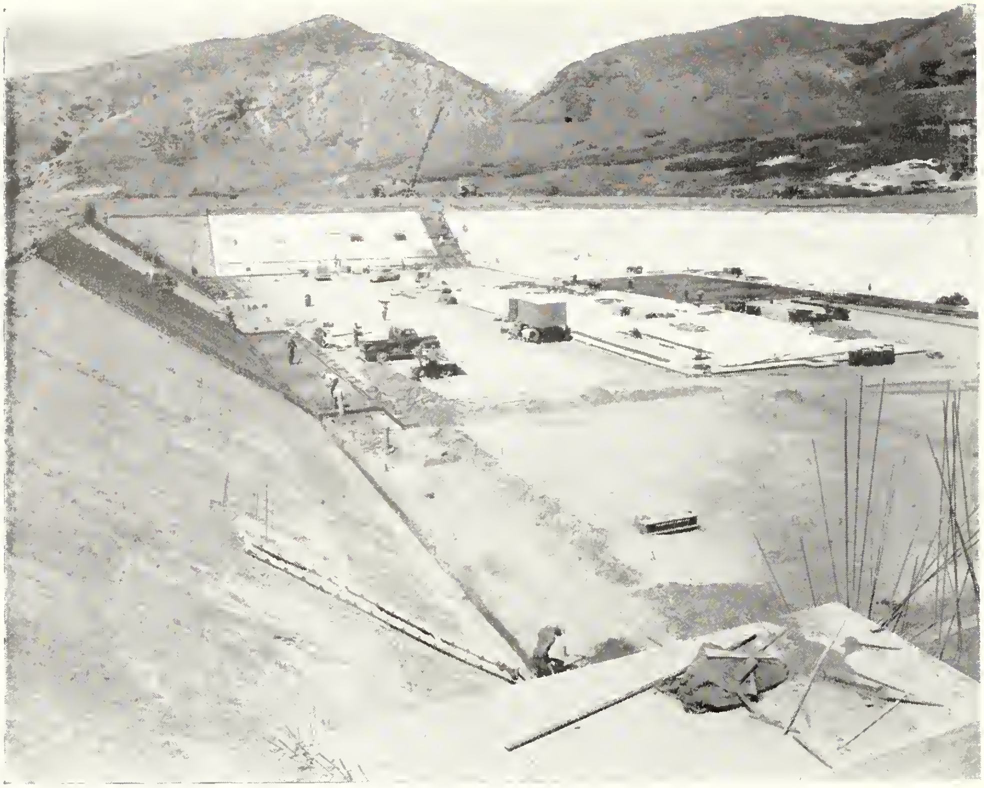
The Bureau of Reclamation in cooperation with the Water Storage Commission of Utah had been studying the area and had a plan for bringing water from the Colorado River basin to the Bonneville basin, merging the waters of the Weber and Provo rivers, storing them in Deer Creek Reservoir and distributing the flow to irrigate the rich farm lands east and north of Utah Lake. According to the plans, there would be enough additional water imported to take care of the needs of Salt Lake City as well as the irrigation farmers, and it would be possible to construct an aqueduct to carry the water to the city.

Here was water—but not for the asking. First, the Salt Lake City corporation applied for membership in the Provo River Water Users Association—the group formed to contract with the Government for repayment of the costs of building Deer Creek Dam and the structures which would carry the water from the other side of the mountains to the farms. The organization was completed on May 2, 1935. Next, the Metropolitan Water District of Salt Lake City was formed and approved by a majority of Salt Lake City electors on August 15, 1935. The city assigned its interest to the district which then had the responsibility of insuring an adequate water supply for Salt Lake City.

Only 3 months later, on November 13, 1935, the Secretary of the Interior (at that time, Harold L. Ickes) put his seal of approval on the project.

In his Finding of Feasibility for the Provo River project, Secretary Ickes found, among other things, that ". . . the furnishing of water for municipal, industrial, and miscellaneous purposes is necessary in order to avoid the further encroachment, for these purposes, upon the present irrigation supply for farm lands."

In other words, when the Provo River project was authorized, unless additional water supplies were developed to meet growing urban requirements, municipalities in the area would be forced to take water from the irrigated farms (exercising their preferential right to condemn irrigation wa-



NORTH TERMINAL—Placing concrete in No. 2 (north) reservoir of Salt Lake Aqueduct Terminal Reservoir. Parley's canyon main gateway to the east can be seen in the background.

ter for municipal use). Since the Provo River project was one of the first Federal Reclamation projects to provide water for municipal use, this justification may be unique in Bureau history. There is little doubt that it was unique at the time.

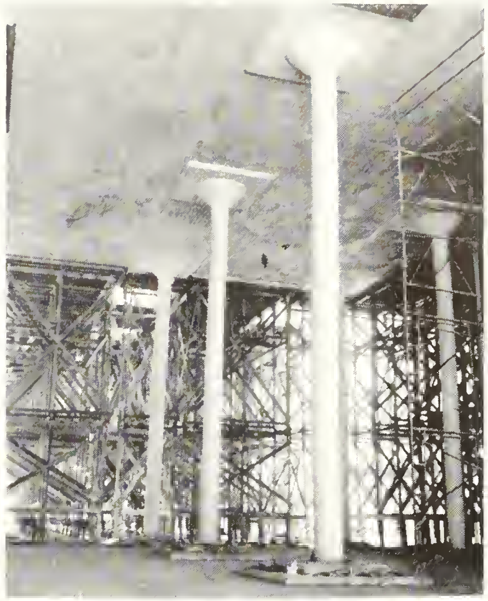
Another unique feature was the speed with which this Finding of Feasibility received Presidential approval—on November 16, 1935—only three days after the Secretary of the Interior affixed his signature to the document.

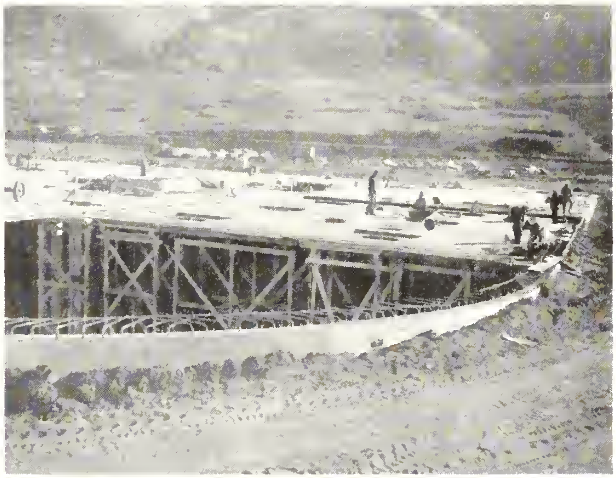
By the following spring, on June 27, 1936, the Provo River Water Users Association, of which the Salt Lake Metropolitan Water District is the largest shareholder, executed a contract to repay the costs of the Deer Creek Division of the Provo River project, including a dam and reservoir, within 40 years.

Two years later, on November 16, 1938, the Metropolitan Water District of Salt Lake City signed another, separate, contract providing for the construction of the Aqueduct Division of the project, paving the way for Utah's first multiple-purpose reclamation development, and making the Provo River project one of the first irrigation projects in the Bureau's history to be extended to supply a municipality with water found to be in excess of the project's irrigation needs.

In the meantime, construction had begun in March 1938, under a PWA allotment of $415,000. On December 22, 1938, a month after the Salt Lake Metropolitan Water District signed the contract for construction of the aqueduct, work was begun on the huge pipeline to the city. On January 13, 1939, a separate contract was let for construction of the Alpine-Draper Tunnel and Olmstead Tunnel, combined length 3.5 miles. The storage facilities were completed in October 1941. The remaining aqueduct construction was accomplished under seven additional contracts, and the last reach of the aqueduct was completed October 4, 1950.

Even before the pipeline's terminal was completed, the Metropolitan Water District of Salt Lake City assumed operation and maintenance of the aqueduct, taking over this responsibility on May 1, 1951. The twin-type 40-million-gallon terminal reservoir to regulate flows of the aqueduct into Salt Lake City mains will be completed by the time this issue goes to press, but during construction water flowed from the aqueduct into the city by one of three different routes: (1) bypassing the terminal reservoir and discharging into the existing Samuel C. Park reservoir, (2) bypassing the Samuel C. Park reservoir and discharging directly





RUBBER GASKETS on the spigot ends of the 20-foot concrete sections of the big woter pipe mode it water-tight (see obove). At upper right, columns supporting the Terminol Reservoir roof. At right, covering Terminol Reservoir No. 2 with a slob roof.

into the city's 48″ feeder main, or (3) spilling into Parley's Creek via an emergency overflow structure and 48″ diameter wasteway conduit.

Before the District operated the aqueduct last summer, the City's water supply was 120 million gallons per day for a population of approximately 220,000. W. C. Hague, former Assistant Superintendent of Salt Lake City Water Works, now employed by the District as Superintendent of the aqueduct, states that 94 million gallons per day comes from flowing wells, the five canyon streams (City Creek, Little Cottonwood Creek, Big Cottonwood Creek, Mill Creek and Parley's Creek), and three small storage reservoirs. The other 26 million gallons per day are from 5 deep wells pumped directly into distribution reservoirs or mains. These 5 wells are the only active survivors of the 17 wells bored in 1934 to meet the drought emergency. Nine are capped for standby use in the event of another dry cycle, and three are no longer usable.

In 1949, the people of Salt Lake City and its suburbs used 17,003 million gallons of water. Based on an estimated population of 212,600 people served, this averaged 219 gallons of water a day for each person. This supply system serves 53 square miles in Salt Lake City plus 13 square miles of suburban areas.

The Salt Lake Aqueduct has a rated capacity of 97 million gallons per day (150 cubic feet per second) and could deliver 35,385 million gallons a year—more than double the amount required by Salt Lake City in 1949. However, the District has subscribed to only 15,152 million gallons (46,500 acre-feet) per year, enough to supply Salt Lake City's supplemental needs and to serve irrigators and domestic water groups outside the District. Ultimately, 10,000 acres of suburban land will be irrigated from the District's share of project water, and as the rural areas become urbanized, irrigation users will be converted to domestic use.

The District hopes to make the project self-supporting from the sale of water not required by Salt Lake City. Some water will also be leased on a year-to-year basis for irrigation.

Assuming 219 gallons per day as the average amount each person uses in the Salt Lake City area, the aqueduct and the previous facilities will be more than adequate to serve Salt Lake City for the next twenty years—even with increasing industrial demands and a steadily growing population. In round numbers, the aqueduct can serve an additional population of 187,000 or a total population of about 400,000.

Sound Financing by District

The District is empowered to levy and collect taxes for the purpose of carrying on the operations and paying other obligations of the District, and it is in such good financial condition that on July 1, 1951, it paid the United States government $200,000 in advance to apply on its obligation of approximately $12,900,000.

The aqueduct which made it possible for the people of Salt Lake City to rout the specter of drought, besides being the latest and greatest water carrier in the State, is unusual in many other aspects. In carrying water from the Colorado River basin into the Bonneville basin, one-third of the aqueduct's supply comes from the North Fork of the Duchesne River watershed of 30 square miles. Two-thirds of the supply is drawn from the 163 square miles of the Weber River system watershed. In occasional dry years, surplus waters of the Provo River can be stored in Deer Creek Reservoir for transportation by the aqueduct to supplement the other sources.

The aqueduct's immediate source of supply, Deer Creek Reservoir, has fifty percent more capacity than the rated annual storage requirements of the Provo River project—thus its 152,600 acre-foot (49,725 million gallons) capacity, designed to provide a safe annual yield of 100,000 acre-feet (32,585 million gallons) can easily take care of the District's full supply of 46,500 acre-feet (15,152 million gallons) even in dry years.

If Salt Lake City's population reaches the one million mark, it may be necessary to roll out another barrel alongside the present aqueduct, or find additional storage. But at the beginning of a new year, 1952, thanks to hard work, sound financing, good engineering, and the enterprise of the Metropolitan Water District officials, the Salt Lake Aqueduct and Deer Creek Reservoir are twin safeguards against another year of drought and water shortage like that of 1934. THE END.

Salt River Meets 160-Acre Requirement

When the last holder of excess lands in the Salt River project in central Arizona complied with the 160-acre limitation of Reclamation Law last year, the Bureau's Region 3, which includes most of Arizona, southern California, Nevada, a small portion of southwest Utah and part of western New Mexico, found itself in full compliance with the limitation law for the first time in a number of years.

According to Region 3's regional director, E. A. Moritz of Boulder City, Nev., this voluntary compliance with the law was brought about largely through the efforts of J. F. Griswold, Secretary of the Salt River Valley Water Users Association which operates the project.

The 160-acre limitation is a provision of Reclamation Law which prohibits delivery of water to more than 160 acres of land in single ownerships, and 320 acres held jointly or as community property by husband and wife. The purpose of the excess land limitation is to afford the greatest number of farms possible to settlers on Reclamation projects which will permit them to make a profitable living. During the depression years acreage in excess of 160 acres was accumulated on many of the older projects. Since then landowners have gradually disposed of their excess holdings. •

What's in the Soil?

(Continued from page 9)

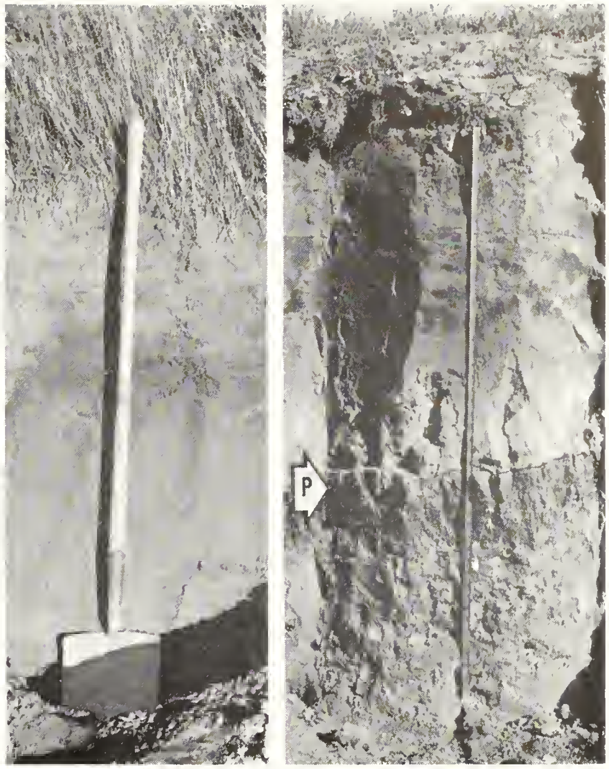
munitions and fertilizers by building elaborate and costly manufacturing plants, there are unseen millions of organisms which remove nitrogen from the air endlessly and plentifully to build themselves up—that is, if soil conditions are right. Good soil conditions include a good supply of other mineral elements, good aeration, reasonable temperatures, sufficient moisture and a plentiful supply of organic residues from the decay of leaves and straw. It further lies within the farmer's power to draw cheaply upon this tremendous reserve by the simple use of legumes such as alfalfa, the roots of which harbor other "nitrogen-fixing" bacteria and build yearly into each acre additional nitrates worth at least $20 or $30 and also add organic residues, such as roots and crowns, which in turn stimulate life in the soil.

In addition to serving as a medium for growth of micro-organisms, organic matter helps to make mineral nutrients available to the crops, contributes to a better mechanical and structural condition, improves soil moisture conditions, and imparts other desirable effects on the soil. The character of the organic fraction of the soil is constantly changing through decay. Unless organic manures and crop residues are added to maintain active decomposition, unfavorable changes in the amount and character of the organic fractions will occur.

These changes are more rapid in cultivated soils because plants which ordinarily become residues are removed, taking the nutrients they have used up and causing certain microbes to slow down their activity. Erosion removes the topsoil along with the nutrients. It is important to maintain a desirable level of organic matter and proper bacterial activity under cultivation. Even in soils which have a naturally high organic content of 3 to 5 percent, such as the grasslands of the Midwest, the amount of organic matter usually sinks below the level occurring under virgin conditions.

The systems of agriculture practiced in the past in many parts of this country drew excessively upon the virgin fertility which developed slowly as organic debris accumulated over long periods of time. Although it has been demonstrated that commercial fertilizers can be relied upon to maintain the plant nutrient level in most particulars, soil productivity will generally diminish as the organic matter is depleted. If you want a productive soil, you need more than an adequate supply of plant nutrients. A large number of coordinating factors, many of which are favorably influenced by organic matter, must be considered.

The organic matter content is normally very low—about 1 or 2 percent—soils that require application of water for satisfactory crop production. Of course, there are notable exceptions, such as the Klamath Basin of Oregon and California, and the San Pete Valley of Utah where the



THE SOIL'S THE THING which in a large measure determines the success of a Federal Reclamation project. At left, a deep, permeable, fertile soil, well suited to irrigation. At right, a soil with a clay-pan layer (P) at a depth of 27 inches—not well suited to irrigation. *Photos by Phil Merritt, Region 1 photographer.*

soils are so highly organic that although special cropping and fertilizing are necessary, the addition of organic matter would be folly. In most instances, however, it cannot be emphasized strongly enough that the relations between soil moisture and organic matter are completely altered under irrigation. The farmer has the power to increase or, at least, maintain the humus content by following certain proved practices: (1) proper rotations which include pastures and legumes such as alfalfa and clover; (2) return of crop residues and plowing under green manures, and (3) adding animal manures and fertilizers. In the initial stages of irrigation the changing soil environment promotes a very rapid increase in the micro-organisms so essential in maintaining a satisfactory level of fertility. Usually under normal farming practices, as many as five years may be required to establish a satisfactory organic matter equilibrium so that such cash crops as sugar beets and potatoes will produce desirable yields.

(Next Month—ELEMENTS IN THE SOIL)

WHAT'S IN YOUR SOIL???

Proper testing of soils takes experience!!!

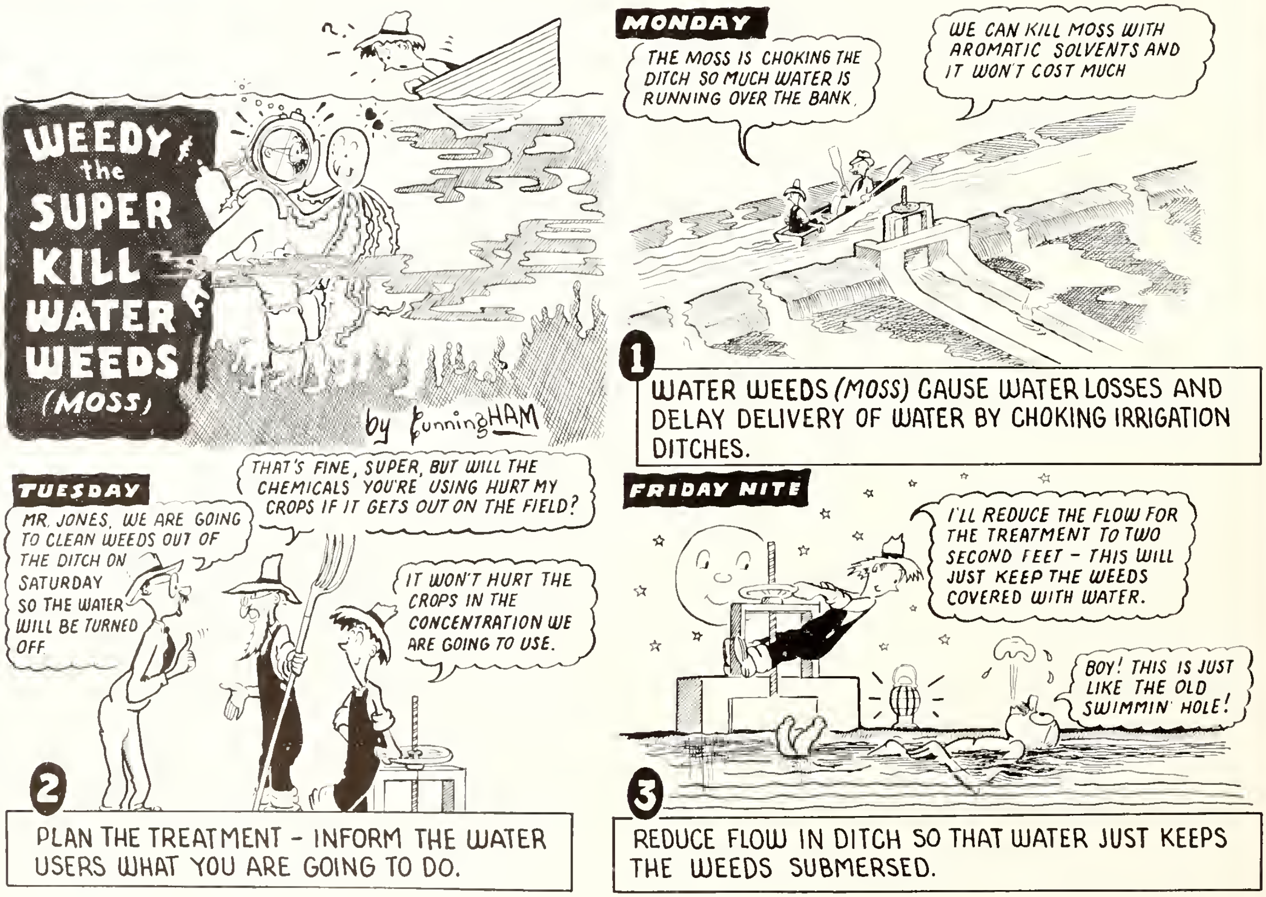
If you have any questions regarding the soil on your farm, you had better see your county agent. He may have field or laboratory equipment to make the more simple tests and for the solution of more complex problems he will refer you to the proper person at the State Agricultural Experiment Station. Your county agent also can give you valuable information on how to take soil samples, package them and ship them—if that should be necessary in order to find out what is in your soil.

SHORT CUTS TO WEED KILLING CALCULATIONS

PART 8—How To Apply Aromatic Solvents To Control Waterweeds

Weeds growing under water in irrigation ditches cause large water losses and expensive maintenance problems. Particularly troublesome are submersed aquatic plants or "moss." Algae, such as blanket moss, frog moss or pond scum, are controlled with copper sulphate or RADA (See Nov. 1951 Reclamation Era) while other submersed aquatics, such as pondweeds, are controlled with aromatic solvents (see April, May 1950 and May 1948 Reclamation Era).

Successful control of pondweeds depends upon obtaining a specified concentration of solvent during a given time interval and accurately measuring the ditch flow. The joint report CH 97, "Controlling Submersed Waterweeds," available from your nearest Regional Director, gives concentration and contact time recommendations. The nomogram on the opposite page will quickly compute the amount of aromatic solvents needed during the specified contact time. Making this calculation is the first step toward effective control. The second step is to calibrate the spray rig so that the discharge from each nozzle introduces the chemical into the water at the correct rate. Both steps are essential if chemical wastage is to be prevented and good kills obtained. Next month's article in this series will show how to calibrate the rig for applying aromatic solvents. ●



by JOHN T. MALETIC

Soil Scientist and Weed Specialist

Region 7 Headquarters
Denver, Colo.

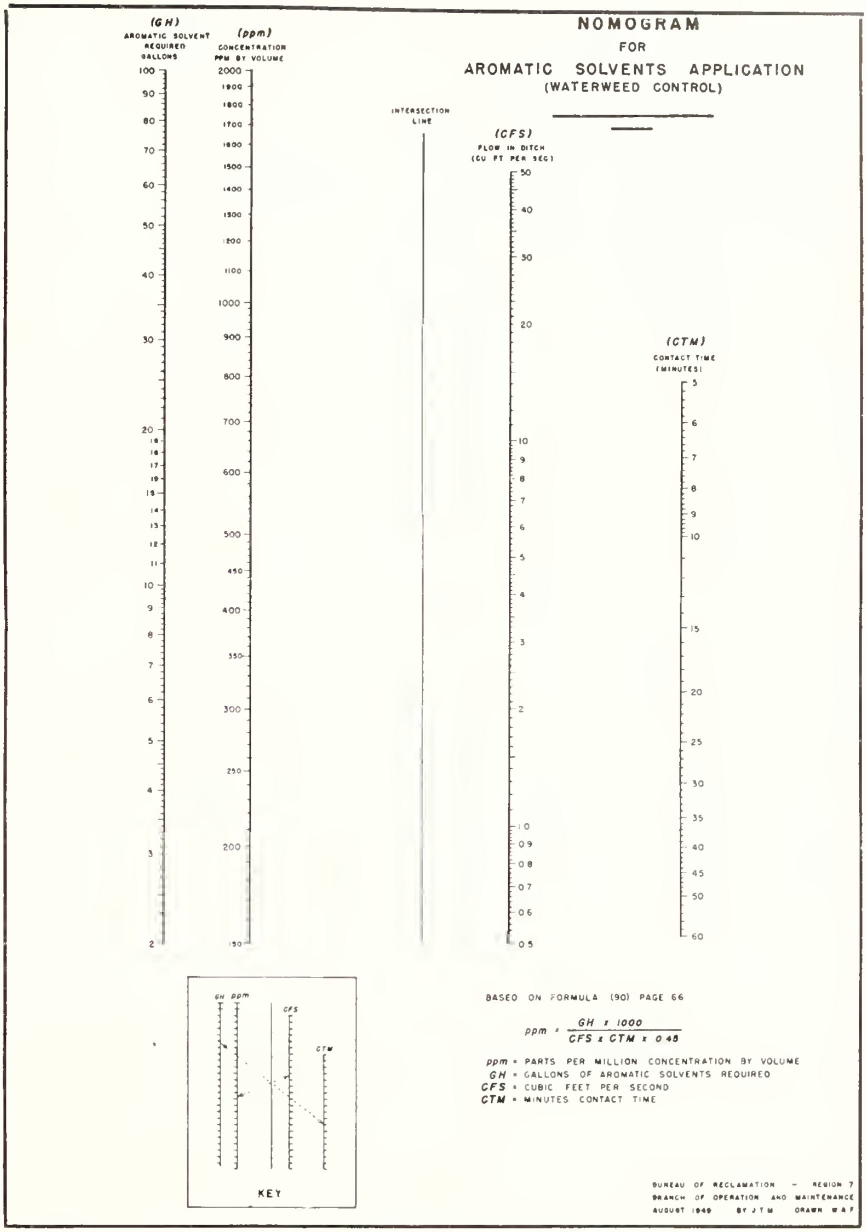
INSTRUCTIONS AND EXAMPLE

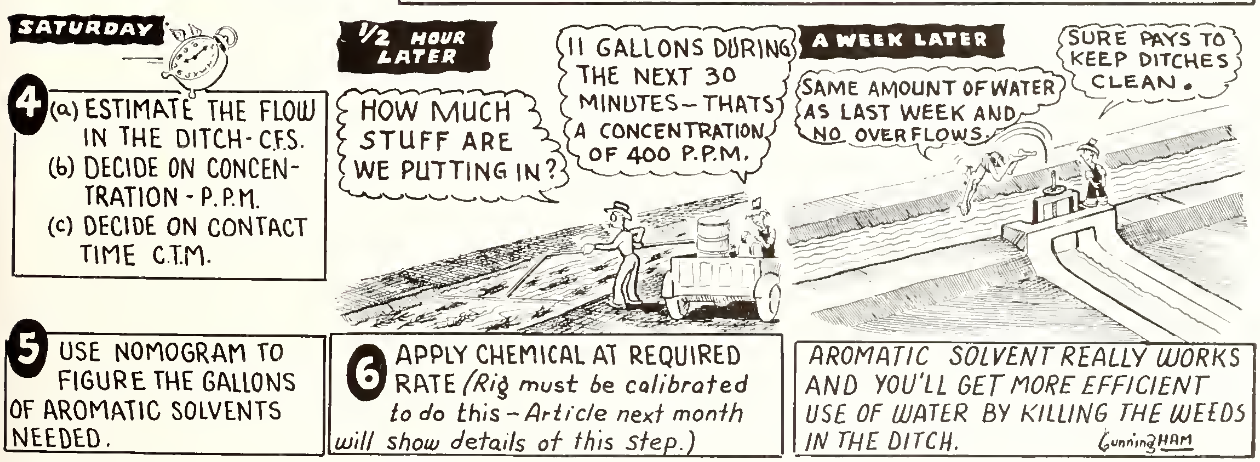
This chart will quickly and easily calculate the gallons of aromatic solvents needed to control submerged aquatic plants like sago pondweed, horned pondweed, Richardson's pondweed, American pondweed, elodea, coontail, and widgeon grass. The key in the lower left-hand corner shows how to use the chart. Simply connect the scales with a transparent straightedge as shown by the dashed line in the key.

Suppose you are making application of aromatic solvents in a lateral whose flow has been reduced to 6 cubic feet per second. The recommended application for the weeds involved is a concentration of 400 parts per million for 30 minutes contact time. How much aromatic solvents is needed? Connect 400 ppm with 6 CFS. Mark the point where the straightedge crosses the reference line. Connect the point on the reference line with 30 CTM, and read the answer—32 gallons on the GH scale.

MINER'S INCHES—If desired, you can calibrate the CFS scale to read in miner's inches. Suppose 50 miner's inches equals 1 cubic foot per second—opposite 1 on the CFS scale insert 50, opposite 2 CFS enter 100, opposite 3 CFS enter 150, and so forth for the remainder of the scale and the intermediate points. Computation is then made in the usual manner as shown in the key.

Editor's Note: Unless you are as good a swimmer as Super, and have an expert life-saving friend like Weedy on shore, don't swim in irrigation ditches—it's dangerous.





FOUR-MILLIONTH VISITOR to take guided tour of Hoover (Boulder) Dam. Mrs. William C. Carr, of Los Angeles, Calif., stands across the border with her son Chuck on the Nevada side of the Hoover power plant and talks to her daughter Myra and her husband who are on the Arizona side. *Photograph by Mark Swain, Region 3.*

Lake Mead Places Second in Popularity

Reclamation's Lake Mead, behind Hoover Dam on the Colorado River in Arizona-Nevada, attracted 2,052,786 visitors in the 1951 travel year, thus becoming the second most popular recreational area in the entire National Park System. It was outranked only by the Blue Ridge National Parkway in Virginia, North Carolina and Tennessee, which was visited by 2,454,924 persons.

The Lake Mead total showed a substantial increase over the previous year, when 1,757,883 people were recorded as visitors in the recreational area administered by the National Park Service.

Other recreational spots provided by Bureau of Reclamation projects also attracted numbers of vacationists and visitors during the year, the National Park service reporting 300,071 visitors at Coulee Dam, on the Columbia River in Washington State, and 462,916 visitors at Millerton Lake, behind Friant Dam on the San Joaquin River in California. •

Water for the Wellton-Mohawk

(Continued from page 2)

there were 11,000 acres. Cotton then occupied 60 percent of the area, while alfalfa grew on 25 percent.

Prior to this time periodic floods recharged the underground waters. However, as increasing upstream use made these floods less and less frequent, the volume of the underground water dropped and its quality deteriorated. Wells and farms were abandoned. There was a rapid decline in farming from 1931 to 1935 and a shift toward alfalfa seed and Bermuda grass seed production. These were the only crops which could be grown profitably with the saline water and on lands that were gradually becoming even more saline. By 1936 alfalfa occupied 72 percent of the area and cotton only 16 percent. The cotton acreage continued to decrease, and by 1940 only Bermuda grass and in a few cases alfalfa could cope with the salty water and soil. In the spring of 1941 floods on the river covered some of the fields. Much of the surface salts was flushed off and carried away. The salty ground water was rejuvenated with a large supply of fresh water. The next two years gave the valley's farmers the highest yields of alfalfa and Bermuda grass seed on record.

But after 1943 history repeated itself. Water analyses in 1945 showed an average of over 6,000 parts per million soluble salts for all wells in the Mohawk municipal water conservation district. Some wells yielded water of 12,000 parts per million salts. This is far in excess of the allowable salt content for general farming.

A few farmers fortunate enough to have fair quality water have continued to produce alfalfa seed, Bermuda grass seed, and small acreages of grain sorghum and barley. But they know that without the rescue supply promised by the Wellton-Mohawk canal, their farming operations, too, would be doomed.

Had it not been for such "salts of the earth" as R. H. McElhaney and Wayne T. Wright, together with their neighbors, the agriculture of the valley would have continued to deteriorate. Congress listened to the pleas of these farmers and in 1947 reauthorized the Gila project to include the 75,000 acres in the Wellton-Mohawk division. Convincing testimony before Congressional committees by McElhaney, Wright, H. J. Woodhouse, Frank Batley, Charley Buckeye, Robert J. Moody, former Yuma County agent, and others have brought the necessary Federal funds thus far to build the irrigation system. Farmers on the Wellton-Mohawk division have formed the Wellton-Mohawk irrigation and drainage district (replacing the old

Gila Valley Power District and the Mohawk municipal water conservation district) to repay costs of the system over a 60-year period. They elected McEllhaney president. And last November the board of directors and the Secretary of Interior agreed on the form of the repayment contract which the water users are now considering—a contract which will bring irrigation water to a maximum of 75,000 acres of Wellton-Mohawk land.

(To be concluded next month—FARMERS AND THE FUTURE)

Fish Protection at Folsom and Nimbus Dams

Although several miles of spawning grounds for the American river salmon run will be cut off when California's Folsom and Nimbus dams are completed, a tripled riffle area to improve the spawning grounds below the dams is being planned to salvage the salmon run which amounts to 15,000 each year.

Fish and Wildlife Service experts are cooperating with the Bureau of Reclamation in this latest of the salmon salvaging programs. In the case of Shasta and Keswick dams on the Sacramento River (see article entitled, "Sacramento Salmon Resettled," on page 143, August 1948 RECLAMATION ERA) improved flow conditions, a system of fish traps, and a hatchery more than made up for the lost spawning ground.

Present studies of the effects of high water on the enlarged riffle below Fair Oaks bridge may improve the spawning areas below the dams and thus make it unnecessary to construct a hatchery.

First Missouri Basin Contract in North Dakota Signed

With the signing of an irrigation water service and repayment contract on October 18, 1951, the Fort Clark Irrigation District became the first organization in North Dakota to execute a Reclamation contract under the Missouri River Basin plan.

Under the 40-year contract, the Bureau will build a pumping plant to lift water from the Missouri River, construct two main canals with a combined length of 9.6 miles, plus a distribution system to carry the water to each individual farm, thus providing irrigation water for 1,800 acres of land in the District. The Fort Clark Unit, which is one of 15 proposed irrigation pumping units along the Missouri in North Dakota, lies on the west bank of the river about 45 miles from Mandan and Bismarck, in Mercer and Oliver Counties. In return for these facilities, the District will make annual payments for water service, repay the cost of the distribution system and pay for operation and maintenance. The irrigation works will be turned over to the District by the Government for operation and maintenance whenever the water users are able to assume administrative and financial responsibilities for the undertaking.

The water users of the area cast an overwhelming vote in favor of forming the district to contract with the Government. Subsequently the District organization proceedings and the water contract approved by the voters were confirmed by an order of the district court in North Dakota. The signing and execution of the contract by the District gave the go-ahead signal for starting work on the project, which is scheduled for the beginning of the spring 1952 construction season.

FORT CLARK UNIT CONTRACT—Participants in the informal ceremony: (seated, l. to r.) North Dakota Governor Norman Brunsdale, Joseph G. Gustafson, chairman of the irrigation district board of directors, and William E. Warne, then assistant secretary of the Interior Department. Standing, l. to r., are Einer Dahl, member of the North Dakota State Water Commission; J. J. Walsh, North Dakota State engineer; Frank Brazda, member of the district board of directors; Bruce Johnson, manager of the Bureau's Missouri-Souris District; Ted Danielson, member of the irrigation district board of directors, and G. A. Freeman, acting supervisor of the Missouri-Souris District operation and development division.

Easterners See Their Machines Producing Grand Coulee Power

HONORED ARTISANS—representing the thousands of craftsmen who combined their talents to create the world's largest power plant at Grand Coulee Dam—from left to right: John S. Bates, superintendent of operation for the Bureau of Reclamation; Charles A. Jinkner, veteran worker for Westinghouse Electric Corp., Pittsburgh, Pa.; Arthur J. Sandler, Westinghouse service engineer on installation of the units; Abel Lester, Newport News, Va., who worked on the 18 hydraulic turbines at the factory, and Homer Phillips, supervising field engineer at Coulee Dam for the Newport News Shipbuilding & Drydock Co. Missing from the photo is William A. Miller, Bureau of Reclamation master mechanic, the sixth representative for the craftsmen.

Two men from eastern factories who had been working on the hydraulic turbines and generators for the Grand Coulee Dam the past 11 years, but who had never seen the completed machines in action shared in the honor of starting the eighteenth, and last 108,000-kilowatt unit on Friday, September 14, 1951, at Coulee Dam, Wash.

The men were brought to the dam site by special arrangements made with the Westinghouse Electric Corp., Pittsburgh, Pa., manufacturers of the 18 generators, and the Newport News Shipbuilding & Dry Dock Co. of Newport News, Va., manufacturers of the 165,000-horsepower turbines.

The men are Charles A. Jinkner, of Greensburg, Pa., assistant superintendent in the Westinghouse Transportation and Generator Division, who started work in 1907 when George Westinghouse was a frequent visitor to the plant, and Abel Lester of Newport News, Va., assistant foreman in the heavy machine shop, who has been engaged in hydraulic turbine work for 35 years.

Four other workmen who have been supervising the installation of the giant units or operating them after completion also were chosen to participate in a half-hour recorded program for three radio networks in the control room of the Grand Coulee Dam right powerhouse.

The Industrial Committee of the Grand Coulee Chamber of Commerce, represented by its chairman Cliff Carlson, sponsored the event.

Because of security restriction, the general public was not invited inside the powerhouse to see the starting of the last unit. Press, radio, and television reporters, however, carried the words of the ceremony into the homes across the nation.

The first generator went into service at the dam approximately 10 years ago, on March 22, 1941. •

Colorado A & M Offers Ph. D. in Irrigation Engineering

The governing board of the Colorado Agricultural and Mechanical College at Fort Collins, Colo. has approved a Ph. D. in Irrigation Engineering. This is the first doctor's degree offered by the College and is in a field for which it has achieved a notable record since 1887.

The degree will be administered in the department of Civil Engineering, which has been offering advanced work in Irrigation Engineering for many years. Dr. D. F. Peterson is head of the Department. The work will be given in conjunction with programs of the Irrigation Institute. These are broad and are intended to cover all aspects of the field of irrigation agriculture. In engineering it can include theoretical or applied fluid mechanics, design, soils and water, operation and management, or project planning.

Students can be accepted at any time to begin work toward the doctorate. A limited number of teaching and research fellowships are available. •

CROPS

Crops at Carlsbad

During 44 years of irrigation farming ith facilities originally rehabilitated nd constructed by the Bureau of Reclamation (or its predecessor the Reclamation Service) farmers on the arlsbad project in New Mexico proluced crops valued at over 50 million ollars. Between 1907 and 1951, they aised over 300 thousand bales of cotton, ver 100 thousand tons of cotton seed nd almost 600 thousand tons of alfalfa ay. An average of about 20,000 acres f land has been irrigated annually ince 1907.

Small grains and sorghums for grain nd forage have always occupied some and, and although farmers started raisng fruits and vegetables, they have radually shifted to cotton production hile vegetables and truck crops have ecome less and less important. ●

FOREIGN ACTIVITIES

Another step toward sealing the bond f friendly relations with one of our ar-off neighbors has been made in the orm of an agreement between the United States and the Commonwealth f Australia. This agreement, signed n November 16 by Mr. Thomas A. Lang, Associate Commissioner of the Snowy Mountains Hydroelectric Authority of Australia, and Mr. Goodrich W. Lineweaver, Acting Commissioner of the Bureau, falls within the terms of Title V of Public Law 402, the United States Information and Educational Exchange Act of 1948, which authorizes the provision of facilities of United States Government agencies to promote the urpose of the act. The facilities to be rovided by the United States in this nstance include the training of about 2 junior Australian engineers a year or the next several years in the Bureau's installation at Denver, Colo., and he design of certain works to be undertaken by the Australian Snowy Mountains Hydroelectric Authority. All of he expenses incurred by the Bureau for his assistance will be completely paid or by the Snowy Mountains Authority. This Authority, similar in scope and form to the TVA, covers an area of about 100 miles in length by 50 miles broad, approximately 70 miles southwest of Canberra, the Capital of Australia. It is expected to provide additional water for existing and proposed irrigation systems, and hydroelectric power much needed in industrial Sydney and Melbourne and adjoining rural areas. It will include 8 major dams, over 80 miles of tunnels, 400 miles of canals, and some 16 power stations with a total capacity of about 3 million kilowatts. The Bureau, with the assistance of the Australian engineer-trainees, will perform part of the design work on the Upper Tumut group of works. These works, which will provide about 666,000 horsepower, would normally take ten or eleven years to complete, but with the help of outside contractors and designers it is expected that the project can be completed in 6 years.

Bureau engineers continue to accept foreign assignments in the fields of water resources development, irrigation and drainage, and hydroelectric power surveys, at the request of the Department of State and the Mutual Security Administration, in order that they might aid in carrying out the President's Point IV Program of technical assistance to underdeveloped countries. A few of the Bureau engineers assigned such missions are:

JORDAN—Mr. Mills E. Bunger has just returned from a 60-day detail in Amman, Jordan, where he completed a review of the water resources phase of the Economic Cooperation Administration's program in that country.

NORTHERN RHODESIA—Mr. Edgar Foster of the Hydrology Division in Denver, recently returned from 6 months' assignment to Northern Rhodesia.

NICARAGUA—Mr. Norval Pope and Mr. Foster (see above) are on a 1 year's assignment to make preliminary surveys and investigations of the Tuma and other rivers of Western Nicaragua, with a view to the development of hydroelectric power. These assignments are expected to be completed by June 1952.

IRAQ—Mr. Fred Locher, of Great Falls, Mont., has accepted an assignment as irrigation and drainage engineer in Iraq, to carry out an experimental drainage program preliminary to drawing a full and comprehensive program of drainage for the Dujaila irrigation system within Kut and Amara Liwas. He will also recommend the site, the size and scope of this experimental drainage work. This work will be undertaken to educate the farmers and landholders of the district regarding the benefits of these works and train them to carry out similar but smaller works where necessary within their holdings.

CHILE—Mr. Kenneth Vernon, Regional Director of Billings, Mont., was invoted by the United Nations Food and Agriculture Organization to conduct a series of lectures at the Latin American Training Center in Santiago, Chile, from December 10 to 14, 1951. The subject of Mr. Vernon's talks was river basin development.

Requests for permission to visit Bureau installations continue to reach the Bureau through the Department of State. There are an average of 24 visitors, representing about 11 countries, each month.

Some of the recent foreign nationals accepted for in-service training in the Chief Engineer's office and on projects, include: Medina N. Bhattarai of Nepal; Mir Bashar Khan and Hasan Shahid Saidi of Pakistan; Somnath Kapur of India; Sayed Ohanessian of Iraq, and Najeeh F. Tleel, Jordan. ●

RELEASES

Water and the World

The Commissioner's Office in Washington, D. C., has available, free of charge, copies of the article, entitled "Water and the World" by William E. Warne, reprinted from the September 1951 issue. These reprints are being used to advantage by groups and persons studying international water conservation problems. ●

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

NOTES FOR CONTRACTORS

Contracts Awarded During November 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3527	Colorado-Big Thompson, Colo.	Nov. 8	One 1,000-kilovolt-ampere unit substation for Flatiron power and pumping plant, schedule No. 1.	Nelson Electric Mfg. Co., Tulsa, Okla.	$22,611
DC-3540	do	Nov. 6	Construction of 9.5 miles of Estes-Pole Hill 115-kilovolt transmission line.	Sturgeon Electric Co., Inc., Denver, Colo.	125,834
DC-3547	do	Nov. 8	Construction of Carter Lake pressure conduit, Estes Park-Foothills power aqueduct, schedule No. 1.	Colorado Constructors, Inc., Denver, Colo.	210,330
DS-3549	do	Nov. 27	One main control board and one recording board for Flatiron power and pumping plant.	Kirkhof Electric Co., Grand Rapids, Mich.	87,210
DC-3551	Central Valley, Calif	Nov. 8	Construction of Columbia pumping plant No. 1 and Mowry pumping plant and delivery systems.	Johnson Western Constructors, San Pedro, Calif.	338,353
DS-3552	Colorado-Big Thompson, Colo.	Nov. 14	One 42-inch regulating tube valve with control stand and connecting piping for pump-turbine bypass, Flatiron power and pumping plant.	Pelton Water Wheel Co., San Francisco, Calif.	38,400
DC-3553	Columbia Basin, Wash	Nov. 15	Preliminary drilling for stabilization of right bank, Grand Coulee Dam.	Forest H. Majors, Salt Lake City, Utah.	22,278
DC-3554	Missouri River Basin, Nebr	Nov. 2	Construction of earthwork and structures for Cambridge Canal, and drains and channel changes, schedule No. 5.	Claussen-Olson-Benner, Inc., Holdrege, Nebr.	774,088
DC-3557	Columbia Basin, Wash	Nov. 8	Alterations of pump discharge pipes No. 1 to 6, inclusive, and repair of pump discharge pipe No. 1, Grand Coulee pumping plant.	Consolidated Western Steel Corp., San Francisco, Calif.	69,703
DC-3558	Eden, Wyo	Nov. 5	Construction of earthwork and structures for Means Canal and Big Sandy Channel change.	Sharrock and Pursel, Casper, Wyo.	315,520
DC-3560	Davis Dam, Ariz.-Nev	Nov. 20	Installation of metalwork, heating and ventilating systems, and piping for Davis Dam and power plant.	Dorrington Sheet Metal Works, Denver, Colo.	186,890
DC-3561	Parker Dam Power, Ariz.-Calif.	Nov. 16	Repairing turbine runners for Units 1 to 4, inclusive, Parker power plant.	S and S Engineering Corp., Los Angeles, Calif.	14,760
DC-3568	Central Valley, Calif.	Nov. 20	Three actuator-type governors with pumping equipment for regulating speed of 74,000-horsepower hydraulic turbines for Folsom power plant.	Woodward Governor Co., Rockford, Ill.	97,080
DC-3578	Columbia Basin, Wash	Nov. 21	Construction of earthwork, pipe lines, and structures, part-time farm units, Block 701 laterals.	George Pfeiffer, Spokane, Wash.	41,806
DC-3592	Boulder Canyon, Ariz.-Calif.	Nov. 15	Completion of construction for operation of Units A3, A4, and A9, and related switchyards, Hoover power plant.	Howard P. Foley, Salt Lake City, Utah.	219,887
117C-121	Columbia Basin, Wash	Nov. 1	Construction residences, garages and utilities for Areas E-2, E-3, P-1, and P-2, O&M ditchrider sites.	Bowe, Nevers and Masser, Inc., and Allied Construction Co., Ephrata, Wash.	92,735
117C-124	do	Nov. 16	Drainage culvert at station 2619+27.50, West Canal	Goodfellow Brothers, Inc., Wenatchee, Wash.	11,664
604C-24	Missouri River Basin, Mont	Nov. 5	Clearing Canyon Ferry Reservoir Areas 5 aud 6	Lindquist, Olson, and Co., Cambridge, Min.	184,300
701C-200	Missouri River Basin, Nebr	Nov. 23	Relocation of County road at Swanson Reservoir	Nichols Construction Co., Geneva, Nebr.	118,767
704C-210	Colorado-Big Thompson, Colo.	Nov. 2	Fort Collins R. E. A. substation and addition to Flatiron temporary substation.	Walter Walking, Denver, Colo.	23,862

Construction and Materials for Which Bids Will Be Requested by March 1952

Project	Description of work or material
Cachuma, Calif	Construction of the Carpinteria Reservoir located northeast of the town of Carpinteria, Calif. The reservoir is to be 25 feet deep and 240 feet square at the bottom with 1½:1 inner slopes. The bottom and inside slopes will be paved with concrete.
Do	Construction of fence around Cachuma dam and outlet works and around Glen Anne and Lauro Reservoirs.
Central Valley, Calif	Construction of ditch riders' houses at Balancing Reservoir and Kern River on Friant-Kern Canal near Bakersfield, Calif. Each house is to be wood frame on concrete foundation and is to contain not more than 1,200 square feet of living area and 470 square feet of garage and storage utility area.
Do	Two 9,400-horsepower at 40-foot head, vertical-shaft, propeller-type hydraulic turbines for Nimbus power plant.
Do	Two 7,000/8, 750-kilovolt-ampere outdoor power transformers, seven 69-kilovolt disconnecting switches, and one 69-kilovolt power circuit breaker for Nimbus switchyard.
Do	Three 230-kilovolt, and one 69-kilovolt outdoor power circuit breakers; three 115-kilovolt, seven 230-kilovolt, and five 69-kilovolt disconnecting switches; one 12,000/15,000-kilovolt-ampere outdoor autotransformer; one 4,160-volt outdoor unit substation switchgear for Folsom switchyard.
Do	Three 230,000-volt outdoor power circuit breakers and nine 230,000-volt outdoor disconnecting switches for Elverta switchyard.
Colorado-Big Thompson, Colo.	Construction of Pole Hill Canal 9 miles east of Estes Park, Colo., involves construction of about 500 feet of bench flume and 2,000 feet of canal to carry a flow of 550 cubic feet per second. The concrete flume has a bottom width of 16 feet 3 inches and a height of 8 feet 8 inches. The concrete-lined canal has a bottom width of 7 feet, a height of 8 feet, and side slopes of 1¼ to 1. Most of the excavation will be in rock.
Colorado-Big Thompson, Colo.—Con.	Installation of carrier-current and control equipment, including 10,000 feet of cable, at Flatiron power plant, Greeley, and Sterling, Colo., and intermediate points; and installation of instrument panels and dispatchers equipment for completion of Flatiron dispatch building near Estes Park, Colo.
Do	Two 84-inch butterfly valves with operating units, handling equipment, and accessories for Flatiron power plant.
Do	Two neutral grounding reactors for Flatiron power plant.
Columbia Basin, Wash	Reissuance of Specifications No. DC-3537 for construction of Lake Lenore pumping plants near Soap Lake Wash., incorporates a redesign of pumping plant No. 1. Construction of pumping plants Nos. 1 and 2 involves installation of three 10-cubic feet per second and one 5-cubic feet per second pumping unit for each plant, manifolds and discharge lines, and electrical installations; construction of 0.3 mile of intake channel and 2.1 miles of connecting channel; construction of 0.2 mile of 36-inch diameter concrete pipe discharge line; construction of a weir and wasteway structures near pumping plant No. 2; and removal and reconstruction of concrete manhole structure in existing Soap Lake siphou and connecting a steel discharge line to the siphon.
Do	Construction of 236-cubic feet per second capacity, 4-unit, outdoor-type Ringold pumping plant. The contractor will construct the 53- by 22-foot reinforced concrete foundation, install Government-furnished pumping units, construct steel motor housings, and four 42-inch diameter concrete pipe discharge lines, each extending about 650 feet to the outlet works.
Do	Installation of two 65,000-horsepower, 720,000-gallon per minute pumping units Nos. P5 and P6 in Grand Coulee pumping plant; miscellaneous metalwork and electrical installations for Grand Coulee Dam, pumping plant, and power plants.

Construction and Materials for which Bids Will Be Requested by March 1952—Continued

Project	Description of work or material
Columbia Basin, Wash—Con.	Installation of lighting standards, luminaries, wiring and control circuits in town of Coulee Dam, Wash.
Do	Construction of 1.5 miles of unlined laterals, 2 miles of wasteways, and 3 small pumping plants to irrigate additional acreage in lateral areas E-2 and E-3 on East Low canal.
Do	Landscaping of school area and terraces in town of Coulee Dam, areas adjacent to pumping plant and hydraulic model, and in vicinity of Grand Coulee 230-kilovolt left switchyard.
Do	Furnishing and placing lawn, shrubs, and trees, and furnishing and installing materials and equipment for lawn sprinkler systems at Mesa, Moses Lake, Warden, and Winchester, Wash., operation and maintenance headquarters.
Do	Drilling domestic water-supply well for Othello development farm.
Do	Drilling 40 drainage observation wells in lateral areas E-3 on East Low canal, near Moses Lake, Wash. W-5 and W-6A on West canal, near Quincy, Wash., and P-1 and P-2 on Potholes East canal near Othello, Wash.
Do	Motor control switchgear consisting of one incoming power cubicle, four motor control cubicles, and one float switch for Ringold pumping plant.
Eden, Wyo	Construction of 2,300 feet of 475-cubic feet per second capacity Means canal, enlargement of 6.5 miles of Eden canal to 300-cubic feet per second capacity, and enlargement of 150-cubic feet per second capacity Farson lateral, located 44 miles northwest of Rock Springs, Wyo.
Eklutna, Alaska	One 60-ton overhead traveling crane for Eklutna power plant.
Fort Peck, Mont	Power and distribution transformers, step voltage regulator circuit reclosers, and switching and protective equipment for Dawson County substation.
Do	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont.
Gila, Ariz	Construction of 28 miles of unreinforced concrete-lined Mohawk laterals and sublaterals of 120 to 15-cubic feet per second capacities, and appurtenant reinforced concrete structures, and removal of existing timber and concrete structures for Unit 1, near Roll, Ariz.
Do	Construction of 8 miles of unreinforced concrete-lined Mohawk canal of 135- to 30-cubic feet per second capacity, appurtenant reinforced concrete structures, and 8 miles of protective dike, near Roll, Ariz.
Grand Valley, Colo	Construction of concrete cut-off and rock chute at Badger Wash, Book Cliffs soil and moisture conservation area, 20 miles northwest of Grand Junction, Colo.

Project	Description of work or material
Hungry Horse, Mont	Construction of three bridges on West Side Forest Service road, 30 miles southeast of Columbia Falls, Mont.
Kendrick, Wyo	Installing pumps and pipe for oil-handling equipment at new Casper substation.
Missouri River Basin, Nebr.	Construction of about 30 miles of laterals on the Cambridge lateral system near Arapahoe and Orleans, Nebr.
Missouri River Basin, Kans.	Furnishing and planting trees and shrubs for public use area at Cedar Bluff reservoir 18 miles southwest of Ellis, Kans.
Missouri River Basin, Mont.	One main control board, one annunciator relay cabinet, one 7,200/480-volt unit substation, one 460-volt and one 125-volt distribution board, and two 5-kilowatt battery chargers for Canyon Ferry power plant.
Missouri River Basin, S. Dak.	Construction of metal or concrete block warehouses and storage garages at Armour, Sioux Falls, Watertown, and Philip substations.
Missouri River Basin, Wyo.	Supervisory control and telemetering equipment for controlling Lovell and Thermopolis substations from Boysen power plant.
Do	Construction of water distribution and sewer systems for Kortes Dam Government community 63 miles southwest of Casper, Wyo.
Do	Construction of Shoshone River power 2,000-kilovolt-ampere substation near Cody, Wyo.
Palisades, Idaho	Construction of Palisades Dam and power plant on the South Fork of the Snake River in Bonneville County, Idaho, 7.5 miles southeast of Irwin, Idaho. Palisades Dam is to be an earth-fill structure about 2,200 feet long and 40 feet wide at the crest and 260 feet high. The 4-unit, 120,000-kilovolt-ampere capacity indoor-type power plant will be 64 feet high and 246 by 60 feet in area and will require construction of tunnel intake control and outlet tunnel discharge control structures. The substructure will be of reinforced concrete; its superstructure will have structural steel framing and either concrete or brick walls, or nonmetallic side wall panels. A machine shop a d valve house, 280 by 40 by 35 feet, will extend west from the south end of powerhouse. Contract will also include excavation of 28-foot diameter spillway tunnel, 26-foot diameter inlets for power and outlet tunnels spillway and outlet tunnel discharge channels, and power plant tailrace; and lining spillway, power, and outlet tunnels and shafts with concrete.
Riverton, Wyo	Furnishing and applying asphalt lining on about 11 miles of Wyoming canal and Badger lateral.
Yakima, Wash	River channel improvement near Zillah, Wash.
Do	Placing buried asphalt membrane canal lining near Prosser, Wash.

United States Department of the Interior

Oscar L. Chapman, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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U S GOVERNMENT PRINTING OFFICE 1952

THE RECLAMATION AREA

The Reclamation ERA

February

1952

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The Reclamation ERA

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CONTENTS

FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

From Brushland to Butter

Four years ago the spot upon which "Genie" Wilbur, 4-year-old son of homesteaders Mr. and Mrs. Eugene C. Wilbur, is standing was barren sagebrush. Today the Wilburs are living comfortably on their farm in the Hunt Unit of the Minidoka project in Idaho. Mrs. Wilbur is justly proud of her attractive, modern kitchen with its electric refrigerator where she stores the soon-to-be-golden butter which Genie is helping to churn. *Photograph by Stanley Rasmussen, Region 1 photographer.*

35 YEARS AGO IN THE ERA

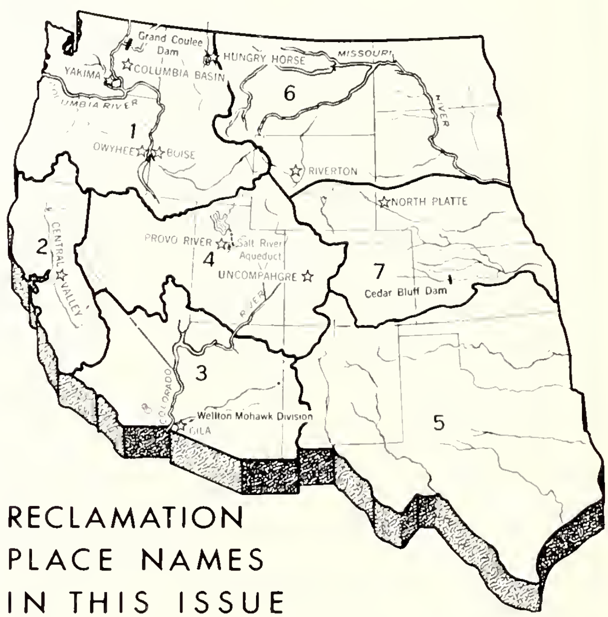
THE FARMSTEAD

Judging by inquiries being received from our farmers regarding lay-out or plan of the farm buildings, orchards, and yards, considerable interest is being taken in the improvement of the farmsteads, due probably to realization that much is lacking toward making everything comfortable and convenient.

Some of our farmers have their farms and farmsteads planned and laid out in such manner as to afford the most comfort and pleasure for the family, the most convenient performance of the "chores," and the most economical working of the fields and handling of the crops. These well-planned farms should be given publicity for the good of the cause, and to this end I wish every farmer who considers his farm scheme a good one would make a pencil sketch of same and send it to me. Out of these various ideas we will be able to develop the lay-out of the ideal irrigated farm for each class of farming.

(From p. 87 of the February 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

WE REPEAT THE INVITATION IN 1952!



RECLAMATION PLACE NAMES IN THIS ISSUE

QUAKES and CURRENTS

"TUNING IN" ON THE GROUNDWAVES—The operator of the seismic apparatus in the truck is learning of the subsurface conditions at the Low Gap Tunnel site, Columbia Basin project in Washington

by E. A. ABDUN-NUR, Engineer, and DAN WANTLAND, Geophysicist, Branch of Design and Construction, Denver, Colo.

MAYBE THE ENGINEERS' LATEST WORK in examining foundation sites for Reclamation structures is not earth-shaking news, but their techniques for revealing the earth's inner secrets through miniature earthquakes and electrical currents are paying dividends in the construction of the Bureau's water developments throughout the West.

These relatively new techniques for giving the earth's innards a quick once-over are known as geophysical explorations. By their use engineers can now determine the depth of foundation rock and the variation in its depth from point to point below the ground surface. They are also able to estimate the extent, depth, and changes in thickness of gravel and rock deposits which are wholly or partially buried below the surface of the ground.

Here's how it is done. Before Reclamation structures are designed or built, geological studies are required to determine the natural site conditions and the problems these will bring to the designer and constructor. The site is mapped geologically to determine the quality of the foundation—how strong it is, how much it will pack down or compress, how watertight it is, how far down to sound rock, and how thick the overlying decomposed material is. In short, an inventory must be made of the foundation conditions before design and construction can proceed.

To expedite this inventory, Bureau engineers have adapted the methods developed by scientists who study the general constitution of the earth—methods which were later perfected by the petroleum industry in its search for oil beneath the surface of the earth. These procedures of studying the earth's anatomy, using the methods of field geology and laboratory physics (hence the name "geophysics"), give an over-all reliable picture of the underground conditions.

Geophysicists use a number of different techniques in solving engineering problems. Reclamation engineers have found two of them to be most useful in their preliminary investigations of water-resource projects.

The first of these techniques, used principally to measure the distance from the ground surface to the top of the foundation rock, is known as the seismic method. With the seismic procedure, a miniature earthquake is produced by exploding a small charge of dynamite in a comparatively shallow auger hole. The waves produced by the explosion travel downward, reach bedrock, travel along it, and return to the surface where they are picked up by special microphones, called geophones.

The velocity of these waves varies with the different types of soil and rock in which they travel. The elapsed time between the detonation and the time a wave is picked up by the geophones is then measured. By relating this time of travel to the distance between the explosion point and the locations of the geophones, it is possible to calculate the depth to the bedrock surface.

The time and cost required to make seismic determinations are the same, whether the bedrock surface is at a depth of 20 or 300 feet. Because the waves from the artificial earthquake travel along the bedrock surface for a long distance and are not reflected from one point only, the information gives a generalized subsurface picture that would otherwise require a great many drill holes to obtain. Only a few drill holes are necessary to provide the yardstick by which the seismic observations are controlled and correlated.

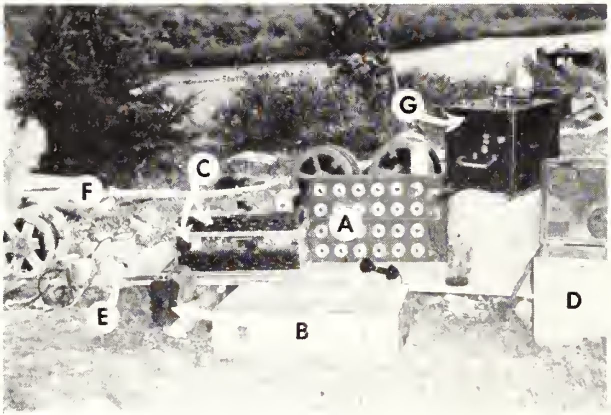
The seismic technique has a decided advantage over the usual exploration methods which require a large number of holes drilled at considerable expense and effort. Moreover, each drill hole, using standard methods, provides underground information at one point only, and the deeper the drilling, the slower the progress.

The second geophysical procedure, known as the electrical resistivity method, reveals the type of materials present, their wetness or compactness, and other conditions existing at the site. It consists of applying an electrical current, from portable batteries, to the surface of the ground through metal pins, and measuring the current and the drop in voltage between them. This permits the calculation of the electrical resistivity (resistance) to the passage of the current which in turn can be translated in terms of subsurface conditions existing at the site.

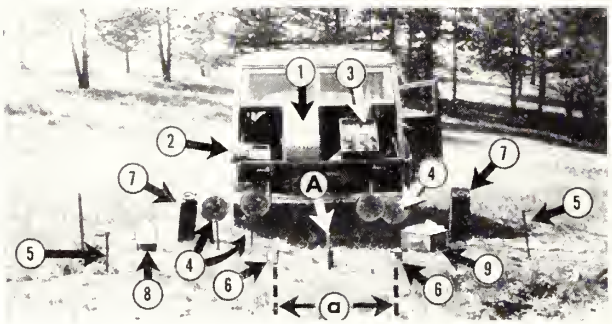
Similar to the miniature earthquake waves of the seismic method, the electrical current travels downwards and outwards and is therefore affected by a large volume of materials rather than by the conditions at one point. The resistivity method is fast and economical and can supply information either beneath a central point, which is analogous to drill hole data, or along a line at a given depth, which is analogous to information obtained from digging a trench. Here again, the control has to be provided either through drilling, test pitting, or by observations made on outcrops of the materials under investigation.

One of the many successful applications of the seismic method in Bureau work was the determination of the depth to bedrock in an old preglacial channel known as Abbott Gorge. This channel intersects the rim of the reservoir behind Hungry Horse Dam, now under construction in Montana. Here, initial geologic studies indicated that the channel was filled with glacial overburden of unknown thickness. For a time, the rock floor of the channel was believed to be below the high water level proposed for the reservoir. If this were so,

(Please turn to page 41)

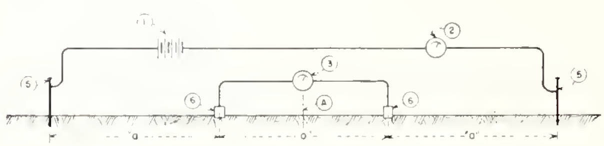


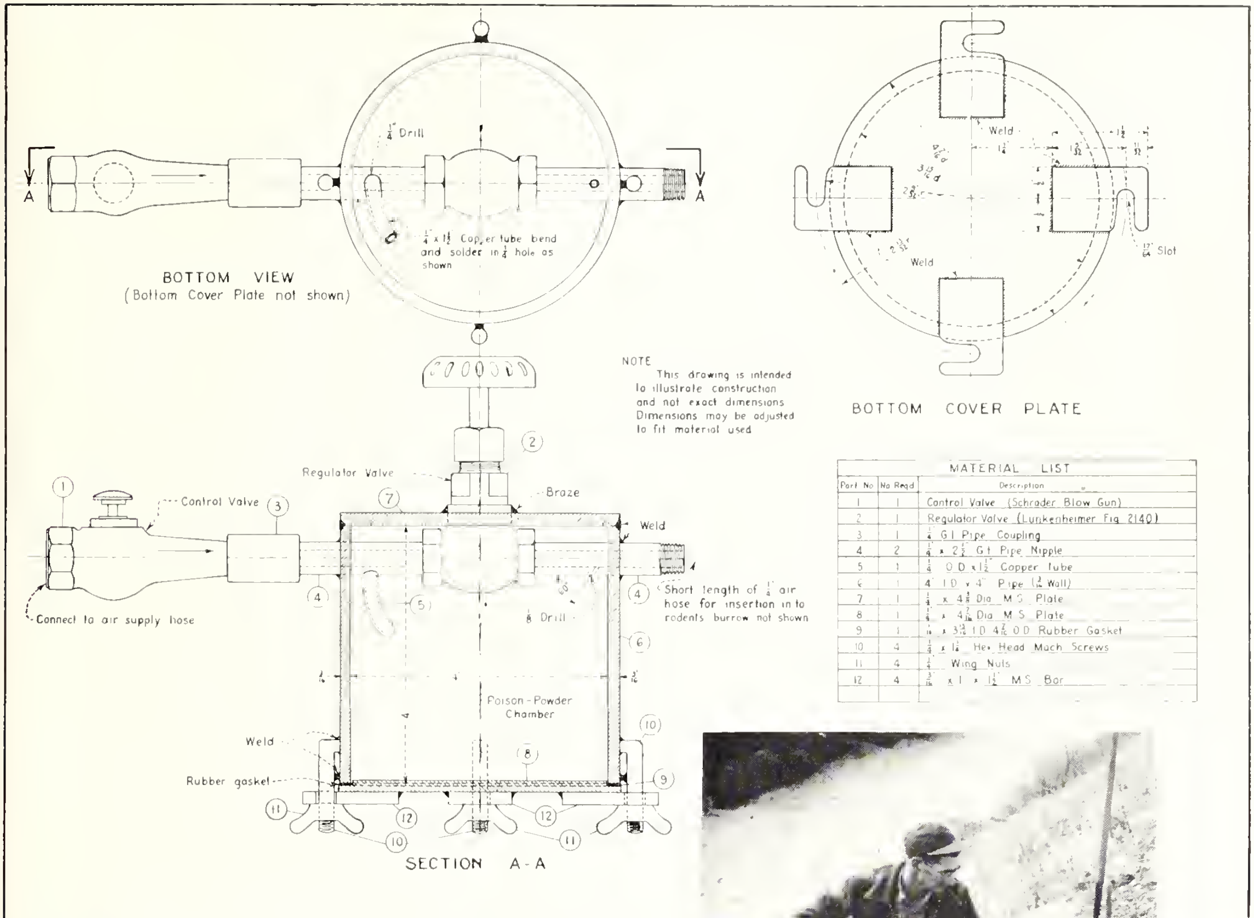
FOR PROBING THE UNDERGROUND—The geophysical equipment above was used to explore the Willow Park dam site in Wyoming: A—Attenuator, B—Field telephone, C—Amplifiers, D—Daylight developing box, E—Geophones, F—Reels, and G—Oscillograph and recorder. Below, the arrangement of resistivity apparatus for geophysical explorations.



(EQUIPMENT FOR MAKING FIELD ELECTRICAL RESISTIVITY MEASUREMENTS)

1 Battery - Power source
2 Milliammeter
3 Potentiometer
4 Reels
5 Field electrodes
6 Porous pots
7 Water cans
8 Copper sulfate solution
9 Box for porous pots
"a" Spacing in feet
A Center of spread





MATERIAL LIST		
Part No	No Reqd	Description
1	1	Control Valve (Schrader Blow Gun)
2	1	Regulator Valve (Lunkenheimer Fig 2140)
3	1	$\frac{1}{4}$" G I Pipe Coupling
4	2	$\frac{1}{4}$" x $2\frac{1}{2}$" G I Pipe Nipple
5	1	$\frac{1}{4}$ O D x $1\frac{1}{2}$" Copper Tube
6	1	4" I D x 4" Pipe ($\frac{3}{16}$ Wall)
7	1	$\frac{1}{4}$ x $4\frac{3}{8}$ Dia M S Plate
8	1	$\frac{1}{4}$ x $4\frac{7}{16}$ Dia M S Plate
9	1	$\frac{1}{16}$ x $3\frac{15}{16}$ I D $4\frac{7}{16}$ O D Rubber Gasket
10	4	$\frac{1}{4}$ x $1\frac{1}{4}$ Hex Head Mach Screws
11	4	$\frac{1}{4}$ Wing Nuts
12	4	$\frac{3}{16}$ x 1 x $1\frac{1}{2}$" M S Bar

WHEN WILLIAM ADAM BATZNER (pictured at right) figured out an easier, faster, cheaper way of getting rid of gophers, he started something—a wave of requests for photos, diagrams, and information, some to be used in the Wall Street Journal, the Deseret News, Business Week, and

Gas Chamber for Gophers

other publications, and some from people who wanted to know how to build the cyanide machine and the rig for their gopher-fighting campaigns. Even a District Agent from the Bureau of Predatory Animal and Rodent Control in New Mexico, asked for more details to help him control pocket gophers in Elephant Butte, Carlsbad, and other New Mexico irrigation districts.

Because of the widespread interest in this topic, here is a cross-section diagram of the chamber for the cyanide powder which is forced by compressed air into the gopher holes. A larger container will cut down on the number of times you need to replace the powder, and a clear plastic cover or container would make it possible for you to see when more is needed. Handling the cyanide powder is dangerous, and separately packaged charges for the gun would make the operation safer on windy days. For more information on how this device was developed and used with great success on the Boise project, read the article entitled, "Gassing the Gophers" by Hu Blonk on page 194 of the September 1951 issue of the RECLAMATAON ERA.

The photo of Batzner, shooting the fumes into a gopher hole on a ditchbank, was taken by Phil Merritt, Region 1 photographer. THE END.

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Elements in the Soil

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer,
Region 1 Headquarters, Boise, Idaho

Part two in a series of articles on soils and land classification

During the development period on Bureau of Reclamation projects, prior to assessment of construction costs, the soil productivity may be significantly increased under irrigation. It is logical that this productivity will be maintained by the same soil-building methods that were used to bring the soil to its present level of productivity. Actually most semiarid soils have an inherently high mineral fertility and acquire favorable organic characteristics under proper irrigation practice. They often have a potential productivity equal to, or in excess of, that of many soils found under more humid conditions where irrigation is not commonly practiced. Soil deterioration can result from many causes, such as the use of irrigation waters of unfavorable quality, or from poor drainage. On irrigated lands, depletion of the commonly low organic reserves may first become evident to a farmer by the slowing up of the intake of irrigation water. Especially is this true in a heavy soil, even if the soil is structurally normal at the start.

Sodium and Calcium

Sodium is the "poor relation" in soils. It has little significance in plant nutrition and is linked with soil structural deterioration, which results from soil dispersion or the running together of soil particles when wet. Under irrigation, a sodium-soil puddles and resists or almost totally excludes the penetration of both air and water. Plant growth is seriously retarded.

Fortunately, most virgin soils are not abnormally high in sodium. However, the use of sodium-bearing irrigation waters often promotes excessive absorption of sodium by the soil. Structural deterioration also results from excessive use of irrigation water and the rise of ground water. These conditions may promote accumulations of soluble salts in the soil, which are commonly called "alkali." Two types of salts may be encountered: The "salines" or "white alkali" include a high proportion of the common table, Glauber, and Epsom salts. Washing soda and lye are the principal constituents in true or "black alkali." The latter, as would naturally be suspected, are the most harmful in soils. Determining the advisability of irrigating or reclaiming wet or alkali land on proposed projects and evaluating the capacity of such lands to pay construction and operation and maintenance costs on existing projects is one of the major problems which confronts Bureau of Reclamation personnel engaged in land classification.

Among the mineral elements that are soil conditioners as well as plant nutrients, none has a more complex role than calcium. On the other hand none has so detrimental an effect on soil struc-

SUCCESS—OR FAILURE of an irrigation project depends upon the soil. The authors (Poulson at left, Swarner at right) inspect the contents of a soil auger to determine in advance whether the farm might go out of production like those in the right panel: Top photo shows saline and alkali soils, forming an irregular pattern across the field; center photo shows saline and high sodium spots on which corn will not grow, and bottom photo shows nearly barren alkali "slick spot" in an alfalfa field. *Photo above by Phil Merritt, Region 1 photographer; photos at right, courtesy of the United States Regional Salinity Laboratory.*

ture and so little known value to plants as sodium although it is essential in animal nutrition. To a large extent, these two elements control or significantly modify the acidity or alkalinity of soils. As calcium decreases in the soils of humid regions, the acidity increases, and it becomes necessary to apply lime to reduce the acidity to a point favorable for crops. Calcium in the carbonate form gradually becomes more plentiful in soils developed under increasingly arid conditions. Where rainfall is insufficient to accomplish much leaching, the soils are alkaline, and lime and soluble salts are often abundant.

In general, the best crop growth is made in soils approaching the neutral point; that is, slightly acid or slightly alkaline. Sodium promotes a very rapid rise in alkalinity and creates toxic conditions limiting crop yields. Certain nutrient elements are rendered unavailable to plants. An excess of lime may also render plant nutrients unavailable.

Magnesium behaves to a large extent like calcium in maintaining soil structure, but it is thought that, under certain conditions, too much may be toxic to plants and cause structural deterioration. As a plant nutrient, it is believed to

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OSCAR G. BODEN— Builder of Lifelines

RECLAMATION'S HALL OF FAME Nomination No. 12

by D. L. GOODMAN, Engineer, Design and Construction Division, Denver, Colo.

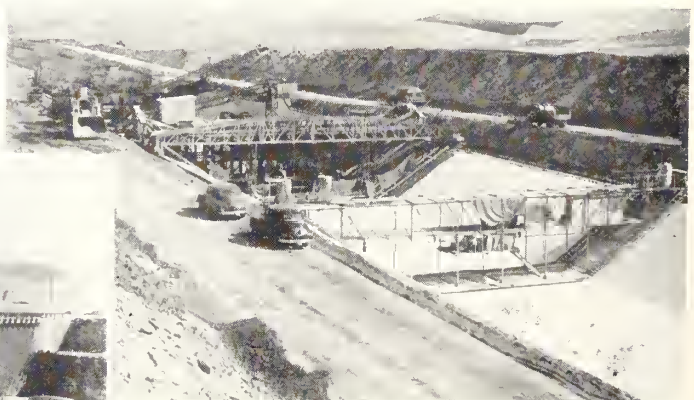
A LONG-TIME STALWART on Reclamation's all-star engineering team is gone. Oscar George Boden, one of the world's foremost authorities on canal construction who during his 40-year-long career of service with the Bureau of Reclamation built more canals and laterals than any other man in Reclamation history, died June 27, 1951, following several months of failing health.

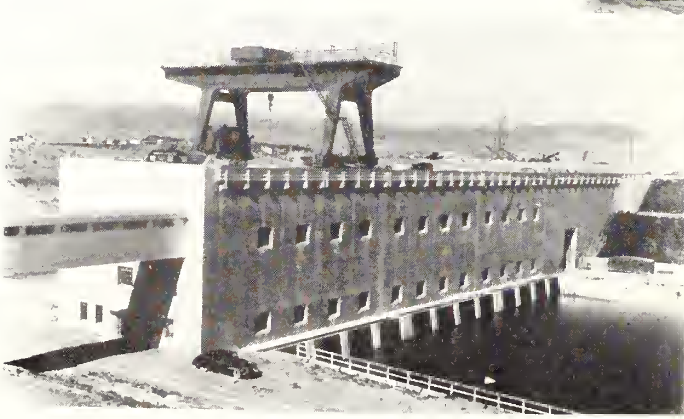
Under Oscar Boden's determined and skilled guidance, thousands of miles of irrigation canals and laterals were built in the West, bringing new life and productivity to the sagebrush wilderness of Idaho, Oregon, and Washington, and the gaunt uplands of Nebraska and Wyoming. As construction engineer for the Delta Division of the Central Valley project in California from 1935 until his death, he administered the construction of such major features as the 120-mile-long Delta-Mendota Canal, the 48-mile-long Contra Costa Canal, the Tracy Pumping Plant—world's second largest pumping installation—and the project's vital artery, the Delta Cross Channel.

In recognition of such accomplishments, Mr. Boden was awarded, posthumously, the Gold Medal award, the highest honor it is possible for the Department of the Interior to confer.

Oscar Boden's 16 years of intensive work in the Central Valley was culminated in August, a little more than a month after his death, when first water flowed from the huge pumps of the Tracy plant into the Delta-Mendota Canal and started on its long journey to the thirsty lands of the Valley. Reclamation Chief Engineer L. N. McClellan, speaking at the dedication of the Tracy pumping plant on August 4, summarized Mr. Boden's Central Valley achievements: "The irrigation works which Mr. Boden planned and built will remain a

LASTING MEMORIALS to Oscar Boden's engineering ability are found throughout the West. One of the most spectacular is the Colossus-like Tracy Pumping Plant, below, its crane astride the pulsating "heart" of the Central Valley project. At right, the "assembly line" construction of the Delta-Mendota Canal, a new technique advocated by Boden.





lasting memorial to his contribution to the development of the water resources of our country."

Oscar Boden came to California in 1935 at the request of Walker R. Young, who at that time was the supervising engineer for the Central Valley project and who in later years was to become chief engineer of the Bureau. As the engineering head in charge of construction of the Delta Division features, Mr. Boden was one of the project's key engineering triumvirate which included Ralph Lowry, construction engineer of Shasta Dam, and R. B. Williams, construction engineer for Friant Dam. Engineering administrator for this sphere of Central Valley activity, Mr. Boden was responsible not only for construction of the Delta canal structures and the Tracy pumping plant but for the investigations, planning, and lay-out as well.

"Brig" Young's choice of Mr. Boden as one of his principal assistants was based on personal familiarity with the latter's already remarkable record of engineering experience and competence. Mr. Boden had distinguished himself as an aggressive canal constructor on the Bureau's North Platte and Riverton projects in Wyoming, on the Kittitas Division of the Yakima project in Washington, and on the Owyhee project in Idaho and Oregon.

Harry W. Bashore, former Commissioner of Reclamation, was one of the first engineering administrators to recognize Mr. Boden's ability. In a letter written in 1925 in his capacity then as superintendent of the North Platte project in Wyoming and Nebraska, Bashore said: "Oscar Boden secures permanent and lasting work at low cost principally on account of foresight and attention to details." Of Mr. Boden, H. D. Comstock, superintendent of the Riverton project (Wyoming) in 1925, wrote: "He is particularly successful in obtaining excellent results from contractors at low cost without friction. He is aggressive, dependable, and loyal."

Mr. Boden's Reclamation career began in 1911. His first 5 years of service were spent in operation and maintenance work as general assistant to the irrigation manager on the North Platte project. Although he was sometimes impatient with the relatively slow pace of maintenance engineering, he recognized the value of this early training. "The experience gained in this work," he wrote, "was of great help to me later on the location and construction of new works."

From 1916 to 1925, he was in charge of topographic survey work, lateral design and lay-out, and canal, drain, and lateral location of the Fort Laramie Division of the North Platte project. In addition to the construction of 50 miles of new canals and an equal number of miles of laterals, he was responsible for the location and construction of distribution systems covering 62,000 acres of irrigable land on the project.

From the North Platte project Mr. Boden transferred to the Riverton project where he remained for a year. In 1926 he was called upon to aid in canal construction on the Yakima project. He was reassigned to the Owyhee project in 1930 and placed in charge of construction of the project's

(Please turn to page 38)

PRACTICAL AND PROGRESSIVE were Boden's plans, and the structures built under his supervision reflect both aspects of his work. At left, the Contra Costa Canal headworks *(photo by B. D. Glaha, Region 2)*. Below, the Delta Cross Channel control structure *(photo by C. B. Hertzog, Region 2)*.

SHORT CUTS TO WEED KILLING CALCULATIONS

PART 9—Calibrating the Rig for Aromatic Solvents Applications

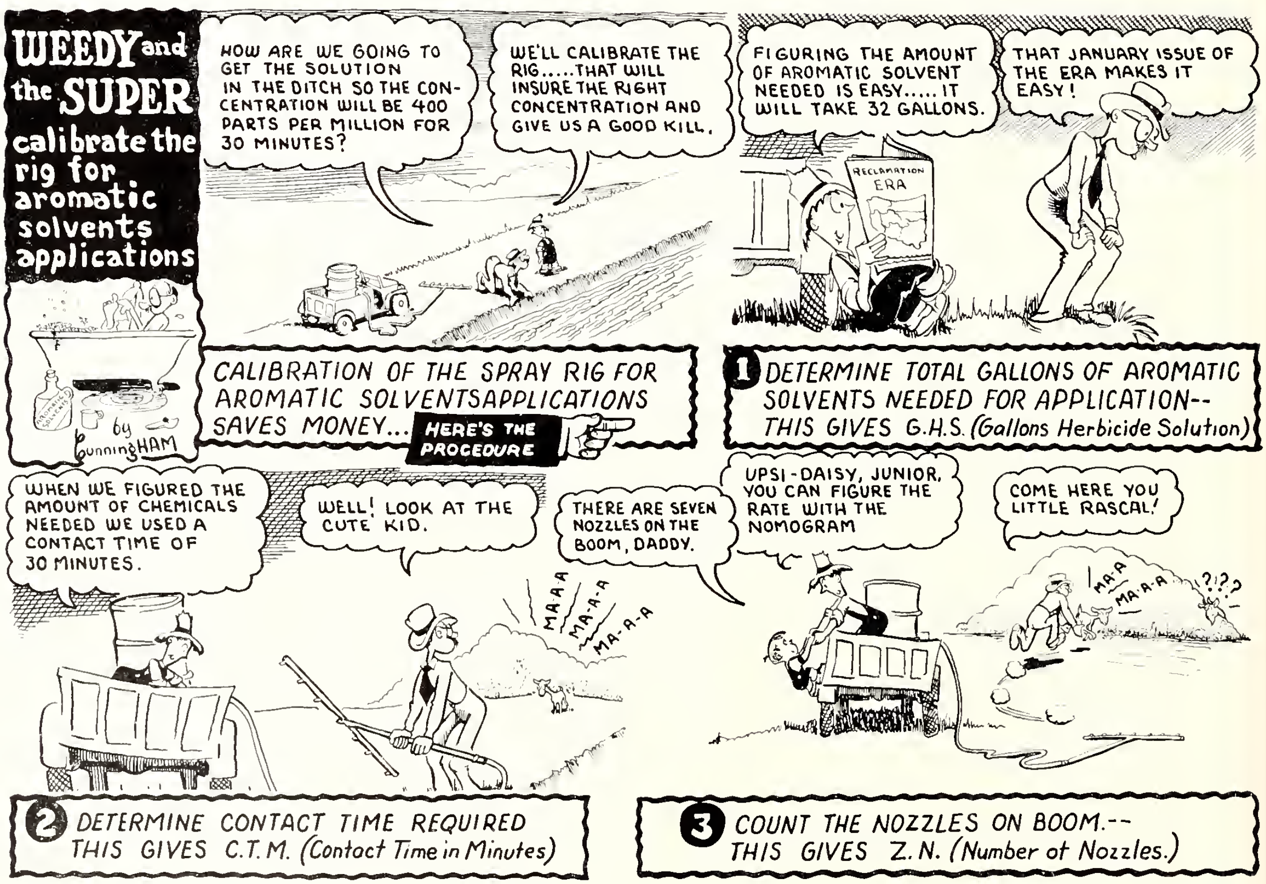
by JOHN T. MALETIC, Weed Specialist and Soil Scientist, Region 7 Headquarters, Denver, Colo.

Aromatic solvents is a new chemical used to kill waterweeds. Compared to other methods of waterweed control, this method is inexpensive. To prevent overuse of materials and to assure success of aromatic solvents applications, it is just as important to calibrate the equipment for waterweed control as it is for land weed control. This saves more money.

Part 8 of this series appeared in the January issue of the Reclamation Era. It showed how to determine the amount of aromatic solvents needed. Follow this first step with rig calibration to get correct amounts of chemical in the water. In the cartoon below, Weedy shows how it is done.

When calibrating, have several different sized nozzles available. This is because the operating pressure needed to discharge the proper amount through one nozzle may be too low or too high for satisfactory operation. For accuracy, calibrate with aromatic solvents in the spray tank. At the same pressure, aromatic solvents discharge from a nozzle at a faster rate than water. To prevent waste, you should arrange to catch all the spray while measuring the delivery from a single nozzle. Remember—effective, economical use of aromatic solvents depends upon accuracy of calibration.

The End.

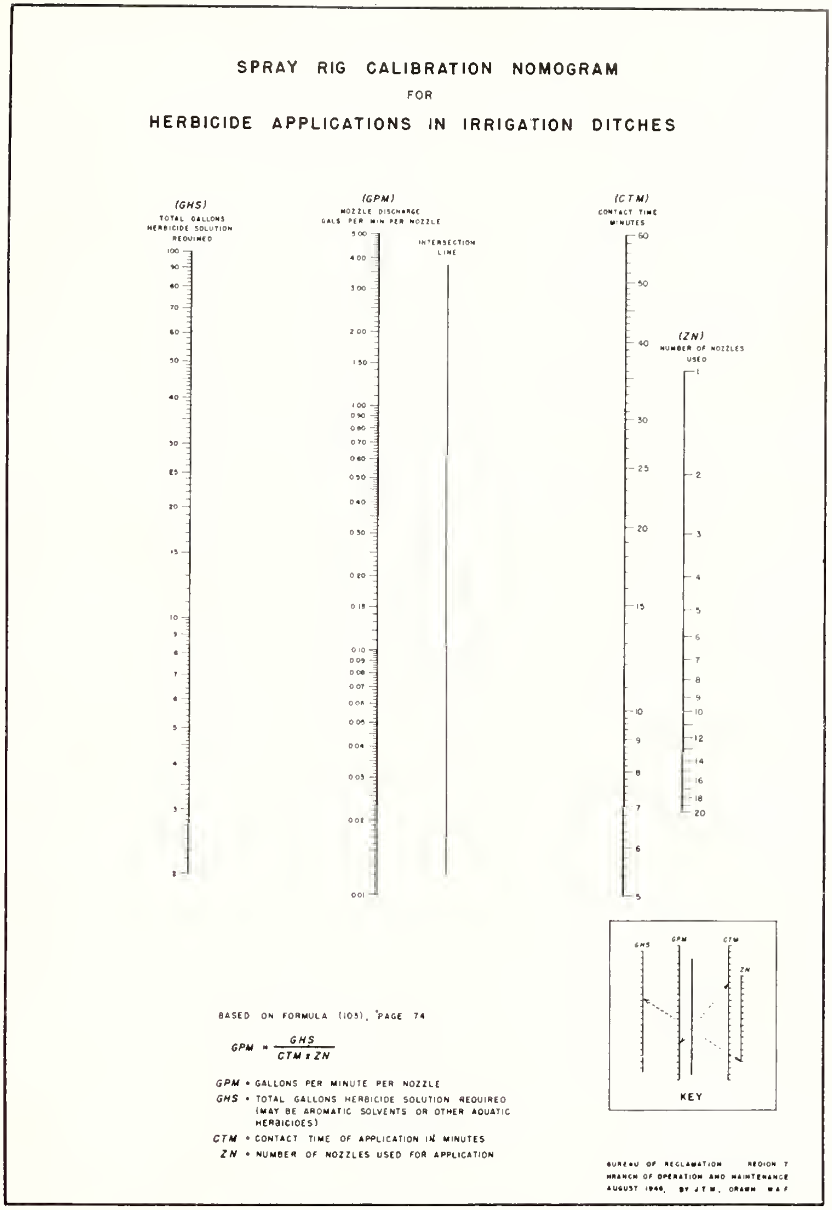


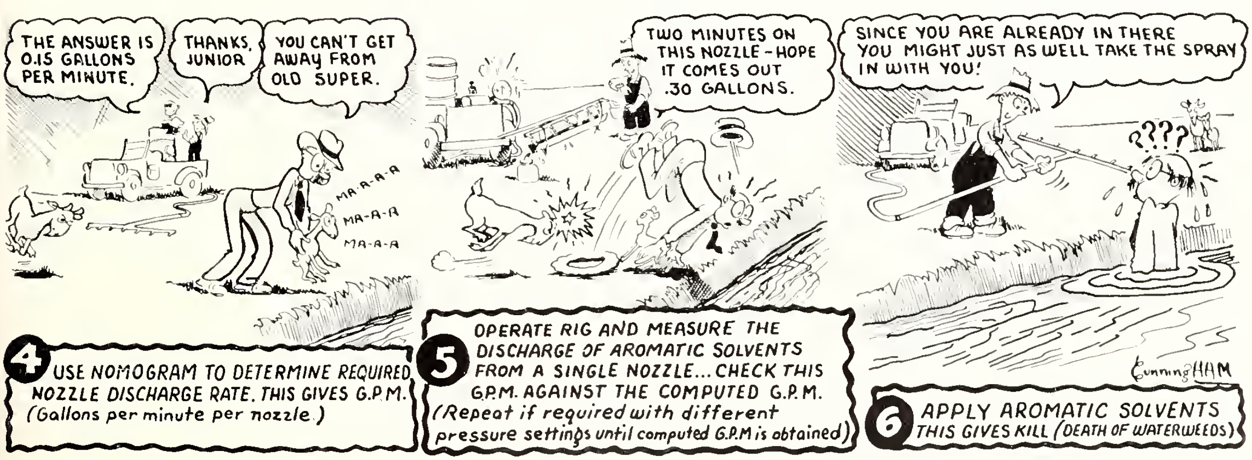
INSTRUCTIONS AND EXAMPLES

This chart will assist you rapidly and easily to determine the nozzle discharge rate needed to apply aromatic solvents. It gives the gallons per minute (GPM) per nozzle required to obtain a specified concentration of the chemical in irrigation water. After obtaining this computed GPM, the pressure is adjusted on the rig until the measured amount obtained in 2 minutes from a single nozzle is approximately equal to the computed GPM. To get the answer, simply connect the scales with a transparent straightedge as shown by the dashed line in the key.

FIRST STATION—For control of pondweed a concentration of 400 p. p. m. aromatic solvents applied over a period of 30 minutes contact time (CTM) is recommended. If a boom with seven nozzles (ZN) is used and the total amount of aromatic solvent needed is 32 gallons (GHS)—what is the required nozzle discharge rate (GPM)? Connect 32 GHS with 7 ZN. Mark the point where straightedge crosses reference line. Connect point with 30 CTM. Read answer 0.15 GPM.

BOOSTER APPLICATION—When applying aromatic solvents, a booster shot of the chemical is frequently needed about 2 miles downstream from the original application point. If the booster shots are to be applied with a 7 nozzle (ZN) boom at a concentration of 300 p. p. m. for a contact time of 30 minutes (CTM) requiring 24 gallons (GHS) of chemical—what is the required nozzle discharge rate (GPM)? Connect 24 GHS with 7 ZN. Mark point where straightedge crosses reference line. Connect point with 30 CTM. Read answer 0.11 GPM.





Elements in the Soil

(Continued from page 29)

be as important in the molecular makeup of chlorophyll, which gives plants their green color, as iron is in the red hemoglobin of the blood of animals.

SULPHUR which can be used to reduce alkalinity in soils, has an important function in the formation of protein in plants. There is a deficiency of sulphur in many of our western soils, particularularly in areas devoted to alfalfa—a high protein crop and undoubtedly the most important crop in Western agriculture.

Of the mineral nutrient elements that plants derive from the soil, none are better known than POTASSIUM and PHOSPHOROUS. Together with nitrogen, these are the major elements most often deficient in soils and are therefore the principal constituents of the more than 16,000,000 tons of fertilizers used annually in the United States. In plant growth, it is important that the nutrient balance of these elements be so maintained in the soil as to provide for a proper physiological balance in the plant. To a large extent, these elements support and supplement each other, which is important in fertilizer economy. Excessive use of one or two fertilizer elements is useless extravagance if the other elements are deficient or unavailable.

In our Western irrigated soils, potassium is seldom deficient and in many cases the availability is adequate for so-called "luxury consumption." The tone and vigor of plants is dependent on it and it exerts a balancing effect on both nitrogen and phosphorus. It is essential in starch formation, aids in chlorophyll development and has other functions important in such crops as sugar beets and potatoes grown so extensively under irrigation.

Phosphorus is not as plentiful as potassium, and in the West is often unavailable to plants in soils characterized by excessive lime or high alkalinity. Application of phosphate fertilizers on irrigated lands is more common than that of any of the other major fertilizer elements. Phosphorus is important in the division of cells during plant growth and in the formation of fat (oil) and protein. Flowering and fruiting are definitely dependent upon it, as is indicated by the large amounts found in seeds. Along with calcium, it encourages and strengthens straw, and increases plant resistance to disease.

In contrast to the heavy demands upon these major elements, there are a number of other elements, such as BORON, IRON, ZINC, COPPER AND MANGANESE, which are also essential for plant growth. All except iron occur in very minute quantities and are called minor or trace elements. The amounts present in soils often can be detected only by special laboratory tests. Deficiencies in soils are recognized by "deficiency diseases" of plants or the animals that consume the crops grown upon them, or by crop deficiency symptoms resulting from lack of or inadequate availability of these elements. Some of these elements are required only in amounts as low as a few parts per million of soil. In excess of this they are very toxic. Sometimes actual iron starvation or chlorosis may occur even though iron is plentiful in all soils. This is because too much lime or alkalinity or both, make the iron and many trace elements insoluble and unavailable. This situation is especially common to soils in arid and semiarid regions. However, because of the minute quantities required, deficiencies are usually readily overcome by spraying the foliage, by small injections into the bark of trees or even by driving one or more metallic nails or tacks into the trunks.

Equally important to plant life is the air from which plants draw the elements of oxygen, carbon, and hydrogen for formation of starch, sugars, and their woody or fiber structure. And, above all, without the soil water in which nutrients are dissolved and transported into and through plants and organisms, biological activities would cease and growth would not be possible. Plant and animal life diminish in more or less direct relation to decreasing moisture.

(NEXT MONTH—SOIL, WATER, AND AIR)

PRIVATE ENTERPRISE AND GOVERNMENT PARTNERSHIP helped win the battle for freedom from salt invasion and water shortage. Mr. and Mrs. Wayne T. Wright (above), prosperous partners on their Roll ranch.

PERSEVERING PRESIDENT of the Wellton-Mohawk Irrigation and Drainage District R. H. McElhaney and his wife (above). All photos for this article by S. B. Watkins, Region 3 photographer.

Water for the Wellton-Mohawk

Part Two—Farmers and the Future

by A. B. WEST, Supervisor, Operation and Maintenance Division, Region 3 headquarters, Boulder, City, Nev.

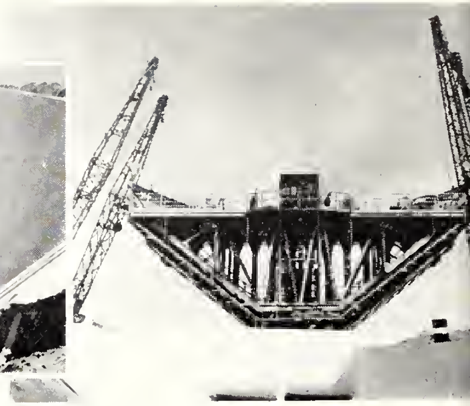
McElhaney and his wife homesteaded 160 acres near Wellton, Ariz., in 1924 and irrigated their first 10 acres 5 years later. He was one of a dozen homesteaders who settled in the valley at this time. The going was rough, and in 1926 he accepted the foremanship of the Wright ranch near Roll, Ariz., to make ends meet. He held this job until 1932. His undying faith in the valley wouldn't let him pull up stakes. With his neighbors he fought the drought and salt cycles, all the time improving his own ranch.

"The Wellton-Mohawk area and Yuma County have the brightest future in the Southwest," he declares. "We're one of the few areas that will have an assured water supply. When we get fresh water we will raise any crops that are growing in the Salt River area or the Yuma area: small grains, cotton, alfalfa, hay, fruit, and vegetables, all those general crops that are grown in our southwest desert areas. We are identical in growing season to the Yuma Valley and the Salt River Valley. We average 253 frost-free days a year. In spite of the poor quality water, several farmers produced cotton that yielded as much as two bales per acre last year."

Further proof that the Wellton-Mohawk Valley can grow the crops when it gets the water is seen on Wayne T. Wright's Antelope Ranch. Wright settled along the north side of the Gila River 3 miles southwest of Roll in 1925. From a small beginning he built up his ranch into one of the most prosperous in the Southwest. Although his irrigation water is some of the best in the valley, it is too salty for human or animal consumption. Fortunately, Wright discovered a vein of fresher water under his sprawling Spanish-type ranch house and sank a well to it. This furnishes palatable water for his household.

Like other farmers in the valley, Wright played along with the water instead of against it. Although his farming operations are perhaps the most diversified in the area, he has stuck mainly to alfalfa and Bermuda grass seed. This year, with the price of cotton high, he has planted as much acreage in that crop as his water supply would permit.

Wright has built up such a thriving seed business, complete with his own modern cleaning plant for processing, that often he cannot fill all the orders. Seed sacks with the Antelope Ranch



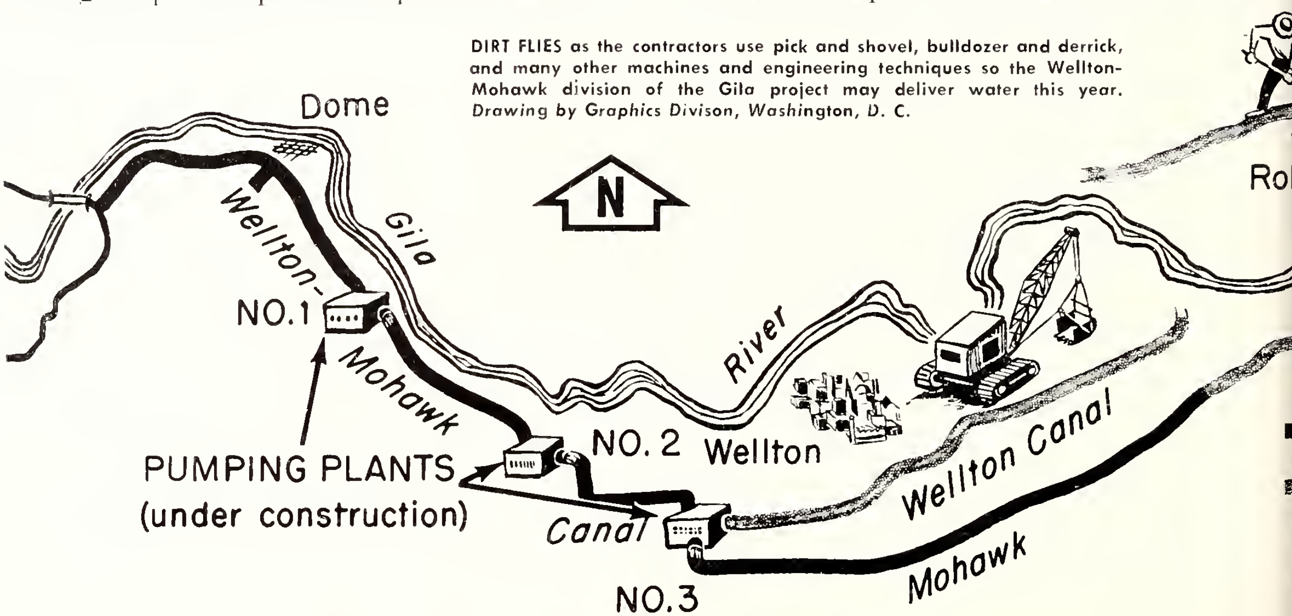
THE FIRST STRETCH—Check and turn-out for the first 8½ miles of the canal (above) and the Wash Siphon (at right). At extreme right, moving the lining machine over the Siphon.

name printed on them are familiar brands in seed stores in the Middle West and North, particularly where the farmers require a seed that will resist bacterial wilt.

Wright has his own single-engine plane and landing strip. He parks the plane in a shed almost at his back door and takes off and lands with the same ease and convenience as when driving his automobile. The plane carries him to nearby and far-off places to talk with seed customers and attend alfalfa improvement and seed certification conferences, and on other trips.

Colorado River water will flow through the valley's irrigation ditches sometime in 1952. Hope for service in early 1952 is dimmed somewhat by flood damage last summer to a portion of the main Wellton-Mohawk Canal while under construction and by material priority problems.

The Wellton-Mohawk division's irrigation system consists of three major canals with appurtenant structures, laterals, three main pumping plants, and two smaller pumping plants. The Wellton-Mohawk Canal, 18½ miles long, leaves the Gila gravity main canal at a point just below the Gila River siphon and about 15 miles below Imperial Dam. Its branches, the Mohawk and Wellton Canals, will carry the water to the lateral systems.



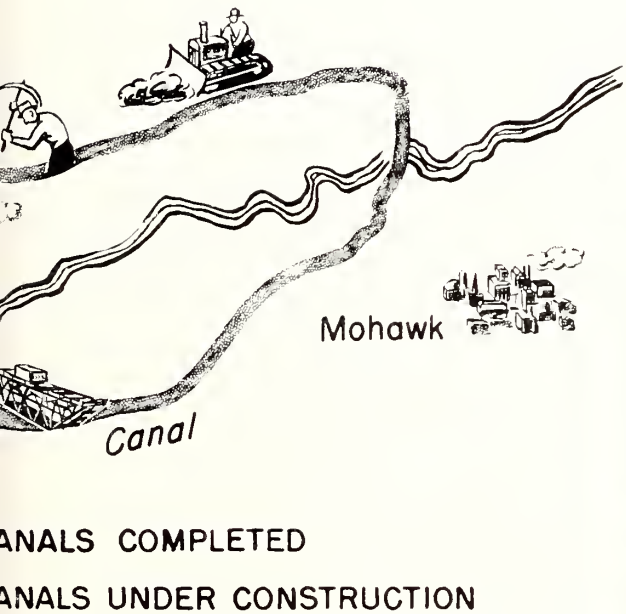
DIRT FLIES as the contractors use pick and shovel, bulldozer and derrick, and many other machines and engineering techniques so the Wellton-Mohawk division of the Gila project may deliver water this year. *Drawing by Graphics Divison, Washington, D. C.*

Work was begun on the first 8½ mile stretch of the Wellton-Mohawk Canal by Fisher Contracting Co. in August 1949. The Morrison-Knudsen Co., Inc., built the remaining 9.9 miles of this main artery. Three large pumping plants along the canal which will lift the water a total of 170 feet are being constructed by the United Concrete Pipe Corp. with pumps being furnished by the Worthington Pump & Machinery Corp. Western Contracting Corp. is building 29 miles of the Mohawk Canal, and is also furnishing and installing radial gates for the Wellton-Mohawk Canal. An additional 10 miles of the Mohawk Canal is under contract to Marshall Haas & Royce. The remaining 5 miles of this canal will be started next spring. Morrison-Knudsen Co., Inc., is building 12 miles of the Wellton Canal. Other contracts will involve principally lateral construction.

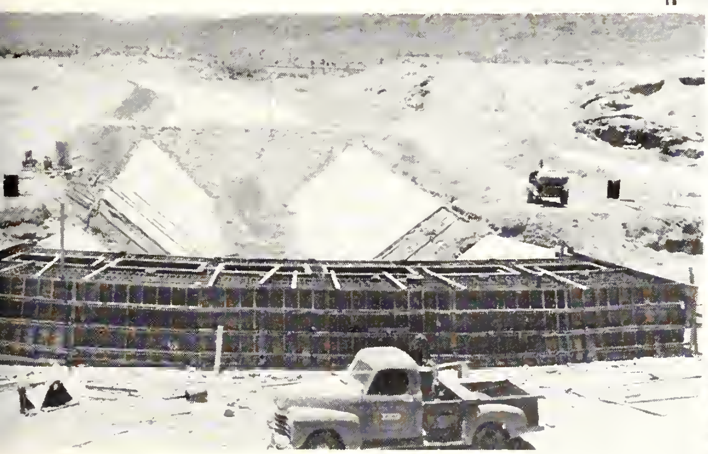
The three pumping stations that will lift the water over the high places will be powered by energy from Davis Dam, some 250 miles up the Colorado River. The Wellton-Mohawk Irrigation and Drainage District will receive this energy at a substation near the No. 2 pumping plant. Besides the power used in pumping, the District will distribute energy to water users on the project. Profits from the resale of power will help offset the cost of pumping.

District President McElhaney regrets that the water on its way to the valley doesn't drop a total of 170 feet instead of having to be pumped that distance. Then the pumping plants could have been small power plants, producing (instead of consuming) electrical energy. But he's happy just the same, and explains that everything can't be perfect. Getting rid of the salt menace and adding acres of irrigated land are near enough to perfection as far as he and other valley farmers are concerned.

THE END.



CLEANING UP the inside of a siphon under Highway 80 (top photo). At lower left, Pumping Plant No. 1 as it began to take shape last July. At lower right, on the same day, men were working on the discharge tubes for Pumping Plant No. 2.



Oscar G. Boden

(Continued from page 31)

major irrigation distribution system. Later he was given the responsibility of determining the location of the Black Canyon Canal on the Boise project in Idaho. He remained on the Owyhee project until his appointment by the Secretary of the Interior to start work on the first features of the Central Valley project.

Born in Kellogg, Iowa, in 1885, Mr. Boden was graduated from the Iowa State College as a civil engineer in 1910. He was employed as a surveyor's assistant on railroad location and construction work during the year following graduation. Married in 1912, he was the father of three children.

The son of a German Lutheran minister, Oscar Boden was brought up in an atmosphere of sincerity and probity. His later life as an engineering administrator typified his early upbringing. He was noted for his honesty and conscientiousness, and his impartiality in his relations with contractors and the Bureau working staff alike.

A practical engineer, he was a determined proponent of good quality in construction. Although of the "old school," he maintained a continued progressive outlook and was noted for his readiness to accept new techniques and improvements. His advocacy of the development of the huge 200-ton canal trimmers and lining machines on Central Valley canal work was notable in this regard. His associates remember him for his attention to detail and insistence on good workmanship. They recall that he would don high-topped "diggers" and walk along every mile of the canal or lateral that he was building.

Oscar Boden was a devoted family man, and his career came second only to his wife and children. He was noted for his keen sense of humor and his willingness to help others. While on the Owyhee project he worked after hours with his junior engineers, clearing off sagebrush near Nyssa, Oreg., to make a nine-hole golf course available for them.

For his record of achievements as a master canal builder, and for his outstanding role in constructing a large part of the more than 16,000 miles of canals that now bring water to far-flung areas of the West, Reclamation pays tribute to Oscar G. Boden by naming him as an inspirational leader in Reclamation's Hall of Fame. The End.

Chemical warfare against weeds is not new. About 40 years ago a scholarship student at the North Dakota Agricultural College, William H. Mercer, more familiarly known as Bill, began experimenting with chemicals to control wild mustard and giant ragweed in grain fields, thus shaping the pattern of his life work—weed-fighting. At that time he experimented with iron sulphate and other chemicals available at that time. Iron sulphate continued in use until several years ago when more selective and effective chemicals were developed.

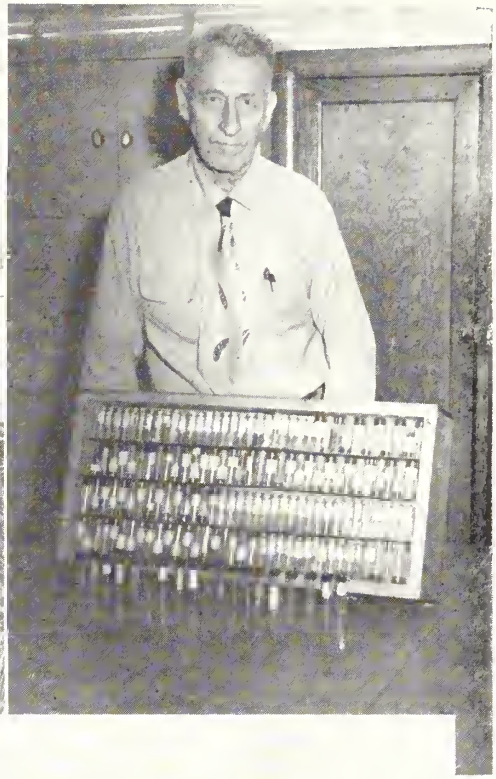
A pioneer from the beginning, Bill Mercer was born 69 years ago in a sod-roofed log cabin in central North Dakota where his Civil War-veteran father had pushed westward after his discharge from the Union Army. Bill grew up on his father's cattle ranch, leaving it in 1904 to enter college, where he did so well in his studies on plant life that he was awarded a scholarship in the Department of Biology. From that time until the present, with but one deviation, forced by the depression years, Bill Mercer's career has followed and helped shape the course of weed warfare.

Bill Mercer has long been in the thick of the weed fighting, and in following his career one can delineate the evolution of weed killing methods during the past 40 years.

In conducting any type of warfare, a sound military precept is to know your enemy. Forty years ago, Bill Mercer started his fabulous

40 YEARS

weed-seed collection, termed by many experts in the field as the best private collection of its kind. It now contains seed from many parts of the world—Europe, South America, Alaska, and Japan, as well as North America. The seeds are of many shapes and sizes, some so tiny as to be almost invisible to the naked eye, others larger than beans. Each seed-type is preserved in a separate, carefully labeled glass vial. More than 500 of these thumb-size vials completely fill a large wooden case, specially constructed by Bill to hold his collection. The work of identifying weeds continues to be of great importance to farmers, and the interna-



WILLIAM H. MERCER—ACE WEED-FIGHTER shown above examining water hyacinth to see how it reacts to a newly developed weed killer. Mercer's work in this Bureau of Reclamation Weed Control Laboratory in Denver is in cooperation with the Department of Agriculture's Bureau of Plant Industry. At upper right, Mercer with his weed-seed collection, rated by experts as the best of its kind. At lower right, the light-weight catamaran on the Uncompahgre project in Colorado in 1940 where hand-operated oil burners were used to eradicate ditchbank weeds.

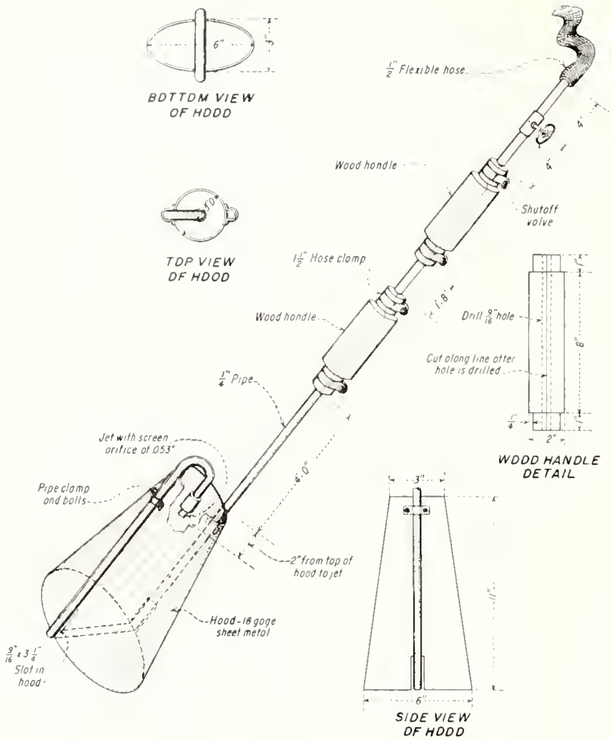
OF WEED-FIGHTING

tional character of Bill's collection reflects the growing interest and concern in foreign agriculture as it affects our own, particularly as weed seeds and weeds have been known to travel great distances around the globe.

Bill believes in sharing his knowledge. While in college he sold some of his writings to farm papers and magazines to help pay for his education, and continues to turn out interesting and valuable articles on his pet subject. Readers of the Reclamation Era will remember his articles entitled, "Tumbling Tumbleweeds" on page 225 of the October 1947 issue, "Weeds and their Worthy Opponent" on page 269 of the December 1946 issue, and "Framing a Weed Control Program for the Uncompahgre Valley" on page 116 of the June 1938 Era.

The students in the Canby, Minn., high school were brought up to date on agricultural subjects by young Mercer at the beginning of his career, until he was lured back to his alma mater to serve as an assistant botanist, conducting laboratory and field experiments on controlling weeds, breeding and selecting plants, and analyzing seeds, besides lecturing and writing on weeds and their control.

Weeds by that time were becoming such a menace to farmers that legislation was needed to keep crop seeds free from weeds, guarantee State maintenance of public property to prevent the spread of weeds, and to control certain weed-killing prac-



PATENT APPLIED FOR—Mercer's invention, a hand-operated propane-butane weed burner, which can be built with a minimum of tools and shop facilities. ***Drawing by Marie L. Lang, Branch of Design and Construction, Denver, Colo.***

tices. Mercer helped write North Dakota's weed and pure seed laws, pioneering in this field also. Later he gave similar assistance to Colorado, Texas, and Idaho when working in those States in later years.

As every farmer knows, there is no substitute for actual personal farm experience when dealing with the weed menace, and in 1917 Mercer began a 12-year bout with weeds on his own full-time farm located on the Uncompahgre project near Montrose, Colo., putting his scientific knowledge to the test. For his purposes, it was an ideal spot. When he joined the Bureau of Reclamation later, he surveyed the entire project and found that more than 33,000 of the 80,836 acres were infested with 10 different types of weeds, leading him to report that there were more weeds and more different varieties of weeds on the project than on any other comparable area in the civilized world.

It was in 1933 that he went to work for the Uncompahgre Water Users Association and the Bureau of Reclamation, serving in a part-time capacity with each until 1938 when he assumed full-time duties with the Bureau as a weed-control specialist, working on the Minidoka project in Idaho, the Rio Grande project in Texas and New Mexico, and at the Bureau of Reclamation's Regional office in Amarillo, Tex. In May 1948 he transferred to the Commissioner's Staff Offices in Denver, Colo., where he works in the chemical laboratories, devoting most of his time to testing the value of newly developed chemicals recommended as weed killers. If these chemicals actually kill weeds, then additional experiments are conducted to test the effect of the weed killer on farm crops. Miniature crop-raising and chemical-testing activities are carried out in two small greenhouses on a hillside behind the giant Engineering Laboratories building. These experiments are conducted in cooperation with the Department of Agriculture.

During the early days of his career, Mercer learned the names, shapes, strengths, and weaknesses of weeds, and began to devise the most effective weapons against each type, keeping in mind that crops, livestock, and soil must be protected at the same time.

Bill can remember when the only weapons against weeds—or "plants out of place"—were the 10 fingers of the hand, a hoe, a rake, or a fire. During his career he improvised several improvements on the mechanical methods for digging weeds out of the ground, dredging them from canals, or collecting tumbleweeds for eventual burning. With the growing interest in chemical control of weeds, and as chemicals become cheaper and easier to get, he continued his pioneering with new mixtures of sprays, dusting powders, and solvents for waterweeds.

For the last 15 years Mercer has been conducting other tests to determine how long weed seeds will live in water and remain harmful if carried to fields in irrigation water. Some seeds remained fertile after being under water more than 3 years. Although results are still inconclusive, Bill has learned a great deal about under-water weeds and intends to write a technical paper on his findings.

Another of his contributions to weed control was his development of weed burners. Bill worked on and helped design a noncapsizable raft called a catamaran for weed-burning operations on the Uncompahgre project in Colorado in 1940, again pioneering the amphibious method of attack which later contributed in part to the building of a flame-throwing tank made from war surplus equipment. (See article entitled, "Building a 'Duck'" on p. 216 of the October 1946 Reclamation Era.)

Truck-mounted batteries of propane-burner heads have been used successfully for the past 2 years for weed control on the ditches of the Las Cruces Division (New Mexico) of the Rio Grande project. These spectacular-appearing weapons still have a place in weed control on irrigation systems both for eliminating green growths on ditchbanks and dry dead plants at clean-up time. However, the development and use of more effective and economical chemical weed killers has replaced many of the burning operations used in the past. Bill Mercer cautions against their use where wildlife might be injured or nearby property or crops might be damaged. When Bill Mercer reaches the compulsory retirement age of 70 in March 1952, he plans to devote much of his time to developing a new, small, hand-operated weed burner head. A patent application on this device (illustrated on p. 40) is now pending. This propane-butane burner is economical, light in weight, simple to manufacture and operate.

Even though Bill Mercer is retiring from the Bureau of Reclamation, he is not giving up his battle against weeds and his lifelong efforts have helped and will continue to help farmers to rid their fields and ditches of these unwelcome intruders. THE END.

Quakes and Currents

(Continued from page 26)

the reservoir would have leaked—unless the channel were blocked, involving expensive procedures.

To determine the true depth of the channel, engineers used a coordinated seismic and drilling program. Contrary to previous information, this work demonstrated that the bedrock floor in the channel was, in fact, relatively shallow and actually at a higher elevation than the proposed maximum water level of the reservoir. Thus, the bedrock floor is effectual in blocking the channel as a path of reservoir leakage. The cost of the work was much less than if the investigation had relied entirely on drilling. In addition, much time was saved.

The resistivity method has been used successfully on a number of projects. For example, it was applied in the search for rock which would be suitable for protecting the upstream face of Cedar Bluff Dam, near Ellis, Kans. Rock of this type (which when broken into pieces is called "riprap") is very scarce in the vicinity of the dam site area. Fortunately, a small deposit was located at a distance of approximately 14 miles from the Cedar Bluff Dam site. The outcrops that were visible were not reliable for estimating the quantities that might be available. Because of the erratic and variable occurrence of the material, it would have taken a very large number of drill holes to provide an answer. Here, application of the resistivity method, supplemented by limited drilling and measurements of the outcrops, resulted in a speedy and economical estimate of the quantities of rock present. THE END.

WARNE LEAVES INTERIOR FOR IRAN—Above, William E. Warne, former Assistant Secretary of Interior, receives a miniature Iranian flag from the late Dr. Henry G. Bennett, Administrator of the Technical Cooperation Administration, Department of State, during a luncheon at which Mr. Warne received a Distinguished Service Award from Secretary of the Interior Oscar L. Chapman (partially visible at right). Assistant Commissioner of Reclamation, Goodrich W. Lineweaver, master of ceremonies for the event, stands behind Dr. Bennett, who died in a plane crash December 27, 1951. Warne resigned from his Interior post on November 8 and in his new capacity will formulate and administer Point Four activities in Iran in cooperation with that Government. He will have the personal rank of minister and will be attached to the United States Embassy in Teheran. *Photo by Glenn Peart, Interior Department photographer.*

Spencer's Speed on Hungry Horse Pays Off

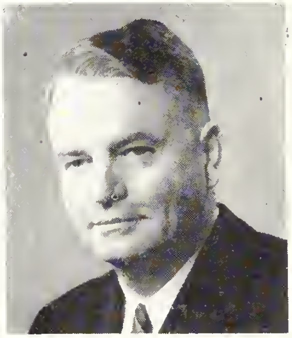
Clyde H. Spencer, construction engineer on the Hungry Horse project in Montana, received a $600-a-year raise in salary on September 5 for his outstanding contribution to efficiency, economy, and cash return to the Government in the construction of this project.

As a result of the excellent cooperation he has given the contractors, General-Shea-Morrison and the Grafe-Shirley-Lane Co., it is expected that the powerhouse will be ready to operate with the first generator several months ahead of the scheduled date—October 1952, thus bringing a quicker return to the Government on its investment in Hungry Horse. •

CVP Sets the pattern

by SAMUEL B. MORRIS, General Manager and Chief Engineer, Los Angeles Department of Water and Power

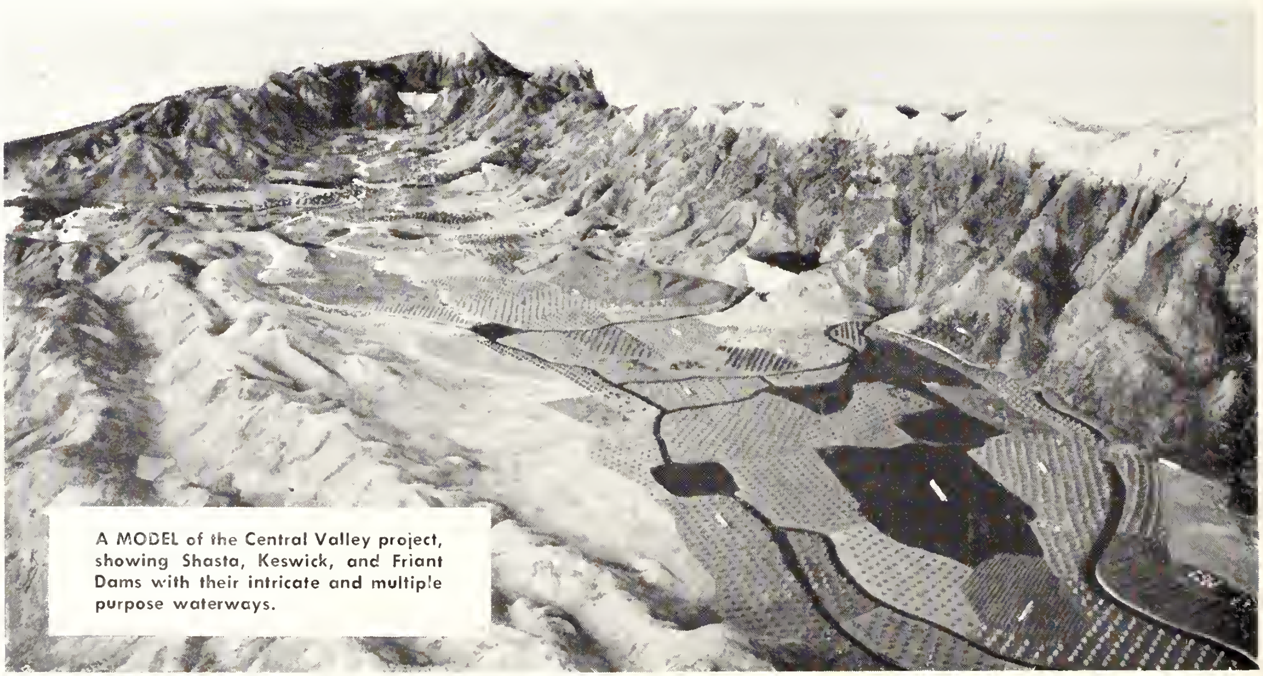
Mr. Morris served the Nation as a member of President Truman's seven-man Water Resources Policy Commission which submitted its epochal report earlier this year. He was a principal speaker at the opening ceremony of the CVP Water Festival at Shasta Dam in August. In this article, based on Mr. Morris' Shasta address, he interprets the recommendations of the Commission in relation to multiple-purpose basin-wide developments like the Central Valley project. Photo at right courtesy of Berton Crandall Photographs, Palo Alto, Calif.



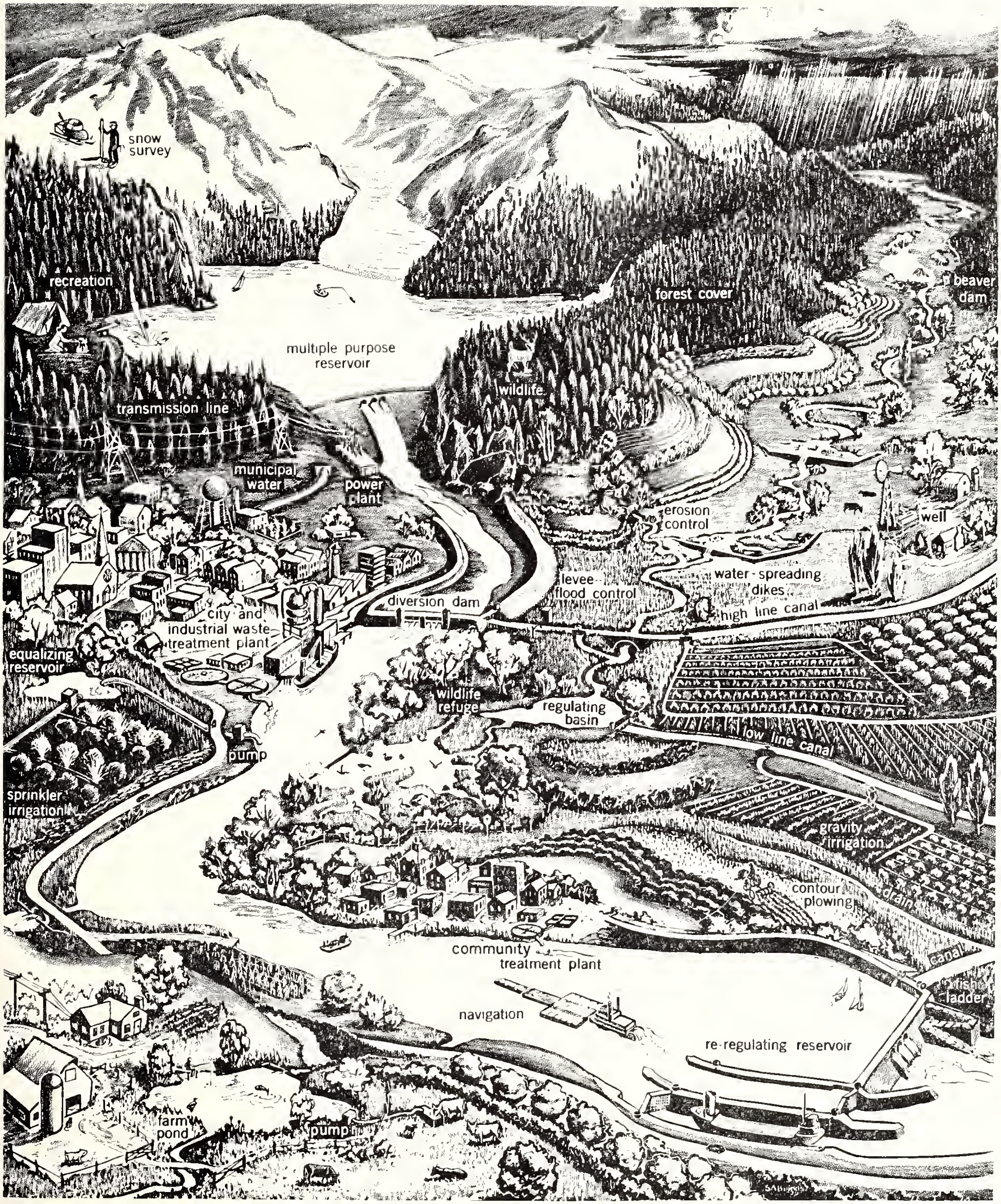
California long has been a leader in the development of bold yet soundly conceived water projects to move vast quantities of water from areas of plenty to areas of greater need. One of the first of these was the Owens River Aqueduct which transported water from the eastern Sierra 238 miles to Los Angeles. Then came San Francisco's Hetch Hetchy and East Bay's Mokelumne projects. The All-American Canal and the Colorado River Aqueduct were additional great steps. But nowhere in the Nation has there been a project providing for such manifold uses of water as the Central Valley project. It represents on a grand scale the best example in the United States of multiple-purpose planning for all uses of the waters of a stream system.

Unfortunately, throughout the Nation the many Federal agencies interested in water- and land-use development have not been organized under the concept of such comprehensive multiple-purpose development. Rather they have been organized under specific legislation to carry out single-purpose projects. Later legislation has attempted to expand their functions from their original single purposes to the multiple-purpose programs which modern day development requires.

Owing to the many diverse statutes governing the policies of the several Federal agencies, President Truman in January 1950 created the President's Water Resources Policy Commission and asked for recommendations for a comprehensive policy for water-resources development. The Commission completed its assignments by February 1951 and issued its full report in three volumes. This report may now be purchased from the Superintendent of Documents and may



A MODEL of the Central Valley project, showing Shasta, Keswick, and Friant Dams with their intricate and multiple purpose waterways.



A TYPICAL MULTIPLE-PURPOSE RIVER BASIN DEVELOPMENT. Readers of the *Reclamation Era* may remember a drawing similar to the one above which appeared in the August 1949 (Water Use and Conservation) issue of our official publication. That drawing was so well received that Shirley Briggs, Reclamation artist, was commissioned to prepare the above revision for the frontispiece of Volume 1 of the report of the President's Water Resources Policy Commission, entitled "A Water Policy for the American People." With the Commission's permission, we are reprinting it here as a graphic illustration of wise conservation and use of water.

be found in most libraries. It is a document that for the first time presents a uniform concept for the orderly conservation and development of our natural water resources, on which our entire future depends. I should like to express my understanding of the underlying philosophy of the President's Water Resources Policy Commission in drafting this report:

Water and land, properly husbanded, are permanent natural resources upon which the very life of our Nation and future generations must depend. Other mineral resources once consumed are no longer available, but water and land properly used are permanent assets. Because this simple but vital distinction has not been understood, we have seen the loss of much of our forests, fish and wildlife, and the serious erosion of soil caused by man's occupation of the land. We must continue to look to the private-enterprise system for the most efficient exploitation of natural resources. At the same time we must look to Government for the conservation of our natural resources, and most of all water and land. Natural resources and human resources are the source of the Nation's wealth and strength.

The Commission's recommendations are therefore not merely negative—that is, stating only that certain work should not be done unless certain standards of feasibility are upheld. Rather they are affirmative, declaring that action is required to conserve water and land for their best continuing use. The report cites the experience of the last two decades, beginning with the Boulder Canyon project and the construction of Hoover Dam and further exemplified by this great Central Valley project which clearly indicate that there is the greatest benefit and economy arising through multiple-purpose water developments. Such developments on our major rivers require comprehensive coordinated planning which takes into account the requirements of the entire river basin. To carry on such plans and programs adequately there is necessity for adequate basic data which should be continuously secured, compiled, and made available. Continuous studies are also required to develop the country's need for food and fiber and determine the proper timing of these great projects to improve the regional and national economy.

While the Commission outlined certain recommendations regarding return of costs it did not fully define standards of feasibility; rather it proposed a plan under which there should be strict accounting project-wise, basin-wise, and nation-wise, covering cost of construction, operation, and maintenance, and capital including interest. It proposed the appraisal of benefits, both tangible and intangible. It proposed that contribution to cost be made by all those benefited, including persons, corporations, State and local governments, including irrigation districts, soil conservation districts, drainage districts, special conservation districts, and the Federal Government. It is believed that such contributions to cost by all persons and agencies benefited would decrease the kind of log-rolling appropriations which all too frequently are sought by those who benefit but pay no direct costs. It is believed that full, honest revelation of costs and benefits, with no hidden subsidies, would be an effective means of screening the desirable from the undesirable projects.

To plan and program river basin water and related land use development, it was proposed that river basin commissions be created, representative of Federal, State, and local government. Opportunities for hearings in the field, and official comments by State and local governments should insure careful, well-drawn plans and properly analyzed programs. Creation of a board of review at the national level to review all such plans and programs, to aid in establishing uniform standards of feasibility, and to submit recommendations to the President and Congress, would be a further means of assuring the undertaking of the best soundly conceived programs under uniform standards of feasibility. Finally, projects would only be authorized by the Congress which, under our democratic process, would offer a final opportunity for public hearings and public reaction on a Nation-wide basis.

The general acceptance of these principles as a guide to sound planning and development of our national water resources will mean a long step forward in conserving and using without waste the great supplies of water which nature has given us. This mighty Central Valley project shows what can be done, on a grand scale and with outstanding success, when the principles of multiple-purpose river basin development are properly applied. May it serve as a forerunner and a source of inspiration for the many great projects of the future which will both save and use our land and water and make America strong and an even better place in which to live. THE END.

P. G. & E. to Buy Central Valley Power

The Pacific Gas & Electric Co. signed a contract with the Bureau of Reclamation on October 3 for Central Valley power which is not needed by preference customers, including Federal agencies.

All Central Valley project power is now produced at Shasta and Keswick Dams on the Sacramento River. The contract will permit the company to purchase excess power also from Folsom and Nimbus Dams on the American River when it is available. This contract together with the previous executed wheeling contract makes possible the delivery of firm power over P. G. &. E. lines to certain Bureau customers. Both contracts terminate on April 1, 1961.

Previously P. G. & E. bought Bureau power under a day-to-day agreement. The sales agreement establishes 300,000 kilowatts (or more than enough power for the city of Oakland, Calif.) as dependable capacity for commercial use for the present CVP hydroelectric power system.

Under the sales contract, the company is obligated to purchase the remaining dependable amount of power after the demands for project operations and Bureau customers have been met. The company will also purchase a large amount of power on a nondependable basis at a much lower rate. P. G. & E. will pay approximately the same rate for dependable power as other customers. •

Owyhee Project Turned Over to Water Users

Irrigation farmers on the 100,000-acre Owyhee Federal Reclamation project in Oregon started the New Year of 1952 by taking over the operation and maintenance of the network of 107 miles of canals and 441 miles of laterals carrying water to the project lands.

Ultimate operation of Federal Reclamation projects by the farmers themselves has been a fundamental policy of the national water conservation program which enters its Golden Jubilee year in 1952. Altogether 76 projects or divisions of projects constructed by the Bureau of Reclamation are now being operated by the water users.

The Bureau has operated the Owyhee project since 1935 when farmers received the first water from Owyhee Dam and irrigation works. In the 16-year interval, until the water users took over on January 1, 1952, the area was being brought to full development and water was distributed on a rental basis. •

BOARD OF DIRECTORS, SALT LAKE CITY METROPOLITAN WATER DISTRICT

Last month's issue featured the article, entitled "The Salt Lake Aqueduct," mentioning the members of the Metropolitan Water District of Salt Lake City as instrumental in providing an assured municipal water supply for the capital of Utah. Here they are, seated l. to r., Chairman George W. Snyder, S. A. Kennedy, and J. A. Nelson; standing, Treasurer Lane W. Adams and Grant M. Burbidge. Board member Blair Richardson was not present when the picture was taken.

Charles A. Bissell Retires With Honors

Charles A. Bissell, Regional Engineer for the Bureau's Region 3, retired September 30, 1951, after 34 years of service, for which he was awarded the Department of the Interior's distinguished service medal on September 28, 1951. J. P. Jones, his assistant since 1945, has been appointed acting regional engineer by Regional Director E. A. Moritz with whom Bissell worked when he joined the old Reclamation Service on the Yakima project in the State of Washington in 1908.

In 1911 Bissell became assistant engineer at Elephant Butte Dam, N. Mex., was appointed engineer in charge of the engineering section of the Washington, D. C., office in 1917, and in 1925 became chief of the engineering division. During 1930 and 1931 Mr. Bissell was senior engineer in the field service at large, in charge of field investigations undertaken by the Bureau in cooperation with the State of California which led to today's Central Valley project.

Between 1931 and 1939 Mr. Bissell was office engineer for the Metropolitan Water District of Southern California. Returning to the Bureau in 1939, he became assistant to the chief engineer in Denver, Colo., until his designation as Region 3's Regional Engineer in 1944.

Mr. Bissell was born in Navasota, Tex., September 11, 1881, where he attended grade and high school. He received a bachelor of science degree from Austin College in Sherman, Tex., and a degree in civil engineering from the University of Texas in 1906. •

Brumback Rewarded for Rescue

Robert W. Brumback, Reclamation employee at Wellton, Ariz., received the Department of the Interior's distinguished service award on October 5 for saving the lives of a father and two sons from the Gila Canal.

A family from Florence, Ariz., had stopped on Highway 80 near Yuma. One of the family's two sons had fallen into the adjacent canal and his brother was attempting to rescue him without success. Brumback, seeing their distress while passing in his car, stopped just as the father was trying to rescue both boys. However, none of the family could swim. Brumback, fully clothed, dived in the canal, helped all three to a sand ridge, then called to his wife for a rope he had in the car. With the assistance of his wife and another passenger he pulled the trio out of the canal.

Not all such incidents have such a happy ending. The Bureau of Reclamation is interested in promoting safety in and around its projects. Learning to swim, having a safe place to swim, providing supervision for swimming places, and learning methods of artificial respiration are all part of this program.

Do you have any suggestions along this line? Do you know of a good safety slogan, or a story about a safety campaign that worked? Send your ideas, information, photos, drawings, etc., to your nearest regional director, or the RECLAMATION ERA OFFICE, *Bureau of Reclamation, Washington 25, D. C., whichever is closer. A free subscription to the* ERA *for 1 year goes to anyone whose material is published in our official magazine.*

Alaskan Resources Report to Congress

Secretary of the Interior Oscar L. Chapman recently presented to Congress a "blue print" for Alaskan Resource development.

The report asserts in part that the development of Alaska is as important and vital to the United States as was the development of our Western States and that a balanced portion of the development must be in agriculture. It further emphasizes that this country as a whole needs Alaska's development from the standpoint of expanding its economy and, as individuals, the people need settlement opportunities, and other assistance necessary in connection with a frontier country.

Among the important topics treated in the report are the need for new hydroelectric plants, expanded agricultural production (estimated at a possible 87,000 acres), increased industrial and municipal water supplies, flood control and navigation of inland waterways (by both the Bureau of Reclamation and the Corps of Engineers), and the appropriation of sufficient funds to permit the efficient investigation of the territory's land and water resources. ●

Conant's Crystal Ball

Dr. James Bryant Conant, President of Harvard University and Honorary President of the Twelfth International Congress of Pure and Applied Chemistry, expressed the following comments regarding the future of solar energy and salt water conversion versus atomic energy, in New York City, September 5, 1951, as he described the world as it might appear in 1985.

The fine structure of the future is beyond the resolving power of my equipment. That I may as well confess. Therefore, the new scientific discoveries, the new theories, the various minor revolutions in physics and inorganic chemistry are not discernible. As to those major revolutions in biochemistry, which by 1985 has become the recognized successor to what was once called biology, to these epochal events I need only allude in passing. What must be described are the slow but steady changes in the production of energy and food. The era of liquid fossil fuels is by the close of the century coming to an end, and the worry about future coal supplies is increasing. For reasons I will explain in a moment, atomic energy has not proved to be an expedient way of lengthening the period in which man taps the sources of energy stored in the earth's crust. Solar energy, on the other hand, is already of significance by the time the American Chemical Society celebrates its 100th anniversary, and by the end of the century is the dominating factor in the production of industrial power. The practical utilization of this inexhaustible source of energy, together with the great changes in the production of food, has already had enormous effects on the economic and hence political relation of nations. With cheap power the economical production of fresh water from sea water became a reality.

This was about 1985, and made more than one desert adjacent to a seacoast a garden spot. This last statement may seem to some of you altogether incredible. Let me, therefore, insert at this point a technical footnote, so to speak. You must understand that my apparatus which forecasts the future operates on a special principle. I feed into it certain ideas which might lead to revolutionary innovations at least in theory but are now regarded as impossible. The machine then scans the future decade by decade on the frequency of the idea in question. If the results were not at times surprising, there would be little use of such a piece of equipment, I am sure you as scientists will all agree. I might note parenthetically that it is an interesting fact that as regards the possibility of distilling fresh water from the ocean, no one has publicized the well-known fact that in theory the energy requirements are extremely low. For example, one gallon of gasoline provides on combustion somewhat more energy than that theoretically required to distill 9,000 gallons of fresh water from the ocean. (Notice I say "energy," not "heat," for as many of you are well aware it is mechanical energy that is required in the modern compression stills.) A corresponding theoretical figure which has been given wide publicity is the energy content of a few grams of Uranium 235 which are said to contain enough atomic energy to drive the *Queen Elizabeth* around the world. The one figure has perhaps as much relevance to future practice as the other. ●

WATER REPORT

For the first time in several months e water report can be founded on a eerful note and not be a dirge of ought and short water supplies. ater supplies in the West showed signs being good to excellent in all except e Rio Grande and Arkansas River asins and in parts of Oklahoma and exas. Even in the Rio Grande, run-off ay be close to normal and there is yet me for improvement in the Arkansas iver Basin.

Region by Region the outlook is as llows:

REGION 1—Water supply uniformly od to excellent. Run-off in the Snake iver Basin is above normal. Above ormal run-off above Grand Coulee Dam Columbia River is in prospect.

REGION 2—Prospects for run-off are od. Late January storms improved e situation in southern California.

REGION 3—Discharges of 77,000 acres f. s. and 45,000 c. f. s. were reported the Verde River above Horseshoe am and Salt River above Roosevelt am by the Geological Survey. Reser-irs for the Salt River project increased 7,500 acre-feet during the month with uch more run-off expected during nuary. Run-off was not high in the per Gila River Basin where the ought still persists. The drought ap-rently is broken in southern Califor-a, as above normal run-off occurred the San Diego area. Expectancy of n-off in the Colorado River Basin is ove normal.

REGION 4—Outlook for water is uni-rmly good. Run-off from Utah reams is expected to be above normal cept in the southeastern parts of ate. Nevada run-off prospects are od—as are those for Colorado and yoming.

REGION 5—This is the only region ving generally poor water supply ospects. It still appears that early ason water will be short in the Rio rande and Pecos River Basins. Pre-pitation has been good on parts of the pper Rio Grande Basin so the seasonal n-off may be near normal. Outlook on e Pecos River is not good for seasonal pply. Outlook for water on Altus oject is good. It is fair for Tucum-ri. Run-off is subnormal in Texas.

REGION 6—Except for the Belle ourche project which has fair pros-ects, the outlook for water is good to cellent throughout the region. Run-f in North and South Dakota in gen-al is much above normal.

REGION 7—Run off in the Platte River Basin is expected to be above average. Prospects are not as good in the Arkansas River Basin, where they are considered only fair. Run-off is above average in Kansas and Nebraska.

LETTERS

Warning on Waste

The following communication was recently received from M. R. Lewis of the Litani Technical Investigation Mission, Beirut, Lebanon. Mr. Lewis, previous to his Lebanon assignment, was chief of irrigation operations for the Bureau of Reclamation and has won wide recognition as an expert on this subject.

Professor Veihmeyer's article, "Don't Waste Water" in the November Era is excellent. He has presented clearly the importance of economical use of water and has pointed out many ways in which wasteful methods, now all too prevalent, can be corrected. A word of warning is necessary, however, in connection with his statement that, "Greater growth is not produced by frequent irrigations as compared to infrequent ones." As Professor Veihmeyer states, the irrigation schedule should be laid out in accordance with the moisture properties of the soil and the depth of rooting of the plants. The water available to shallow-rooted crops on soil with low water-holding capacities from a single irrigation is much less than that for other crops on soils with high water-holding capacities. The former will require more frequent irrigations than the latter.

Other experimenters have found that many crops do not grow as rapidly when the moisture content of the soil in the root zone approaches the lower limit of availability as they do when a more ample supply is present. These results, which appear to be in contrast to those reported by Professor Veihmeyer, may indicate the effect of different soils, different crops and different climatic conditions.

This comment does not in any way contradict the recommendation that water be applied only in the amount needed to supply the needs of the crops. It points up, only, the need for carefully considering crop needs rather than assuming that crops are all right so long as they do not wilt.

THE ADMIRAL'S COMPLIMENTS

THE PRESIDENT'S COMMITTEE
ON NATIONALLY EMPLOY THE
PHYSICALLY HANDICAPPED WEEK,
U. S. DEPARTMENT OF LABOR,
Washington, D. C., November 27, 1951.

DEAR COMMISSIONER STRAUS: Please permit me to compliment you and your staff on the excellent article titled "America Needs All of Us," which appeared in the October 1951 issue of The RECLAMATION ERA.

We believe that there is no better way of acquainting employers with the abilities of the physically impaired than by pointing out successful work performance of handicapped workers. The article presents outstanding examples of persons who have relegated their physical impairments to the unimportant, insofar as their ability to do a top notch job is concerned.

We should like to give this article as wide circulation as possible. With this thought in mind, we have asked the Editor of the RECLAMATION ERA, Mrs. Ruth Sadler, for permission to reprint the article in our monthly magazine, PERFORMANCE, THE STORY OF THE HANDICAPPED. PERFORMANCE is circulated in both this country and overseas.

We appreciate your cooperation in helping us to break down some of the existing barriers to the employment of a large segment of our population who are being denied the full fruits of our way of life.

Cordially,

ROSS T MCINTIRE, M. D.
Chairman.

We appreciate the Admiral's comments, and look forward to reading the reprint of "America Needs All of Us" in PERFORMANCE.—Ed.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

NOTES FOR CONTRACTORS

Contracts Awarded During December, 1951

Spec No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3543	Kendrick, Wyo	Dec. 14	2 butterfly valves with operating mechanisms, control systems, and accessories for Alcova power plant.	Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.	$274, 6
DS-3548	Central Valley, Calif.	Dec. 11	2 motor-control switchboards and 2 distribution switchboards for pumping plants E1 and E2, Exeter irrigation district, Friant-Kern canal distribution systems.	Lexington Electric Products Co., Inc., Newark, N. J.	13, 1
DS-3550	Columbia Basin, Wash	Dec. 29	3 motor-driven, centrifugal-type pumping units for Upper Scooteney pumping plant, area P-2, Potholes East canal laterals, schedule 3.	Economy Pumps, Inc. Division of Hamilton-Thomas Corp., Philadelphia, Pa.	14, 4
DC-3564	Kendrick, Wyo	Dec. 5	Construction of Alcova power plant and appurtenant works.	A. S. Horner Construction Co., Denver, Colo.	2, 324, 2
DS-3566	Central Valley, Calif	Dec. 4	5 lots of radio equipment and 29 mobile radio transmitter-receiver assemblies for additions to an existing installation in vicinity of Shasta Dam, schedule 1 except item 6.	Motorola, Inc., Chicago, Ill.	40, 0
DC-3569	do	do	Construction of 230-kilovolt Tracy switchyard addition.	George E. Miller, Long Beach, Calif.	45, 4
DS-3570	Kendrick, Wyo	Dec. 7	2 115,000-volt horn-gap switches and 3 115,000-volt disconnecting switches for Alcova power plant switchyard.	Memco Engineering & Manufacturing Co., Inc., Commack, Long Island, N. Y.	11, 1
DC-3583	Columbia Basin, Wash.	Dec. 11	Construction of Scooteney pumping plants and laterals, area P-2, Potholes East canal laterals.	Hunt and Willett, Inc., Wenatchee, Wash.	234, 2
DC-3585	Central Valley, Calif	Dec. 27	Construction foundations and erecting steel towers for 20 miles of Folsom-Elverta 230-kilovolt transmission line, schedule 1.	James H. McFarland San Francisco, Calif.	481, 9
DC-3586	Palisades, Idaho	Dec. 7	Open-cut and tunnel excavation and construction of construction substation for Palisades Dam.	J. A. Terteling & Sons, Inc., Boise, Idaho.	1, 242, 7
DS-3591	Columbia Basin, Wash.	Dec. 28	1 motor-control equipment for Lower Scooteney (PE-27) pumping plant.	General Electric Co., Denver, Colo	17, 6
DC-3606	Boise, Idaho	Dec. 12	Drilling drainage holes for Black Canyon Dam	Lynch Bros., Seattle, Wash	19, 0
DC-3614	do	Dec. 21	(Negotiated contract.) Spillway rehabilitation of Black Canyon Dam.	Morrison-Knudsen Co., Inc., Boise, Idaho.	366, 9
117C-123	Columbia Basin, Wash.	Dec. 6	Fencing and protective structures	McWaters and Bartlett, Boise, Idaho	38, 5
200C-183	Central Valley, Calif.	Dec. 17	Furnishing or processing hauling and placing gravel, Station 4535+00 to 5485+50, Delta-Mendota Canal.	Vernon Dark	41, 1
601C-19	Missouri River Basin, Wyo	Dec. 10	Exploratory drilling for investigations of Hunter Mountain, Thief Creek, Bald Ridge, and Lower Sunlight Dam sites.	Mac Exploration Co., Garrison, N. Dak	24, 2
617C-24	Riverton, Wyo	Dec. 14	Buried asphalt membrane lining, Wyoming canal station 2560 to station 3131 and Badger lateral and wasteway.	Hicks Construction Co., Pinedale, Wyo.	183, 0
617C-25	do	Dec. 17	Asphalt membrane lining, Pilot canal, station 943+00 to station 978+00.	Blacktop Construction Co., Billings, Mont.	11, 5
703C-219	Kendrick, Wyo	Dec. 11	Construction of 12 two-bedroom residences at Alcova Dam Government Community.	Spiegelberg Lumber & Building Co., Laramie, Wyo.	166, 8
703C-225	do	Dec. 14	Repairing overhead ground wires on the existing Seminoe-Casper 115 kilovolt transmission line.	The American Electric Co., Caldwell, Idaho.	13, 2

Construction and Materials for Which Bids Will Be Requested by April 1952

Project	Description of work or material
Cachuma, Calif.	Construction of Carpinteria reservoir and control station located northeast of Carpinteria, Calif. The reservoir is to be 25 feet deep and 270 feet square at the bottom with 1½ to 1 inner slopes. The bottom and inside slopes will be paved with concrete. The control station requires furnishing and installing chlorination equipment.
Do	Construction of Ortega reservoir and control station north of Summerland, Calif. The 60 acre-foot capacity concrete-lined reservoir is to be 20 feet deep with 1½ to 1 side slopes. The control station requires furnishing and installing chlorination equipment.
Do	Construction of Lauro chlorination and control house, an 18- by 65-foot concrete building with tile roof and open concrete pit for control valves, located near Santa Barbara, Calif. Installation of about 15 36-inch diameter valves and 1,500-feet of 54-inch diameter steel pipe, venuri meters, and other equipment for chlorination of 55 cubic feet per second of water for domestic purposes.
Central Valley, Calif	Three 3,000-ampere bus structures with current and potential transformers, lightning arresters, capacitors, and disconnecting and grounding switches; and 1 air circuit breaker for Folsom power plant.
Do	Two 7-cubic feet per second, 1 4-cubic feet per second and 1 2-cubic feet per second, all at 25-foot head, deep-well or propeller-type motor driven pumping units for pumping plant E-3, Delano-Earlimart irrigation district.
Colorado-Big Thompson, Colo.	Raising power and control lines from the ground and placing on poles southeast of Estes Park, Colo. Contractor will erect 23 structures and string messenger cable and hand power and control lines.
Colorado-Big Thompson, Colo.—Con.	Adding vibration dampers and armor rods to overhea ground wires on 23 miles Flatiron-Greeley, 2 mile Estes-Marys Lake, 13 miles Estes-East Portal, 3 miles Flatiron-Brighton, 70 miles Brush-Limon, 1 miles Wiggins-Hoyt, 36 miles Brush-Sterling, 2 mile Brush-Wray, and 1 mile of Sterling-Holyoke trans mission lines.
Do	Construction of partially lined St. Vrain supply cana about 10 miles long of which 5 miles is designed fo 625 cubic feet per second capacity and the remainde for 575 cubic feet per second.
Columbia Basin, Wash.	Construction of 3 miles of distribution system of 2 t 5 cubic feet per second capacity for part-time farn units in Block 41, lateral area E-2 on East Lov canal, near Moses Lake, Wash., consisting of 1 mil of precast-concrete pipeline with appropriate turn out structures to 55 part-time farm units, and ap proximately 2 miles of 5 cubic feet per second unline wasteway for interception and conveyance of groun water.
Do	Construction of 0.6 mile of distribution system of 1. cubic feet per second capacity for part-time farr units in Block 49, lateral area P-1 on Potholes Eas canal, near Othello, Wash., including appropriat turnout structures for 15 part-time farm units.
Do	2 12.5 cubic feet per second at 40-foot head, 2 8 cubi feet per second at 50-foot head, and 2 18 cubic feet pe second at 49-foot head horizontal-shaft, centrifuga type motor-driven pumping units for pumping plant PE-60, PE-56, and PE-51, lateral area P-8.
Do	Construction of 20 miles of unlined laterals and wast ways of 180 to 2 cubic feet per second capacities t irrigate about 6,000 acres in lateral area P-3 on Pot holes East canal.

Construction and Materials for Which Bids Will Be Requested by April 1952—Continued.

Project	Description of work or material
umbia Basin, Wash.—Continued	Construction of 48 miles of unlined laterals and wasteways of 119 to 2 cubic feet per second capacities to irrigate about 18,000 acres in lateral area E-4 on East Low canal.
Do	Construction of the 236-cubic feet per second capacity, 4-unit, outdoor-type Ringold pumping plant on Potholes East canal, area P-8.
Do	Installation of two 65,000-horsepower, 720,000-gallons per minute pumps Nos. P5 and P6 in Grand Coulee pumping plant; and miscellaneous metalwork and electrical installation for Grand Coulee Dam pumping plant, and power plants.
vis Dam, Ariz	Supervisory control and telemetering equipment for ED-2 and ED-4 substations.
lutna, Alaska	Main control board, annunciator relay cabinet, station-service transformers, distribution board, battery control and distribution board, and battery chargers for Eklutna power plant.
t Peck, Mont	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel structures, installing major electrical equipment, and furnishing and installing all other equipment; and construction of operation and maintenance and service buildings.
a, Ariz	Construction of 8 miles of unreinforced concrete-lined Mohawk canal of 135- to 30-cubic feet per second capacity, appurtenant reinforced-concrete structures, and 8 miles of protective dike, near Roll, Ariz.
math, Oreg.-Calif	Channel enlargement of the Lost River in Upper Langell Valley to improve the river course is to involve excavation of 6 miles of new channel to 4,000 cubic feet per second capacity and improving 1 mile of existing 4,000 cubic feet per second channel excavated under a previous contract, enlargement of 1 mile of 200 cubic feet per second capacity West canal, and construction of 2.5 miles of 35 cubic feet per second laterals. The work is located 50 miles from Klamath Falls, Oreg.
ndrick, Wyo	Two 15,000-volt switchgear assemblies with a 250,000-kilovolt-ampere interrupting capacity removable element or draw-out type air circuit breaker in each assembly; and 2 protective equipment cubicles consisting of potential transformers, lightning arrestors, and capacitors for Alcova power plant.
isades, Idaho	Construction of Palisades Dam and power plant on the south fork of the Snake River, 7.5 miles southeast of Irwin, Idaho, and relocation of 14 miles of State highway. Palisades Dam is to be an earthfill structure about 2,100 feet long and 40 feet wide at the crest and 260 feet high. This contract will also include excavation of 28-foot diameter spillway tunnel, 26-foot diameter
Palisades, Idaho—Con.	inlets for power and outlet tunnels, spillway and outlet tunnel discharge channels, and power plant tailrace; and lining tunnels and shafts with concrete. The 4-unit, 120 000-kilovolt-ampere capacity indoor-type power plant will be 64 feet high and 246 by 60 feet in area and will require construction of tunnel intake control and outlet tunnel discharge control structures and installation of embedded turbine parts. The substructure will be of reinforced concrete; its superstructure will have structure steel framing and brick walls. A machine shop and valve house, 280 by 40 by 35 feet, will extend west from the south end of powerhouse.
Do	Construction of permanent Government camp about 56 miles southeast of Idaho Falls, Idaho. The contract will include 20 three-bedroom temporary houses, 20 two- and three-bedroom permanent houses, 1 office building, 1 dormitory, 1 garage, and warehouse, one 12-car multiple-stall garage; facilities for 25 trailers; and streets, walks, sewers, and water mains.
Do	Four vertical-shaft hydraulic turbines each 39,500-horsepower at 190-foot head for Palisades power plant.
Missouri River Basin, Colo.	Construction of 3,000-kilovolt-ampere Julesburg substation.
Missouri River Basin, Nebr.	Construction of about 40 miles of laterals on the Cambridge lateral system near Arapahoe, Nebr.
Missouri River Basin, N. Dak.	Construction of 1,110-foot-long and 100-foot-high Jamestown earthfill dam on the James River will require 1 million cubic yards of earth fill, 1,700,000 cubic yards of excavation; and construction of spillway cut-and-cover conduit, intake structure, gate chamber and shaft, and shaft house and stilling basin.
Do	Construction of 2,500-kilovolt-ampere DeVaul substation, 11 miles southeast of Almont, N. Dak.
Do	Construction of 115-kilovolt, 750-kilovolt-ampere Fort Clark substation for Fort Clark irrigation unit in central N. Dak.
Do	Construction of 1,000-kilovolt-ampere Custer Trail substation, 8 miles southwest of Bismarck, N. Dak.
Missouri River Basin, Wyo.	Construction of 2,000-kilovolt-ampere Shoshone River power substation, near Cody, Wyo.
Do	Construction of water distribution and sewer systems for Kortes Dam Government Community 63 miles southwest of Casper, Wyo. The contractor is to excavate and lay 1,700 feet of clay sewer and wrought-iron pipelines; construct pump and chlorinator houses, septic tank, filter bed, well, and 20,000-gallon reinforced-concrete reservoir, install 2 pumping units, chlorinating unit, electrical equipment and materials, and place 4-foot diameter well tile.

United States Department of the Interior
Oscar L. Chapman, Secretary
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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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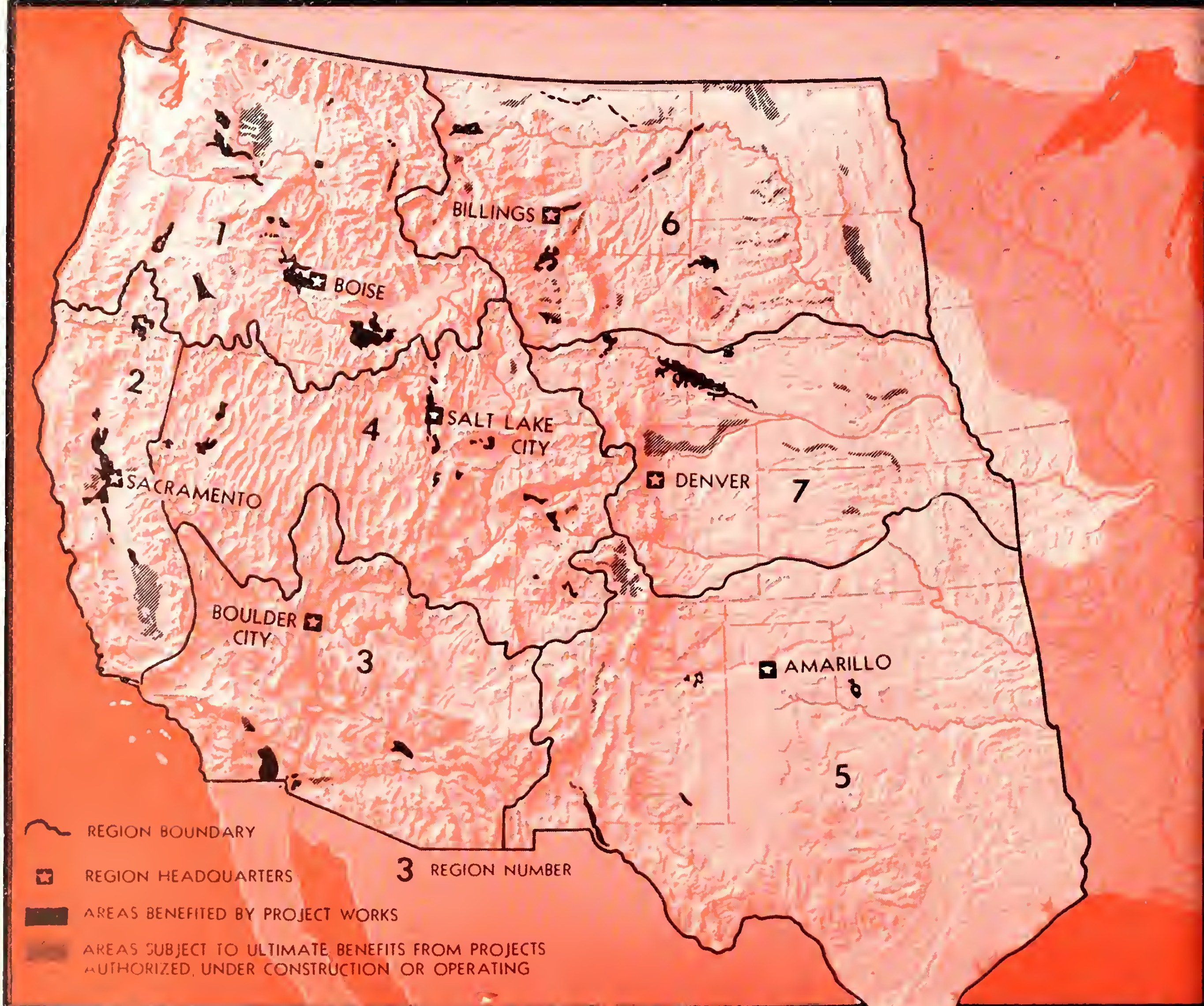

THE RECLAMATION AREA

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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

Desert Blossom

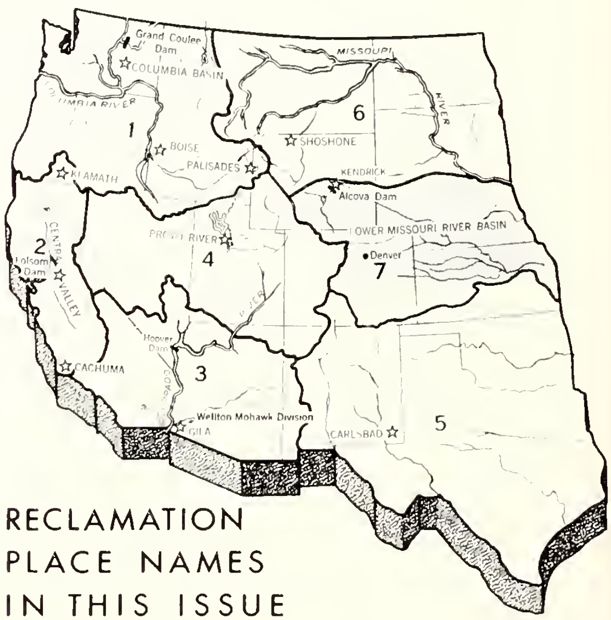
"A thing of beauty is a joy forever," and with this striking photo of the bloom of the Joshua Tree, we pay tribute to one of the Bureau's best photographers, William S. Russell, who died last spring. The desert-defying Joshua Tree marks the limit and extent of the Mohave desert in west-central Arizona, and although the greenish white blossom does not appear every year during the February to April blooming season, the tree furnishes food, shelter, and nest-building materials for small denizens of the desert, and gives up its small red roots to the Indians who use them to weave patterns in their baskets. Called yucca *breviflora* by the botanists, the Mormons named it Joshua Tree because it seemed, like Joshua in the Bible, ιo be lifting its arms in supplication.

35 YEARS AGO IN THE ERA

The occasional gathering of employees of the United States Reclamation Service to consider ways and means of improving work has precedent—if a precedent were necessary—in the frequent calling in by large business corporations of their important employees to acquaint them with the policies and aims of the corporation; to inject enthusiasm into the personnel of the corporation; and to encourage that cooperation between workers which is the basis of the success of big business.

On close consideration, a Government irrigation project is not unlike a great business corporation. The water users on the project might well be called the stockholders in the corporation; the project manager is the business head of the institution; and the Government makes the regulations which control the workings of the business in the same manner as the Nation and the States control the operations of corporations.

From article entitled "The Purpose of Operation and Maintenance Conferences" by I. D. O'Donnell, Supervisor of Irrigation, on page 107 of the March issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.



RECLAMATION PLACE NAMES IN THIS ISSUE

SECRETS IN THE SNOW are ferreted out with a sampling tube (above). Surveyors use various means of transportation over the snow courses (inset). *Both photos by the Soil Conservation Service, United States Department of Agriculture.*

WITH A FINGER ON THE PULSE of arteries like this one (Moore's Creek, Boise River, Idaho), the forecaster determines the run-off for the irrigated areas of the West. *Photo by Phil Merritt, Region 1 photographer.*

FORECASTING SPRING FLOODS

by ROBERT W. GAY, Supervising Hydraulic Engineer Region 1 headquarters, Boise, Idaho

The October 1950 issue of the RECLAMATION ERA carried an illustrated feature entitled, "Saved—More than Five and a Half Million Dollars." The story explained how $5,600,000 in flood damages had been prevented on the Columbia River and tributaries during the spring flood crest by the control of flood waters at 13 Bureau of Reclamation reservoirs in the Pacific Northwest. The flood control operations were coordinated with the flood control measures of the Corps of Engineers.

The total represented damages averted by control of flood waters at Grand Coulee Dam on the Columbia River in Washington, at three reservoirs in the upper Snake River Basin in Idaho, two reservoirs in each of the Boise and Payette River Basins in Idaho, and five reservoirs in the Yakima River Basin in Washington. These reservoirs constitute the bulk of storage space now available in the Columbia River Basin.

Behind this feature is a story—a story which started over 50 years ago when a scientist named C. A. Mixer cut cylinders of snow, melted them, and measured the water they contained. Since that time, hydrologists (those who deal with the science of water, its properties, phenomena and distribution over the earth's surface) have continued to improve what we now call "snow surveys" until nowadays they are used to help forecast spring floods which result from the melting snow.

Another side of the story behind the news of the multi-million-dollar saving in Columbia Basin flood damages, is that of the increasing importance of using irrigation reservoirs for multiple purposes. Not so long ago, an irrigation reservoir superintendent's only concern was to fill the reservoir before the irrigation season started, regardless of how much surplus water flowed over the spillway. In recent years, however, damaging floods, water shortages, and a growing realization of the need for conserving and using water to the utmost, have brought about attempts to develop and use the flood control possibilities of irrigation reservoirs, along with recreation, fish and wildlife preservation, power development, silt control, and other available benefits.

In the Columbia Basin, the reservoir operators work as a team with the Corps of Engineers, the Soil Conservation Service of the United States Department of Agriculture, the Weather Bureau of the Department of Commerce, and other cooperating agencies, with the objective of holding enough water in each reservoir for irrigation, or irrigation and power, releasing enough to make room for the expected floods, and keeping in mind the effects such releases will have on the rivers and reservoirs below.

ACCURATE FORECASTING keeps Arrowrock Reservoir (at right) at just the right level for serving the Boise project and reducing flood losses like that of the Columbia River flood of 1948 (below), through efficient coordination of operations at other Reclamation reservoirs in the Pacific Northwest. *Photo at right by H. W. Fuller; photo below by Stanley Rasmussen, both Region 1 photographers.*

The key to the entire complex operation is the seasonal flood forecasting system, which enables each reservoir operator to obtain advance information on how much flood water must be handled.

The spring run-off of most northwestern streams is the result of the melting of snow accumulated during the winter, plus the rainfall occurring during (or shortly before) the flood season. Not all of the water in the snow or rain will eventually reach the flood flow. Some will evaporate. Some will be consumed by plants, or held in the soil. Some will percolate down through the soil to become part of the groundwater.

The hydrologist must determine how much water, either from melting snow or from rainfall will find its way to the rivulets and streams, to mingle with, and add to the dimensions of, the spring flood.

Fortunately for the hydrologist of today, preparation for spring flood forecasting as well as other run-off reports and forecasts often begins before a dam is completed. Long before the reservoir is ready to hold any water, hydrologists, mathematicians and engineers are busy studying its watershed, and devising a forecasting procedure to be used when construction is completed. They gather, evaluate and test the data that have been and will be available, the physical characteristics of the watershed, how to allow for variations in soil moisture, how much rainfall occurs during the spring, the temperature of the area, evaporation, methods of operating the reservoir, and innumerable other things which go into a forecast.

During the fall and winter months, the forecaster is busy collecting background data, and planning in advance for the day he will receive all the pieces of the puzzzle, so that he will be able to convert the mass of reports into information about the volume of the spring flow.

In the fall of the year, provisions and equipment are cached away in the snow survey cabins located far in the isolated mountains. Some of these cabins are equipped with "Santa Claus chimneys," steeplelike structures to provide entrance even when the cabins are buried by gigantic snow drifts. If it were not for these shelters, the snow survey crews would have to carry heavy loads of food and equipment as they follow the snow courses on foot, on horseback, on snowshoes, skis, in automobiles, or special snow vehicles. The trips may take a few hours or several days.

Once at the sites of the snow survey courses, the surveyors locate the same spots which previous surveys have shown to give a representative indication of the snow depth and water content. They then take a hollow, pipelike tool, and bore it down through the snow to the solid ground. From the markings on the tube, they learn the depth to ground level. They then pull the tube out of the snow, weigh the snow-laden tube and determine the weight of the snow and thus the weight of the water. Sheaves of data from the frozen snow courses become important parts of the mosaic which is fitted together to form the pattern of the future flood.

By mutual agreements, in most of the western

States, the Soil Conservation Service of the Department of Agriculture makes the surveys, or arranges to have them made.. The Weather Bureau compiles rainfall records as a part of its normal responsibilities. However, for the purpose of flood forecasting, some additional gages have been installed. A few gaging stations even send the data by radio or telephone wire to the using office.

The forecasters thus are ready for spring forecasts like that which helped hold the 1950 flood in check.

A spring flood, to the hydrologist, is not a matter of water rushing downhill, it is a complex problem of adding, substracting and converting somewhat odd bits of information into a prediction of things to come.

At the end of each month, by mail, telephone, teletype, radio, and messenger, the latest reports on snow cover, soil moisture, rainfall, reservoir storage and other related facts are fed to the forecaster. With his working graphs, charts, slide rule, facts and background material, he makes his report and forecasts the water supply. And he must do it quickly if it is to be of value.

The hydrologist makes his first forecast, usually during the first week in April, based upon the data compiled as of April 1st, and predicting the volume of water to be expected between April 1st and July 30. Forecasting is not an exact science, but for practically all reservoirs, there is a range of answers which will serve for practical purposes and yet permit floods to be reduced and the reservoir to be refilled.

Accumulated snow and past rainfall can be measured at the given spots, but tomorrow's, next week's or next month's snow or rain cannot. Periodic new forecasts can be made to permit reservoir operation to be modified if necessary.

Again in May a forecast can be made of the expected flow during May, June and July. Each month the chances of error are less, as more of the spring run-off becomes a matter of record, rather than calculation. Another forecast is usually made during June and July. By the end of July the stream flow has usually dropped to a near normal, marking the end of the forecast period.

The number of forecasts required varies in different localities. Only one forecast may be sufficient during a year of low run-off when the reservoir will obviously be able to retain much more water than it will receive. However, these same conditions might require even more careful forecasting procedures in order to indicate how stringently water-saving measures should be employed to avoid serious water shortages.

Through the medium of the various interagency committees, and by cooperative studies, the various governmental agencies are exchanging ideas and working together to improve the hydrologic work of all agencies. The West-wide spring forecast published in the May issue of the RECLAMATION ERA each year, the West-wide water report published in the fall, and the brief Water Report appearing in other issues, are examples of the results obtained through this cooperation.

THE END.

Shasta's Flood Control Job

Shasta Dam, during the storms of December 1951 and January 1952, gained 130,000 acre-feet of storage as a result of a torrential rainfall within 24 hours. At times the inflow exceeded 90,000 cubic feet per second, which if added to the river channel at Red Bluff, Calif., would have been critical. Releases from Shasta Dam during this period averaged only 3,700 cubic feet per second, necessary for power generation. The flood crest of 143,000 cubic feet per second in the Sacramento River at Red Bluff on December 27, 1951, was almost entirely the result of 50-year record peaks on streams flowing into the river below Shasta Dam.

Due to misunderstandings over the functions of Shasta Dam during periods of flood danger, the Bureau of Reclamation's Acting Regional Director R. S. Calland issued a statement pointing out that Shasta was doing its job in controlling floods, and should not be held responsible for flood crests which occurred below the dam. •

Moore Repeats Presidency

John S. Moore, former Reclamation official now retired, was re-elected president of the Washington State Reclamation Association at the annual meeting of the Association early in December 1951. •

NEXT MONTH!

Special Columbia Basin Issue

How the project began; what has been done and what is now being built, and how the new Chief Engineers—the Columbia Basin farmers—are putting the water to work.

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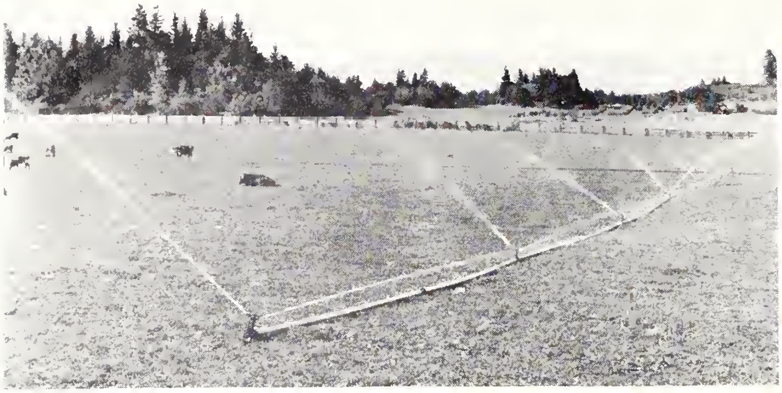


CATTLE AND CROP PRODUCTION flourish in the Pacific Northwest under proper sprinkler irrigation practices. *Photos by Morris Hodge, Portland, Oreg., submitted through the courtesy of the author.*

ALUMINUM AND SPRINKLER IRRIGATION

by JOSEPH T. KING, Counsel for the Association of Sprinkler Irrigation Manufacturers

The successful application of water to thirsty crops through sprinkler irrigation systems has become an important phase of irrigation farming in every section of the country. The reports from neighboring farmers about the saving of water, the saving of precious top soil, and the consistently high quality of their crops probably started you thinking and figuring as to how sprinkler irrigation can better your operation. The sprinkler test plots at the experiment station or information from your County Agent have given you plenty of good sound advice as to the best method of handling cropping programs under sprinkler irrigation. You have spent the winter gathering your information and planning for next season's crops to be sprinkled.

Has it occurred to you that maybe you won't be able to get the sprinkler system this year? Well, maybe it won't be you, but it might be the fellow across the road or the one that joins your place on the north. Perhaps you wonder why. From the reports you have read in the papers, it sounds as if aluminum production is being increased, and you may think that plenty of aluminum may be available for the sprinkler equipment that you plan to install this spring. But—let's take a look at the over-all picture of aluminum and what it is being used for.

Before the outbreak of hostilities in Korea, the annual production of aluminum in the United States was about 750,000 tons annually. Plans are progressing at the moment to increase that production to about 1,250,000 tons annually. But there will be precious little increase by the time you need your sprinkler equipment this spring. The Defense Production Authority has the responsibility of dividing this huge amount of aluminum each quarter along with the other controlled materials, copper and steel. First, of course, the requirements of the military along with other highly essential programs such as the Atomic Energy Commission, and the Defense Electric Power Administration are assigned approximately 50 percent of the total supply. The remaining 50 percent must be split between all classifications of civilian production. Out of this remainder must come automobiles, trucks, refrigerators, radios, cooking utensils, sporting goods, farm machinery and the many items you use in your daily lives. Your sprinkler irrigation equipment is part of this latter group. Pots and pans, for example, use as much aluminum under the controlled materials plan as does sprinkler irrigation.

During the fiscal year ending July 1952, there will be approximately 148,200 acres of land in the

West coming under Bureau of Reclamation water for the first time. Of this acreage, the largest single project is the Columbia Basin project of Washington where, it is estimated, there will be approximately 65,650 acres for which water will be available. Much of this land plus thousands of acres of farm land from coast to coast will come into production this year under the controlled urging of sprinkler irrigation.

Since the end of World War II, the land under sprinkler irrigation has increased at the rate of 125 percent per year. But this year, because of the shortage of aluminum, such increase will not be possible. Will you be among those unable to carry out your well-calculated plans because the equipment is not available? In the second quarter of 1952, because of the operations of the Controlled Materials Plan, there will be only about 45 percent of the sprinkler irrigation equipment produced as was manufactured in the same quarter of 1950.

Each year, whether or not equipment production is normal, many farmers are not able to get their equipment as early as they need it because they have delayed too long in making the necessary arrangements. Remember that investing in sprinkler irrigation equipment is not as simple as buying a new tractor. The equipment must be specially designed for your farm to fit your soil and cropping program. This takes time and the help of a capable technician who completely understands sprinkler irrigation. There are usually such men available to your area through reliable machinery outlets.

The sprinkler irrigation industry is relatively new, but today it is ready to serve your needs except for the shortages of material. The shortages of aluminum will have an adverse impact on farm production, water conservation, and soil conservation.

So make the most of the equipment you have, get experts to help you design your sprinkler operations, get your orders in early, and bear with us during these difficult times.

The Secretary of the Interior, the Secretary of Agriculture, the Commissioner of Reclamation, and the industry have your welfare in mind and are doing the best they can to make certain you get your rightful share of materials. Some action has already been taken toward enlarging the allocations of aluminum for sprinkler systems, based on the importance of maximum food production to this country's welfare and the increased yields made possible through proper use of sprinkler irrigation. The allocation of aluminum to the sprinkler industry for the second calendar quarter of 1952 is slightly above the amount allocated for the first quarter. However, because the second quarter demand is normally the greatest, the increased amount set aside for the industry falls far short of meeting the need. Unfortunately, many people do not realize the essentiality of this type of farm machinery, and the vital role it plays in agricultural production, and in soil and water conservation. THE END.

Three-Way Tunnel Job At Eklutna

Three firms and three adits characterize the Eklutna job at this stage of its construction. Working through an Alaskan winter, about 200 employees of Palmer Constructors (a three-firm organization of Peter Kiewit Sons, Coker Construction Co. and Morrison-Knudsen Co.) and the Bureau of Reclamation have made a good start in boring the 4½-mile-long, 9-foot-diameter tunnel which will pierce Goat Mountain and carry water from Eklutna Lake to a power plant on the Knick Arm side of the mountain at tidewater.

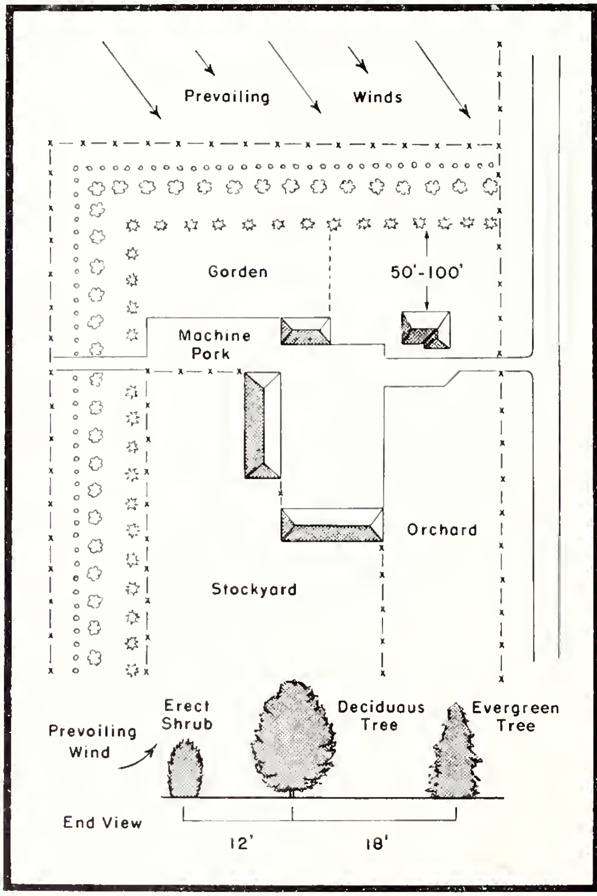
According to Joseph M. Morgan, District Manager of the Alaska District Office in Juneau, the contractors have already constructed their own auxiliary powerhouse, heating plant, mess hall, and barracks, and are holing through the tunnel from three adits. The crews sank a 200-foot-deep shaft into the mountain, 1100 feet from the shore of Eklutna Lake. By the middle of January they were drilling in two directions, and had bored 60 feet toward the lake and 90 feet toward the other side of the mountain. On this side of Goat Mountain the cullings (or excavation materials) are lifted up the elevator in the 200-foot shaft. At the Knick Arm (or power plant) end of the tunnel, where the crews began to drill toward the Lake side of the mountain, the materials can roll down the slope where the 1,250-foot penstock for the power plant will be constructed. The weather has averaged 35° below zero but within the tunnel it is just above freezing temperature.

The $17,348,865 contract for the transmountain diversion tunnel and other facilities was awarded in September 1951, the contractors starting work on the 1050-day job on October 11, 1951. •

Windbreak Plans for Irrigated Areas

EDITOR'S NOTE: This represents only one of the thousands of items that a new settler should know as he moves onto the Columbia Basin project in Central Washington. With the permission of the Institute of Agricultural Sciences at the State College of Washington, we are reproducing this section of chapter F on "Tree Plantings" one of the 25 chapter headings for the "FARMERS HANDBOOK for the Columbia Basin project" which begin with Chapter A–1 entitled "What Kind of a Farm Should I Develop?" and wind up with Chapter Y–1, entitled "Your Community."

Three agencies (the Soil Conservation Service, the Extension Service and the Bureau of Reclamation) collaborated on the following article, such collaboration being typical of the contents of the Farmers Handbook. In addition to the Soil Conservation Service and the Farmers Home Administration, which played especially important roles in the preparation of a number of the Handbook sections, the following agencies made significant contributions in the work of compiling and reviewing material: The State of Washington's Department of Agriculture, Department of Conservation and Development, and Department of Health; the United States Department of Agriculture's Bureau of Agricultural Economics, Bureau of Plant Industry, Soils and Agricultural Engineering, Farm Credit Administration and Production and Marketing Administration, and the Interior Department's Fish and Wildlife Service. The Handbook itself was printed by the Agricultural Extension Service of the State College of Washington, and will not be generally distributed other than by specific request because of the cost of preparation.



Plan at least a 2-row windbreak. The shrub row should be planted on the windward side to give protection while evergreen trees are getting established. Shrubs and evergreens can be planted fairly close to irrigation ditches.

RECOMMENDED SPECIES

2–row windbreak

Windward row—any of the following:
- Southernwood
- Russian Mulberry
- Bladder Senna (colutea)
- Caragana

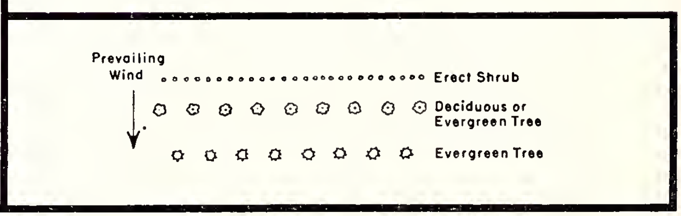
Second row—any of the following:
- Norway Spruce
- Blue Spruce
- Douglas Fir
- Austrian Pine
- Ponderosa Pine
- Scotch Pine

3–row windbreak

Windward row—any of the following:
- Southernwood
- Caragana
- Russian Mulberry
- Bladder Senna (colutea)

Second row—any of the following:
- Black Locust
- Green Ash
- Russian Olive
- Norway Spruce
- Douglas Fir
- Austrian Pine
- Ponderosa Pine
- Scotch Pine

Third row—any of the following:
- Norway Spruce
- Blue Spruce
- Douglas Fir
- Austrian Pine



Wildlife plantings (Contact the Washington State Department of Game for assistance):

- Bladder Senna (colutea)
- Snowberry
- Southernwood
- Multiflora Rose
- Black Locust
- American Plum
- Russian Mulberry

Snow fences and shrub rows:

- Caragana
- Bladder Senna (colutea)
- Southernwood
- Russian Mulberry

PREPARATION FOR PLANTING

The plan: lay out the planting area so that the mature trees will give the desired benefits.

WINDBREAK PLANTINGS

1. Use at least two rows.
2. Plant at least 50 feet from nearest building.
3. Locate the planting so that it will break the prevailing winds.
4. Space rows 12 feet apart or more; adjacent broadleaf and evergreen rows should be at least 18 feet apart.
5. Plant shrubs 3 feet apart in the rows—except Russian mulberry, which should be 6 feet.
6. Plant trees 12 feet apart in rows—except Russian olive, which should be 8 feet. The slower growing evergreens, spruce, juniper and arborvitae, can be planted with 6-foot spacing and thinned out when trees reach competitive size.
7. Plant trees at least 15 feet from lined irrigation ditches. Locate plantings so that they will not interfere with irrigation practices.

PREPARATION OF GROUND

Work the ground the fall before planting by plowing and leaving rough. Cultivate shallow in spring to level site and kill weeds. Apply rotted barnyard manure before plowing, if available.

OBTAINING PLANTING STOCK

Trees and shrubs are available at low prices from the Federal-State Forest Tree Nursery, the State College of Washington, Pullman, Washington. Price list-order blanks can be obtained from County Extension Agents. Place your order early.

PLANTING INSTRUCTIONS

1. Plant trees as soon as possible after receiving them. Keep the tree bundles moist and protect from exposure at all times. If trees are not planted immediately upon receipt, the bundles should be opened and the trees heeled in and well watered.

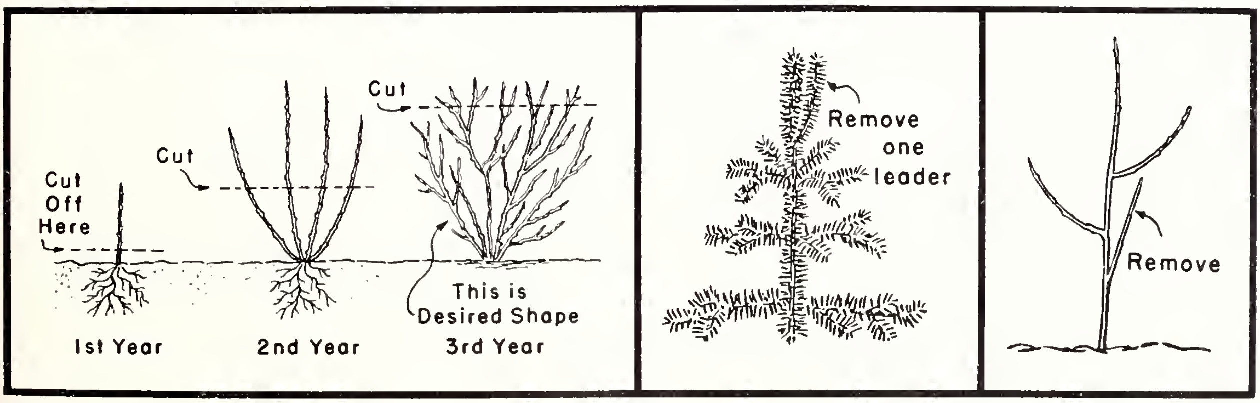
2. Keep roots covered and moist at all times during planting by keeping them covered with wet burlap or in a bucket of water.

3. Line out the planting area and mark places for individual trees before starting to plant.

4. Plant trees one at a time, using a mattock, spade, or irrigation shovel. The hole dug should be large enough to take the roots without bending or cramping.

5. Set the plant not more than 1 inch deeper than it was grown in the nursery to allow for settling of the soil. Natural depth can usually be easily determined by difference in bark color. Tramp the soil firmly around the roots; settling the soil with water during planting is well worth the extra effort.

(Please turn to page 58)



MORE WATER for MORE PEOPLE

by EDMUND G. BROWN, Attorney General of the State of California

Attorney General Brown is a member of the California Water Project Authority and a key figure in dealing with the water problems of the State. This article is based upon Mr. Brown's address during the CVP Water Festival at Redding, Calif., in August, 1951.

THE COMPLETION OF THE INITIAL FEATURES of the Central Valley project is certainly a reason to rejoice and to take justifiable pride in the works of man. But the works of man, unlike the works of God, are not perfect. One of the paradoxical things about the CVP is that although we have been able to solve its stupendous engineering problems, we have not yet successfully solved all the legal, social, economic and political problems, left in the wake of the engineering. I am speaking of the political problem in the largest sense—that is, the relationship between local, State and Federal governments in the operation and control of the project.

In trying to find a solution, I have found rather than a solution, something more in the nature of an approach that may some day lead to a solution. We are at the brink of a tremendous adventure in the conservation of resources. It is not given to any one man to see where all the paths into the unknown may lead. If we have faith, however, in the American way of life, faith in government based on the free and objective discussion of ideas, I believe we can face this adventure unafraid and full of confidence that our ultimate solution will provide the greatest good not only to us in California but to everyone in the Nation.

Applying this faith which I most firmly have, I have adopted the following immediate policy for the Attorney General's office of California in dealing with our water problems:

IT IS OUR OBJECT TO GET AS MUCH WATER FOR AS MANY BENEFICIAL USES, AS QUICKLY, AS INEXPENSIVELY, AND FOR AS MANY PEOPLE AS WE CAN.

To this end, I have and will continue to use all the facilities of my office to negotiate with the Federal government, to advocate or oppose legislation and to conduct litigation to achieve our goal. You will notice that I put litigation as the last item. This is deliberate. Litigation produces little water except the litigants' tears and the lawyers' perspiration, and these are salty and not much good. I believe that much more can be accomplished by treating each other as men of good will and trying to solve our problems in the spirit of amity and mutual respect, than by crossing swords and dealing at arm's length in court.

Of course, litigation is sometimes inevitable. In the Central Valley it is inevitable. This is because the law requires that the contracts between the Bureau of Reclamation and the various water districts be declared valid by an appropriate court. In this litigation, those dissatisfied with the contracts have attacked them on the ground, among others, that the State laws which authorize them are unconstitutional. They have urged me to join in this attack. Of course, I have refused to join because it is my job as Attorney General for the State and its people to try to establish the constitutionality, not the unconstitutionality of State laws. But there is another and equally fundamental reason why I have refused to join this attack; this is because the attack is actually an attack on having the Bureau of Reclamation in this State at all. This is a political rather than legal problem, and while I feel a good deal of sympathy for increasing the State's share of control of the project, I see no way now of reaching any good result by litigation. So, I take the position that the contracts offered by the Bureau are valid under State law.

Similarly, there is a great deal of talk about ownership of water rights—talk carrying the sinister connotation that somehow the Federal Government is going to deprive us of our water. In the first place, such talk is not legally sound; the United States by its own laws has to get its water rights in the same way as any private person, that is under the conditions fixed by the State Engineer according to California law. I have found no one in the State or Federal Government who feels that the State Engineer's authority will not be fully effective. In the second place, there is the practical consideration; the best way for the Federal government to get paid for its investment is to keep on delivering the water. Finally, there is the physical problem; as our own United States District Judge Oliver Carter once said:

IT IS INCONCEIVABLE THAT THE PHYSICAL WORKS OF THE CENTRAL VALLEY WOULD, AT THE END OF THE 40-YEAR PERIOD, BE ROLLED UP AND TAKEN ELSEWHERE.

Our rivers must not waste idly to the sea while we conduct a debating society. We all can't phrase it as beautifully as Mr. Justice Holmes, but I think we all feel it:

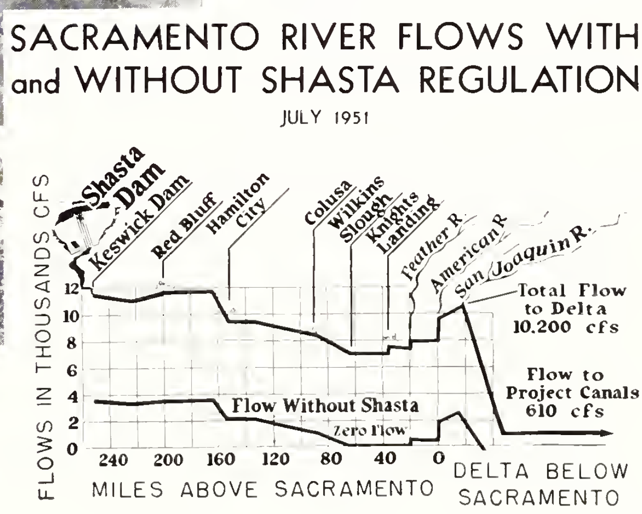
A RIVER IS MORE THAN AN AMENITY, IT IS A TREASURE. IT OFFERS A NECESSITY OF LIFE THAT MUST BE RATIONED AMONG THOSE WHO HAVE POWER OVER IT.

The recent CVP celebration was like a college commencement—it represents more of a beginning than an ending. The Central Valley illustrates what can be accomplished on an even grander scale. We have the imagination to see the possibilities. We have the experience to show us that despite the astronomical cost of these projects, nobody is impoverished by them: for it is elementary and classical economics that nobody under our democratic system can be impoverished while the means of production are increased. Poverty and destruction result from the failure to control our waters, not from the investment in opportunity for abundance.

There is a scheme of thought in dealing with water problems, sometimes derisively called the Last Water Hole Theory. Under this, thinking is in terms of the days of the old wild west where you either got water from the last water hole or you didn't get it at all. I would like to suggest that the facts show a new last water hole theory—that we have seen the last of the water holes, and that instead of fighting over what we have, we ought to be devising plans on how to get more.

THE END.

"KEEP ON DELIVERING THE WATER" . . . last July Shasta Dam in California, shown at left, held back and controlled the Sacramento River with the results shown below. Note that without Shasta there would have been no water from 30 to 70 miles above Sacramento and none on the Delta below, whereas with Shasta's control 10,200 cubic feet per second flowed to the Delta and 610 cubic feet per second to project canals.



Windbreak Plans for Irrigated Areas

(Continued from page 55)

CARE OF TREES AFTER PLANTING

1. IRRIGATE sufficiently to keep growth satisfactory. Thorough soaking at less frequent intervals is better than frequent light watering.

2. CULTIVATION. Practive shallow cultivation frequently enough to keep the area free of weeds until planting is well established. Do not cultivate after the last of August, so that some vegetative cover will grow for winter protection. After a windbreak has reached a size that makes cultivation difficult, seed the planting to a tolerant grass, such as orchard grass.

3. PRUNING. DECIDUOUS TREES—Prune to a single stem. Remove one side of narrow "V" crotch which will split or break in the wind.

EVERGREEN TREES—No pruning necessary unless double leaders develop. In this case, remove the weakest leader.

SHRUBS—Caragana should be cut back to the ground at the beginning of the second growing season to force branching. Other shrubs need no pruning.

4. PROTECTION. Fence the area to exclude livestock and chickens. Chickens are especially damaging to the buds and roots of your evergreens. Observe frequently for symptoms of insect or disease infestation. Consult your County Extension Agent if any unusual conditions are noted.

If this reprint from the Farmer's Handbook is useful to you and you wish to see more of the same, send a letter to the Editor, RECLAMATION ERA, Bureau of Reclamation, Washington 25, D. C., and we shall be glad to extend the usefulness of this data through printing additional extracts from the Handbook in future issues of the ERA.

More Columbia Basin Farms For Sale

Forty-two full-time farm units in the East-Columbia Basin irrigation district, Adams County, Wash., ranging in size from 51.8 to 115.3 irrigable acres and priced from $707.70 to $2,266 are ready for sale by the United States Government, according to Public Announcement No. 9—Columbia Basin project, Wash.

The farm units are within two to ten miles south and west of the town of Othello (population 500). The center of the area in which the farms lie is about 135 miles southwest of Spokane, Wash., and about 185 miles southeast of Seattle, Wash. Grand Coulee Dam, the key structure of the project is 100 miles to the north, and the farm units are scheduled to receive water in 1953 through a lateral system stemming from the Potholes East Canal.

Farm Application Blanks (Form No. 7–511a) and additional information may be obtained from the Bureau of Reclamation, Ephrata, Wash. The deadline for receiving applications is April 6, 1952.

Applications were received between January 15 and the deadline of February 29, 1952, for nine farm units, ranging in size from 42 to 82 irrigable acres, and priced from $924 to $2,650, in the Quincy-Columbia Basin irrigation district near the northern boundary of the project. The public drawing for these units, made available under Public Announcement No. 8, is scheduled around the middle of this month. •

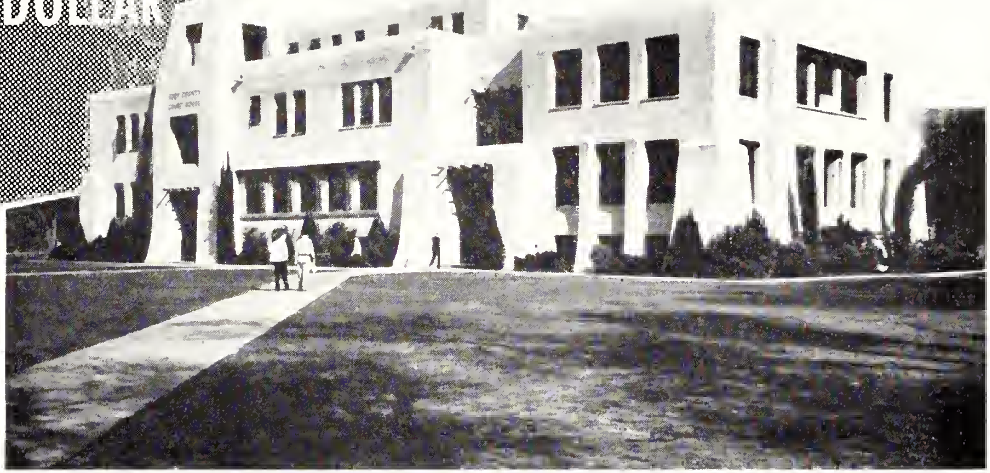
Work Started on Kendrick's Alcova Plant

During the first week in December 1951, the A. S. Horner Construction Co. of Denver, Colo., was awarded the $2,324,224.35 contract for 22 major construction features of the Alcova power plant and appurtenant works on the Kendrick project near Caspar, Wyo. Work was begun in January and is to be completed in time for power to go on the line by July 1954.

Two eastern manufacturers are now working on the hydroelectric generating equipment under separate contracts awarded last June. The Elliott Co., Jeanette, Pa., is manufacturing and will install two 18,000 kilowatt electric generators, under their $887,916 contract, and the Newport News Shipbuilding and Dry Dock Co., of Newport News, Va., was awarded the $496,800 contract for two vertical-shaft 26,500-horsepower turbines for the generators.

A unique heating system for the power plant at Alcova will make it possible to save an estimated $5,000 a year. Natural hot water from a nearby spring, which flows at the rate of 400 gallons of water per minute at temperatures ranging from 100° to 115°, will thus cut down on the heating bill, and also conserve power which would otherwise be used for this purpose. •

The CARLSBAD DOLLAR GOES TO TOWN



BUILDING BUSINESS, CREATING A COMMUNITY of prosperous people in the middle of the desert, and adding to the economic wealth of the Nation. *Photo of the Eddy County Court House (above) in Carlsbad, N. Mex., by C. W. Kapus of Region 5.*

by WILLIS C. BOEGLI, Agricultural Economist, Region 5 headquarters, Amarillo, Tex.

A DOLLAR DOESN'T GO VERY FAR these days, but a dollar's worth of farm crops goes a long way in its effect on local and national business.

First, the farmer sells his crops, pays his hired labor, and the families go to town to buy food and clothing, and maybe take in a show. In town the "butcher, the baker, and the candle stick maker" buy, sell, and trade, and the farmer's dollar—"around it goes, and where it stops nobody knows."

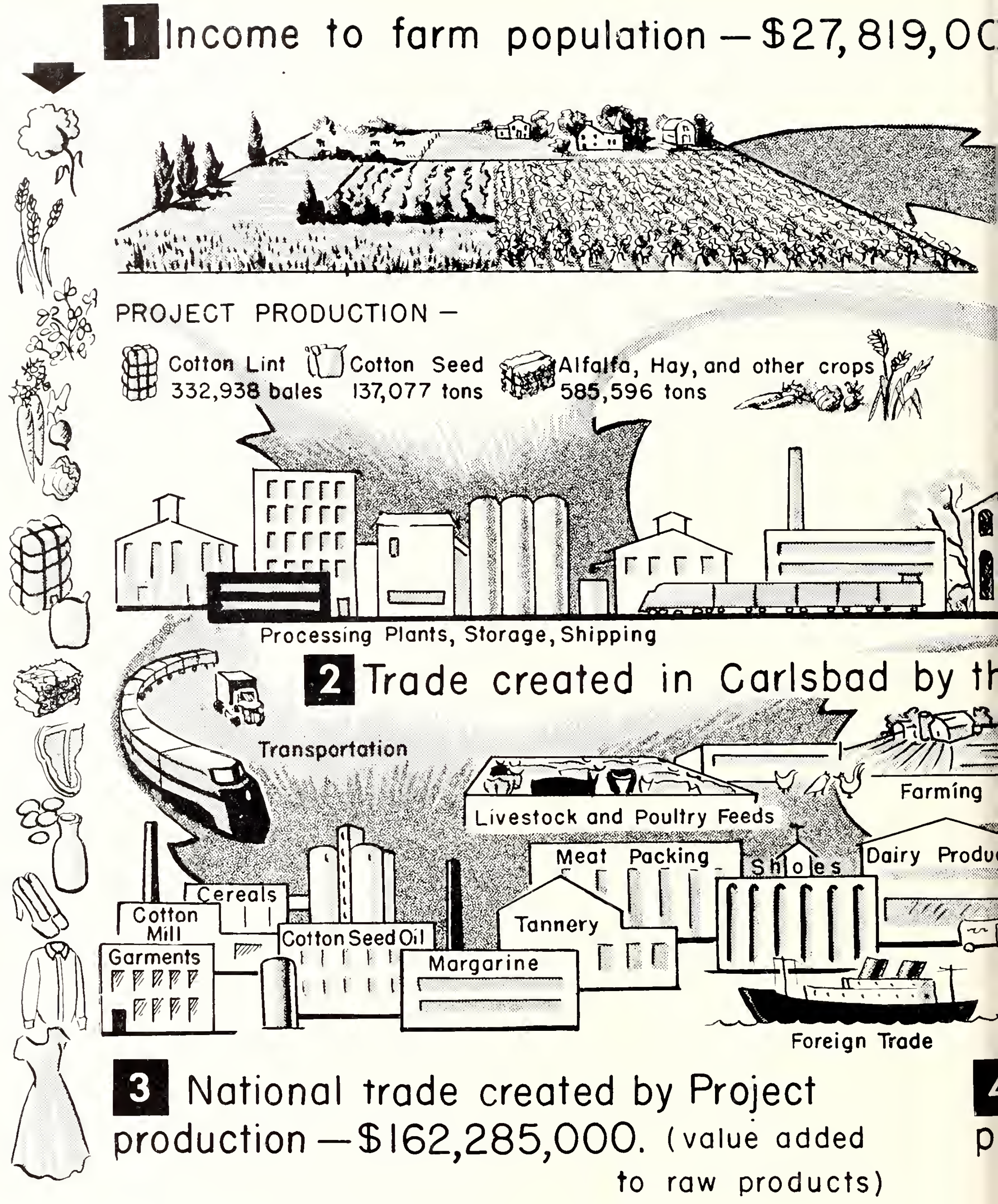
While this is going on, the cotton, hay, grain or other things the farmer sold and the laborer helped to produce, go through the mill, or the gin or the elevator, and head out of town. Some place they are made into cloth, or bread, or sausage, or leather, and some day they will be used by someone, somewhere. A lot of people put a lot of work and a lot of money into making these raw farm products ready for the consumer.

The mine, the forest, and the far away farms produce things that are processed, manufactured, fabricated, canned, and shipped. They come to the town, too, and the farmer, his wife, his family and his hired man buy them. So do the "butcher, the baker, and the candle stick maker" with the money they made from the farmer and his hired man.

These are generalizations. Let's get specific and find out what effect one particular project had on local and national trade in all the business activities it has created in its 44 years of production. Region 5 of the Bureau of Reclamation answers this sixty-four dollar question in its recent report, "An Evaluation of the Effect of the Carlsbad Irrigation Project on the Local and National Economy." This typical southwestern project produced, since it was constructed in 1907, 332,938 bales of cotton, 137,077 tons of cotton seed, and 585,596 tons of alfalfa hay and other crops, with a total value of over 50 million dollars.

The net income of project farmers, the wages earned by farm workers, and the equity developed in farms is estimated at $27,819,000—but this is only the first income created by the project.

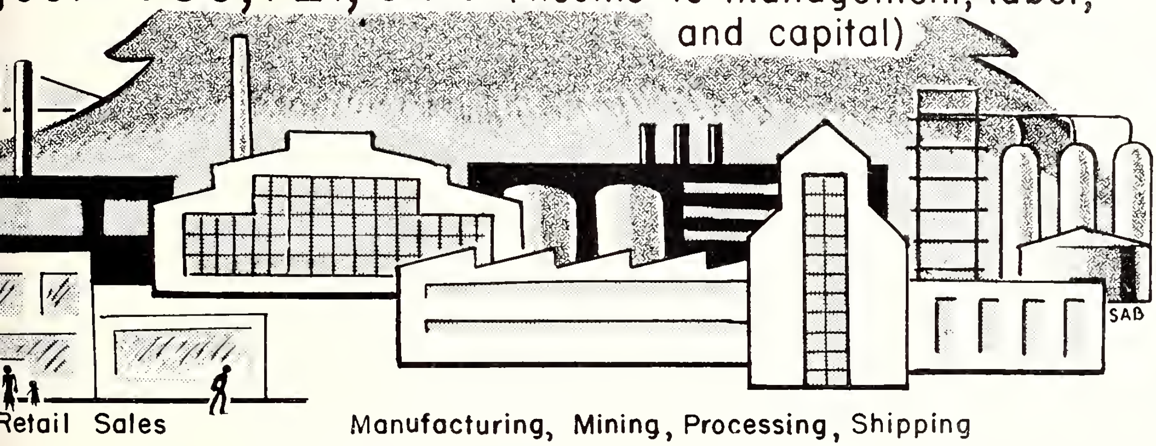
Data from the United States Business Census, adjusted to apply only to the people in the City of Carlsbad that are dependent on the project (62 percent in 1939 and 29 percent in 1948), show that city workers, shop owners and investors had an income of $80,727,000 for their labor, management and capital. During the forty-four years this new trade created by the project on the farms and in the city of Carlsbad is more than double the value of the crops produced. This is about the same relationship as shown by the trade created in Payette, Idaho, by the surrounding irrigated area. (See article entitled, "Irrigation



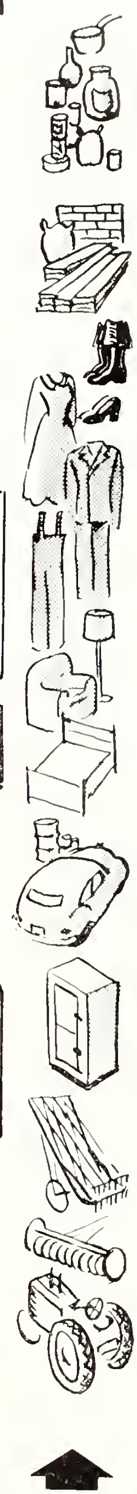
Effect of the Carlsbad Project on Fo

t farm income, wages to farm workers, equity in farms, and Government payments to farmers)

ject – $80,727,000 (income to management, labor, and capital)



ional trade to supply Project rural and urban
tion — $35,791,000. (income to management, labor, and capital)



reas of National Economy (1907–1950)

Goes to Town" on page 152 of the August 1950 RECLAMATION ERA.—Ed.)

What happened to those 332,938 bales of cotton, the 137,077 tons of cotton seed and all that hay? They took a long trip. Some of the cotton and the goods made from it went abroad, but most of it stayed in the Nation. The spinners, weavers, apparel manufacturers, brokers, wholesalers, shippers, jobbers, all did business with the cotton before it became underwear, shirts, towels, sheets and a thousand and one different things.

The cotton seed went through mills and manufacturing plants, was shipped and hauled, bought and sold, and some place became table margarine, cooking compound, plastic and many other things. The by-products became stock feeds and eventually ended as meats, dairy products, hides, leather, shoes, medicines, fertilizers, and an endless list of things we use every day. The other crops—the hay and the grain—also took a trip, made jobs, and made business for mills, plants, railroads and cities.

If we take the value that is added to all of the crops produced on the project as they pass along the long, long road to the consumer, as the measure of the trade created, we get $162,285,000. Now that's mostly income to labor, capital, and management—additional income actually created by the production of the Carlsbad project.

Now don't forget the purchasing power of the people of Carlsbad. Timber was cut, logs sawed, coal mined, iron smelted, and steel made for farm machinery, furniture, cars, and trucks to go to Carlsbad for that farmer, his farm laborer, and the families in town that live from his trade. Food was canned and frozen, clothes were manufactured, drugs made, and all got to Carlsbad. We have already counted all the trade created by the project in Carlsbad, so we count the income from labor, management and capital that went into all those goods shipped to the city. The value of their trade created to satisfy the purchasing power created by the project is $35,791,000 over the forty-four years.

Altogether, the trade created over the Nation that is measurable is $306,622,000, or about six times the value of the crops produced on the project. This particular business would not have existed without the project.

The project only cost the Government five million dollars, including interest, which is not paid by farmers. Only a little more than $2,000,000 remains to be repaid by the water users under the present contract.

The Carlsbad Irrigation District's Board of Directors and the farm and community leaders deserve a great deal of credit for the successful development of this project and its far-flung benefits.

What effect did the project have on the Nation? Well these are some of the business activities it created. In addition, it changed a desert into an oasis, and made homes for many fine Americans.

THE END.

1951 Good "Reclamation Resort" Year

According to reports recently received, Hoover Dam's Lake Mead, Shasta Lake and Friant Dam's Millerton Lake are becoming major recreation spots in the West.

In addition to marking the year when the four millionth visitor took the guided tour of Hoover Dam, and Lake Mead placed second in popularity among National Parks (see p. 20, January 1952 issue), 350,549 persons visited the Bureau of Reclamation's Exhibit Building in 1951, an all-time record for this popular attraction since it was opened to the public in late 1946. Visitors came from all 48 States.

Nearly a million persons visited the major features of the Central Valley project in 1951. At Shasta Lake many of the 159,000 visitors were attracted by the black bass fishing and other water sports. Camping and picknicking were popular along the lake shore. An estimated 650 locally owned power boats were in use on the lake which has a 265-mile scenic shoreline.

Private organizations, such as California Kamloops, Inc., made excellent progress in the project of stocking Shasta Lake with the famous Kamloops trout of British Columbia (see article entitled, "The Coming of the Kamloops" on page 112, June 1951 issue).

Steelhead trout fishing in the Sacramento River has materially improved over pre-Shasta Dam days. Millerton Lake, behind Friant Dam, has good year-around blue gill fishing, with a total counted annual catch of 100,000 fish. The report showed that 2,225 private boats were licensed for use on Millerton Lake during 1951, in addition to 4,670 rentals. Privately owned concessions operate docks and boat rental services on the shores of both Shasta and Millerton reservoirs. •

WHAT KIND OF SOIL?—The soil auger can be used to obtain samples for determining soil texture as well as finding out the moisture holding capacity of the soil, and when to apply irrigation water. *Photos by Phil Merritt, Region 1 photographer.*

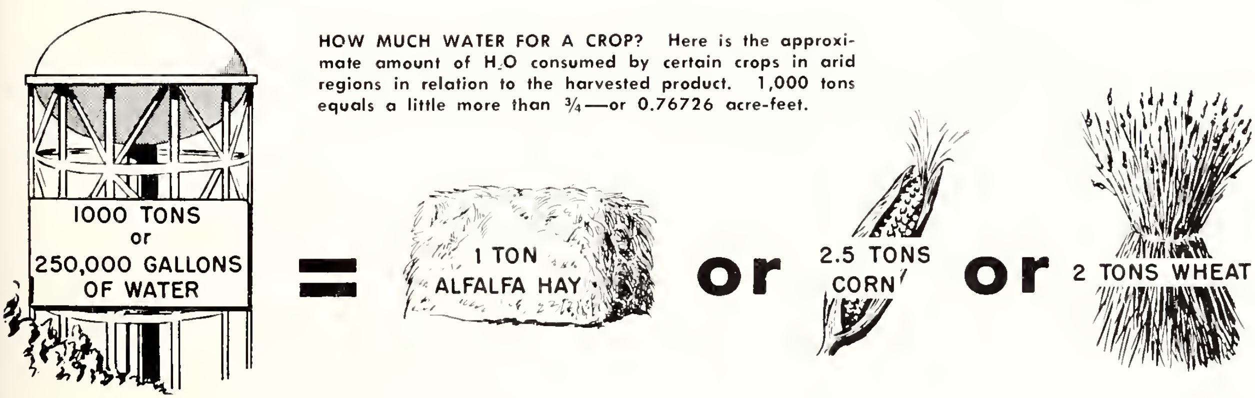
SOIL, WATER, AND AIR

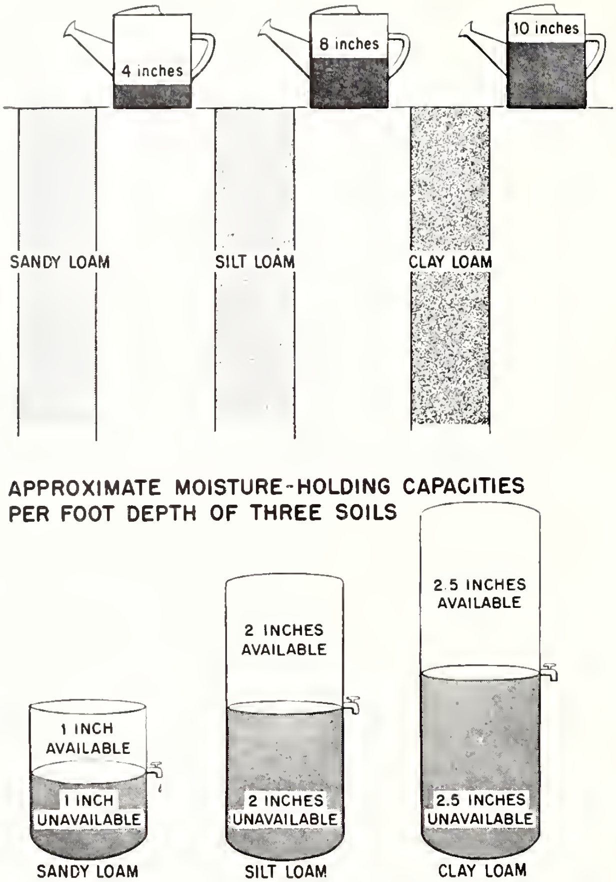
by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer Region 1 headquarters, Boise, Idaho

(Part three in a series of articles on soils and land classification)

Among the important physical properties of soils are those which enable them to absorb water readily from precipitation or irrigation and to hold and transmit it for the use of crops. Water which enters the soil may be held with varying degrees of availability in three forms, namely: (1) That held tightly in the lower range of balance with the water vapor of the air (humidity) which is not available to plants, (2) that held less tightly in liquid films or masses around the soil particles which form the soil solution and is available to plants, and (3) that which moves freely downward through the root zone unless retarded or obstructed by barriers or layers of low permeability. The latter free-moving water normally percolates downward rapidly and except for

HOW MUCH WATER FOR A CROP? Here is the approximate amount of H_2O consumed by certain crops in arid regions in relation to the harvested product. 1,000 tons equals a little more than ¾—or 0.76726 acre-feet.





THREE SOILS and the approximate inches of water required to replenish the available moisture to a depth of 4 feet, at top of chart. Bottom portion gives an idea of how much water these three soils can make available to plants for each foot of depth. ***Drawing at right and at bottom of page 63 by Graphics Section, Washington, D. C.***

a short period is not available to plants. Therefore, the water that is retained in the soil is available to plants until evaporation and plant transpiration reduce it to a point where it is tightly held by the soil. Since plants cannot obtain it, they are permanently wilted. Some crops wilt more readily than others, but the controlling factor in determining the amount of moisture available to crops before they wilt varies with the water-retaining properties of different soils.

The water holding capacity of a soil depends largely upon the total surface area of the soil grains and the percentage of voids between them. The amount of pore space varies with the size and arrangement of the soil particles and ranges from about one-third by volume of the soil mass in sands to about two-thirds in clays. In addition to water, this pore space holds air which is necessary for root development and for the soil micro-organisms. The air volume varies with the soil moisture content. It is greatest in sandy soils and least in clay soils, in contrast to the water volume, which is greatest in the latter. These volumes are, of course, significantly modified by the organic matter and the way in which the soil particles are grouped. In general, a sandy loam retains about one inch of usable water per foot of soil depth, silt loams about two inches, and clay loams about 2½ and sometimes as much as 3 inches or more.

The soil must hold a tremendous amount of water to support plant life and produce satisfactory crop yields. One inch of rainfall or irrigation water spread over an acre provides the soil with 113 tons of water. Of this, 300 to 500 pounds or more of water are necessary to produce only one pound of dry plant material depending on the climate. Alfalfa in humid sections requires about 500 pounds of water for every pound of dry hay produced. That means that a five-ton annual yield of hay will require five million pounds of water and possibly twice as much water per acre. It may be twice this amount in the

HOW MUCH WATER WILL YOUR SOIL HOLD???

If you want to find out how much water your soil holds, use a soil auger to get samples of the soil from the root zone. Gently rub some of the soil sample between your thumb and forefinger to determine the texture. If the "feel" is harsh and gritty, your soil is of a sandy character. If it is smooth and "silky," it is a silty soil. If it rolls up or "balls" between your thumb and fingers, it is clayey. Here is a list of different classes of soil and the amount of water each can hold to feed the root zone of your plants:

Soil class:	*Available water capacity per foot of depth (inches)*
Sands	¼ to ¾
Loamy Sands	¾ to 1¼
Sandy Loams	1 to 1½
Fine Sandy Loams	1½ to 2
Clay Loams	1½ to 2
Clays	2 to 3

Since you seldom, if ever, wait to irrigate until all of the available moisture is gone from the rooting zone, you do not have to replace the entire moisture-holding capacity of the soil.

more arid regions. This amount of water is actually required by the plant and does not include the water lost through evaporation or otherwise. Of course, the soil cannot absorb and hold this moisture in the root zone at one time, and, therefore, it is important that rainfall should occur well distributed during the growing season and that under irrigation the water be applied at a time and in quantities that will produce the most satisfactory yields without excessive loss from run-off and deep percolation.

(NEXT MONTH—PREPARING FOR IRRIGATION, the story of how the Columbia Basin lands were surveyed and classified.)

Nevada Reclamation Association Organized

Nevada's first State Reclamation Association was organized in Carson City September 28, 1951, superseding the Nevada Water Conference, which closed its sixth session on that date. The elected officials are Phil Hoover of Ely, president; Carl Gelmstedt of Yerrington, secretary-treasurer, and Alfred Merritt Smith, State director to the National Reclamation Association. •

Walter H. Price Succeeds Robert F. Blanks

Chief Engineer L. N. McClellan announced the appointment of Walter H. Price on November 7 to succeed Robert F. Blanks as head of the Bureau's Engineering Laboratories in Denver, Colo.

Price has been with the Bureau since 1930 and has been a staff member of the Bureau's laboratories since 1934. In this latter capacity he acquired a wide experience in hydraulic and structural studies and experiments, structural design and research, and materials testing and research. At the time of his appointment he was head of the Materials Laboratories.

Price is a member of the Board of Directors in the American Concrete Institute, holds committee chairmanships and memberships in the AIC, as well as the American Society of Civil Engineers, and is a member of the Colorado Society of Engineers and Sigma Xi. He has authored many reports and papers on concrete technology. He received his degree in civil engineering from Tulane University in 1930.

Mr. Blanks resigned from the Bureau to accept the position of Vice President with Great Western Aggregates, Inc. of Denver, Colo. •

Progress at Palisades

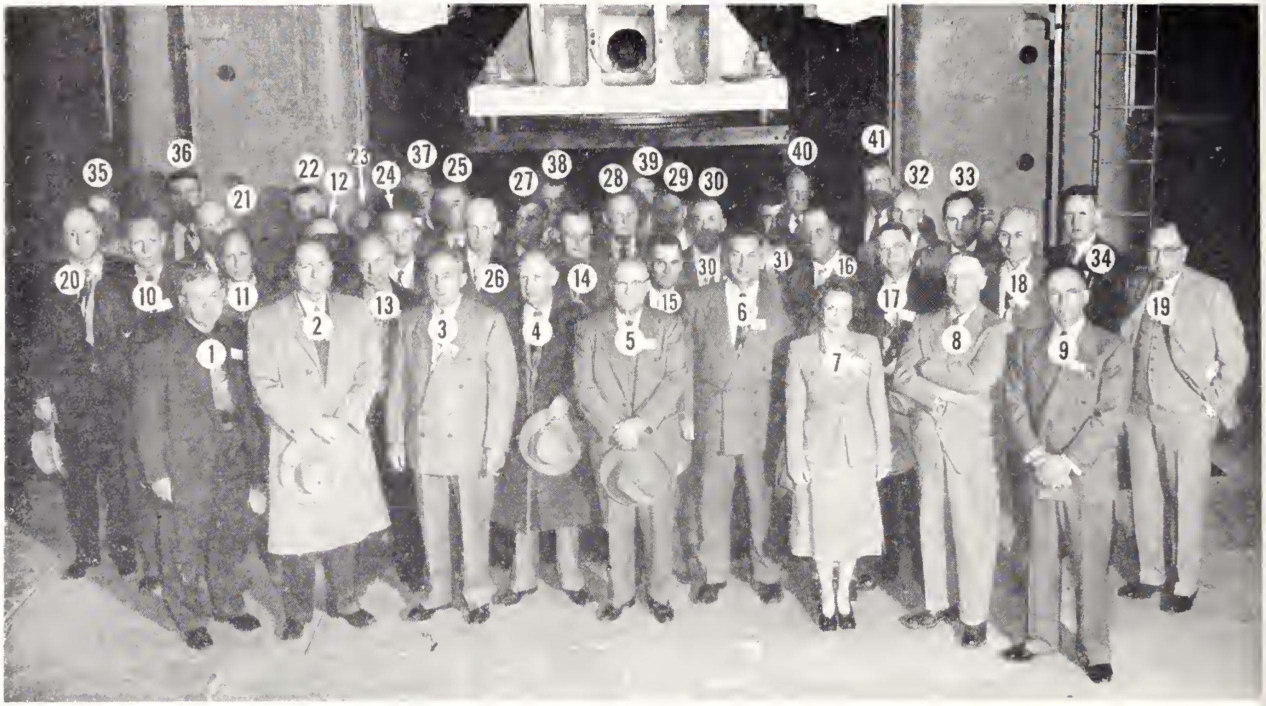
J. A. Terteling and Sons, Inc., of Boise, Idaho, successful bidders on the first major Palisades Dam and power plant contract, began work on the tunnel and construction substation in December 1951, less than a month after Congress authorized \$2,000,000 for construction of this plant as a Defense Electric Power Administration-approved project. The construction substation was to be completed in February and the entire contract, which includes open-cut and tunnel excavations for the power and outlet tunnels, must be finished by August this year.

The \$76,600,000 multiple-purpose Palisades project will feature the largest earth-fill dam yet built by the Bureau of Reclamation. It will provide 114,000 kilowatts, capable of producing 700 million kilowatt-hours of energy annually, for developing phosphate and atomic energy for defense needs, and will provide downstream benefits for an estimated 650,000 acres of land and flood protection for other lands. In order to provide power for the emergency, irrigators have agreed to a five-year plan giving priority to the use of Palisades water for power production.

Louis B. Ackerman, long-time career engineer in the Bureau of Reclamation, has been appointed construction engineer for the project; I. Donald Jerman is his assistant, and Henry Patrick "Pat" O'Donnell, the experienced earth-dam engineer from Coulee Dam, Wash., is field engineer, supervising all field engineering for the construction of the dam and tunnels. •

MEMBERS OF THE WELLTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT—Photographed last December as they worked out the terms of their repayment contract. (See "Water for the Wellton-Mohawk" in the January and February 1952 issues.) Seated, from left to right, Frank Botley, L. A. Hicks, President R. H. McElhaney, C. G. Buckeye, and H. J. Woodhouse. Standing, from left to right, J. M. Reilly, Marion F. Griffin, George A. Leach and Wayne T. Wright. *Photo by Samuel B. Watkins, Region 3 photographer.*

The Four States Irrigation Council



REPRESENTATIVES OF WATER USERS on Bureau of Reclamation projects in Nebraska, Kansas, Colorado, and Wyoming voted to talk things over every year with Region 7 officials. They are photographed during their tour of the Engineering Laboratories at the Denver, Colo., Federal Center.

FIRST ROW: (1) Clyde Paine, Frenchman Cambridge; (2) B. W. Moore, Farmers; (3) M. O. Andrews, Pathfinder; (4) E. O. Daggett, Farmers; (5) Ben Harrington, Nebrasko-Bostwick; (6) H. E. Thomas, Nebrosko-Bastwick; (7) Ruth Sadler, USBR, Reclamation Era; (8) Galen Lowery, Gering-Ft. Laramie; (9) Harold Hobson, Lingle. SECOND ROW: (10) Andrew Young, Mirage Flats; (11) Floyd Brown, USBR; (12) F. M. Jordon, Colorado Ext. Service; (13) Charles Klingman, Gering-Ft. Laramie; (14) Floyd Freeborn, Kirwin; (15) Perry L. Sweat, Kirwin; (16) Jerry Hoys, Farmers; (17) Dr. J. B. Fuller, Goshen; (18) Floyd Raush, USBR; (19) Nels Nelson, USBR, Casper. THIRD ROW: (20) Walter Skeen, Mirage Flats; (21) Carl Rohwer, Soil Conservation Service; (22) unidentified; (23) A. B. Robinson, Colorado A & M; (24) Don Thompson, Frenchman-Cambridge; (25) A. J. Hammond, Colorado Ext. Service; (26) T. Guy Stewart, Colo. Ext. Service; (27) S. L. Bowman, Pathfinder; (28) Gordon Storm, Pathfinder; (29) Nat Tolman, USBR; (30) Lee Vohland, Farmers; (31) T. P. Winchell, Gering-Ft. Laramie; (32) Paul Hobson, Lingle; (33) Paul Miller, Nebraska Extension Service; (34) James Doyle, Windsor Reservoir and Canal Co. FOURTH ROW: (35) Walter Barnes, Mirage Flats; (36) Al Richardson, Mirage Flats; (37) Val Kusko, C. B. & Q. RR; (38) Arnold Lepik, Central Nebr. Public Power & Irrig. Dist.; (39) Earl Phipps, Northern Colo. Water Conservancy Dist.; (40) J. M. Dille, Northern Colo. Water Conservancy Dist., and (41) Harold Ledingham, Gering-Ft. Laramie. Photo by Norton T. Novitt, Region 7 photographer.

SERVICE AND SAVINGS were the main themes of a helpful, 2-day conference held in the Bureau of Reclamation's Region 7 headquarters at Denver, Colo., on January 16 and 17, 1952.

This was a meeting "of the water users, by the water users and for the water users" called by Avery A. Batson, Regional Director, to give the representatives of water users on reclamation projects in the southern Missouri River Basin an opportunity to discuss mutual problems with the Bureau officials.

At the opening session, the conferees appointed Mr. E. O. Daggett of the Farmers Irrigation District in Scottsbluff, Nebr., as chairman, and nominated a representative from each of the States concerned as members of an operating committee: from Nebraska, R. O. Canaday of the Central Nebraska Power & Irrigation District in Gering, chairman; from Kansas, Perry L. Sweat, Kirwin Irrigation District; from Colorado, James Doyle, Windsor Reservoir & Canal Company and from Wyoming, Dr. J. B. Fuller, Goshen Irrigation District.

At the conclusion of the conference, Chairman R. O. Canaday submitted the following report:

MR. PRESIDENT AND GENTLEMEN:

Full names and addresses of the water users' associations mentioned in connection with the above photo (in alphabetical order) are as follows: Central Nebraska Public Power and Irrigation District, Hastings, Nebr.; Farmers Irrigation District, Scottsbluff, Nebr.; Frenchman-Cambridge Irrigation District, McCook, Nebr.; Gering-Ft. Laramie Irrigation District, Gering, Nebr.; Goshen Irrigation District, Torrington, Wyo.; Kirwin Irrigation District, Kirwin, Kans.; Lingle Water Users Association, Lingle, Wyo.; Mirage Flats Irrigation District, Hays Springs, Nebr.; Nebraska-Bostwick Irrigation District, Superior, Nebr.; Northern Colorado Water Conservancy District, Greeley, Colo.; Pathfinder Irrigation District, Mitchell, Nebr., and Windsor Reservoir and Canal Co., Windsor, Colo.

Your committee has given consideration to the advisability of making this organization permanent and continuing these meetings hereafter.

We believe that substantial benefits will be derived by having representatives of the operating personnel of the various projects get together and discuss numerous problems arising in the operation of our projects, telling us of the manner in which they have solved their problems and obtaining the advice and help of others who have similar problems.

We believe that such an exchange of experiences will save headaches for the new projects and thousands of dollars for each of the projects.

Your committee therefore offers the following resolutions:

1. Be It Resolved that this organization express to the Reclamation Bureau and to Mr. Batson and his assistants its appreciation for calling the meeting and preparing a very interesting and helpful program.

2. Be It Resolved that this organization be made permanent, that its officers consist of a president and a committee consisting of five members, one member to be chosen by the representative of each of the four States represented and one from the Bureau of Reclamation.

3. Be It Further Resolved that the name of this organization be "Four States Irrigation Council."

4. Be It Further Resolved that this organization confine its programs and its endeavors to construction, operation and maintenance problems.

5. Be It Further Resolved that it hold one meeting annually at such time and place as shall be determined by the committee.

6. Be It Further Resolved that the committee and the President have the powers and it shall be their duty to handle all of the business affairs of the organization.

7. Be It Further Resolved that the President and the Committee be instructed to prepare and submit to this organization at its next annual meeting a set of by-laws to govern its future activities.

Respectfully submitted,

R. O. Canaday, *Chairman.*

Following the unanimous approval of the report and its resolutions, the water users voted that the temporary President and the four committee members serve as their elected officers for the coming year, and that Regional Director Avery A. Batson be requested to serve on the committee or designate a representative of the Bureau of Reclamation, to work with the Four States Irrigation Council.

This meeting was run by the water users with the entire facilities of the Regional office and the Engineering Laboratory placed at the disposal of the conferees in order to help them in their business of operating and maintaining Federal reclamation projects. The emphasis of the meeting was on reducing irrigation and maintenance costs, the conferees discussing such items as controlling upland run-off, installing lower cost canal linings, use of new equipment and methods for irrigation districts, maintaining canals, laterals and drains, and new developments in weed control. Several of the discussions will be published in future issues of the Reclamation Era, due to the water users' interest in obtaining and circulating material on these topics. The End.

Harry Strunk Receives Conservation Award

Harry D. Strunk, president of the Republican Valley Conservation Association, and owner and publisher of the McCook Daily Gazette, was presented with the first Interior Conservation Service Award to be given to any man in the Western States on August 31, 1951, by Goodrich W. Lineweaver, Assistant Commissioner of the Bureau of Reclamation, as the personal representative of Secretary Chapman at the annual meeting of the Republican Valley Conservation Association in McCook, Nebr.

The award was made in recognition of his lifetime of work in behalf of the conservation and utilization of the natural resources of the Republican River Basin and the entire Missouri River Basin. Additional information regarding Mr. Strunk's career may be found in the September 1949 issue of the Reclamation Era, which carries his nomination to Reclamation's Hall of Fame.

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the Reclamation Era at your door, but we have to know where it is.

Reclamation Loses Nelson to Point Four Program


WESLEY R. NELSON, at right, now member of the Technical Cooperation Administration. HARVEY F. McPHAIL, at left, former Director of thhe Division of Power Utilization, who succeeds Mr. Nelson as Assistant Commissioner of Reclamation.

Assistant Commissioner of Reclamation Wesley R. Nelson left the Bureau after 24 years of service on February 1, 1952, to accept an overseas assignment with the Technical Cooperation Administration of the Department of State. On January 31, during a ceremony in Washington, D. C., Secretary of the Interior Oscar L. Chapman presented Mr. Nelson with the Department's highest award, the Distinguished Service Medal, before a gathering of hundreds of Mr. Nelson's friends. He also received a bound volume of letters, telegrams, and messages containing over a thousand names of persons who expressed their regret at his leaving the Bureau and their best wishes and congratulations on his foreign assignment.

Mr. Harvey F. McPhail, Director of Power Utilization, a career employee with more than 30 years' service in the Bureau, was appointed successor to Mr. Nelson, on February 1, 1952. At the same time Henry B. Taliaferro (pronounced Tol-iv-er) was designated Acting Director of the Division of Power Utilization.

"We are sorry to lose Mr. Nelson," said Commissioner of Reclamation Michael W. Straus, "and we are fortunate to have available a man of Mr. McPhail's capabilities to succeed him." •

Summer School at Colorado A & M

Colorado A & M College will feature "Hydraulics of Sediment Bearing Channels and Rivers" and "Ground Water Hydraulics" in the annual graduate summer program in hydraulic and irrigation engineering during the first term of the 1952 Summer Session, June 16 to July 11.

"Hydraulics of Sediment Bearing Channels" will be taught by Prof. T. Blench, Associate Professor of Civil Engineering at the University of Alberta. Professor Blench was formerly Director of Research for the Punjab irrigation district and is widely recognized as an authority on the hydraulics of channels in erodible materials. He is author of "Hydraulics of Sediment Bearing Channels" (Evans Industries Ltd. Vancouver, 1951) and numerous technical papers.

C. E. Jacob, Head of the Department of Geophysics, University of Utah will teach the course in "Ground Water Hydraulics." Professor Jacob was formerly Chief of the Section of Ground Water Hydraulics for the U. S. Geological Survey and is author of numerous articles on ground water flow including "Drawdown Test to Determine the Effective Radius of Artesian Well" which won the Rudolf Hering Medal in 1948.

Other graduate courses will be taught by regular staff members both during the first term and during the second term July 14 to August 8.

A limited number of fellowships are available for students interested in regular graduate work. Further information may be obtained by writing to the Dean of Engineering, Colorado A & M College, Fort Collins, Col. •

Region 6 Water Users Hold Fourth Annual O & M Meeting

Discussion of two major themes, better project operation and maintenance and better use of land and water, marked the fourth annual Region 6 water users operation and maintenance meeting held in Billings, Mont., January 8 and 9, 1952.

Water users from all major Bureau of Reclamation projects in Region 6 attended the two-day meeting. These projects include the Shoshone and Riverton in Wyoming; Milk River, Sun River, Lower Yellowstone, and Huntley in Montana; Belle Fourche, Angostura, and Rapid Valley, South Dakota and Buford-Trenton, North Dakota.

At the noonday luncheon on the first day of the conference, A. G. Martin, vice president of

Cachuma Passes Half-Way Mark

In mid-January 1952, construction work on the $34,193,000 Cachuma water project for the City of Santa Barbara and adjacent communities in California had passed the half-way mark, and citizens of Santa Barbara and nearby Montecito were enjoying a 5,000,000-gallon-a-day emergency water supply from a Santa Ynez mountain strata intercepted during the boring of the main Cachuma project tunnel. The construction schedule calls for completing the Cachuma project, begun in 1950, in the Spring of 1954.

By the beginning of this year the 7.6-mile highway around the Cachuma Reservoir had been completed, the Goleta section of the South Coast Conduit was 85 percent complete, the Tecolote Tunnel, and Lauro regulating reservoir had reached or passed the half-way mark, and work was well under way on the Glen Anne regulating reservoir, and Carpinteria section of the South Coast Conduit. Bids are now being requested for the Otega and Carpinteria regulating reservoirs. Funds for the lateral distribution systems, which are to distribute water from the conduit to the crop lands in the water districts, have not as yet been appropriated. ●

ONE OF THE FOUR regulating reservoirs for the Cachuma project in California is the Lauro Dam, now past the half-way mark. *Perspective drawing by M. H. Willon, Denver, Colo.*

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the Billings Commercial Club, spoke of industry's interest in not only the Reclamation development of new land but in maintaining the continued high productivity of land now under irrigation, due to the fact that so much of Montana's continued progress is dependent on irrigation. Speaking at a luncheon meeting the following day, H. L. Buck, Billings Commercial Club secretary, who also serves as Montana State director and national treasurer of the National Reclamation Association, reviewed the NRA resolutions of particular interest to water users that were passed at the 1951 meeting in Amarillo. Buck particularly stressed the importance of the National Reclamation Association's resolution pertaining to soil and water research. Ivan D. Wood, irirgation specialist, Soil Conservation Service, Denver, Colo., the featured speaker at the conference banquet, talked on proper land development for better water application.

Plans for the meeting were developed by E. F. Landerholm, Region 6 operation and maintenance supervisor, working in cooperation with project water users. At the opening session, Hollis Sanford, assistant director, Division of Operation and Maintenance, Washington, D. C., and K. F. Vernon, Region 6 Director, emphasized the underlying purpose of the two-day meeting—the exchange of views and information that would result in more efficient operation and maintenance with resultant lower costs to water users. Both speakers also stressed the need for proper care of land under irrigation so that high productivity can be maintained. Equal emphasis was placed on the necessity for restoring the productivity of project lands which had been lost in the past through a lack of knowledge of the best use of land and water. ●

Time to Renew?

You'll find the expiration date of your subscription on the address stamped on the back of your copy of the RECLAMATION ERA. If the number at the left-hand side of the address, directly beneath the number and street reads "6–52," for example, the last issue under your subscription will be the 6th month—June—of the year 1952.

Make sure that you will receive all copies of the RECLAMATION ERA by mailing your renewal at least 2 months before your present subscription expires.

Just send your payment of $1.50 (or $1 if you are a water user or Bureau employee) for 1 year, along with a clipping or copy of your address stamp to Commissioner, Bureau of Reclamation, Washington 25, D. C. Make money orders or checks payable to the Treasurer of the United States. Coins or currency will be accepted—but no stamps, please.

WATER REPORT

By the first of February, with the exception of projects in New Mexico and Texas and the Belle Fourche project in South Dakota, prospects for water supplies for Bureau projects during the coming irrigation season were uniformly good. The Rio Grande project in New Mexico and Texas may be short of water in the early part of the season. If snow accumulation is normal for the remainder of the season on the upper Rio Grande watershed, late season and next year's supply should be more than adequate. Run-off in the Pecos River basin was very low with poor prospects for improvement so water shortages are to be expected on the Carlsbad project. The drought continued in Texas.

In Arizona, storage for the Salt River project had jumped from less than 50 percent average at the end of November to about 160 percent average. In southern California the drought had been broken but run-off to reservoirs was disappointingly low except in the Santa Barbara area.

In three major river basins, the Columbia, Sacramento, and Colorado, flood hazards were beginning to develop. Snow pack on the Columbia River basin was uniformly above average. Grand Coulee Reservoir had been drawn down to offer a measure of flood control. Season precipitation above Shasta and Millerton reservoirs had been almost 150 percent above average and the snow pack was reported as 250 percent normal in some places. Precipitation in the Colorado River Basin continued to be above normal, being 179 percent of the 39 year normal for the period October-January. Lake Mead was being drawn down to provide for storage of a spring run-off considerably in excess of normal.

Although it was still too early for adequate forecasts, it appeared that run-off in the Platte River Basin will be above normal as may be the case in the upper Arkansas.

Here are the water prospects of various regions (see map on back cover for locations) as of February 1, 1952:

REGION 1—outlook for water for all projects was good ranging from above normal for the Yakima project to above normal and excessive elsewhere. Run-off in the Snake River Basin will probably be much above normal. Reservoirs were being operated with the expectation of above normal run-off. Storage in Grand Coulee was about 2,000,000 acre feet less than on the same date last year.

REGION 2—run-off into Shasta and Millerton Lakes was about 150 percent normal. Prospects are for much above-normal run-off for the remainder of the season. Existing storage in Santa Barbara area had been filled for the first time in several years. Run-off past and prospective for the Orland project was above normal.

REGION 3—record breaking run-off was still being expected at Lake Mead. Precipitation on the upper Colorado River basin during January was above average continuing a trend that developed last fall. Lake Mead storage was being reduced by maximum power production to provide storage for excess run-off. However, releases may have to be so high as to seriously interfere with the work on the spillway at Davis Dam and with the maintenance of the temporary weir for the Palo Verde project. Storage on the Salt River project was much above average with more storable run-off in prospect. Storage in reservoirs in the San Diego area of California remained low.

REGION 4—run-off from the San Juan River basin was expected to be much above normal. Gunnison River run-off should be high since Uncompahgre project reported that the snowfall on the upper Gunnison River watershed had already reached the season's normal. Inflow to Utah Lake was the highest January run-off yet recorded. All Utah and Nevada projects expected above normal water supplies.

REGION 5—combined storage in Elephant Butte and Caballo reservoirs of Rio Grande project held 82,400 acre feet at the end of January. The project reports that spring planting requirements are 175,000 acre feet, part of which can be supplied by pumps. Prospects are that these requirements will not be met unless there is above normal precipitation at low elevations in the basin or unseasonable warmth at high elevations. Heavy snow pack in the upper Rio Grande watershed indicates that the total seasonal run-off will be above average. Water supply for the Carlsbad project was inadequate with little prospect for improvement. Storage at the end of January in Conchas Reservoir of the Tucumcari project had declined steadily since 1946, but water supply seemed adequate for this season. Altus Reservoir storage was adequate for project demands.

REGION 6—except for the Belle Fourche project, the outlook for water was uniformly good over the region. Storage in Belle Fourche Reservoir was about the same as it was on February 1st last year. Snow pack was good in practically all mountain areas although precipitation on the plains had not been above normal.

REGION 7—storage for the Kendrick and North Platte projects in the North Platte River basin was above average. The snow pack was above average, but it was still too early in the season to forecast run-off. However, the prospect was for above normal run-off. Run-off in the plains area was about normal for February. Ample water was stored in Medicine Creek, Enders, Bonny and Cedar Bluff to meet all anticipated project demands. Water supply prospects for the Colorado-Big Thompson project were reported as very good. ●

LETTERS

RADA Not Toxic

SOUTHERN OKONAGAN LANDS PROJECT
DEPARTMENT OF LANDS AND FORESTS
Oliver, B. C., Canada December 12, 1951.

DEAR SIRS: Reference to your article in your November 19, 1951, magazine "THE RECLAMATION ERA" re RADA for algae, will you kindly advise if this is dangerous to human consumption. We have the problem in our project but also the irrigation water is used for domestic water.

May we have the courtesy of your reply please.

Yours very truly,

D. S. HODSDON,
Project Manager.

Here is our reply to Mr. Hodsdon:

Your letter of December 12 has been received requesting information as to whether consumption of Rosin Amine D Acetate (RADA) would be dangerous to humans.

Our only information on this subject has been obtained from the publication, Rosin Amine D and its Derivatives, distributed by the Hercules Powder Co. of Wilmington, Del., the manufacturer of these products. This publication states, "Toxicity tests were made by the Industrial Toxicological Laboratories, Philadelphia, Pennsylvania, on Hercules Rosin Amine D and Rosin Amine D Acetates." In regard to oral toxicity the publication states:

"Acute oral toxicity tests made by the Industrial Toxicological Laboratories indicate white rats may be fed approximately 70 milliliters per kilogram of body weight of a 1 percent solution of Hercules Rosin Amine D Acetate in distilled water without producing ill effects. This translated to human body weight would be roughly 70 ml./kg. x 70 kg. (weight of average man); or a total of 4,900 milliliters, which is roughly 5 quarts in one dose."

We are forwarding a copy of your letter and our reply to the Hercules Powder Co. as its representatives will be informed of your problem and can furnish any additional information they may have available.

Cattail Spray Safe for Cattle

MIAMI COPPER COMPANY,
Miami, Ariz., November 29, 1951.

THE RECLAMATION ERA
Bureau of Reclamation,
Department of the Interior,
Washington 25, D. C.

GENTLEMEN: We have read with interest a digest in Plant Engineering of your report on "TCA" which states "The combination of TCA and 2, 4-D has proven effective in the control of cattails."

We are troubled with cattails in our mill ponds, pH 8.4, and would appreciate any published information that you could supply. Also we would like to know whether spraying cattails with a combination of TCA and 2,4-D would make the pond water injurious to cattle.

Very truly yours,

B. R. COIL,
Assistant General Manager.

Here is our reply to Mr. Coil:

We have received your letter of November 29 requesting information on the use of TCA and 2,4-D for the control of cattails.

We are enclosing a copy of the January 1951 issue of the RECLAMATION ERA which contains on page 6 the original article of which you have read a digest in Plant Engineering. Our standard procedure for spraying cattails is to prepare a solution of 10 pounds of TCA and one pound of 2,4-D (ester or amine form) to each 100 gallons of water and apply this solution at the rate of from 300 to 400 gallons per acre of cattail plants. It is essential that the plants are thoroughly wetted with the solution. As cattail leaves have a waxy covering, it has been found desirable to add to this solution a small amount of wetting or emulsifying agent or 5 to 10 gallons of diesel oil per 100 gallons of water to aid penetration. Perhaps the best time to spray is when the cattail heads are just beginning to form.

We do not believe that this combination will be injurious to livestock as 2,4-D has been tested numerous times with no ill effects. Tests made with TCA on pastures in Michigan did not injure livestock. One of the chemical companies selling TCA reports in its literature "Experimental studies conducted on laboratory animals have shown that sodium TCA 90 percent is very low in toxicity when swallowed. No appreciable hazards are believed to exist in regard to wildlife or livestock which may feed on sprayed foliage." It is believed that any of the solution getting into the pond would be so greatly diluted that there would be no hazard to animals drinking the water.

If you desire more detailed information on the results of TCA and 2,4-D on cattails and the results of tests in your locality, it is suggested that you contact Mr. H. Fred Arle, agronomist, Bureau of Plant Industry, Room 24 Post Office, Phoenix, Ariz., who has aided our Bureau in testing this chemical combination, or write to our Regional Director at Boulder City, Nev.

RELEASES

Point Four in Action

A new illustrated 38-page publication which describes the part that the various Interior Department Agencies are playing in the President's Point Four Program of technical cooperation with peoples of underdeveloped areas of the world is now available free of charge by writing to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. ●

Heading Off Halogeten

The Bureau of Land Management has issued a new illustrated pamphlet entitled "Halogeten" designed to assist farmers in disposing of this poisonous menace. It illustrates the manner in which this weed spreads and poisons livestock, explaining how it can be controlled through reseeding grass.

Copies of this pamphlet may be obtained free of charge by writing to the Bureau of Land Management, Washington 25, D. C. ●

New Shoshone Project Folder

A new folder on the Shoshone project in Wyoming has recently been released. In addition to a number of "before and after" photos it contains a descriptive résumé and statistics regarding the project. Copies may be had without cost by writing to the Regional Director, Bureau of Reclamation, Billings, Mont. ●

Irrigation Advisers' Guide

A 215-page handbook prepared by the Burau of Reclamation in cooperation with the Land Grant Colleges and Universities, and Agencies of the United States Department of Agriculture, is now available at 60¢ a copy from the Superintendent of Documents, Government Printing Office, Washington, D. C. This publication is designed to insure that new irrigators have competent advice in preparing their fields for efficient use of water, constructing effective water distribution systems, and using irrigation water to the best possible advantage. ●

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NOTES FOR CONTRACTORS

Contracts Awarded During January 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3506	Eklutna, Alaska	Jan. 3	Two 25,000-horsepower, 600-revolutions per minute vertical-shaft hydraulic turbines for Eklutna power plant.	Newport News Shipbuilding Dry Dock Co., Newport News, Va.	$335,000
DC-3536	do	do	Furnishing and installing two 16,667-kilovolt ampere generators for Eklutna power plant.	Pacific Oerlikon Co., Tacoma, Wash.	474,294
DS-3562	Colo.-Big Thompson, Colo.	Jan. 16	One 1,700-ampere bus structure and 1 generator-voltage switchgear assembly for Pole Hill power plant, schedules 1 and 2.	Westinghouse Electric Corp., Denver, Colo.	23,601
	do	Jan. 31	1 generator and motor voltage switchgear assembly and 1 protective equipment cubicle for Flatiron power and pumping plant, schedule 3.	Brown Boveri Corp., New York, N. Y.	132,380
DS-3565	Central Valley, Calif	Jan. 18	Three 66,000-kilovolt ampere transformers for Folsom power plant, schedule 1.	General Electric Co., Denver, Colo.	577,044
DC-3579, DC-3580, DC-3581, and DC-3582	Missouri River Basin, S. Dak.	Jan. 10	Construction of 2,500-kilovolt ampere Wall, 2,000-kilovolt ampere Wicksville, 6,000-kilovolt ampere Midland, and 5,500-kilovolt ampere Philip substations.	Frank Brink Electrical Construction & Lange Electric, Corsica, S. Dak.	180,410
DC-3587	Colo. River Front Work and Levee System, Ariz.-Calif.-Nev.	Jan. 5	Construction of earthwork and structures for reservation levees, Lower Colorado River district.	R. P. Shea Co., Indio, Calif.	690,785
DC-3589	Hungry Horse, Mont	do	Furnishing and installing 2 electric elevators for Hungry Horse Dam.	Otis Elevator Co., San Francisco, Calif.	169,000
DC-3590	Eklutna, Alaska	Jan. 18	Two 20,000-kilovolt ampere transformers for Eklutna power plant switchyard.	Westinghouse Electric Corp., Denver, Colo.	114,242
DS-3594	Kendrick, Wyo	Jan. 17	2 actuator-type governors with pumping equipment for regulating speed of 26,500-horsepower turbines for Alcova power plant.	Woodward Governor Co., Rockford, Ill.	55,650
DC-3599	W. C. Austin, Okla	do	Construction of earthwork, asphaltic membrane lining, and structures for Drains A-1, "162", "E", and "F" extension, Altus 21.7 lateral wasteway, and Altus Canal.	Sheppard and Luce, Vernon, Tex.	82,642
DS-3602	Kendrick, Wyo	Jan. 25	One 100-ton traveling crane for Alcova power plant	Moffett Engineering Co., Albany, Calif.	82,980
DC-3610	Colo.-Big Thompson, Colo.	Jan. 23	Installation of equipment and appurtenances and construction of structures and transmission line for Beaver Creek substation.	Donovan Construction Co., St. Paul, Minn.	134,499
117C-128	Columbia Basin, Wash	Jan. 11	Earthwork, concrete structures and timber bridges; Area W-3 and W-5 laterals, West Canal laterals.	Lakeside Bulldozing Co., Bellevue, Wash.	19,985
117C-131	do	Jan. 17	Lining repair, East Low and West canals	Cherf Bros. Construction Co., and Gandkay Contractors, Inc., Ephrata, Wash.	46,523
300C-31	Davis Dam, Ariz.-Nev.	Jan. 30	Warehouse extension O & M Area at Phoenix, schedule 1	Daum-Donaldson Construction Co., Phoenix, Ariz.	67,242
	do	Jan. 24	Utilities and paving O & M Area at Phoenix, schedule 2	Fisher Contracting Co., Phoenix, Ariz.	101,460
703C-220	Kendrick, Wyo	Jan. 2	Casper-Alcova telephone line	Lively Electric Co., Borger, Tex.	56,684
701C-223	Missouri River Basin, Nebr.-Kans.	Jan. 21	Drains and protective works for Superior-Courtland Unit	Claussen-Olsen-Benner, Inc., Holdredge, Nebr.	45,455
701C-226	do	Jan. 29	Stabilization of canal side slopes and construction of timber bridges and concrete checks for Superior and Courtland Canals.	Winslow Construction Co., Englewood, Colo.	102,811

Construction and Materials for which Bids Will Be Requested by May 1952

Project	Description of work or material
Cachuma, Calif	Control station chlorination equipment for Ortega and Carpenteria control stations.
Central Valley, Calif	Construction of the semi-outdoor type 14,000-kilowatt Nimbus power plant to house two 7,500-kilovolt-amperes generators, and the concrete Nimbus diversion dam, on the American River about 7 miles from Folsom, Calif. The concrete dam is to be 22 feet high and 800 feet long with eighteen 40- by 24-foot radial gates. A 10-foot operating roadway is to be provided on top of dam. The power plant structure is to be 120 feet long and 100 feet wide. Installation of embedded turbine parts and 60-ton gantry crane will be included in the contract.
Do	Two 69-kilovolt disconnecting switches, one 69-kilovolt power circuit breaker, and 3 potential transformers for Nimbus switchyard.
Do	2 vertical-shaft, propeller-type, 9,400-horse-power at 41.5-foot head, hydraulic turbines for Nimbus power plant.
Do	Moving and placing houses on foundations, constructing water and sewerage systems, and drilling well at Newman and San Luis wasteways on Delta-Mendota canal near Newman, Calif.
Do	Moving and placing houses on foundations, constructing water and sewerage systems, and drilling well at Balancing reservoir and Kern River on Friant-Kern Canal near Bakersfield, Calif.
Do	Construction of about 14 miles of 340 to 278-cubic feet per second capacity main lateral and 20 miles of 85 to 15-cubic feet per second sublaterals near Madera, Calif.
Central Valley, Calif	Three 230-kilovolt (900 kilovolt basic insulation level) 1,000-ampere, 5,000,000-kilovolt-amperes or an alternate of 7,500,000-kilovolt-amperes interrupting capacity rating, outdoor, power circuit breakers; one 69-kilovolt power circuit breaker; and seven 230-kilovolt, five 69-kilovolt, and three 115-kilovolt disconnecting switches for Folsom switchyard.
Do	One 4,160-volt outdoor unit substation switchgear having compartments for the following: one 5,000-kilovolt-amperes 3-wire incoming circuit; one 1,000-kilovolt-amperes 3-wire incoming circuit; and seven 3-wire outgoing circuits for Folsom switchyard.
Do	One 12,000/15,000-kilovolt-amperes autotransformer for Folsom switchyard and two 7,000/8,750-kilovolt-amperes power transformers for Nibus switchyard.
Do	Three 3,000-ampere bus structures with current and potential transformers, lightning arresters, and capacitors, disconnecting, and grounding switches; and one 13.8-kilowatt circuit breaker for Folsom power plant.
Do	Station-service unit substation for Folsom power plant.
Do	Main control board extension for P. G. & E. lines and transfer breaker in Tracy switchyard.
Do	Traveling water screens for Exeter Irrigation District No. 2.
Do	Two 7-cubic feet per second, one 4-cubic feet per second, and 2-cubic feet per second, all at 25-foot head, deep-well or propeller-type motor-driven pumping units for pumping plant D-3, Delano-Earlimart irrigation district.

Construction and Materials for which Bids Will Be Requested by May 1952—Continued

Project	Description of work or material
Colorado-Big Thompson, Colo.	Installation of trashrack and bulkhead on Rist Creek siphon entrance to Poudre supply canal 9 miles northwest of Fort Collins, Colo.
Do	Installation of gaging equipment and control line at Olympus siphon and deicing equipment at Olympus dam near Estes Park, Colo.
Do	Addition of 10,000-gallon septic tank complete with effluent line and drying bed at Green Mountain government camp 15 miles south of Kremmling, Colo.
Do	Landscaping and construction of concrete gaging station at West Portal of Alva B. Adams tunnel near Estes Park, Colo.
Do	Eight draft-tube bulkhead gates with lifting frame and one bulkhead for Flatiron power and pumping plant.
Columbia Basin, Wash.	Installation of two 65,000-horsepower, 720,000 gallons per minute pumps Nos. P5 and P6 in Grand Coulee pumping plant; miscellaneous metalwork including doors, louvers, handrailing, ladders, grating, covers, and plenum in Grand Coulee dam, pumping plant, and power plants; and electrical installation for Grand Coulee dam, pumping plant, and power plants.
Do	Construction of 17 miles of laterals, 36 miles of sublaterals, and 14 miles of drain wasteways, from 511 to 3 cubic feet per second capacities, for lateral area W-6A on West canal, south and east of Quincy and Winchester, Wash. The laterals will be unlined except where buried asphalt membrane is used.
Do	Construction of 3 miles of 30 cubic feet per second capacity lined channel, 5 miles of 60 cubic feet per second capacity unlined channel, and 9 culverts and a drop for interception and conveyance of excess ground water in the vicinity of Soap Lake, Wash.
Do	Construction of 1¾ miles of unlined wasteway for lateral area E2, 3 checks, 1 small pump structure, and railroad crossing.
Do	Construction of permanent vault and temporary storage room in the Ephrata warehouse. The 21- by 13-foot vault will have concrete block walls and reinforced ceiling slab. The 21- by 20-foot temporary storage room will have concrete block walls and wood ceiling.
Eden, Wyo.	Construction of 0.42 mile of 475 cubic feet per second capacity earth-lined Means canal; enlargement and rehabilitation of 6.5 miles of Eden canal to 300 cubic feet per second capacity, part of which is to be lined; construction of 2 miles of Eden canal laterals, 20 to 5 cubic feet per second capacity; and relocation of 0.35 mile of Dry Sandy Creek channel, 670 cubic feet per second capacity, 44 miles northwest of Rock Springs, Wyo.
Eklutna, Alaska	Construction of the two-unit 30,000-kilowatt Eklutna hydro-power plant near Palmer, Alaska. The powerhouse superstructure will have steel framing and concrete curtain walls; either wood piles or concrete caissons will be required for the foundations. The structure will measure 71 by 74 feet in area and 50 feet in height from generator floor to ceiling. The contractor will install two 21,000-horsepower Government-furnished turbines and a 40-ton traveling crane. Switchyard steel structures, to be furnished by the
Eklutna, Alaska—Con.	contractor, will be installed on the roof of the power plant. A machine shop similar in construction to the powerhouse will be built adjacent to the powerhouse.
Do	Main control board, annunciator relay cabinet, station-service transformers, distribution board, battery control and distribution board, and battery chargers for Eklutna power plant.
Do	Two 66-inch butterfly valves with accessories for Eklutna power plant.
Fort Peck, Mont.-N. Dak.	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel bus structures, installing Government-furnished major electrical equipment, and furnishing and erecting warehouses and service buildings. The Government will furnish the steel for most of the 115-kilovolt structures and the contractor will furnish the remaining 115-kilovolt and 12.47-kilovolt wood structures. Installation of an additional bay in Williston substation is also included.
Kendrick, Wyo	Alcova warehouse to be erected near Alcova Dam, 32 miles southwest of Casper, Wyo., requires the contractor to place concrete foundation and floor and gravel under floor, erect a 50- by 77-foot prefabricated metal warehouse, furnish and install electric unit heaters and lighting system, and construct a wood-timber loading dock. The Government is to furnish the prefabricated building and loading dock timber.
Do	Installing transfer pumps and furnishing and installing pipe for oil-handling equipment at new Casper substation.
Do	Station-service unit substation for Alcova power plant.
Do	Turbine draft-tube gates and accessories for Alcova power plant.
Palisades, Idaho	Construction of Palisades earth-fill dam and 114,000-kilowatt power plant and relocation of 21.5 miles of road on the south fork of the Snake River in Bonneville County, Idaho, 7 miles east of Irwin.
Do	Four vertical-shaft, Francis-type 39,500-horsepower at 190-foot head, hydraulic turbines for Palisades power plant.
Missouri River Basin, Mont.	Three 33.3-cubic feet per second capacity at 180-foot head horizontal, centrifugal-type, motor-driven pumping units for Crow Creek pumping plant.
Missouri River Basin, Nebr.	Construction of 15 miles of Franklin unlined earth canal, having 14-foot bottom width and 230 cubic feet per second capacity, diverting from Harlan County Dam and running along the north side of Republican River Valley to about 3 miles beyond Bloomington, Nebr. Work will include fourteen 78-inch precast-concrete pipe structures; 24 precast-concrete pipe culverts; 9 monolithic box culverts; 27 turnouts; 2 orifice checks, highway and farm bridges, 2 wasteway structures, drain inlets, and check; and road relocations and intercepting drains.
Missouri River Basin, N. Dak.	Construction of 29 pumping and relift pumping plants for the western one-third of the Heart Butte unit, 8 miles north of Flasher, N. Dak. to the Heart Butte Dam.

United States Department of the Interior, Oscar L. Chapman, Secretary

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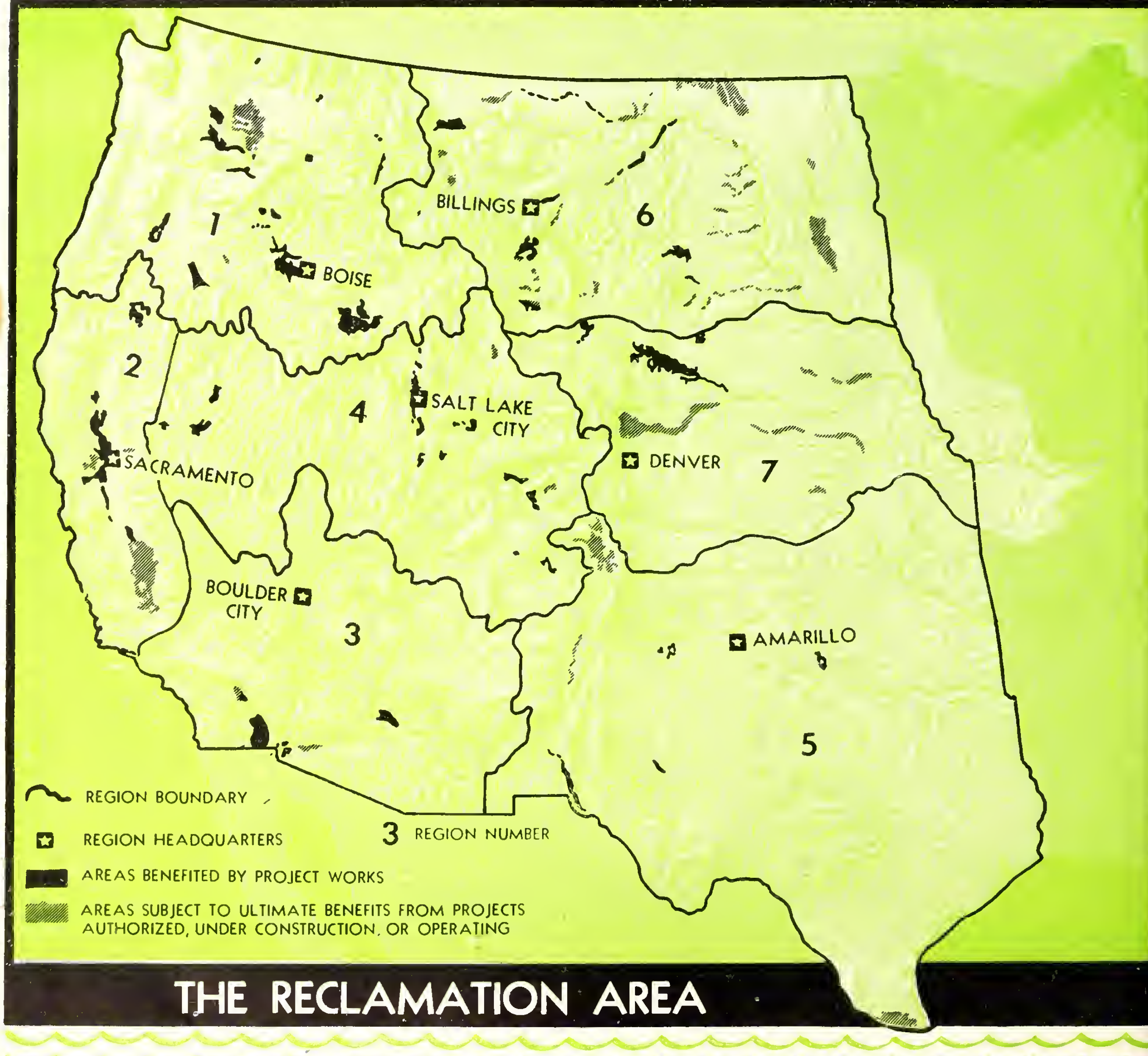
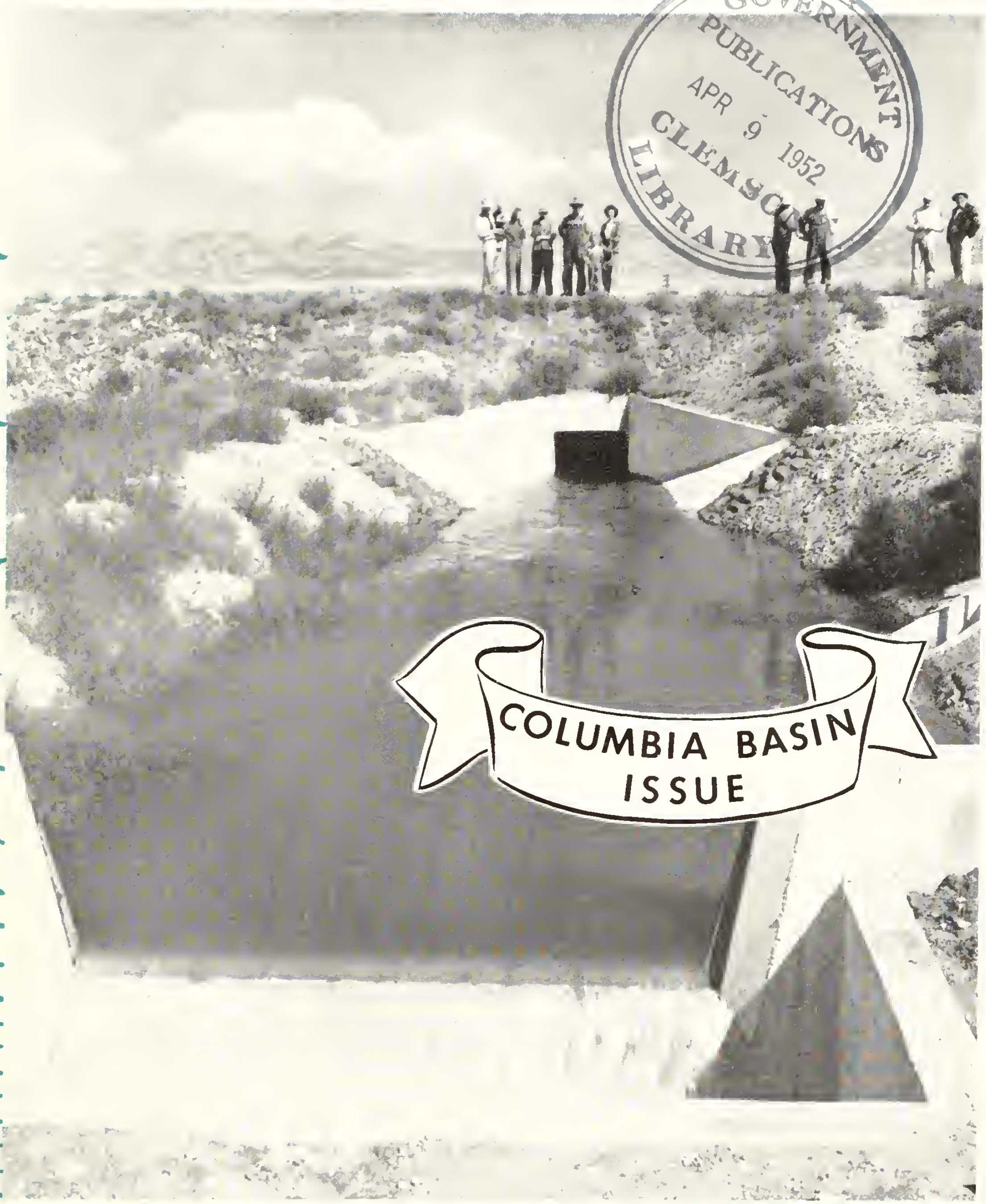


THE RECLAMATION AREA

The Reclamation ERA

April

1952



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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

NEW HORIZONS—NEW FARMS

This scene will be repeated many times in the future as Columbia River water reaches the main laterals on its way to the project lands. After the initial delivery of enough water for 87,000 acres this year, the Bureau plans to add 60,000 acres a year until a million acres are under irrigation. *Photo by H. E. Foss, Region 1 photographer.*

35 YEARS AGO IN THE ERA

In the great work of making our Nation prepared for any emergency that may arise, the Reclamation Service is doing its part as well as limited funds will permit. Personally we regard it just as important that every acre which will grow crops should be planted as it is to spend hundreds of millions on battleships and munitions. We are not joining the pacifists either. While millions are being provided for the soldier and sailor, we think it would be wise to add another million acres of irrigated land to our crop-producing area. We have the land and water, we have the land hunger, but we haven't $50,000,000 for the irrigation works. Why not ask Congress to issue bonds and raise it? It will be repaid not only in dollars, but in making citizens who will have something better than a boarding house to fight for; in $50,000,000 worth of food each year and in the development of a dozen commonwealths. In the crisis which threatens our Nation the farmer is going to play a mighty important part. . . . It takes a lot of fellows hammering away far from the scenes of strife to keep one man at the front, and a good many of these will be farmers.

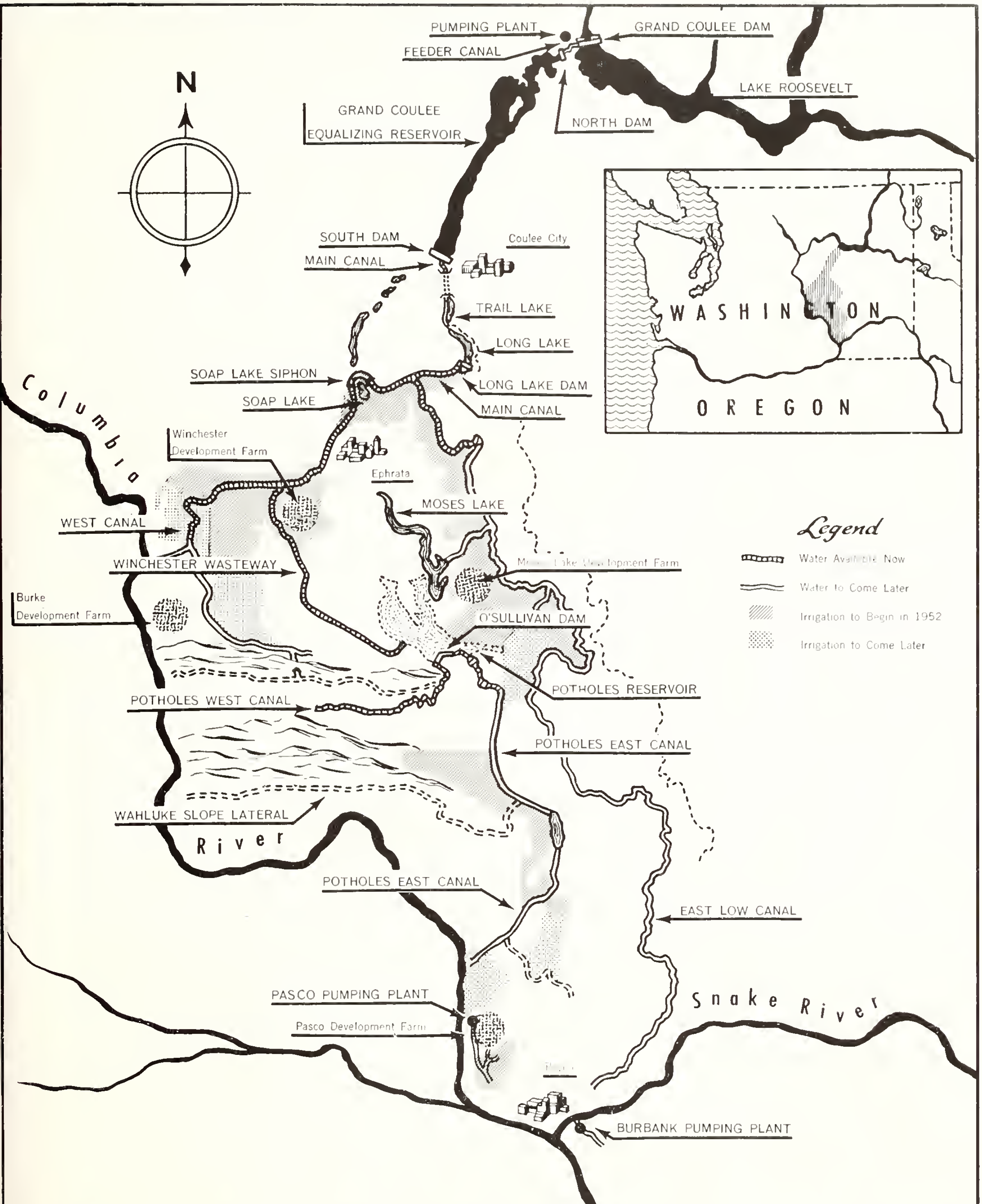
(From column entitled "Current Comments" by C. J. Blanchard, statistician, on p. 162 of the April 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

THE FIRST OF A MILLION ACRES

Next month the State of Washington will celebrate the completion of facilities for irrigating the first 87,000 acres of an ultimate 1,000,000-acre project—the Columbia Basin project—under construction for a little more than 18 years.

For 35 years or more people of the Northwest have dreamed of the day when a dependable supply of water could be delivered to the huge tract—water that would turn the sagebrush-covered area into a community of fertile farms.

In honor of the celebration, the RECLAMATION ERA has devoted the entire contents of this issue to topics concerning the Columbia Basin project. Obviously, many interesting items have been omitted, and many phases of this gigantic work have not been mentioned, but we wish to express our deep appreciation to those who have contributed to this special issue, particularly representatives of cooperating agencies in the Pacific Northwest who are working together to make the most of this vast project, designed to benefit the entire Nation.



COLUMBIA BASIN PROJECT

992016—52—— 1

HOW THE PROJECT BEGAN

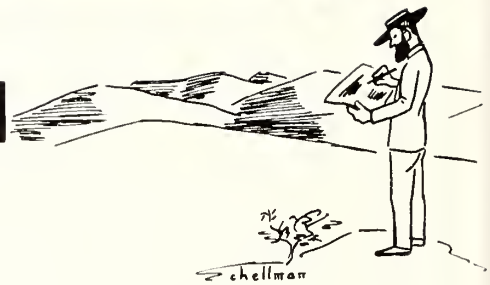
by W. GALE MATTHEWS

Resident of the Ephrata, Wash., area since 1890 and President, Grant County Title Abstract Co.

How, WHEN AND WHERE did the Columbia Basin Reclamation project start?

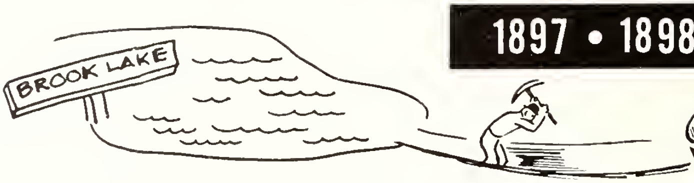
Probably the full story will never be written for there is no one who really knows all of the details which led to the inception of this tremendous project, but on this and the following page are depicted some of the highlights and sidelights of which I have learned and through which I have lived.

1879



FIRST REPORT ON COLUMBIA BASIN—Lt. Thomas W. Symons, U. S. Army Corps of Engineers, in charge of Northwest area, says of the Columbia Basin in annual report: "All in all, it is a desolation, where even the most hopeful can find nothing in its future to cheer."

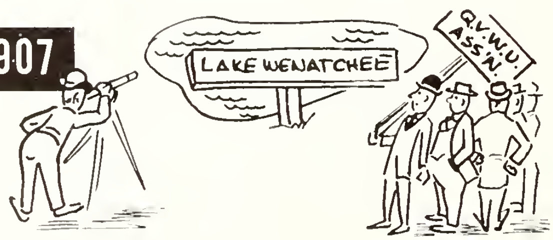
1897 • 1898



BROOK LAKE PLAN PROPOSED by J. R. McIntyre, of Puget Sound country, who has vision of irrigating approximately a half a township of land between Stratford and Ephrata in the general area south and east of Soap Lake by diversions from Brook Lake (now known as Stratford Lake). McIntyre contracts to buy a large number of 640-acre railroad grant sections from the Northern Pacific Railway Co. He forms the Cooperative Irrigation Co. and assigns his interest to it.

GREAT NORTHERN RAILROAD FINANCES PLAN.—McIntyre contracts with James J. Hill of Great Northern Railway Co. to finance construction. Ditch started. Company gets into financial difficulties. After one or two reorganizations, ditch is constructed, large aqueduct built across swamp west of Adrian. Water actually delivered to some land, but the program fails. Reclamation Service surveys area in 1904 and 1905, considering possibilities of Columbia, Spokane, and the Palouse rivers.

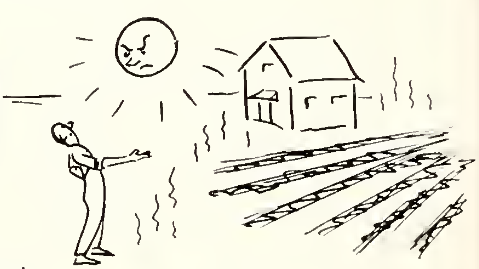
1907



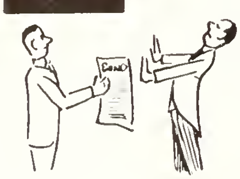
LAKE WENATCHEE PLAN PROPOSED.—Quincy Valley Water Users Association formed. Joseph Jacobs, Seattle consulting engineer studies plan of watering Quincy Valley from Lake Wenatchee. Water users encouraged by his report.

WATER USERS ORGANIZE Quincy Valley irrigation district under State law, and levy assessments on land to pay for detailed plans and studies. By 1910 Columbia Basin area settled by homesteaders encouraged by lush appearance of bunch grass and sagebrush. Dryland farming unsatisfactory. Crops dwindle year after year due to lack of rainfall.

1910



1914

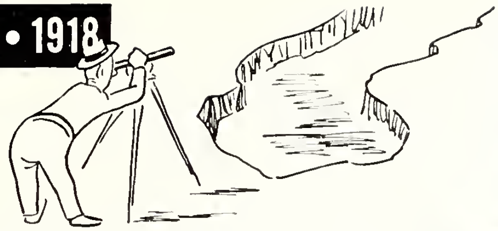


STATE TURNS DOWN WENATCHEE PLAN when asked to raise bond issue of several million dollars to irrigate Quincy flats. State and Reclamation Service cooperate in survey of Palouse River to irrigate Pasco area. War breaks out in Europe. Emphasis on raising food.

1917

GRAND COULEE PLAN PROPOSED.—Famous meeting in Attorney William M. Clapp's office, with A. A. Goldsmith of Soap Lake, Paul D. Donaldson, Superior Court Judge Sam B. Hill, W. Gale Matthews, at Ephrata, Wash.

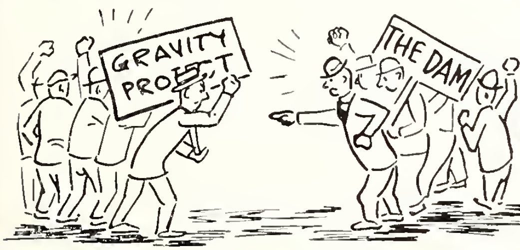
1917 • 1918



SURVEY OF GRAND COULEE.—Ephrata group, intrigued by Donaldson's report of trip with Dr. Landis, of University of Washington, regarding theory of nature having dammed Columbia River with ice, manages to obtain county commissioners' approval for Norval Enger (Grant County deputy engineer) to make "off-the-record" survey of possibilities of damming it with concrete. Enger runs a set of levels from the river up into Grand Coulee. Reports back that the idea might have merit, but requires more study and more money than the county could pay.

JULY 18, 1918

COULEE SIGNAL GUN FIRED.—Rufus Woods, publisher of the Wenatchee Daily World, visits Matthews for a story, is taken to Clapp for information on a proposed dam in the Columbia River at the head of Grand Coulee. As a result the first article ever written on Grand Coulee Dam appears with its famous illustration of 2,000,000 wild horses. Story ridiculed. Woods called "Baron Munchausen."



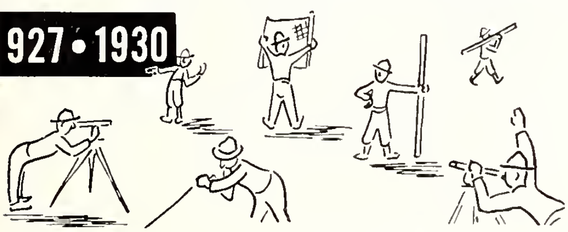
1918 • 1919

THE FIGHT BEGINS.—Columbia Basin Irrigation League formed in Pasco to support Pend Oreille, or gravity plan, to reclaim Columbia Basin lands by bringing water from Idaho lakes. Hon. J. P. Simpson dedicates his Grant County Journal to Grand Coulee. Grant County Treasurer Frank T. Bell, Reclamation Commissioner A. P. Davis, Engineer Col. Hugh Cooper, and Jim O'Sullivan favor and work for Coulee Dam plan.

1923

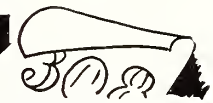
AT THE NATION'S CAPITOL.—Frank T. Bell becomes private secretary to Washington State's Senator Clarence C. Dill. Bell convinces Dill of merits of Grand Coulee proposal. Dill becomes active proponent of dam. Explains need for full and complete investigation to senior Senator from Washington, Wesley L. Jones, chairman of the Senate Appropriations Committee. Jones succeeds in including $600,000 in Rivers and Harbors part of the appropriations for the first session, Sixty-ninth Congress, for investigating the Columbia River from the Canadian boundary to the mouth of the river, considering the river's maximum development for power, navigation, flood control, and reclamation. The appropriation passes.

1927 • 1930



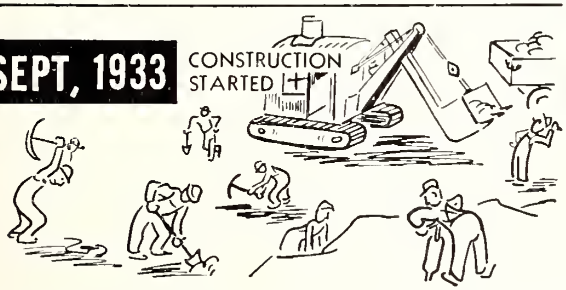
1931

"308 REPORT" SUBMITTED by Corps of Engineers, United States Army, incorporating former studies by Columbia Basin Commission and Bureau of Reclamation. Settles controversy over source of water for the project, and forms basis for further and more complete investigations leading to the authorization of the Columbia Basin project as a multiple-purpose reclamation development. Stakes driven for dam axis Sept. 1933.

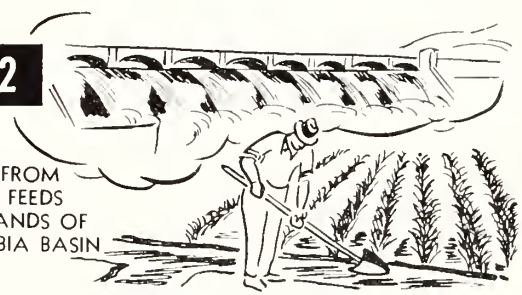


SEPT, 1933

CONSTRUCTION STARTED



1952

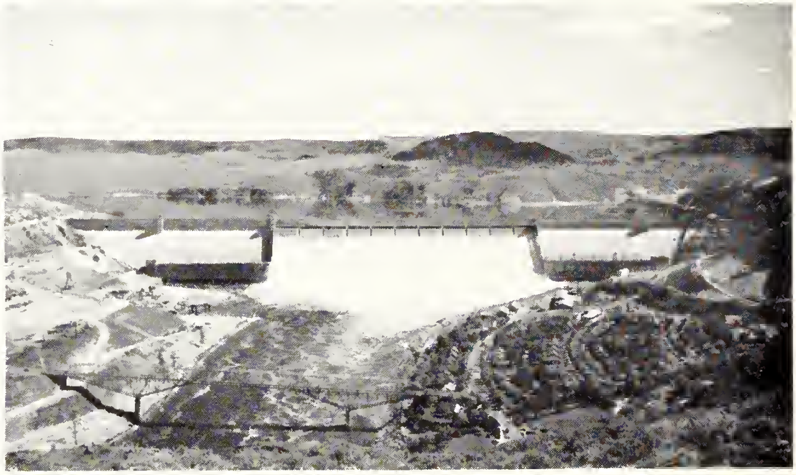


WATER FROM COULEE FEEDS ARID LANDS OF COLUMBIA BASIN

A few names are mentioned in this short presentation. It must be understood that the persons named are not the only ones who took an active part in the promotion of this great project. The number of those engaged in the work is thousands. It became a great community, county, State, and Federal project, and through the magnificent work of the people in the entire Northwest, the project is no longer the dream of a few timid souls in Ephrata, but it is a reality. For generations to come, it will be a monument to united community effort. It will be a memorial to those hardy individuals who braved the uncertainties and hardships of a pioneer existence to homestead this area at the turn of the century and pave the way for a new empire. ###

992016—52——2

GRAND COULEE AND THE DAM.—At left, a view of the site of Grand Coulee Dam from Crown Point in July 1934, just after the awarding of the contract to M. W. A. K. Below, the same view in May 1950, with the Government town of Coulee Dam in the foreground. *Photo at left by K. S. Brown, below by J. D. Roderick, both Bureau of Reclamation photographers.*



by FRANK A. BANKS

Builder of Grand Coulee Dam and former District Manager, Columbia Basin project

How the Dam Was Built

It took but eight years to build the Grand Coulee Dam. In the period between December 1933 and the end of December 1941, the main structure of the dam was placed in the Columbia River Canyon, to become the biggest concrete structure ever built by man.

Construction on the power plant, and more recently in the pumping plant, continues to this day. Even now, the total construction of the Columbia Basin project is only a little more than 60 percent completed.

Grand Coulee Dam naturally presented a number of problems of unique proportion. Others were neither unique nor of great proportion, but they were still problems.

Before construction could get well under way, towns had to be built from the ground up by the contractors and by the Government, 30 miles of railway built, an access road provided, and high-tension transmission lines strung in to satisfy the demands for electric power to run the vast operation.

There were only the old Seaton cable ferry and three farm families in the damsite area when C. M. Cole, Althe Thomas, Harold Shearer and I drove the stakes for the axis of the dam on September 9, 1933. A few months later, the preliminary contract for removal of overburden was let, and work was under way.

By July 1934, the first major contract for the construction of the dam was awarded to a combination of builders known as M. W. A. K., the Mason-Walsh-Atkinson-Kier Co., named after the principal builders in the group.

In a little more than 3 years, this group built the base of the large dam. The base itself was the biggest man-made monolithic structure on earth, far surpassing the great Pyramid of Cheops, for centuries man's biggest structure, until Hoover Dam was built.

In general, the problem of handling the bulky swift-running Columbia River was treated successfully as a juggling operation. The river was channeled to the right, while work was under way at the left; back to the left, so the work could proceed at the right; back and forth until the eventual completed height was reached.

One of the first steps was the building of the west cofferdam, virtually along the left bank of the then-existing channel. Inside the cofferdam, a 60-acre work area was provided, and the job of scraping clean to bedrock proceeded.

As soon as the granite was cleaned and surface grouted for water tightness, the placing of the first of the 10,230,776-cubic yards of concrete began. This was celebrated on December 6, 1935, when Gov. Clarence D. Martin officially tripped the first 4-cubic yard bucket onto bedrock.

In the completed dam, 12,000,000 barrels of cement or 48,000 carloads were required. The weight of the water alone that went into the dam was 1,040,000 tons.

As soon as the base for the west side of the dam was brought up to an elevation above low water, the west cofferdam was opened, and the cross-river cofferdams were closed, so that similar work could proceed on the east side.

It was in the course of this excavation that a 200,000-yard mass of plastic clay on the east bank began sliding, thwarting all the efforts of our engineers to stop the mass, so the pouring of concrete could proceed.

One of our young engineers came up with the idea of freezing the toe of this mass of clay, using refrigerating equipment, and the now-famous ice dam was born. With its help, the east abutment foundation was poured between August 1936 and April 1937.

The base of the dam was completed in the following winter, and on February 7, 1938, the second contract, for the completion of the dam, was awarded to another group of contractors, known as the Consolidated Builders, Inc. These included, in addition to the original contractors, the famous Six companies that had built Hoover Dam, and the General Construction Co. that built Owyhee.

Parts of three steel trestles, used in construction to place concrete, were buried in the dam as the structure rose toward its ultimate height of 550 feet above lowest bedrock.

Records were set, too. In the top day, May 25, 1939, a total of 20,684 cubic yards of concrete was placed.

In the peak year of employment, more than 7,000 men were at work.

The job had started in a depression, and it was nearing completion in a period of mounting national tension. When Pearl Harbor came, the main structure of Grand Coulee Dam was virtually completed.

The center of attention became the power installations. One 108,000-kilowatt generator was already in service before the end of 1941.

Five more main generators were rushed to completion and two units scheduled for Shasta Dam, not then ready for them, were installed temporarily at Grand Coulee, to boost the power output in the Northwest.

Shipyards on the Pacific Slope turned out a vast flotilla of many sizes and types of ships for the democracies. One Portland shipyard, it is estimated, launched more ships than the entire Nation did in World War I.

Aluminum also became important to aircraft production and other uses, and shortly after the end of World War II, almost half of the Nation's supply of this metal was produced in the Pacific Northwest. Large blocks of Grand Coulee power went to the aluminum plants.

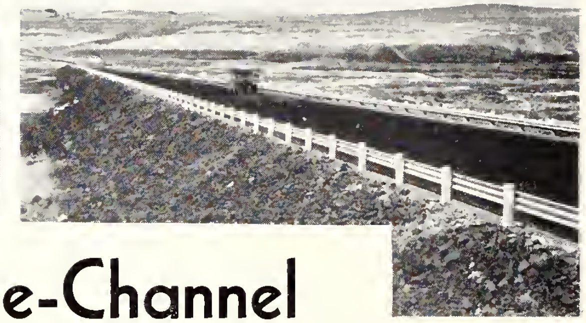
The demand for Grand Coulee power continued so high even after the war, that the installation of generating equipment was accelerated so that the left powerhouse facilities were completed in 1948, far ahead of original schedules. Installations were started in the right powerhouse in 1949. That powerhouse, too, is virtually completed, its last unit being placed into service on September 14, 1951. Only miscellaneous architectural finishes or other final touches remain to be done.

When the word of the Japanese surrender arrived and the first peacetime appropriation was received, we were ready to begin the construction of irrigation facilities. Once again, Grand Coulee buzzed with heavy construction equipment, as the building of the 12-unit pumping plant was started.

Now the pumping plant is in operation; the 12-foot discharge pipes are ready to carry the water which is lifted 280 feet out of the river canyon, to flow onto the first land to produce crops this season.

The installation of pump units will continue, until 10 units, capable of pumping more than 10,000,000,000 gallons of water a day, will be able to irrigate a total of 1,029,000 acres. Eventually two more units may be installed as "spares" or to utilize off-peak power.

The construction of the Columbia Basin project already is in the nineteenth year. It may be close to twoscore years before the final piece of heavy construction equipment leaves and the last Bureau of Reclamation contract on the job is marked completed. ###



Sealing the Ice-Channel

by H. P. "PAT" O'DONNELL

BETWEEN NORTH AND SOUTH DAMS—THE EQUALIZING RESERVOIR.—At left, a view of North Dam and the Feeder Canal. At right, the South Dam. *Photo at left by H. W. Fuller, at right by F. B. Pomeroy, both Region 1 photographers.*

H. P. "Pat" O'Donnell, who was resident engineer for the Bureau of Reclamation on both the North and South Dam jobs, worked on the Columbia Basin project for approximately 11 years. He was recently appointed Field Engineer at the Bureau of Reclamation's Palisades Dam in southern Idaho, and he is now at work on that project.

NATURE TOOK SEVERAL THOUSAND YEARS to carve the Grand Coulee with the steep vertical walls that towered as high as 600 feet above us.

Forty cubic miles of earth and rock had been washed away by the Columbia River in carving the channel after ice blocked the original course, much as the Grand Coulee Dam does today. We put just a small portion of that back.

It took the Bureau of Reclamation and private contractors almost 5 years and approximately $8,000,000 to create the earth-fill dams. At that, we finished a little ahead of schedule. The dams are small but only when compared to the massive works of nature that surround them, and of course to the Grand Coulee Dam, which is the biggest of all concrete dams.

Our dams, unlike Grand Coulee, are earthfill. They are known by the accurate, descriptive, if unromantic, titles of North and South Dams. South Dam is almost 2 miles long and the crest is sufficiently wide to accommodate the main east-west United States and State Highway 2.

The two dams we built are 27 miles apart by air. By boat, it is about a 30-mile trip. Between them, today, is a peaceful reservoir.

Our job, in the main, was to provide a natural, 27-mile channel, which otherwise would require far more expensive construction in a concrete-lined main canal, and to provide a large storage reservoir for the project.

Approximately 1,000,000 acre-feet of active storage capacity for irrigation water is available in this lake. That's almost enough to raise crops for 1 year on 250,000 acres of land—just about a fourth of the entire ultimate million-acre Columbia Basin project development.

Water can be pumped into this reservoir, in the 280-foot lift out of the Columbia River by the world's largest pumps.

Some of this water can even be pumped into the reservoir in the fall for the next irrigation season almost 6 months away.

South Dam was built under a contract for $3,221,253.23 by Roy L. Blair and James Crick & Sons, Spokane contractors. They got their notice to proceed on August 28, 1946.

Only at the end of this work, almost 3 years later, was the contract for North Dam (including a portion of the Nation's largest feeder canal which empties past it) awarded to J. A. Terteling & Sons Co., Boise, Idaho, for $5,216,049.16.

Structure of the dams was nothing unusual as earth-fill dams go. Digging them, however, was. It meant going thousands and even millions of years into the past.

W. E. "Brownie" Walcott, our Bureau of Reclamation geologist, traced the age of the basalt lava flows to the Miocene age which, according to general belief, took place about 16,000,000 years ago.

The glacial deposits are of Pleistocene age, and less than 1,000,000 years old. In excavating the foundation for North Dam, we ran into shales, sands, and basaltic formations of both ages and many in between—partly because the site was an old slide area. Time had been the mixer of the ages. We had advance information—drill holes sunk more than 600 feet in places along the axis—but to be on the safe side, we deepened our excavation about 30 feet in the center and in the contacts with the left abutment.

Big chunks of basalt rock overhanging the feeder canal near North Dam also presented a problem. Some of the chunks were more than 50 feet high—about as big as a five-story building. There was danger that some of them might tumble into our canal excavation, so we replaced the open canal in one 2,100-foot-long stretch, by buried twin water pipes, each 25 feet in diameter. These two pipes can almost carry the average flow of the Colorado River at Hoover Dam—or about 16,000 cubic feet of water per second.

The excavation for them was a delicate job. The contract originally called for digging no more than 100 feet ahead of the barrel and backfilling no more than 100 feet behind.

However, as the contractor cut into the critical area, the uphill side began to slide. We re-negotiated to reduce the distance to 75 feet in the slide area. In addition, the contractor expedited his work to a 24-hour-a-day schedule, 7 days a week. He continued that schedule for three weeks. At the end of that time, the job was completed, without mishap. Measurements have shown that there has been no movement of earth in that area since.

Some of the basalt boulders that had tumbled down from that north wall of the coulee centuries before stood in the way of North Dam. One of them was big enough and sufficiently solid that we made it the right abument of the dam.

We also had to build an auxiliary dam, in a part known as the Delano Saddle near the left abutment of the North Dam. We found a side channel the Columbia had left. Backfilled, in the course of time, this little fork, which turned out to be about 110-feet deep, had to be sealed up to assure against any major leaks in the north end of the reservoir.

The clay and silt used for fill material was nearby in the case of each dam. Some of it had been left, conveniently for us, by the glacial run-off. The rest was wind-blown material, all within relatively handy hauling distance for the 20- and 24-ton carry-alls that hauled in the earth. The material was closely compacted by sheepsfoot rollers and the continual packing down was accomplished, in general, in layers of 6 inches.

We started building up South Dam in the center with a concrete core wall several feet high. Around this, we compacted the clay and silt, permitting the use of zones of coarser materials as the fill continued outward to the coat of jagged rock riprap to guard against erosion on the surfaces.

In North Dam, the concrete core, or cutoff wall, was only on the two rock abutments. The backfill in the old channel was on original ground with no concrete cutoff wall.

In South Dam alone, there were more than a million and a half cubic yards of fill material. The finished dam was 450 feet wide at the base, 42 feet wide at the top, and it stood 80 feet above the natural ground level. The length is nearly 10,000 feet.

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SOUTH DAM'S CONCRETE CORE (below) with "Pat" O'Donnell supervising man to the left who is cleaning up the bedrock. At center, below, the old highway through the Grand Coulee as the water gradually rose in the ice-age channel of the Columbia River. A new highway skirts the east wall of the Coulee. At right, O'Donnell is dwarfed by the giant outlet channels which release water from South Dam into the Main Canal of the project. *Photos below by H. W. Fuller, photo at right by F. B. Pomeroy. Both are Region 1 photographers.*

PREPARING FOR IRRIGATION

(PART 4 IN A SERIES OF ARTICLES ON SOILS AND LAND CLASSIFICATION)

by W. W. JOHNSTON, Project Development Supervisor, Columbia Basin Project, Ephrata, Wash.

Two months after the Columbia Basin area was authorized as a Federal irrigation project in the Rivers and Harbors Act of August 30, 1935, a survey force assembled at Ephrata, Wash., to start one of the largest single topographic survey jobs ever to be undertaken. Their first job was to retrace land lines so that section and quarter section corners could be reestablished and provide a clear-cut base for other surveys. Next, topographic maps with a horizontal scale of 400 feet to the inch and a contour interval of 2 feet, were made—a separate sheet for each square mile of project land. These provided data on the surface relief necessary for planning canals, siphons, tunnels, and reservoirs, needed to bring water from behind Grand Coulee Dam to the project lands. The topographic sheets also were used to appraise the topography and as base maps for the land classification—a job that was started in September 1937.

In August 1941, 5 months after the last topographic map had been completed (representing the culmination of about 4½ years of work) the land classification job was finished. The crews had dug 45,000 soil borings and pits to examine soil conditions. Each of these was 5 feet deep except where rock or gravel was encountered closer to the surface. Over 8,000 soil samples were analyzed and over 7,000 tests were made to determine the presence of alkali. All this was done to determine the location and acreage of lands suitable for development as irrigated farms and to further divide these "arable lands" into three classes—class 1 for the best lands, with smooth, gently sloping topography and deep fertile soil, free from alkali and rock and adapted to the production of a wide range of crops; class 2 for the average arable land, which will make good farm land but is inferior to class 1 in one or more respects; and class 3 for the arable land of restricted utility which is inferior to both classes 1 and 2 in one or more respects. The standards for the land classification, which were based on experience with similar lands under irrigation, were established with the aid of a board of consultants composed of Macy H. Lapham, Senior Soil Scientist, United States Department of Agriculture; L. C. Wheet-

PROFILE OF PRODUCTIVITY.—At left, class 1 land in the Quincy Basin—a deep silt loam. Below, class 3 land (3–S) of the West Wahluke Slope—coarse sand and gravel close to surface. Note Saddle Mountains in the background. Markers show depth of pit, numbers indicate location, according to land classifier's map. *Both photos by F. B. Pomeroy, Region 1 photographer.*

ing, Research Professor of Soils, Washington Agricultural Experiment Station; and H. C. Davis, a farmer with many years of irrigation farming experience in the Yakima Valley.

An act passed by Congress on May 27, 1937, required that lands of the project be appraised on the basis of dry-land values and that a contract or contracts be made with an irrigation or reclamation district or districts to provide for the repayment of construction charges before the construction of irrigation works could be started.

The land appraisal was made by the same appraisal board that had appraised most of the right-of-way for the reservoir behind Grand Coulee Dam. The board included three members who had had long experience in land valuation in the general vicinity of the project. They were Thomas F. Roddy and George H. Pfau, of Wenatchee, and S. J. McDonnel, of Soap Lake. The appraisal was started in September 1938 and was virtually completed by the close of December 1941.

The landowners with aid from the State of Washington Columbia Basin Commission and some help from the Bureau of Reclamation organized the project lands into three irrigation districts in 1939—the Quincy-Columbia Basin irrigation district, the East Columbia Basin irrigation district, and the South Columbia Basin irrigation district, in accordance with the laws of the State of Washington. Some time later repayment contracts were negotiated between the Bureau of Reclamation and the irrigation districts. The electors voted overwhelmingly in favor of the contracts on July 21, 1945.

In 1939 Mr. John C. Page, who was then Commissioner of Reclamation, realizing that the successful development of a project so large and varied as the Columbia Basin required consideration of many factors in addition to the construction of the project works, initiated what were to become known as the "Columbia Basin Joint Investigations." Prof. Harlan H. Barrows, eminent economic geographer of the University of Chicago, Ill., was placed in charge of these investigations in collaboration with the Bureau's Mr. William E. Warne who later became Assistant Commissioner of Reclamation, then Assistant Secretary of the Department of the Interior, and recently a Minister to Iran. Dr. E. N. Torbert with a small staff was located at Ephrata as field coordinator for the joint investigations.

The investigations were truly "joint endeavors."

SURVEYING THE LAND in the heat of the August 1937 summer, using a platform on top of a station wagon to improve the topographic view of the Columbia Basin. *Photographer unknown.*

Some 40 agencies and 90 individuals participated in some degree in the studies which were directed to 28 separate problems.

The joint investigations were independent studies which did not establish policy. However, the findings contributed in a major way to the Columbia Basin Project Act of March 10, 1943, which governs the development and settlement of the project, as far as the Bureau of Reclamation and its contractual arrangements are concerned. Also many of the recommendations were embodied in the repayment contracts, and the reports on the various problems continue to provide guidance as the development of the project proceeds and the project lands are placed under irrigation.

With these basic surveys, appraisals, and studies finished, and with the added benefit of intensive study by a small group of engineers during the war years, the Bureau of Reclamation was prepared to start construction at a rapid pace in 1946 when money and materials began to be available for nonmilitary uses after the close of the war.

NEXT MONTH—The Evolution of Land Classification

PRE-TESTED FARMING

BEST BY TEST.—Hairy vetch proved to be best winter cover crop at Columbia Basin development farms. At present nitrogen prices, a good crop of hairy vetch is worth over $20 per acre for nitrogen alone. *Photo by H. E. Foss, Region 1 photographer.*

by H. P. SINGLETON, Project Leader, Division of Soil Management and Irrigation Agriculture, United States Department of Agriculture; and Superintendent, Irrigation Experiment Station, Prosser, Wash.

New settlers on the Columbia Basin irrigation project will find that the soil and climate have been pretested—given "trial runs" by a critical group of agricultural research agencies. The farmers will not have to learn all the answers by bitter experience—what crops will grow, what fertilizers are needed, what pests and diseases are waiting for them. For the past 6 years research men of the United States Department of Agriculture and the Washington Agricultural Experiment Stations have been working together with the Bureau of Reclamation putting the basin through its paces.

The "core" of this testing program is the Bureau's system of development farms. Out in the sagebrush, miles from civilization, are scattered pilot farms, irrigated from wells, that are telling the story of the Basin's productivity, its limitations and its farming problems. The Bureau of Reclamation has built these farms in locations selected with the advice of the research agencies so that they represent the soils and climates of large areas of future irrigated land.

From the studies of these farms and intensive laboratory and greenhouse investigations at Experiment Station headquarters, is coming a clear picture of what the new farmer can expect from his farm. It is already clear that the Basin is going to be one of the best irrigated areas of the West. It is also going to have its problems.

Since the program was begun in 1946 a series of development farms has been established. The Moses Lake farm was started in 1947, followed in 1948 by the Pasco farm. In 1950 the Winchester farm, featuring sprinkler irrigation, was established, and last year the Burke farm joined the group. Still another, in the Othello area, is now being planned. Research work by both the Agricultural Experiment Station and the United States Department of Agriculture on basin problems is also being carried out at the Experiment Stations, chiefly at the Irrigation Experiment Station at Prosser, Wash. Here the United States Department of Agriculture research group of technicians has its headquarters.

An area as big as the Columbia Basin does not give up all its secrets in 5 years, but already a better understanding of this future farming area is possible. Washington Agricultural Experiment Station's Bulletin 520 on soil, water, and crop management investigations in the Columbia Basin project gives a detailed report of the first 4 years work. Some of the results of this testing and research program to date are outlined below.

Corn—much more productive than any of the small grain cereals in the Columbia Basin. The mid-season hybrids are better adapted in general than the early or late season hybrids. Iowa 939, a representative mid-season hybrid, yielded 150 bushels per acre on land previously in alfalfa and on which 160 pounds of nitrogen had been applied just previous to seed bed preparation. Wisconsin 416, one of the better early hybrids, produced 125 bushels per acre and U. S. 13, a late hybrid, produced about the same as Iowa 939 but with a much higher moisture content at harvest time.

Soybeans—22 varieties grown in 1951. Only the varieties in the early maturing group show any promise. The yields of these, however, were less than one-third the yields of good corn hybrids.

Grain sorghums—show some promise as a grain crop. Yields have approached corn yields in some instances and some varieties of sorghum can be harvested with a combine. Double dwarf white sooner and early hegari are good varieties.

Small grains—as many as 60 varieties or strains of small grains (wheat, oats, and barley) have been tested in one season. As a result of these studies, varieties adapted to the Basin are known to service agencies and seed dealers before the arrival of the farmers on the new land.

Other new crops—safflower, seed flax, and caster beans have been tested. Safflower and seed flax have not appeared to be promising crops to date. A 1-year test of castor beans showed that it can be grown, but additional studies will have to be made to determine whether it can be grown profitably.

Nitrogen—when water is first applied to the desert soils of the Columbia Basin a deficiency of nitrogen is usually the first factor in limiting the production of nonlegume crops. Results with these nonlegume crops indicate that, with adequate irrigation water, nitrogen at rates of from 120 to 160 pounds per acre can be used profitably. Even where alfalfa has been grown on the new lands for 3 years the use of some nitrogen in the nonlegume crops that follow will produce economical yield increases. Corn on new land has produced 140 bushels (shelled corn 15 percent moisture) per acre with 160 pounds of nitrogen, and 165 bushels per acre after 3 years of alfalfa with only 80 pounds of nitrogen per acre. Potatoes under similar conditions have produced 15 and 21 tons of No. 1 potatoes, respectively. Sugar beets on new land have produced yields of 33 tons with 160 pounds of nitrogen per acre.

Hairy Vetch—legume green manure crops are valuable in supplying organic residues and nitrogen and in soil protection. A good crop of hairy vetch will contain as much as 160 pounds of nitrogen in the top growth. At the present price of nitrogen, this top growth of vetch is worth over $20 per acre for nitrogen alone. Hairy vetch is the best winter cover crop that has been tested. It should be planted at the rate of 30 to 35 pounds an acre, generally not later than September 15. The amount of dry matter and nitrogen increases during the time the vetch is allowed to grow in the spring before turning under.

Zinc deficiency—noted in beans in many new locations in the Columbia Basin in 1951. All of the important soils appear to be subject to the deficiency, particularly where some of the top soil has been removed. The deficiency was comparatively uniform and severe on some fields around Moses Lake where beans were grown following several years of potatoes. Zinc sulphate sprays have produced good results experimentally and are now being used on a field scale. Zinc sulphate was applied as a spray commercially with air and ground equipment on about 5,000 acres of beans in the Yakima Valley and in the Basin in 1951. Growers appear to be well satisfied, but recognize need to improve application techniques.

Zinc deficiency in corn—found in the Moses Lake and Pasco areas. Except in cases of extreme deficiency, which are rare, zinc spray applications have not increased yields. Completion of the analyses of plant samples may help to understand this problem.

In opening up large areas of new land there is a chance to take advantage of disease-free ground and keep diseases out. Surveys reveal which diseases are already present in the area and which ones will most likely come in first. Research is directed towards providing control measures where needed.

Curly top virus disease—will limit production of many crops to varieties bred for resistance. In many cases these resistant varieties are now available or are being produced. Similarly with potato leaf roll, a breeding and testing program is being followed in which satisfactory progress has been made in finding resistance. Much more needs to be done before resistant commercial varieties are available.

Potato scab—may be a problem in most Basin soils. Tests of soil amendments such as sulphur, and new and cheaper soil fumigants, are being conducted along with adaptability tests of new scab-resistant varieties. Other studies are directed towards using green manure crops and rotation systems in controlling the many soil-borne diseases.

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THE NEW "CHIEF ENGINEER"—the farmer—plans land leveling or sprinkling programs carefully. *Photo at left, F. B. Pomeroy of Region 1. Below, Soil Conservation Service.*

by JOE BLACK, Columbia Basin Project Farmer whose land will get water in 1952

Getting Ready for the Water

COLUMBIA BASIN FARMERS may pay an average of $85 an acre for construction charges so that water will be delivered to their farms. They will probably spend an equal amount to make certain the water does the job for which it was delivered, and does the job properly.

The farmer may not talk of such things as consumptive use, penetration problems, impervious strata, and water duties, but you can rest assured he has worked with them.

He will want his water to run through the rills or furrows the required distance in the required time without flooding or erosion, and he wants to carry that shovel over his shoulder as much as he can instead of down on his knee and full of mud. He will do this by careful land preparation.

Land leveling, sprinklers, headgates and checks, farm ditches, siphons, spiles, and pipelines will all be used in controlling Columbia Basin water. The type of irrigation system and the extent to which the farmer will prepare his land will be determined both by the type and depth of soil and the finances available to the individual farmer.

Many farmers who have light textured, shallow soil where leveling cannot be done will use sprinkler irrigation. Here the problem is simply the designing and installation of an efficient system, although higher installation costs and later power charges should not be overlooked.

To determine what type of irrigation system is needed, the Columbia Basin farmer will be able to consult with a special group of county agents, plus agricultural engineers and other specialists.

A large portion of the land in the Columbia Basin will be prepared for surface irrigation by leveling. The cost of this leveling will vary from a low of $5 an acre for a simple land planing operation to as high as $100 per acre where heavy leveling is done.

Here the large earth-moving machines switch from the construction phase of the project to the land preparation phase. Many farmers started leveling in the fall of 1951, when, it was estimated that over 60 pieces of leveling equipment were working near Quincy, with many more in the surrounding areas.

Machines used vary from 16- to 20-yard scrapers pulled by large crawler tractors down to farm scrapers or floats pulled by a wheel tractor. The larger machines generally move the bulk of the dirt and leave the finishing operation to the smaller units.

While most of the leveling is done on the basis of hourly rental for the equipment used, some contractors contract for leveling by the acre or by the yard, with costs running from 15 to 20 cents per yard.

In most cases the leveling is done with the help of cut-and-fill data prepared by one of the various cooperating agencies, with the farmer marking the stakes and checking on the work performed. After the leveling is completed, assistance can be obtained in laying out the ditch lines. Complete plans of structures are available for the farmers.

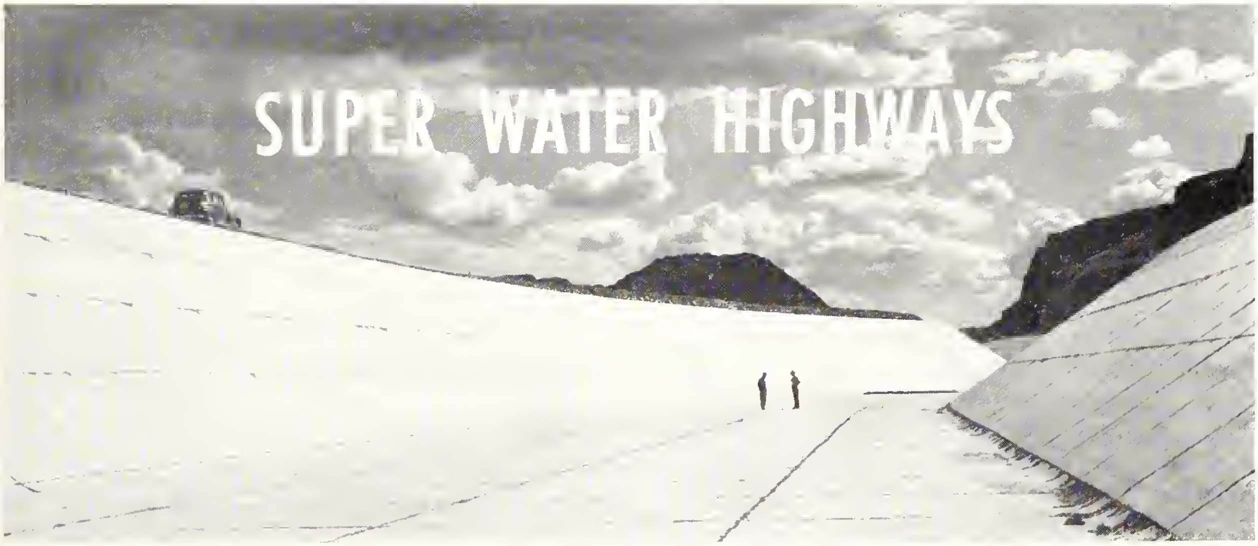
While the responsibility for the operation falls on the farmer's shoulders, his job is made easier by this assistance. He no longer needs to spend the first year seeing how the water will run. The use of larger equipment has also reduced the final cost. Farmers find it profitable to do the job right in one operation. If a farmer cannot afford the initial outlay for preparing all his farm, he is urged to prepare only a part of it and complete the rest of the farm at a later date.

Land preparation is usually a cash operation and the financial arrangements must be made at an early date in order that leveling can be completed in time for seeding the crop.

Winter weather will halt or at least interfere with a good job of leveling. After spring leveling, the land should be irrigated before planting to settle the ground and replace the surface moisture. The farmer who forsakes a cropping season to level in the summer finds that the dry powdery soil cuts down the efficiency of the equipment and results in higher costs.

Severe wind erosion often follows on the freshly leveled dry soil, and a few aggressive leveling contractors have portable sprinkler systems which can be used to wet the soil down both before and after summer leveling operations. They offer this service to the farmer free, a return from their longer working season.

If we drive down any of the new roads, we see heavy equipment working in the fields, engineers working with instruments and profiles amid the final construction phase of transforming arid land into productive farms, and somewhere amid the confusion or over on the canal bank talking to the ditch rider, we will see the new chief engineer, the farmer. He will be easy to identify, for he will be carrying the tool of his trade, a shovel—"long handle, round point"—ready to stop a leak or turn a little more water down the furrow. ###



SUPER WATER HIGHWAYS

by ROY JOHNSON, President of Sandkay Contractors, and Former Project Manager Morrison-Knudsen Construction Co.

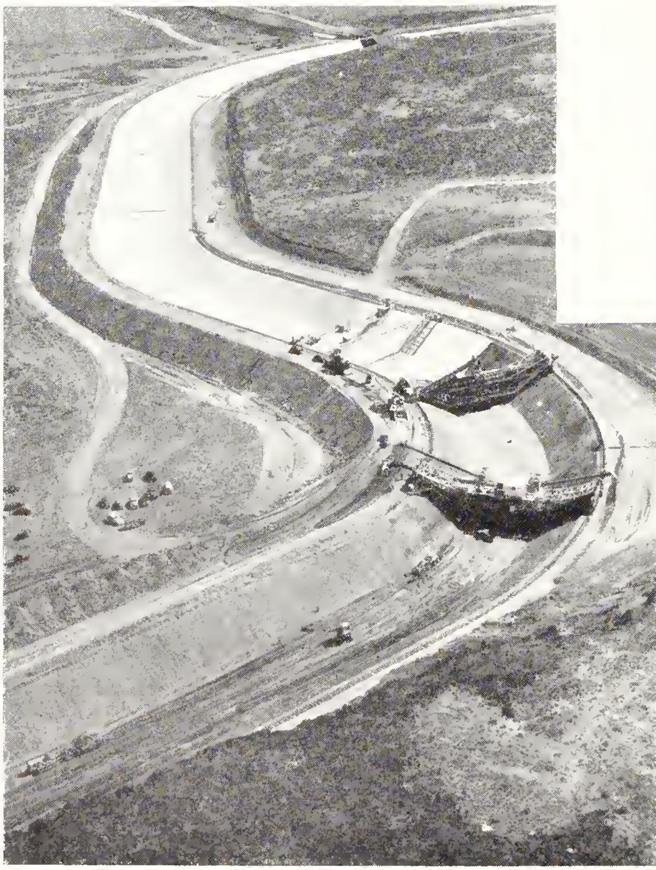
MAIN CANAL.—A four-lane water highway on the Columbia Basin project, wide enough to carry four lanes of auto traffic easily with room to spare. Now ready to carry life-giving water to 87,000 acres of land in the State of Washington. ***Photo by H. E. Foss, Region 1 photographer.***

A TREMENDOUS IRRIGATION SYSTEM starts from Grand Coulee Dam, to water more than 1,000,000 acres of the fertile soils of the Columbia Basin. These concrete-lined canals remind you of super highways, or more appropriately, "super water highways." The bottom width of the largest of these canals is wider than necessary for 4 lanes of cross country traffic, and over the entire concrete lined perimeter 12 lanes of traffic could be handled with ease.

That is the picture you get now, but the scene has changed greatly from the time the first survey crews worked from ropes along 100-foot high rock cliff sections to insure a uniform grade to carry the flow of water to its destination many miles away. Next, the construction crews moved

WORLD'S LARGEST PUMPS (above) lift water 280 feet out of the Columbia River, into the Feeder Canal. Farther south the water is held behind Long Lake Dam (at left). Brook Lake in the foreground. ***Photo above by H. W. Fuller, at left by F. B. Pomeroy, both Region 1 photographers.***

in with heavy earth and rock-moving equipment to commence carving out the Super Water Highways. Low sections were built up to grade by the use of large crawler tractors and scrapers. The purpose of this type of equipment for the particular phase of the work was the necessity of



MACHINES THAT WALKED A MILE A WEEK.—At left, lining operations in the Main Canal. In the background is the fork where the East Low and West Canals take off from the Main Canal. Below, the West Canal. ***Both photos by H. E. Foss, Region 1 photographer.***

SUBWAY SYSTEM on the West Canal where water travels underground through dry Coulee siphons No. 1 and No. 2, as part of the 60-mile-long route taken by Columbia River on its way to irrigate project lands. *Photo by H. E. Foss, Region 1 photographer.*

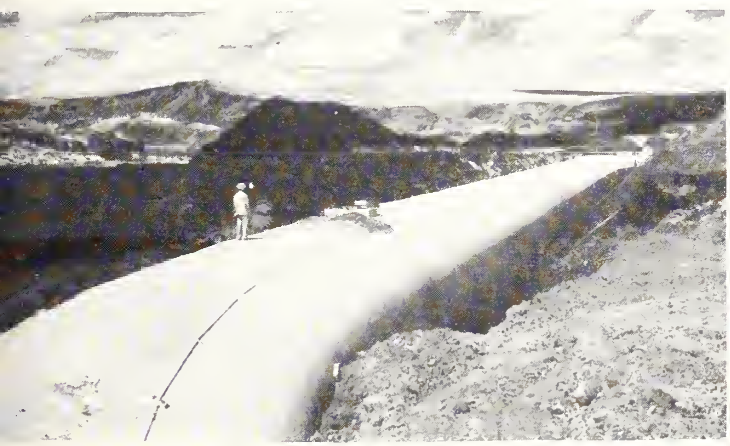
hauling and placing earth in layers so that it could be compacted to insure a firm foundation for the concrete lining. Draglines with capacities up to 25 tons of earth and rock in a single bucketful were used where compaction was not needed, no embankment was required, and the excavated material did not have to be placed on the canal bank.

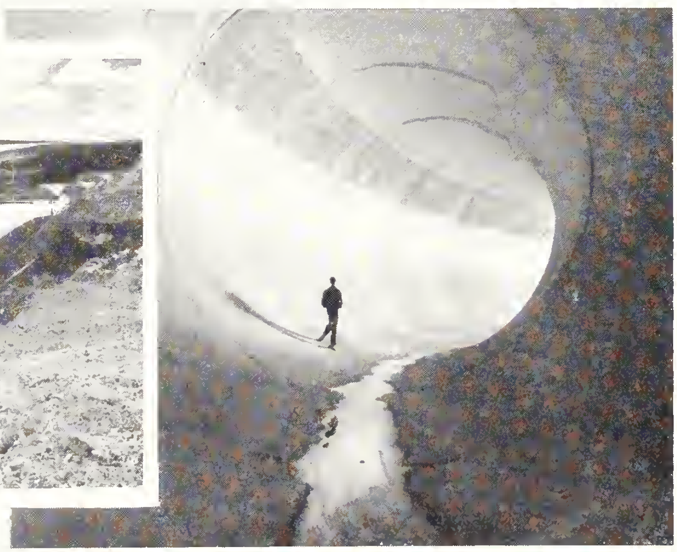
The drilling and blasting of rock cuts and cliff sections, which had to be done ahead of the draglines, usually required the greatest number of man hours, as well as the greatest number of headaches for the man in charge. Through these sections of lava rock nearly every formation conceivable was encountered. Often we would drill into a clay seam, soft rock or crevice, which made the blasting very difficult. Explosive charges follow the lines of least resistance, and would often follow the clay, soft rock or crevices leaving the hard rock nearly in its original place, requiring redrilling or very slow progress with the large draglines.

After the carving was done with this type of earth-moving equipment to within 6 inches of grade, a specially built earth trimmer and concrete slip form were used. These machines run on a rail placed on each side of the canal, making the over-all span of the machines up to 130 feet. A trimmer with an endless bucket line going around the entire perimeter left a near perfect grade line so as to insure a uniform thickness of concrete. The slip form which then followed spanned the canal in like manner. The concrete was placed in front of the slip form which moved it, vibrating and leaving a finished surface of 4½-inch thickness of concrete, covering as much as 16,000 square yards per single shift.

This left the super water highways as you see them today, but you will also find three-mile-long tunnels 25 feet in diameter through solid rock hills, and concrete siphons 25 feet in diameter and 2½ miles long across valleys, all of which help make up a great monument that far-sighted engineers challenged the construction men to build. This monument and others still in the minds of engineers or on drafting boards will make better living for a prosperous progressive country. ###

OAP LAKE SIPHON (below) outside view. At lower right, nside the Soap Lake siphon, a 25-foot-diameter tube, 2½ niles long. *Both photos by H. E. Foss, Region 1.*





Training New Agents

by MEL A. HAGOOD, Leader, Settler Assistance Program, Extension Service, Washington State College, stationed at Ephrata, Wash.

"WHERE DO I START?" could well be the typical question of a farmer in any new irrigated area after he has purchased his land. "What should I plant? How much should I fertilize? Where is the best place on my farm to locate my farmstead? How should I irrigate?"

All of these problems that face a new settler any place are facing hundreds of farmers in the Columbia Basin today. Many farmers have worlds of experience in other areas and in areas similar to the Basin, but quite a few have had no irrigation farming experience whatever, or have never faced the problem of starting from scratch to bring a piece of undeveloped land into full production in a short period of 1 or 2 years.

A few bad mistakes in the first few years can be costly to a person starting on limited finances—maybe just costly enough to discourage or completely bankrupt a young family trying to get ahead in the farming business.

Realizing that these mistakes not only are costly to the individual family, but to the community and country as a whole, the State College of Washington and the Bureau of Reclamation have entered into an agreement to provide technical assistance to the settlers in the Columbia Basin through county extension agents especially trained in the field of irrigation farming.

This program is not new to irrigated areas of the West, as similar programs to this have been in force in Washington on the Pasco pump unit and the Roza, and in Oregon on the Owyhee, and North unit of the Deschutes at Madras, as well as many projects in Idaho and other States.

With water being available to 87,000 acres in 1952 in the Columbia Basin for about 900 farmers, it was obvious to all concerned that the agents who were to help these farmers should become thoroughly familiar with conditions long before the needs became critical. Therefore, on July 1, 1951, four county agents in irrigation reported for work at Ephrata to start an intensified training program.

These agents were college graduates who had majored in either soils or agricultural engineering or any other agricultural field with special emphasis on soils and engineering. In addition, and perhaps more important, they also were required to have actual knowledge gained through living on an irrigated farm. This combination of irrigation farm background and technical knowledge were required to assure a practical approach in helping solve the farmers' problems.

Training for county agents is never over, but for the agents working with the settler assistance program, a period of 6 months was designated for special training in phases of agriculture that would affect the new settler.

INTENSIVE TRAINING IN LIVESTOCK PRODUCTION, *an important adjunct to irrigation farming, was part of the program for the agents. Below, a dairy scene at Columbia Basin's Winchester Development Farm. Photo by H. Foss, Region 1 photographer.*

One of the first steps in helping a farmer to start off right is to work out a plan for irrigating the farm unit. To do a complete job it is also necessary to locate the farmstead site, determine what farming enterprises best suit the farm, and above all to know what the farmer himself wants to do in a long-time program. So, first we had to train the agents in engineering techniques such as making topographic maps, staking for leveling, figuring cuts and fills from the profile method, and adequately checking grades for irrigation and ditches. We gave special emphasis to adapting sprinkler and gravity irrigation to different soils and land classifications, as many Columbia Basin farmers will be faced with this problem due to the many wide and varied soil conditions. In keeping with the Extension Service policy of helping folks to help themselves, the agents were trained on the advantages and disadvantages of various methods in order that unbiased information could be passed on to the farmer so that he could make an intelligent decision.

Since the Columbia Basin irrigation project is being constructed and operated by the Bureau of Reclamation in the first phases, it is necessary for the agents to be familiar with all the operations of the Bureau. These include such items as policy of constructing access roads, turnout elevations, land eligible for water, amounts of water available to farms, right-of-way rulings, and methods of delivery. Considerable time has been spent in training the agents in these Bureau policies in order that the information can be passed on to the settlers.

The Extension specialists from the State College of Washington have taken a lively interest in this program. They gave the agents special training in farmstead location and farmstead building arrangement, permitting the agents to work with a particular farm and farm family, to get their viewpoint, as well as that of specialists. The agents spent several days in intensive training on livestock production in the Basin with emphasis on laying out an irrigation plan and field lay-out for livestock production.

They also attended joint meetings with various agencies to help understand the various interlocking activities and lessen confusion.

It is virtually impossible for any one person to be an expert in all phases of farming in the Columbia Basin, but if the farmer can be directed to the right source, he can save time by getting the answer to his problems quickly.

SETTLER ASSISTANTS who have recently come to the Columbia Basin. From left to right, Mel Hagood, leader, a graduate of Oregon State College with experience on the Deschutes project; Roy Deming, University of Idaho graduate who was stationed at Moses Lake after his training period; Gene Thompson, Washington State College, now stationed in Ephrata; Burke Giles, Utah State graduate, now headquartered in Quincy, and Ben Roché, University of California, also stationed at Ephrata. *Photo by F. B. Pomeroy, Region 1.*

First water to the project under gravity was delivered last fall for testing purposes; consequently many newcomers were ready to start leveling and building in anticipation of a big year in 1952. Nearly all requests for assistance were satisfied, and about 25 land-leveling units were kept busy. Trained engineers who had worked in other projects for many years, supervised surveying and layout work.

This year will be a busy one for the agents. Spring brings with it settlers from all over the country wanting immediate help in getting a start in the right direction. Many of the questions are the same with slight variations, which can be answered partially by the "Farmer's Handbook" (see p. 54 of the March 1952 Era).

The primary job of the irrigation agents is to give actual in-the-field help in surveying and laying out an irrigation system. By working along with the farmer, both have an opportunity to discuss all possibilities and angles. The agent knows what the farmer wants, the farmer knows what the agent is doing, and at the same time they both can discuss all other agricultural problems and fit them into the over-all plan. When the work is completed, the farmer has a plan he has helped design, knows the reason for every move and has a good start toward making a success of irrigation farming. ###

VALUABLE TOPSOIL can go with the wind, as graphically indicated at left. Below, Maynard Brown of the Soil Conservation Service consults with a farmer regarding a soils map. *Photo at left by H. E. Foss, Region 1 photographer. Photo below, courtesy of the Soil Conservation Service.*

SAVING THE SOIL

by CECIL McCORMAC, District Conservationist, Soil Conservation Service, Columbia Basin Project, Wash.

In the public interest, the best land use and soil conservation principles are to be applied to land in the Columbia Basin project from the very beginning of the delivery of water to the land.

The Soil Conservation Service is the agency authorized by the Congress to furnish technical assistance in soil conservation. It is charged with the responsibility of preparing land capability information for all farm and range lands in the Nation. It is also responsible for assisting farmers in using their land according to its capability and to treat each parcel of land in accordance with its needs.

In the Columbia Basin, land capability maps have been prepared for the lands to receive water in 1952. A map of each farm unit, showing the various land capabilities for the unit, is available to the owner or operator. The major factors that determine the land capability are slope, soil texture, soil depth, underlying materials, stoniness, and alkalinity or salinity. Combinations of these factors determine the intensity of land use that can safely be recommended.

Treatment sheets have been prepared which furnish information as to the best conservation practices for each land capability unit on the farm. Personnel have been assigned to assist farmers in the on-site planning and application of conservation practices.

Some of the major problems of soil conservation relate themselves to the opening of the land to cultivation under irrigation.

1. In the first place it is necessary to adapt the land leveling program to the effective soil depth of the area to be prepared.

2. Some of the soils of the Columbia Basin are so shallow as to limit sharply, or, in some cases, to prohibit making cuts in land grading for surface irrigation.

3. Another problem of great importance is designing the irrigation system to fit the slope, soil texture, soil depth, and underlying material. On steep slopes or on very light textured soils the length of the irrigation run has to be shortened so that erosive amounts of water do not have to be applied to the furrow in order to reach the lower end of the run within the desired time limit. On light textured soils too long runs result in over-irrigation at the upper end of the run. This leads to water logging and high water tables, which contribute to the drainage problem.

The cropping system to be used in order to maintain or increase organic matter and soil productivity and to prevent excessive losses of soil from erosion is of high importance to conservation of the soil. Some of the steeper, shallower, and sandier soils should be planted to grasses and legumes continuously except for necessary cultivation incidental to reseeding. The percentage of time that a given parcel of land may safely be used for clean tilled crops varies with land capability. One of the major conservation jobs is that of assisting farmers with the development of cropping systems that fit conservation needs of the land as well as being consistent with the type of farm enterprise the farmer wishes to carry on.

The proper application of irrigation water to the land is as important to conservation as the installation of an irrigation system that fits the land. The application of irrigation water at excessively large rates results in severe losses from soil erosion, as well as in large amounts of wasted water.

When the duration of irrigation is longer than is needed to replenish the soil moisture, over-irrigation results, with the consequent waste of water. build-up of the water table, and aggravation of the drainage and alkali problems.

Enough has been said to indicate the scope and nature of the conservation job. The Soil Conservation Service operates through Soil Conservation districts, which are local subdivisions of the State government. They are organized and operated by landowners of the area involved. Each district is governed by a five-man board of supervisors, all of whom are landowners in the district. The Soil Conservation Service furnishes technicians to the Soil Conservation districts to assist in planning and applying soil conservation practices in accordance with land capabilities.

Five Soil Conservation districts have been organized in the Columbia Basin project. Headquarters of the districts are at Ephrata, Quincy, Moses Lake, Othello, and Pasco. Personnel have been assigned to all of the districts having land that will receive water in 1952. Any landowner or operator can get help from the district by applying to the Soil Conservation district board of supervisors.

Land capability maps are available for each farm unit, along with treatment recommendations for each capability class on the farm. Technicians are available to furnish on-site assistance with planning and applying the necessary conservation practices up to the limit of the personnel available to the Soil Conservation Service. ###

Developing a Farmstead

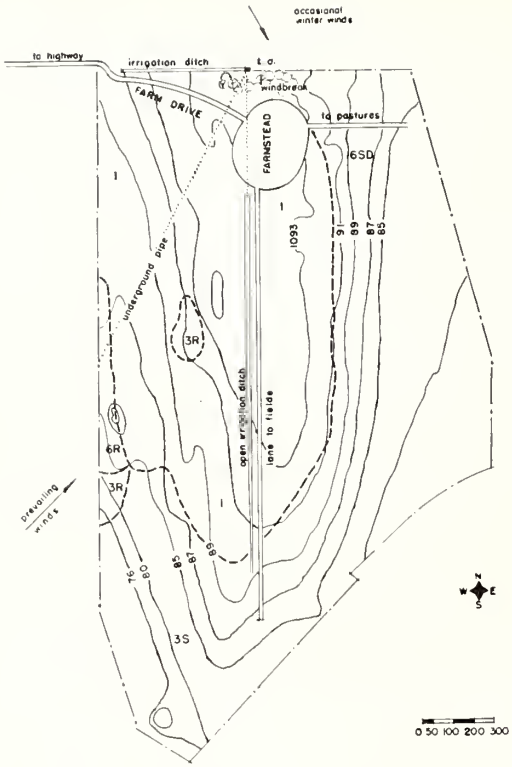
A WELL-PLANNED FARMSTEAD on the Columbia Basin project—farm dwelling, chicken house, and combination garage and machine shed at Pasco development farm. ***Photo by H. E. Foss, Reg. 1.***

by H. E. WICHERS, Extension Specialist in Rural Architecture, Washington State College

Developing a farmstead which will suit the farm family, the farmland, the farm program, and the farm area has always been a problem. Nowadays, with increasing costs for labor and material, we are doing our best to make changes and improvements which will do the job as efficiently and economically as possible.

This is particularly true in the Columbia Basin project where farmers must build many "adaptable" farmsteads in a relatively short time to get new land under production. In some ways new land poses entirely new problems, but essentially, the problems are the same as for any farmstead except for the location of irrigation ditches.

Farmstead arrangement depends upon many things—the owner, the farm and its characteristics, the size, quality of land, farm layout, contours, type of farming, prevailing winds, and lo-



cation of the well, plus any special features for a particular farm.

All of these things taken together determine the location of the farmsite almost automatically. There may be a choice between two or three spots, but the advantages in favor of one or the other can be ironed out as we think the problem over.

Once you know definitely where your site is and what crops you will produce, the farmstead can be simply and logically worked out. List the farm buildings needed and the amount of space needed for each one, then by using a few principles of efficient arrangement, you can figure the layout of the buildings into a pattern that saves time, work and steps, and safeguards health and family comfort.

The house is usually the dominant building as far as appearance from the road or highway is concerned. It should also have dominance over the farm buildings because they are tools for the family's use.

The farm buildings, as tools, should be laid out for easiest use. The buildings most often used should be nearest the house, and other buildings should be arranged in consecutive order of use. It should never be necessary to cross a muddy corral to go from one building to another.

Farm buildings should also be located so that stored machinery is near and accessible to farm lanes leading to the fields. Space for parking the machinery in the farm court near the farm lanes should also be considered.

Each type of farming presents its special problems. Take a poultry farm. for instance. You'll need to follow a rather definite pattern in regard to wind and slope in locating the laying house relative to the house, and the brooder house relative to the poultry house. Drainage from each should be away from the other to prevent spread of disease.

On a dairy farm we have a different problem; we need to consider the milkhouse in relation to the road or highway as well as in relation to the corral. And always we have to keep in mind that the dairy barn should not be too close to the farm house and should be downwind from the house.

An easy way to develop the best possible pattern or arrangement is to map out a flow chart of the work to be done on the farm, showing the logical progression of one job to the next and the shortest distance between the two.

Suppose we work out a definite farmstead arrangement in rough form, using a contour map of plot 167 near Moses Lake, Wash., shown in the upper left hand corner of this page.

First we write in the points of the compass, the road, and the best entry from the road into the farm, depending on the location of an existing irrigation ditch and turnout.

We also spot the direction of the prevailing wind. According to local data this wind is seldom of great intensity, but there is an occasional violent winter wind from the northwest. That knowledge makes it possible to pick out the best spot for the windbreak once we locate the farmstead site.

Next, let's look at the contour of the farm. We note that the land is fairly level. The highest spot is in the north center end of the farm near the turnout. From this high spot, a slight rise runs right through the middle of the farm. The most fertile soil on the farm—85 acres of class 1 land—is smack in the middle of the farm, on and bordering the slight rise. This acreage above will be irrigated. So—this slight rise, sloping gently toward the lower or southern end of the farm will make it possible to irrigate the farm from a ditch leading out from the turnout.

There is considerably poorer land on the border of the class 1 land. This land will undoubtedly be used for pasture. So—there should be a connection between the farmstead and this pasture.

Any irrigation requires a service road alongside. That could be our lane to the fields.

Now, if we locate the farmstead to the west of the windward side of the ditch to take advantage of the drainage for the farm buildings, the prevailing winds would tend to blow odors from the farm buildings toward the house. It would be better to place the farmstead to the east or leeward of the ditch which supplies the farm with water. Then we could place our corrals on the poorer land, using some good land for farmstead and garden. The entrance drive would run alongside the ditch if the location of the windbreak did not change our plans.

The final arrangement then is to spot the farmstead in the circle shown—on or near the high point of the farm. All corrals, the farmhouse, and other farm buildings would be located on this plot with easy access to the fields and pasture. The farmstead would be on high ground to a point south of the farmstead to supply the irrigation with water from the turnout. (It could run under the farmstead.)

Now, for wind protection, we could place a windbreak to the east and west of the turnout thus protecting the farmstead from winter winds. Since the prevailing wind is more of a breeze, special protection is unnecessary except for low berry bushes in the garden.

Next, we indicate the best view on the contour map and mark a line to locate the driveway.

We have left some space on the farmside of the windbreak for snowbanks. The driveway into the farmstead can go south of that area and on into the farmstead.

With that information on the contour map, it's not too difficult to decide the location of the buildings. We plot them on sheet of paper to look like the sketch on this page.

The farm house should go west of the driveway and 10 feet east of the nearest point of the underground irrigation pipe. With the driveway placed east of the house, the prevailing winds will blow the driveway dust away from the house.

We need an all-purpose building—a machine shed, placed so a driveway can go past it to the lane leading to the fields. Then we'll place a loafing shed or animal shelter past, and possibly a little south of, the machine shed. Whether the owner goes into beef or dairy cattle, the loafing shed will work in either case. We'll need a lane to the pasture not too far from this loafing shed and to the north of it. North of the lane to the pasture we can mark in a small chicken house, and a garden plot west of the house.

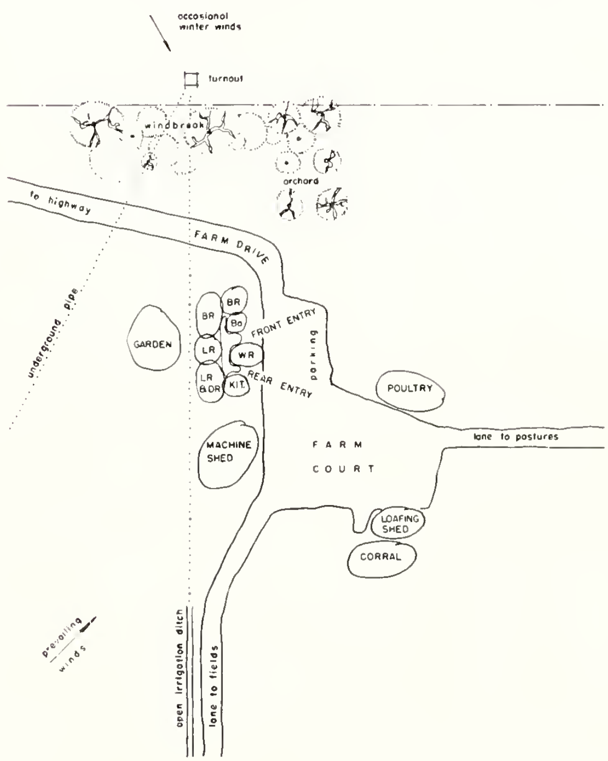
We don't have to worry about the location of the well, as water will be piped in from a neighbor's well on the north.

The school bus will run along the road. The power line will be along the main road and come down the drive to a point just beyond the turnout and then to a meter pole not far from the machine shed. The telephone line follows this same route.

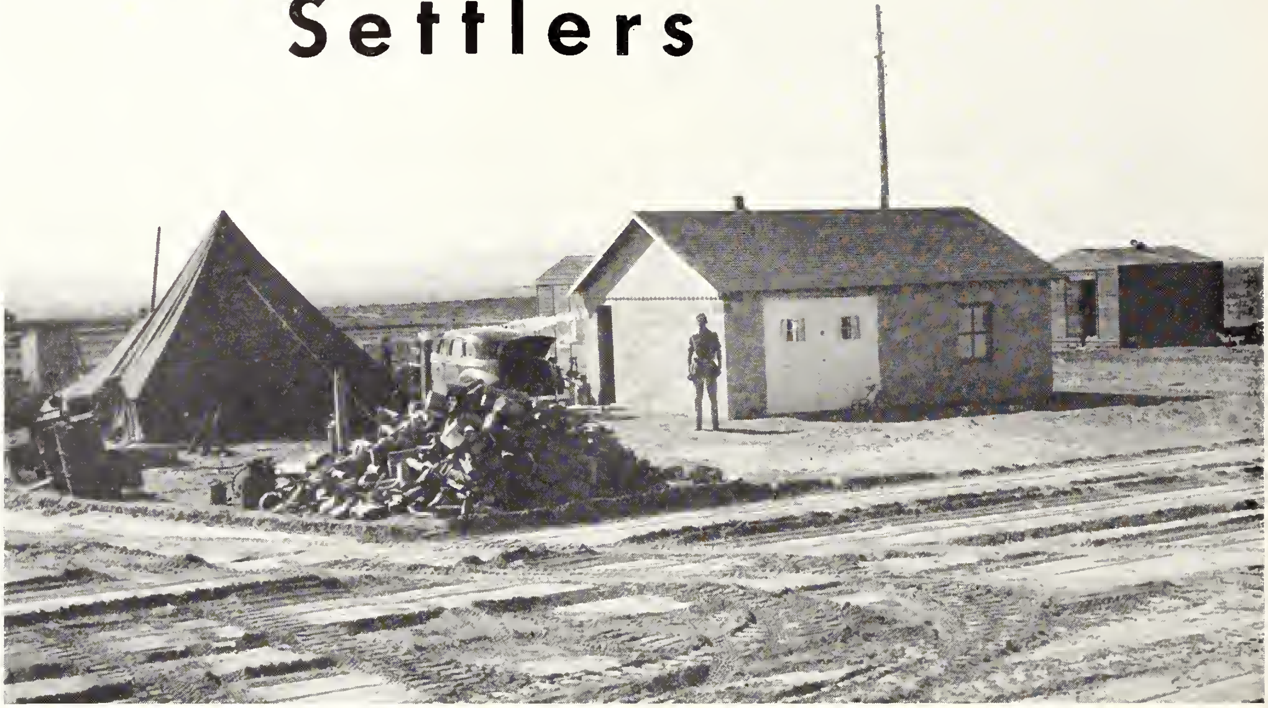
There you have the whole plan arrangement. It's individual and based on existing conditions.

As plans for each building develop, we can determine their exact location and their exact relationship one to the other. But the general position has been determined and will make it easy to work on a farmhouse plan or any other farm building plan.

The location of the drive, the parking lot, the view, the slope of the ground, the location of the farm buildings all contribute to spotting entrances and rooms in the farmhouse itself just as they determine the plan and location and openings into other farm buildings. ###



Credit for Settlers



GROWING A FARMSTEAD.—H. D. Bair, Jr., on unit 68 of the Pasco unit, Columbia Basin project, starts in a tent, builds his first "house" of concrete blocks. Later it will be a garage. *Photo by H. E. Fass, Region 1 photographer.*

by CARL E. LARSON, County Supervisor, Farmers Home Administration, Pasco, Wash.

The Pasco pumping unit, which was the first unit of the Columbia Basin project to come under water, was opened up for settlement in 1948. Three or four settlers raised a crop during the year; however, it was late in 1948 and early in 1949 when the bulk of the new settlers began moving in.

Most of these settlers are veterans and their families who have moved in from other States in the West, the mid-West, and South, with their household goods and farm equipment. The first thing they had to do was to build some type of shelter for themselves—a tent, a shack—or rent a place in town until a small house could be built. Usually the first shelter was a building which could later be converted into a garage or a chicken house.

After the families were settled, the next order of business was to make plans for developing an irrigation system, cropping programs, domestic water, and credit. These veteran families had a net worth of approximately $7,000 on an average. However, as this was not enough to take care of the development needed, a source of credit had to be explored. Since these families were not known locally and had a great deal of expense ahead of them, the private lending agencies were not able to give them enough long-term development credit to be of any help at this time. That is why the Farmers Home Administration was called upon to provide credit for these settlers to develop these farms. Whenever a settler reaches a point where his resources are such that private lending agencies can take over, the settler agrees to refinance his indebtedness to the F. H. A.

We have four types of loans that were used on this project:

1. Production and Subsistence Loans (commonly called farm-operating loans) for the purchase of necessary equipment, livestock, feed, seed, fertilizer, and other necessary farm and home-operating expenses.

2. Water Facilities Loans, to provide needed facilities for water storage and use in the arid

and semiarid areas of the 17 western States. These loans can be made for the development of domestic water systems or irrigation systems.

3. FARM OWNERSHIP LOANS—for over-all development of the farm such as buildings, irrigation systems, etc.

4. FARM HOUSING LOANS—for constructing and repairing farm houses and other farm buildings.

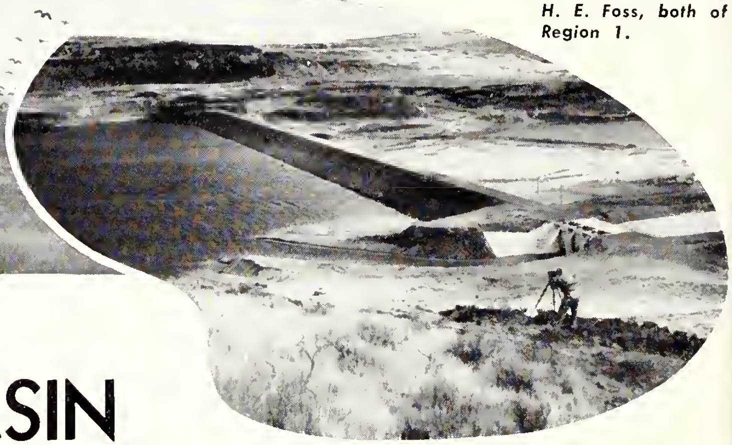
A total of $802,020 has been loaned since the beginning of the project, and $254,308.03 has been repaid during the same period. The break-down on the total amount loaned is $379,855 for production and subsistence loans, $204,555 for water facilities loans, $186,735 for farm development, and $30,875 for farm housing.

Approximately $100,000 of the $802,020 which was loaned this winter to purchase equipment, livestock, and provide operating expenses for the 1952 crop year will not be due prior to the fall of 1952. Also included in this total is $58,000 loaned to the group to develop a domestic water system. This system will provide approximately 50 families with domestic water for farm and home use—one of the great problems in settling a new project.

Here is a typical example of a Pasco family. When they arrived at Pasco, they had a net worth of about $6,500 and immediately put up a tent to live in, until they bought an old house and had it moved to their farm. Shortly after this they got a development loan of $12,000 to complete the house, drill a well, build a barn to meet grade A specifications and install a sprinkler system to cover about 80 acres. They got another $3,000 on a production and subsistence loan for operating expenses and additional equipment. The land was cleared of sagebrush and planted to alfalfa, pasture, clover for seed, and about 15 acres to Red Mexican beans for a cash crop. Today this farm is all in hay and pasture and the family has 20 head of Holsteins producing a little over 400 pounds of butterfat. They also have 30 head of young stock of various ages coming on which in about 2 or 3 years should allow for a herd of about 35 milk cows. They are current on their obligations although they do owe in the neighborhood of $19,000. This year they sold approximately 70 tons of hay plus furnishing feed for their own herd. This is one of the better farmers who has had a lot of dairy experience plus a college education in agriculture.

This project, I believe, has provided a good opportunity for the young family who has farm experience, a reasonable amount of capital and is willing to get out and work hard. Above all, the wife has to be able to withstand the inconveniences, discomfort, and hard work connected with settling new land. ###

FROM TENT TO "DREAM HOUSE."—Mr. and Mrs. Robert Tschirky and their daughter Yvonne on unit 32, started out in a tent. The photo at left was taken in April 1949. Below, 1 year later, Mr. Tschirky, with the help of his neighbors, had built this attractive two-bedroom home. Timely FHA loans helped similar Pasco settlers off to a good start. ***Both photos by H. E. Foss, Region 1 photographer.***



MILLIONS OF GEESE at Long Lake (at left). Below, Long Lake Dam and Reservoir, a large preserve for waterfowl. *Photo at left by Ralph Bennett, below by H. E. Foss, both of Region 1.*

COLUMBIA BASIN WILDLIFE POSSIBILITIES

by EUGENE MAXWELL, District Supervisor, Department of Game, State of Washington

HERE IS SOME IDEA of what can be expected in the way of benefits to game in the Columbia Basin with the completion of the Columbia Basin project. This deals only with waterfowl and upland birds.

Generally speaking, the abundance of waterfowl in any given area is governed by the food supply and the amount and type of water available for feeding, resting, and rearing of young. Any deficiency or improvement in meeting these requirements affects the number of birds for the autumn harvest.

With the completion of the Columbia Basin project, the amount of available water for waterfowl will be increased manyfold. Desirable habitat will certainly increase and only a small amount will be lost. The two most important areas affected adversely will be the potholes south of Moses Lake, and Lewis and Devils Lakes north of Coulee City.

The potholes area, which will be inundated by the back-water created by the O'Sullivan Dam, will not be a complete loss, however. The surface acreage of water will be increased, and Bureau of Reclamation engineers estimate that water will seep through the west bank of the new impoundment and thus create small potholes among the existing sand dunes which will provide ideal breeding areas for ducks. The much longer shoreline should form nearly as many potholes for duck production as before.

In 1949 State game department personnel estimated there were approximately 889 potholes and lakes in that area designated as the Potholes, south of Moses Lake. This survey, made by air, was followed by a 5 percent sampling of the area on foot, in order to determine as closely as possible the number of waterfowl produced during that summer. This ground survey disclosed that an estimated 21,200 ducks were produced in the potholes area.

Some presently valuable duck-producing habitat will be lost when Lewis and Devils Lakes north of Coulee City are inundated as the water level in the equalizing reservoir rises. However, even though stabilized plant growth along its banks will be impossible to achieve due to the fluctuation of the reservoir, this body of water will be valuable to waterfowl as a resting place for birds during migration.

The construction of many miles of irrigation canals, wasteways, and drain ditches will add immeasurably to the habitat available to ducks. Studies in the Yakima and Kittitas irrigation districts prove this. For example, in 1949 approximately 244 miles of drain ditch averaged 2.6 duck broods per mile. Irrigation canals in the Yakima Valley produced one brood per mile during the same year, and canals in Kittitas County averaged three broods per mile. In general, the drain canals and wasteways provide better duck habitat than the main canals since many of the latter are cement lined and therefore do not allow as much seepage for the growth of vegetation, nor easy access to and from the water.

Goose hunting has improved in the Columbia Basin since the flooding of the area behind Long Lake Dam, which included the Stratford reserve. Geese had previously used Stratford Lake as a refuge, and last year thousands of additional birds used the area. As geese are primarily grazers and feed largely in wheat fields during the fall months, the nearby grain fields provide adequate feeding areas. An increased kill of geese during the 1951 season in the Basin reflected this increase in habitat.

Upland game birds found in the Columbia Basin include the pheasant, valley quail, chukar partridge, Hungarian partridge and sage hen. The Reclamation project should not greatly alter the habitat of the chukar and the sage hen since both species frequent the higher sagebrush areas. The habitat of other birds will be greatly increased. These species, known as "farm game," find preferred habitat on irrigated lands. They are found in only fair quantities in the Columbia Basin at the present time, due mainly to the lack of suitable cover, food and water. Their food consists of weed seeds, cereal grains (mostly waste grain) and grasses. Insects and wild fruits are readily taken in season.

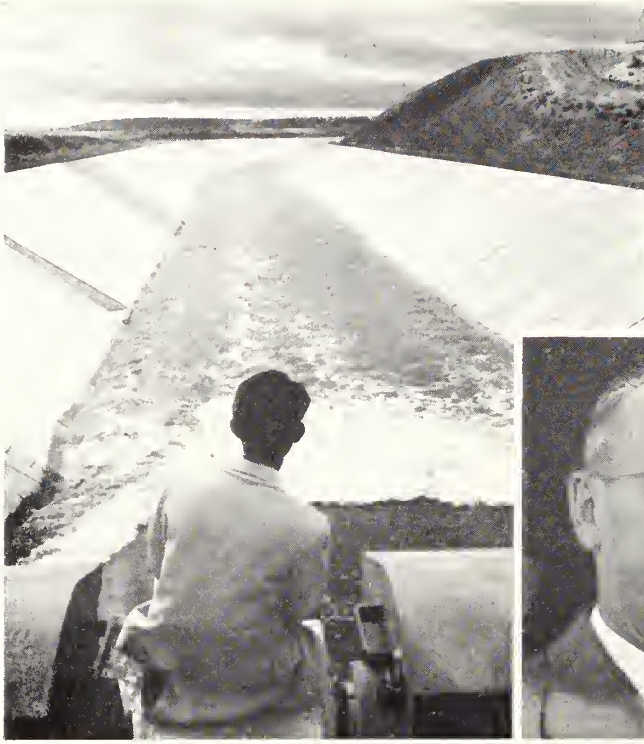
For a number of years the department of game has had a fair check on the number of pheasants killed in the State. In addition to a legal hunting license, the department issues "punch cards" to hunters, who are required to keep tally of the number of pheasants they kill and return the punch cards to the department at the close of the season. The returned cards help to determine the number of pheasants killed in the State, and in various counties. In 1949, a double-check was made by sending a questionnaire to 1 percent of the hunting license holders.

The irrigated areas of Yakima and Kittitas Counties have ranked high in pheasant production and kill for many years as well as for duck habitat. Yakima County consistently ranks first in annual kill and Kittitas County ranks third or fourth, alternating with Spokane County. In 1949 the pheasant kill in Yakima County was 81,824 birds. Kittitas County, with its smaller acreage of farm lands, ranked fourth with 25,251. During the same year Grant County had a kill of 8,456 pheasants. When one considers the number of acres of habitat that will be made available to pheasants in the Columbia Basin compared with the acreage of habitat in Yakima and Kittitas Counties, it is easy to predict that pheasant production and kill could easily surpass these figures in years to come.

Upland bird production will be stepped up as soon as cover is increased. Habitat areas under State control should be selected for the improvement of cover and must be exempt from grazing by livestock. These tracts should be selected mostly from class 6 land in low lying areas where they can be irrigated with waste water from surrounding farms. With the possibility of some lands being set aside as public hunting areas for waterfowl, such lands can readily serve a twofold purpose: hunting and year-around cover for both upland birds and waterfowl.

This is the first time the Washington State Game Department, functioning as a State organization, has had the opportunity to plan on the recreational potentialities of any new area. It is therefore necessary to explore every possibility within or on the perimeter of the Columbia Basin so that the people of this State can enjoy the recreation derived from wildlife production. ###

GIVING THE GOOSE CALL on the Columbia Basin on the opening day of the 1951 season is Ted Ahl of Seattle. *Photo by Ralph Bennett, Region 1, October 27, 1951.*



WATER'S ON THE WAY! At left, water on the way to Columbia Basin forms via the West Canal. Below, H. A. Parker. *Photo at left by H. E. Foss. Photo below by F. B. Pomeroy. Both are Region 1 photographers.*

LOOKING AHEAD

by H. A. PARKER
District Manager
Columbia River District
Ephrata, Wash.

Bulldozers, carryalls, power shovels, and other heavy equipment have been scratching at the surface of the earth for almost 20 years now in the several-thousand-square-mile area designated as the Bureau of Reclamation's Columbia Basin project. Even now, we are able to say only that the construction phase of this largest single reclamation development in the Nation is little more than 60 percent completed.

The Grand Coulee Dam is built. The world's largest power plant, with a rated capacity of 1,974,000 kilowatts is capable of supplying almost 40 percent of all the existing hydroelectric power in the Pacific Northwest. Yet the most vital phase of the 1,029,000-acre project is only now beginning.

This is the starting of settlement. The dramatic benefits that this project can give to the Nation will only begin to be felt in their entirety in the next 20 years. For here today are benefits that we can understand in terms of human values—homes and opportunities for veterans who are able to farm and own their own land.

The Bureau of Reclamation is providing homes and livelihood. Equally important, it is providing, through this project particularly and elsewhere through similar undertakings, a market for the materials exported from every State in the Nation.

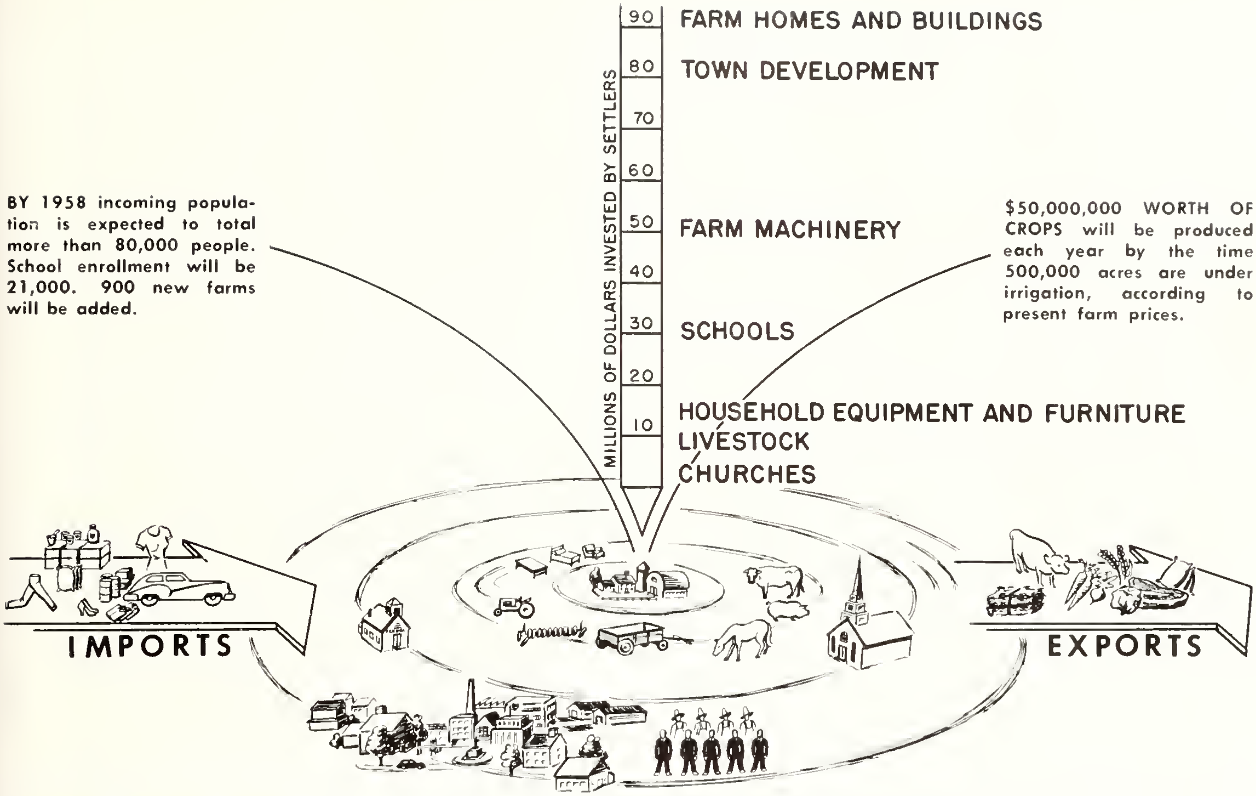
Following are just some of the investments that new settlers will have to put into their property to establish homes and transform sagebrush land into irrigated farms. The figures are supplied by the economics branch of our project development division, after an exhaustive study of the potentialities of the area.

These figures are for the development of only the first 500,000 acres, or approximately one-half of the total project:

- $49,520,000—farm machinery.
- $90,373,000—farm homes and buildings.
- $80,000,000—town development.
- $8,000,000—livestock purchases.
- $10,000,000—household equipment and furniture.

These are only a few of the total number of items. The incoming population is expected to total more than 80,000 by the end of 1958 and about 200,000 by the time the total settlement is completed.

School enrollment will jump 21,000 by 1958, with expenditures of approximately $29,400,000 for school facilites by that time.



AT HALFWAY POINT

WHEN THE FIRST 500,000 ACRES, or approximately one-half of the total Columbia Basin project, have been developed, new settlers will have invested almost a quarter of a billion dollars in the items designated above—representing $237,893,000. The simplified diagram indicates the approximate amount of the investments for specific items—not an accumulated total. ***Drawing by Lloyd Chellman, Graphics Section, Washington, D. C.***

Church groups are busy surveying for their future needs, and one estimate by a group representing 22 denominations placed the building figure at $1,000,000 for these denominations alone in the next 10 years.

About 900 new farms will be ready for water to flow over them each year for the next 7 years.

By the time 500,000 acres are being irrigated, the value of farm crops produced will be approximately $50,000,000 each year, based on 1950 prices.

This is just the start of what is going to happen in the next 10, 15, or 20 years, and which thereafter will be a continuing source of wealth to the national economy.

These settlers will be the market for future automobiles, homes, sewing machines, dish washers, clothing, and thousands of other items.

For each group of four new settlers on the land, it is estimated that the livelihood for five persons is provided in some nearby town.

So we might say that the effect of the Columbia Basin project on the future is like that of dropping a pebble into a still pool. Ever-widening ripples will extend from this project to the State of Washington at large, to the Pacific Northwest, to every State, and to the combined economy of the entire United States.

The benefits and lessons learned from this project, in turn, will spread to future projects. Many parts of the Nation and many persons who 20 years ago had never heard of Federal Reclamation now know of the works that are being built to benefit the Nation here.

No one can predict the future for Reclamation, but perhaps because of what is happening on the Columbia Basin project this year, 50 years from now, people will look back on a hundred years of bringing semiarid land under cultivation and think, just as we are thinking today of the Columbia Basin project:

"We're just a little more than at the half-way point. This is only the beginning!" ###

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

NOTES FOR CONTRACTORS

Contracts Awarded During February 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3600	Missouri River Basin, Colo.-Kansas-Nebr.	Feb. 12	Very high frequency FM radio equipment for Kansas River District, schedule 2.	General Electric Co., Syracuse, N. Y.	$19, 710
DC-3603, DC-3604, and DC-3605.	Missouri River Basin, S. Dak.	Feb. 13	Construction of Brookings, Groton, and Summit substations.	D. A. Gill Co., Inc., Sioux Falls, S. Dak.	120, 877
DS-3608	Colorado-Big Thompson, Colo.	Feb. 15	Two 84-inch butterfly valves with operating units and handling equipment for Flatiron power and pumping plant, schedule 1.	Willamette Iron & Steel Co., Portland, Oreg.	155, 963
DS-3609	Davis Dam, Ariz.-Nev.	Feb. 1	1 main control board for Prescott substation	Berry Engineering Co., Long Beach, Miss.	18, 750
DC-3613	Columbia Basin, Wash.	Feb. 15	Construction of Lower and Upper Saddle Gap and PE-17 pumping plants, lateral PE-16.4 pipe siphon in area P-1, and laterals in P-13.	Intermountain Plumbing Co., Inc., and Henry L. Horn, Connell, Wash.	852, 815
DS-3615	Central Valley, Calif.	Feb. 29	One 275-ton traveling crane and 1 lifting beam for Folsom power plant.	Judson Pacific-Murphy Corp., Emeryville, Calif.	209, 737
DC-3618	Gila, Ariz.	Feb. 28	Construction of earthwork, concrete lateral lining, and structures for unit 1, Mohawk distribution system.	Macco Corp., Paramount, Calif.	1, 099, 033
DS-3621	Eklutna, Alaska	Feb. 14	1 variable-diameter penstock with two 51-inch inside diameter branches for Eklutna power plant, schedule 2.	Southwest Welding & Manufacturing Co., Alhambra, Calif.	235, 582
DS-3623	Cachuma, Calif.	do	57,000 barrels of bulk portland cement for construction of Tecolote tunnel, schedule 1.	Monolith Portland Cement Co., Los Angeles, Calif.	211, 005
DC-3626 and DC-3627.	Missouri River Basin, S. Dak.	Feb. 11	Construction of Armour and Tyndall substations	Donovan Construction Co., St. Paul, Minn.	83, 173
DS-3628	Eklutna, Alaska	Feb. 12	One 7.08- by 9-foot fixed-wheel gate leaf for surge tank of Eklutna pressure tunnel, item 1.	Johnson Machine Works, Inc., Chariton, Iowa.	11, 857
DC-3629	Columbia Basin, Wash.	Feb. 13	Construction of Lake Lenore pumping plants Nos. 1 and 2 and intake and connecting channels.	Duncan Construction Co., and Commercial Builders, inc., Moscow, Idaho.	158, 201
DC-3630	Deschutes, Oreg.	Feb. 4	Construction of cut and cover conduit structure in the channel of existing North unit main canal.	G. T. Gentle, Portland, Oreg.	63, 818
DC-3631	Columbia Basin, Wash.	Feb. 7	Repair of floor slabs in Feeder canal pump discharge outlet transition.	Cherf Bros. Construction Co., Ephrata, Wash.	64, 324
DC-3632	Boulder Canyon, Ariz.-Calif.-Nev.	Feb. 14	Construction of earthwork, pipelines, and structures for laterals 97, 98, 99.4, and 99.8 0.5L, and sublaterals, part 2 of unit 9, Coachella Valley distribution system, All-American Canal system.	R. V. Lloyd & Co., Coachella, Calif.	1, 598, 798
DC-3633	Missouri River Basin, Kans.	Feb. 8	Construction of Kirwin Dam foundation	Cook Construction Co., Jackson, Miss.	1, 226, 246
117C-119	Columbia Basin, Wash.	Feb. 7	Roosevelt memorial at Grand Coulee Dam	George V. Nolte & Co., Bellingham, Wash.	34, 262
117C-132	do	Feb. 8	Permanent residences, garages, shop, and utilities at Royal O & M headquarters.	Van Werven & Van Andel, Lyden, Wash.	191, 235
117C-133	do	Feb. 11	Lateral extensions in areas E-2 and E-3	Minnis & Shilling and United Concrete Pipe Corp., Moses Lake, Wash.	34, 054
200C-187	Central Valley, Calif.	Feb. 19	Shasta Dam-Buckeye water line	Coast Construction & Excavating Co., and Jeske Bros., Eugene, Oreg.	37, 710
300C-31	Davis Dam, Ariz.-Nev.	Feb. 5	Construction of railroad spur for system O & M area at Phoenix.	T. A. Kvale and L. L. Driggs, Phoenix, Ariz.	16, 970
703C-230	Kendrick, Wyo.	do	Streets, sidewalks, drainage, sewage, and water distribution systems at Alcova Dam Government camp.	Landon Construction Co., Casper, Wyo.	125, 301

Construction and Materials for Which Bids will Be Requested by June 1952

Project	Description of work or material
Cachuma, Calif.	Construction of 18- by 65-foot concrete Lauro control house with open 140- by 34-foot concrete pit for control valves; installation of chlorinating equipment, steel pipe, valves, and meters; and 500 feet of 154-inch diameter buried steel pipe for Lauro dam outlet works. The control house is located at Santa Barbara, Calif.
Central Valley, Calif.	Construction of 19 miles of 12- to 36-inch diameter reinforced concrete and concrete irrigation pipe lines for the Stone Corral irrigation district on the Friant-Kern canal distribution system.
Do.	Construction of 14 miles of main lateral of 340 to 278 cubic feet per second capacity and 20 miles of sublaterals of 85 to 15 cubic feet per second, near Madera, Calif.
Do.	Construction of 43 miles of pipelines for Exeter irrigation district on the Friant-Kern canal distribution system.
Do.	One 3,000-ampere, 13.8-kilovolt air circuit breaker for Folsom power plant.
Do.	Station service unit substation for Folsom power plant.
Do.	Main control board and auxiliary control and graphic board for Folsom power plant.
Do.	Three 3,000-ampere, 15-kilovolt, isolated phase bus structures, with current and potential transformers, lightning arresters, and capacitors for Folsom power plant.
Do.	One 4,160-volt unit substation switchgear having compartments for the following: one 5,000-kilovolt-ampere, 4,160-volt incoming circuit; one 1,000-kilovolt-ampere, incoming circuit; and seven 4,160-volt outgoing circuits for Folsom switchyard.
Central Valley, Calif.—Continued	Construction of the semioutdoor type 14,000-kilowatt Nimbus power plant to house two 7,500-kilovolt ampere generators, and the concrete Nimbus diversion dam on the American River about 7 miles from Folsom, Calif. The dam is to be 22 feet high and 800 feet long with eighteen 40- by 24-foot radial gates.
Do.	One 60-ton gantry crane for Nimbus power plant.
Do.	Embedded metalwork for eighteen 40- by 20-foot radial gates for Nimbus power plant.
Do.	Traveling water screens for Delano-Earlimart irrigation district No. 2.
Do.	Vertical-shaft, motor-driven pumping units of the following capacities: two 7.5 cubic feet per second, one 4 cubic feet per second, and one 2 cubic feet per second, at 25-foot head for pumping plant D-3; two 1 cubic feet per second and one 2 cubic feet per second at 18-foot head for lateral 115.8W pumping plant; one 6 cubic feet per second, one 4 cubic feet per second, and one 2 cubic feet per second at 13-foot head for lateral 121.0W pumping plant; and one 4 cubic feet per second and two 2 cubic feet per second at 18-foot head for lateral 118.1W pumping plant on unit 2 of Delano-Earlimart irrigation district.
Do.	Construction of 9,200 feet of 19-cubic feet per second capacity reinforced concrete pipeline for lateral 25.6 for Contra Costa County water district on the Contra Costa canal. Pipe varies from 30 to 24 inches in diameter under heads up to 125 feet.

Construction and Materials for Which Bids Will Be Requested by June 1952—Continued

Project	Description of work or material
Columbia Basin, Wash	Completion of electrical installation in industrial area, machine shop, warehouses A and B; removal of existing heating plant; and installation of Feeder canal gaging equipment at Coulee Dam, Wash.
Do	Construction of 3 miles of distribution system of 2 to 5 cubic feet per second capacity for part-time farm units in block 41, lateral area E-2 on East Low canal, near Moses Lake, Wash.
Do	Construction of 6,200 feet of type A barbed wire fence, gates, and 12 ladder rungs on Potholes East canal.
Do	Vertical-shaft, motor-driven pumping units of the following capacities: three 39.3 cubic feet per second at 14.5-foot head for Ringold relift pumping plant; one 7 cubic feet per second at 32.5-foot head for PE-62 pumping plant; two 11.5 cubic feet per second at 30-foot head for PE-64 pumping plant; 1 cubic feet per second at 20-foot head for PE-64 relift pumping plant; one 3.2 cubic feet per second at 18-foot head for PE-64C pumping plant: and two 9 cubic feet per second at 52-foot head for PE-65 pumping plant on Potholes East canal.
Do	Installation of two 65,000-horsepower, 720,000 gallons per minute pumps No. P5 and P6 in Grand Coulee pumping plant; miscellaneous metalwork and electrical installations for Grand Coulee Dam, pumping plant, and power plants.
Davis Dam, Ariz.-Nev.	Completion of architectural finish and miscellaneous metalwork for Davis Dam and power plant.
Do	Erecting steel structures, installing electrical equipment, and constructing control house at Prescott substation.
Eden, Wyo	Construction of 0.12 mile of 475 cubic feet per second capacity earth-lined Means canal; enlargement and rehabilitation of 6.5 miles Eden canal to 300 cubic feet per second capacity, part of which is to be lined; construction of 2 miles of Eden canal laterals, 20 to 5 cubic feet per second capacity; and relocation of 0.35 mile of Dry Sandy Creek channel, 670 cubic feet per second capacity, about 44 miles northwest of Rock Springs, Wyo.
Eklutna, Alaska	Construction of the 2-unit 30,000-kilowatt Eklutna hydropower plant near Palmer, Alaska. The powerhouse superstructure will have steel framing and concrete curtain walls; either wood piles or concrete caissons will be required for the foundations. The structure will measure 71 by 74 feet in area and 50 feet in height from generator floor to ceiling. The contractor will install two 21,000-horsepower Government-furnished turbines and a 40-ton traveling crane. Switchyard steel structures, to be furnished by the contractor, will be installed on the roof of the power plant. A machine shop similar in construction to the powerhouse will be built adjacent to the powerhouse.
Eklutna, Alaska—Con.	Main control board, distribution board, and battery chargers for Anchorage substation.
Fort Peck, Mont.-N. Dak.	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel bus structures, installing Government-furnished major electrical equipment, and furnishing and erecting warehouse and service buildings.
Kendrick, Wyo.	Placing earth lining on a reach of lateral, 15 miles southwest of Casper, Wyo.; compacting bottom and banks and placing gravel cover on about 3,000 feet of lateral, 20 miles southwest of Casper; and constructing seven drainage inlet structures, 8 miles west of Casper.
Do	Placing asphaltic membrane lining on about 6,000 feet of existing lateral in Natrona County, Wyo., 5 miles west of Casper, Wyo.
Do	Two 15,000-volt metal-clad switchgear assemblies for Alcova power plant.
Do	Main control board extension and auxiliary control and graphic board for Alcova power plant.
Palisades, Idaho	Construction of permanent Government camp about 56 miles southeast of Idaho Falls, Idaho. The contract will include twenty 3-bedroom temporary houses, twenty 2- and 3-bedroom permanent houses, 1 office building, 1 dormitory, 1 garage and warehouse, one 12-car garage, facilities for 25 trailers, and streets, walks, sewers, and water mains.
Missouri River Basin, Nebr.	Construction of 7,500-kilovolt-ampere Ogallala substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the Government; and erection of a 16- by 20-foot control house.
Do	Construction of 10,000-kilovolt-ampere Chadron substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the Government.
Missouri River Basin, N. Dak.	3 single-phase, 26,667-kilovolt-ampere autotransformers for Jamestown substation; one 3-phase, 15,000-kilovolt-ampere transformer for Washburn substation.
Missouri River Basin, S. Dak.	One 3-phase, 300-kilovolt-ampere transformer for Watertown substation.
Riverton, Wyo	Construction of a permanent check near Wyoming tunnel; construction of Wyoming lateral structures; and construction of Cottonwood drains.

United States Department of the Interior, Oscar L. Chapman, Secretary

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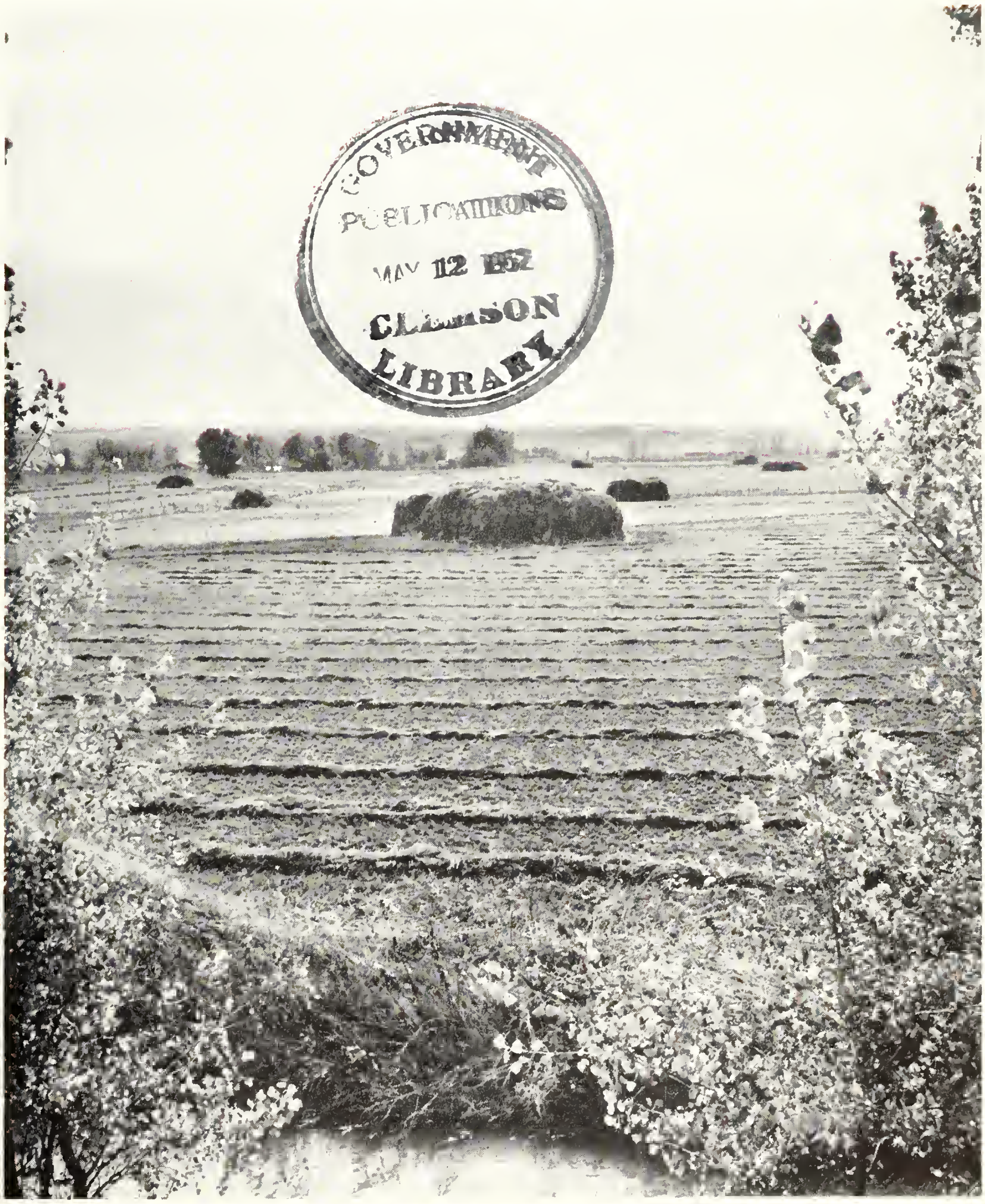
THE RECLAMATION AREA

The Reclamation ERA

May

1952



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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

A typical irrigated spread producing a hay crop in the Milk River project for livestock feeding. Photo by Donald H. Demarest, former Region 6 photographer.

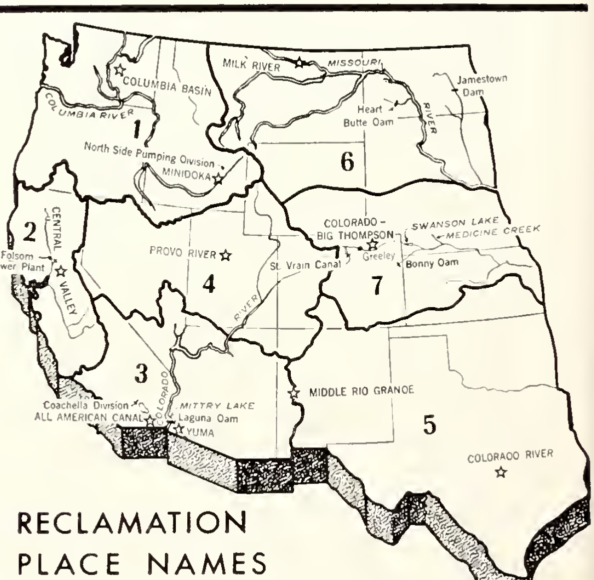
35 YEARS AGO IN THE ERA

Food Crops Must Be Increased

by Hon. D. F. Houston, Secretary of Agriculture

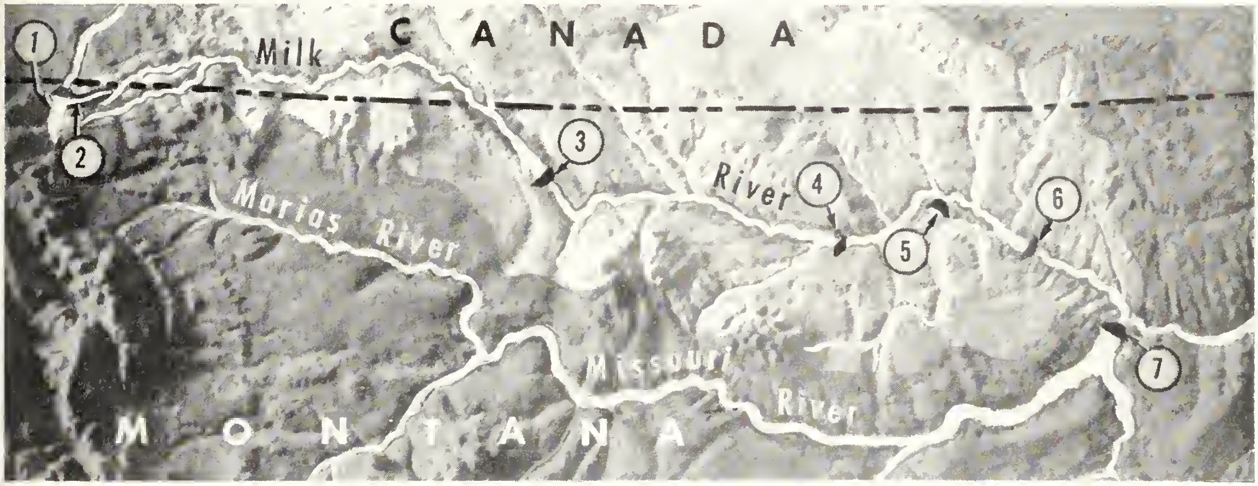
The importance to the Nation of a generously adequate food supply for the coming year can not be overemphasized in view of the economic problems which may arise as a result of the entrance of the United States into the war. Every effort should be made to produce more crops than are needed for our own requirements. Many millions of people across the seas, as well as our own people, must rely in large part upon the products of our fields and ranges. . . . Recognition of the fact that the world at large, as well as our own consumers, must rely more strongly on American farmers this year than ever before should encourage them to strive to the utmost to meet these urgent needs.

(From Page 231 of the May 1917 issue of the *Reclamation Record*, predecessor to the *Reclamation Era*.)



RECLAMATION PLACE NAMES IN THIS ISSUE

The Valley of the Milk River



MILK RIVER BASIN, with the St. Mary River visible at upper left, (1) Sherburne Lakes Reservoir, (2) St. Mary Canal, (3) Fresno Reservoir, (4) Dodson Diversion Dam, (5) Nelson Dam, (6) Vandalia Diversion Dam, and (7) Fort Peck Dam. *Artwork on relief map by Graphics Section, Washington, D. C.*

Part 1—Development of the Project

by B. E. GARLINGHOUSE, Superintendent, Milk River Project, Malta, Mont. Region 6 (headquarters in Billings, Mont.)

On the Milk River project, close to the Canadian border in northern Montana, the ranchers and farmers are gradually developing an ideal agricultural setup, combining irrigation and dry-land farming, with available grazing units, to provide a stabilized enterprise.

Ever since the first cattlemen and sheepmen drove their herds across the Missouri River into the Milk River Valley in the 1880's, the range livestock industry has been well established in this area. Irrigation farming is not new, either, although it really began to come into its own around 1940 after the Fresno Dam was completed, providing carryover storage within the project. Up to that time, the Milk River project received its water from the Sherburne Lakes Reservoir on the St. Mary River in Glacier National Park 400 miles west as the crow flies. The water used on the project is a mixture of the flow of two international streams, the St. Mary and the Milk Rivers, both of them having their drainage basins in northern Montana and Alberta, Canada. The St. Mary rises in Glacier National Park and flows north into Hudson Bay via the Saskatchewan River. The Milk River's North Fork and the South Fork also begin in the United States in the rolling country immediately northeast of the St. Mary Basin. The two forks of the Milk River flow north, meet in Canada, travel east about 216 miles above the border, and reenter the United States to meander through the Milk River Valley on its way to the Missouri River.

St. Mary river water is stored in Sherburne Lakes Reservoir, transported through a 29-mile

LATE NEWS BULLETIN: As this issue goes to press, Milk River floods are decreasing, although warm weather holds danger of snow melt from the mountains to the north. Damage has been extensive. Some canals have washed out, pumping plants are completely covered with water, diversion dams are submerged, and farm families and livestock have been evacuated to higher ground.

Downstream, below Fort Peck dam, the ice jam in the Missouri River broke on April 3, freeing the flood waters which had covered the entire west bottom of the Buford-Trenton project.

Estimates of flood damage cannot be made until water recedes.

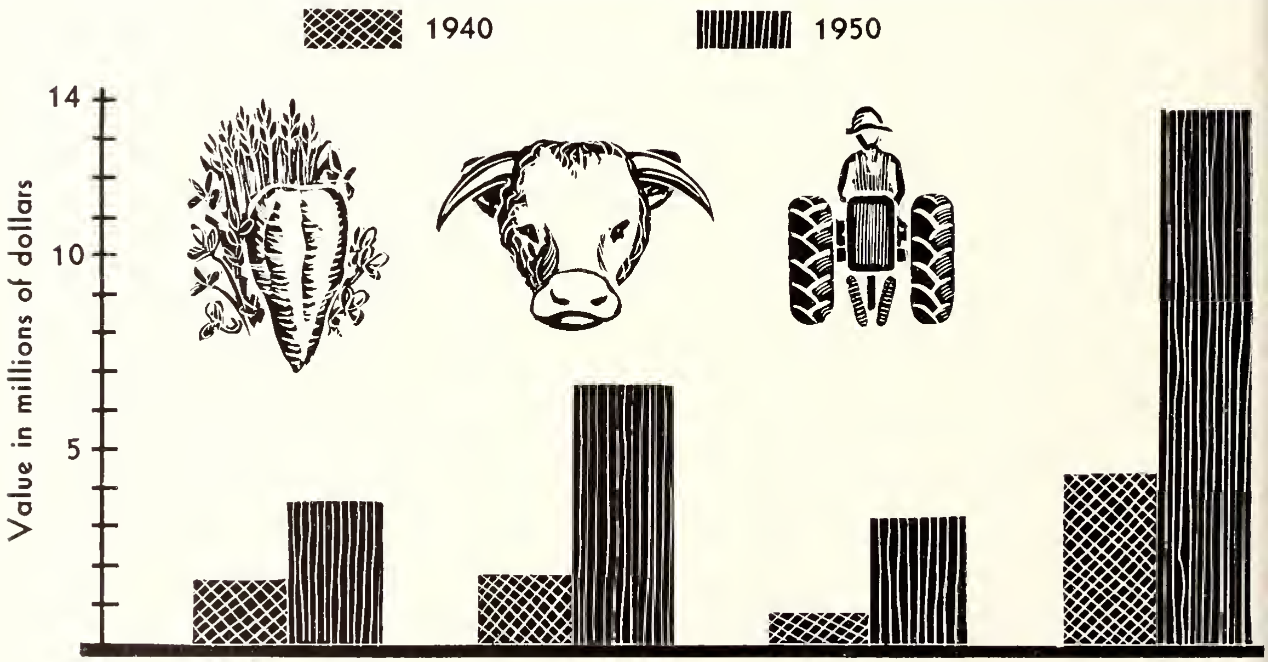
canal into the North Fork of the Milk River, and according to a treaty between the United States and Great Britain, signed in 1909, the water of the combined rivers is divided between the two countries with Canada receiving approximately 370,000 acre-feet during recent years and the United States about 290,000 acre-feet. Safe passage is guaranteed for United State's water in the Milk River channel as it journeys through Alberta. By this arrangement with Canada, which has vast reserves of irrigation water (over 4,000,000 acre-feet in Alberta alone), it has been possible to convey about 260,000 acre-feet of western Montana water through Canada for use on eastern Montana lands during recent years. Although it would have been possible to build a canal entirely within the United States, which might have served this purpose, Canada and the United States jointly saw the wisdom of measures to convey the United States portion of the waters via the existing Milk River channel through Canada.

Irrigation from Milk River began around 1890 when an experienced irrigation farmer named T. B. Burns, along with some other settlers, built a brush and rock dam near the present site of the Fort Belknap diversion dam at the Agency Canal in what is now known as the Chinook Division of the Milk River project. But the Milk River, named by Captain James Merriwether for the color of its silt-laden water during each untimely flood, was and is an erratic stream. Some years there would be more than enough rainfall to grow dry-land crops, and plenty of water to flood and irrigate fields—mostly winter feed for livestock—and the farmer-ranchers built up their herds and prospered. At other times, the Milk River ran thin, and rainfall was scarce. During those years the settlers and their livestock faced hard times, and looked around for a more dependable source of irrigation water.

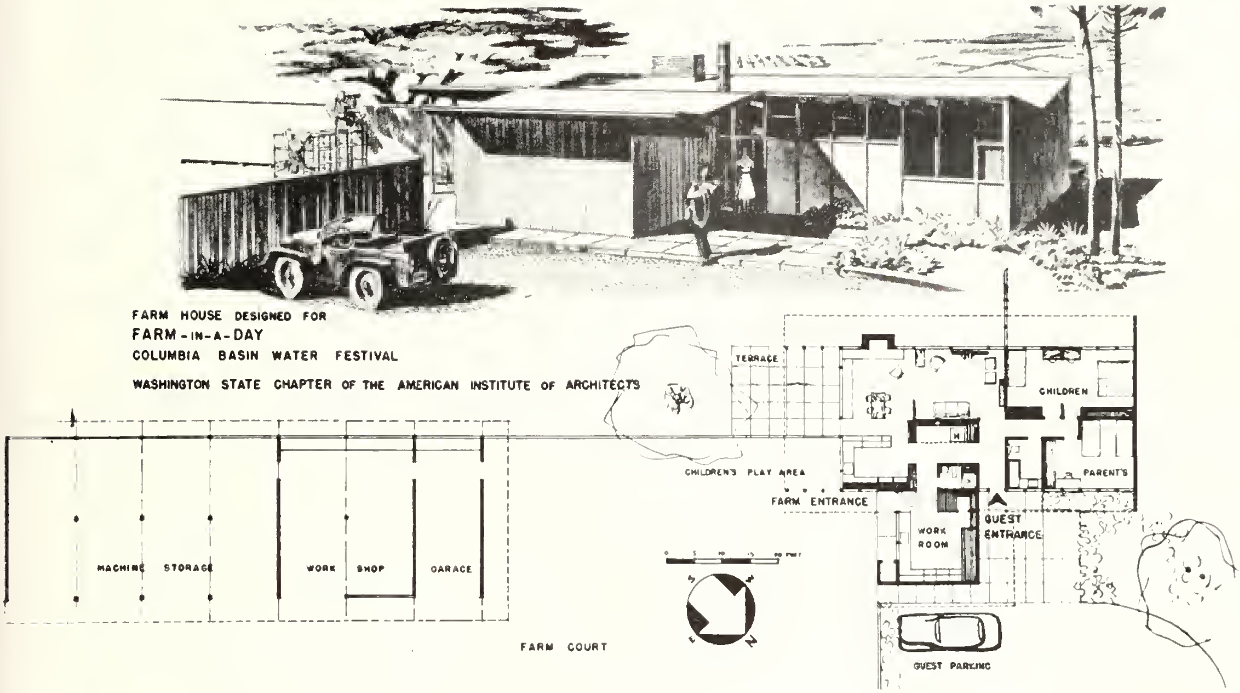
Early surveys by the United States Geological Survey in 1891 and the United States Reclamation Service in 1902, paved the way for the Milk River reclamation project and construction began in 1906. Water for the irrigation of Milk River lands from the diversion works and canals on the project itself was first delivered in 1911. The remote canal to carry St. Mary water to the North

(Please turn to page 120)

BY COMBINING IRRIGATION FARMING AND LIVESTOCK PRODUCTION MILK RIVER OPERATORS CAN AND DO INCREASE EQUIPMENT VALUE.



Value	CROPS	LIVESTOCK	EQUIPMENT	TOTAL
1940	$1,409,944	$1,687,249	$847,253	$3,944,446
1950	$3,578,087	$6,649,835	$3,480,417	$13,708,339



Design for MODERN FARM LIVING

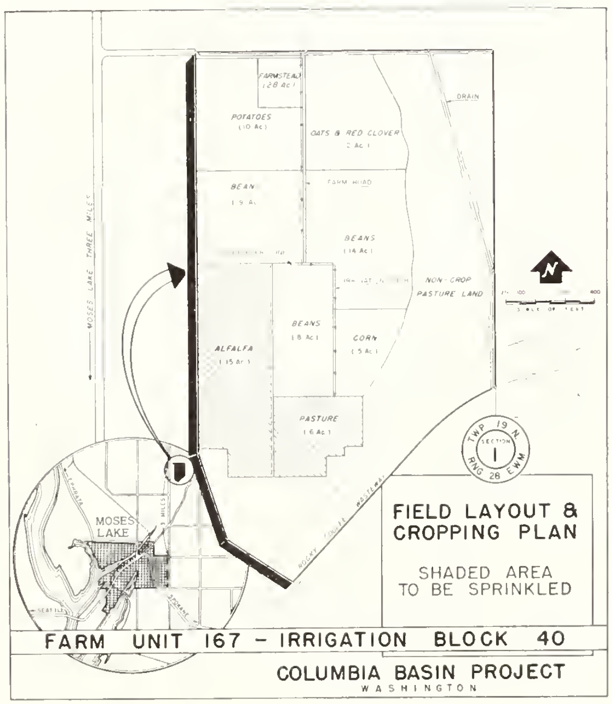
On Thursday, May 29, 1952, on the Columbia Basin Project in Washington, Donald D. Dunn will be $50,000 richer and many spectators will see a rare demonstration difficult to evaluate in dollars and cents, but worth time and money to home owners, and farmers anywhere.

This will be the highlight of the Columbia Basin Water Festival from May 22 to June 1st, when the people of the State of Washington celebrate the completion of irrigation works to supply water to 87,000 Columbia Basin farms. (See last month's special Columbia Basin issue.)

A Nation-wide search was made by the Veterans of Foreign Wars for the most worthy qualified veteran to receive the farm which will be transformed from raw, sagebrush covered land into a going 80-acre farm, complete with the latest in farm homes, buildings, furnishings and facilities, all within a 24-hour period. Dunn won.

This prize along with the eleven-day celebration was made possible through the cooperation

(Please turn to page 112)



ADDRESSING OPERATION AND MAINTENANCE CONFERENCE of the Bureau of Reclamation in Washington, D. C., Representative Clair Engle stresses need for close cooperation with State and local organizations. At extreme left, in profile, Floyd Dominy, Assistant O & M Director; at Engle's right, O & M Director E. D. Eaton; Engle is standing addressing the group, and at extreme right is Assistant O & M Director Hollis Sanford. *Photo by Glenn Peart, Interior Department photographer.*

FORMULA FOR FEDERAL-STATE COOPERATION on Water Resource Development

by the Honorable CLAIR ENGLE, Representative from California

Chairman of the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs of the House of Representatives

MOST PEOPLE DO NOT REALIZE that in a few years we may face a food shortage.

The rapid increase in our population requires that our land and water development keep pace with the growing demands of our population. That does not take into consideration whatever strains may be put on our agricultural economy in the next decade or the one thereafter by international emergencies such as we have encountered since the start of the Korean war. And even though we could keep pace without too much difficulty with the growing demands of our population and the rising standard of living in this country, irrigated farm lands throughout the Nation are a bulwark against the ravages of drought, dust storms, and floods which sweep away our land resources.

Incidental to water development usually is the development of hydroelectric power. Such has been the history in the far West. Today electrical power is critically short in every area of the Nation, and our reserves are insufficient in view of our anticipated power needs.

Through a water resource development program, we can meet the necessary food requirements of our growing population, stabilize our agriculture and add to the short power reserves all in one program. There is no question that these things need to be done, and in one way or another will be done.

Most of the easy water and land development projects have been built. As far as I know there are very few States in the far West that have the financial resources to build the huge water and power projects that are now necessary. Moreover, there is a recognized necessity of planning for river basin development as a whole, instead of having a patchwork of plans by separate agencies for separate purposes. There should be one plan for one river or one system of rivers, even though it involves a number of States. That is the only way of assuring the most harmonious development of the water resources of a basin from an engineering or any other viewpoint.

It is a well-known axiom that Federal jurisdiction follows the Federal dollar. If the Federal Government is permitted to continue to carry the whole financial burden of water development programs in this country, Federal jurisdiction will inevitably follow.

The first step toward solving the problem of preventing the complete Federalization of the water resources development program in this country is to get some "State dollars" into the water development program—and this should start right with the planning stages of a project. Thereupon, State jurisdiction will start following the State dollars.

Heretofore the reimbursement to the Federal Government for the costs of water development projects, particularly Reclamation projects, has been based upon the direct beneficiaries—the actual water and power users—repaying the reimbursable costs. All of the indirect benefits reflected in an improved and enlarged tax base, higher assessed valuations, increasing prosperity, better soil conservation, reduced flood damage, improved navigation and the development of fish and wild life and all other benefits have been absorbed by the Federal Government. In short, the States receive benefits from these projects which can and should, in part at least, be paid for. Here is a proper field for local and State contribution which will not only lessen the burden on the Federal Government but will provide for the payment of benefits where benefits are received.

The second step is that the Federal Government should be required to recognize the supremacy of State law in the allocation of water rights and water uses. The controlling effect of State law over the water resources of a State has been recognized time and again in Federal statutes and has been asserted without dispute by the Congress of the United Statees on innumerable occasions. As a corollary of that basic proposition, it has been admitted that in the construction of a Reclamation project the Federal Government is merely a carrier and does not acquire title to the water which belongs to the people of the State, and does not acquire any jurisdiction over the distribution of that natural resource beyond that which is inherent in the project operation itself.

It may seem strange that in the light of the precedents in this field that question should have been put in issue as recently as in the Santa Margarita case in Southern California.

In the last 20 years during which we have seen a tremendous growth of Federal Government, many people have lost sight of the fact that under our constitution the Federal Government only has those powers specifically delegated to it in the constitution and such as may be reasonably implied from those granted. All other powers are reserved to the States or the people. The power to regulate commerce, for instance, does not give the Federal Government title to the water in the navigable streams of this country. Nor does the building of a dam give the Federal Government title to the water caught behind the dam.

The third step is to set up a Federal-State liaison which will insure effective State participation from the beginning in the planning and execution of water development projects.

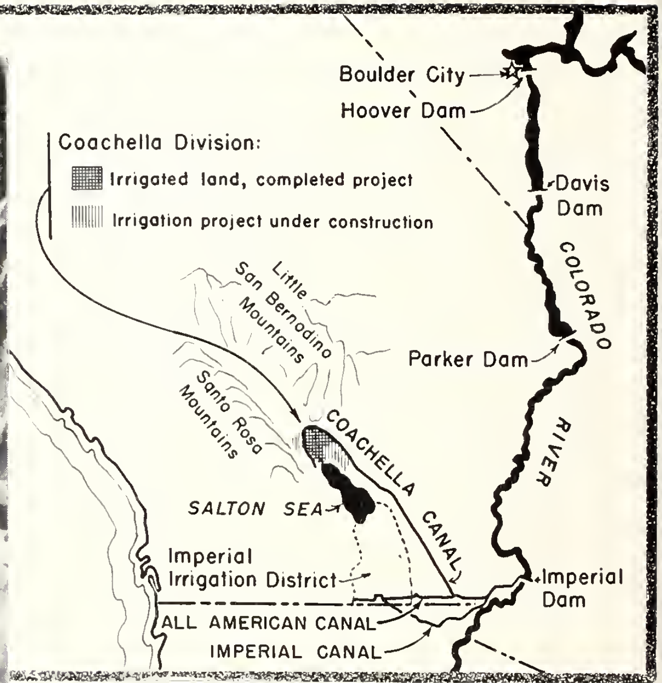
On this point I have in mind a formal organization consisting of the representatives of Federal and State agencies charged with the responsibility for water development. The Federal Government has already set up inter-agency committees on a voluntary basis in the Missouri, Columbia, and Colorado Basins. Provision has been made for participation of the basin States in the Missouri and Columbia basin committees. This is a start in the right direction, and must be followed up vigorously by the States.

The National Reclamation Association has held meetings with representatives of the Bureau of the Budget in an effort to arrive at an understanding of the relative voting power of the State and the Federal agencies in just such an organization.

This last is the mechanical or functional step to give real meaning to the first two steps I have suggested. It provides for the method of operation, the means of protecting the State investment in the water project, and the machinery for bringing to bear the controlling force of State law in the distribution and use of water.

If these three steps are taken, the planning and building of future large water and land development projects can go forward cooperatively and with a maximum of efficiency. Our objective should be to retain the benefits of necessary Federal participation without losing the benefits of local administration and control. # # #

An adaptation of Congressman Engle's address during the thirty-third annual meeting of the American Farm Bureau Federation at the Stevens Hotel in Chicago, Ill., December 11, 1951.



BELOW SEA LEVEL lies the Salton Sink, represented in the relief map at left, the white blob being the Salton Sea. Above, Coachella's relationship to the Boulder Canyon project.

THE COACHELLA DRAINAGE

Part 1—Forewarned Is Forearmed

IN CALIFORNIA'S COACHELLA VALLEY, the people are doing something about drainage before drainage difficulties do something to them.

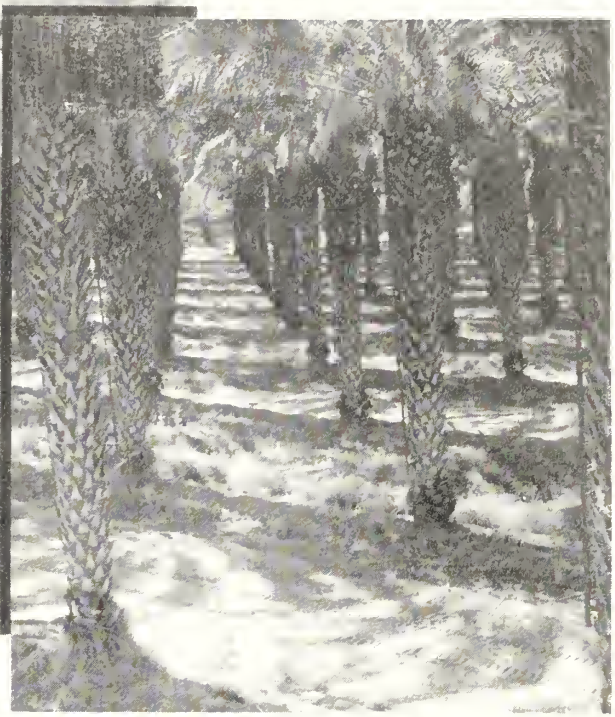
They have sentries posted to give them warnings of dangerous underground water movements. They have a crew of technicians ready to plot the best means of foiling any dangerous uprising, and they have new machines, laboratory equipment and engineering devices available to save the valuable lands of the Coachella Valley from the insidious invasions of the elusive underground water.

Four agencies work together to perform these unique tasks, which all come under the title of the Coachella Valley Cooperative Drainage Investigations. The Coachella Valley County Water District, the Department of Agriculture's United States Salinity Laboratory at Riverside, Calif., and the University of California, through its Division of Irrigation and Soils at Los Angeles, and the Bureau of Reclamation, are the primary forces behind this work.

If this sounds like an elaborately precautionary program, just remember the fall of Babylon and the passing of the Ho-Ho-Kam. According to archeologists and historians, these once-flourishing irrigated areas were abandoned because of waterlogging and seepage, due to inadequate drainage. Proving that history repeats itself, the Bureau of the Census reports that over 21½ million acres of crops were spoiled or completely lost in the United States in 1950 due to fair or poor drainage—and this is only the preliminary figure relating to acreages of 500 or more.

People in the Coachella Valley have taken these ancient and modern lessons to heart. This valley is an American version of the "Land of the Arabian Nights," one of the most highly developed agricultural areas in the United States. In 1950, the total value of crops grown on 31,000 irrigated acres amounted to $13,437,977. The average gross value per acre was $434. Here the farmers produce ninety percent of the Nation's domestic date supply. This crop was valued at about $586 per acre in 1950.

Land values are high. Vineyards, citrus



A WEALTHY OASIS, Coachella Valley. *Maps on the opposite page by the Washington, D. C., Graphics Section. Photos above and at right by Harry W. Myers, former Region 3 photographer.*

INVESTIGATIONS

by J. S. REGER, Hydraulic Engineer, Coachella Division, All-American Canal System, Coachella, Calif., Region 3 (Headquarters at Boulder City, Nev.)

groves, and date gardens sell for as much as $2,000 to $3,000 per acre. People are willing to pay $100 to $300 an acre for undeveloped desert land, even though they may have to invest at least $200 an acre just to level it, and much more to get it under cultivation. But they know they will get their money back when the lands produce.

In addition to the agricultural wealth of the Valley, it is one of the most highly developed winter recreational areas in the world. It is an inland valley of unsurpassed desert beauty, located between the Little San Bernadino Mountains on the east and the Santa Rosa Mountains on the west. At the lower end of the Valley, about 238 feet below sea level, lies the home of the Salton Sea Regatta, the Salton Sea, filled in its present form when the Colorado River broke through levees in 1905–6. Palm Springs, internationally known winter resort, is located near the upper end of the Valley. These recreational developments put an even higher value on the lands of the Valley.

No wonder the people of Coachella are willing to take every precautionary measure possible to prevent these lands from becoming damaged or completely ruined because of inadequate drainage.

The problem today is different than it was about 20 years ago. Then the farmers in the Coachella Valley were entirely dependent upon the ground water resources to supply their irrigation water requirements. Like Babylon and Ho-Ho-Kam, history began repeating itself. Year after year, more and more farmers mined the underground source of supply. As additional acres went under irrigation, farmers went deeper and deeper to tap the water supply. Some wells failed altogether; many had to be deepened periodically, and in a few areas the cost of sinking additional and deeper wells was more than the farmers would regain through crop production.

Farmers abandoned hope of developing large acreages of raw land. Their only hope was to find enough water for the crops under cultivation.

Then in 1928 the Boulder Canyon Project Act was passed, authorizing the construction of the

INVESTIGATORS OF THE UNDERGROUND during a field conference of an annual meeting conducted by the United States Salinity Laboratory. From left to right, J. H. Snyder, former General Manager-Chief Engineer, Coachella Valley County Water District; Dr. C. E. Kellogg, Chief of the Soil Survey Division, United States Department of Agriculture; J. S. Reger, resident engineer for the Coachella Valley Cooperative Drainage Investigations, and Dr. H. E. Hayward, Director of the United States Salinity Laboratory. *Photo courtesy of the Indio-Date Palm Newspaper.*

Coachella Branch of the All-American Canal, to carry Colorado River water into the Coachella Valley. The Bureau of Reclamation started constructing the Coachella Branch of the canal on August 11, 1938, completing it 10 years later. Work is now proceeding on the buried concrete pipe lines to carry water from the canal to 74,800 acres of Coachella Valley land.

As the Coachella people saw the new water highway take shape in the desert, they realized that they had a new problem to face. What would happen to their lands when the new water supply came surging through the pipes and was turned onto their fields? They knew about capillary action and what happens when surface water meets ground water. They had already had some experience with waterlogging and salty soil as a result of ground water rising too close to the surface.

The first thing to do, they reasoned, was to investigate the underground—find out how much water was underground, where the water was, whether it was rising, sinking, or remaining at a constant level, whether it contained salts, whether it fluctuated seasonally (if so, how much), and where additional water would come from. In 1945, before the canal was finished, the people organized the Coachella Valley Cooperative Drainage Investigations to answer these questions.

According to the four-way agreement, the Coachella Valley County Water District supplies field and office forces—well drilling crews, well readers, record keepers, draftsmen, as well as most of the drill rigs, well pipes, and other equipment and supplies needed for the field work. All groundwater observations are made and recorded by Water District employees. The Department of Agriculture's United States Salinity Laboratory at Riverside, Calif., and the University of California's Division of Irrigation and Soils at Los Angeles, Calif., furnish staff and laboratory facilities as needed and some equipment as available for analyzing well cores, samples of soil strata, water samples, and performing other tasks pertaining to the investigations. The Bureau of Reclamation maintains a drainage engineer at Coachella who devotes a major portion of his time to the investigations.

Representatives of these agencies meet at periodic intervals to study the progress, review data, and consider future phases of the investigation. This group is known as the cooperator's committee. A smaller group consisting of one member from each of the four agencies, and known as the technical committee, meets quite often to actually study minute technical details. Finally, because of the interest which has been shown in the investigations, there is a group, known as the advisory committee, which meets on the average of once each year. This committee includes, in addition to representatives of the previously mentioned agencies, representatives of the Federal Land Bank, the Bureau of Indian Affairs, and others. While not active participants in the investigation, these agencies have a real interest in the future of the undertaking. As a result of this free exchange of ideas, the investigation represents the coordinated thinking of a group of trained and experienced men, pooling their knowledge and efforts to prevent a serious drainage problem from becoming a reality.

The purpose of this four-way investigating committee is to detect and correct adverse drainage conditions before the lands involved become seriously damaged. They also are finding new and economical methods for investigating and correcting drainage problems. The people of Coachella will be ready with the answers before the questions become serious—questions like, "How much of your crop did you lose? How much of your land is ruined? You mean it's too late to do anything about it?"

(Next Month—Investigating the Underground)

BEATING THE PURPLE SAGE

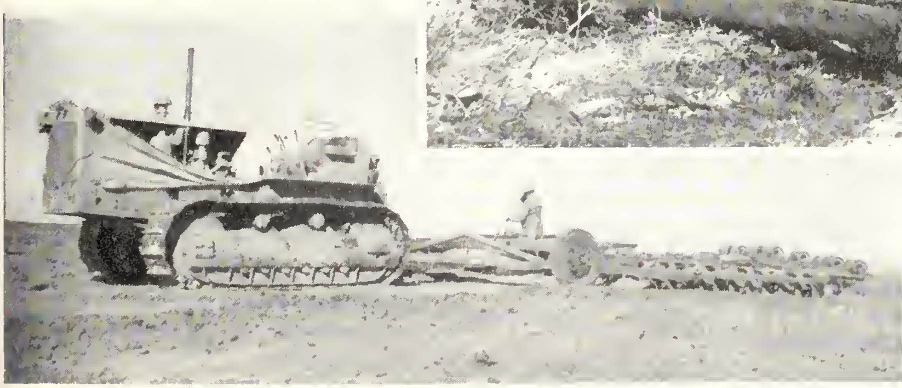
by O. L. KIME, Project Engineer, North Side Pumping Division, Minidoka Project, Burley, Idaho, Region 1 (headquarters at Boise, Idaho)

EDITOR'S NOTE: The December 1947 issue of the RECLAMATION ERA carried an article entitled "Australian Sagebusting Plow" which described a novel type of plow with disks mounted on individual spring-controlled arms, which permitted the disks to ride over rocks and thus reduce breakage. Following the preliminary tests reported in the Era, this sage-busting plow was modified slightly and found its way into widespread use by the Forest Service in breaking down the brush sufficiently to permit seeding on the broad ranges of Wyoming, Utah, Nevada, and elsewhere across the Nation. Particularly adapted to widespread plowing operations such as range clearing, the Australian-designed plow is not reported here in author Kime's article dealing with methods of cleaning sagebrush from irrigation farmland.

FROM TIME IMMEMORIAL, SAGEBRUSH has stood as a challenge to the pioneer farmer in the West.

This woody shrub was dramatized by Zane Grey as "Purple Sage," was rhymed by poets as "wormwood" and scientists call it *Artemisia*. There are several species in the West but one of the most widespread is big sagebrush, *Artemisia tridentata*, so-called because of the three teeth at the end of each leaf. While sagebrush is aromatic and resembles the true sage in odor, it is not the sage raised for seasoning which is really a *salvia*. Coyotes, jack rabbits, and sage ticks thrive in sagebrush. It has prevented soil erosion, has been used for livestock shelters or windbreaks, is sometimes browsed by sheep but otherwise has no value, commercial or otherwise. On the western foothills and plains it normally reaches a height of from one to three feet. In exceptionally fertile soil, and with proper amounts of moisture, it will grow to a height of 8 feet, and until recently, no marked strides have been made in methods to exterminate it.

"RAILING" AND PLOWING superseded "grubbing" as illustrated in the sketch above. At right, the early and tedious method of dragging a heavy rail or log across the land to clear off sagebrush. Below, the wheatland plow, a method which came into favor in the 1940's. The machine can clear a swath 30 feet wide through the pesky brush. *Drawing by Lloyd Chellman, Graphics Section, Washington, D. C.; photo at right by O. L. Kime, and photo below by Stan Rasmussen, Region 1 photographer.*



RAY SHERWOOD'S BRUSH CLEARER.—At left, the thin sharp blades which slice the brush off 2 or 4 inches below the ground. Below, the special rake, also designed by Sherwood, which does a good job of windrowing the sagebrush. *Both photos by O. L. Kime.*

Perhaps the reason why the farm machinery industry has neglected to develop a machine for clearing sagebrush is that it is not a continuous seasonal operation. Once the brush is removed and crops are started, the brush never reappears. But those who have had to contend with it, and who are now facing the problem of clearing a rugged growth of sagebrush, recognize it as a menace to western irrigation development.

The early pioneer used a grub hoe. A good day's work was a quarter acre by the dinner bell, an additional one-quarter by sundown, a cramped back, sore muscles, and a huge peeve against sage—purple or otherwise.

Next came "railing." Two spans of horses or mules dragged a heavy rail (sometimes unknowingly furnished, without due compensation, by the Union Pacific Railroad Co.) back and forth across the brush-covered ground in an attempt to wear out the sage. After each trip much of the brush would remain standing, and it was always a toss-up as to which would wear out first, the horses, the mules, the man, or the brush. This method was favored, or rather accepted, in the West for possibly a period of 60 or 70 years, the only marked change being the substitution of a tractor for the horses or mules.

The first real improvement was made by welding two of the rails into a "V" shape, with cutting blades attached along the outside of the rails. Another rail was extended along the bisector of the angle thus formed, and a rudder was installed to hold the machine in a straight line behind the drawbar. Other cross pieces were provided to strengthen the equipment. Although this equipment required more drawbar horsepower and moved too much soil into windrows with the brush, it was an improvement.

In grubbing or railing, the loosened or uprooted brush would be raked, bunched and burned. With the V-shaped sage cutter, the brush was pulled from the windrows of soil and burned, after which the soil had to be levelled back in place.

In the 1940's the wheatland plow came into favor. This required a large amount of drawbar

"BEATING" THE SAGE with a machine originally designed for beet topping or tilling the soil. The dogged little machine chops away at the sagebrush. *Photo by O. L. Kime.*

power, usually powered by tractors of the crawler type with 35-horsepower and over. Disc plows arranged side by side can clear a swath 30 feet wide when drawn by a 113-horsepower caterpillar tractor. The brush is usually raked with a modified morrell rake in which the spokes of the rotating wheels are covered with a shield of tin. This moves the brush to the side and keeps it from becoming entangled in the spokes. Brush cleared by this method in 1949 cost $6.75 per acre—$2.50 for plowing and $4.25 for raking and burning.

A commercial cultivator with a V-shaped blade suspended from a heavy frame supported by two wheels can also be used for clearing sagebrush. The blade is set to penetrate the ground at a given depth by use of a hydraulic mechanism, and slashes the brush 3 to 6 inches below the ground surface. Although this process is successful, we have not used it widely on our project, possibly because the machine requires a high powered tractor, and also represents a considerable initial expense for equipment that can only be used for one purpose.

Ray Sherwood of Twin Falls, Idaho has designed a machine along the same lines as the cultivator with thin sharp blades for cutting the sagebrush off 2 or 4 inches under the ground. Two or three cutting blades can be drawn side by side with one tractor. With two tractors and two operators, Mr. Sherwood is able to cut 80 acres in an 8-hour day. The machine has an improved rake which does an excellent job of windrowing, and removes 90 to 98 percent of the brush. Its only drawback is that it will not work in rocky ground. Mr. Sherwood also improvised a "flame-thrower" and burns the brush by traveling in a moving truck at 5 to 8 miles per hour and spraying an ignited stream of kerosene on the rows of sagebrush. Burning is very complete and is accelerated if there is some wind. Mr. Sherwood's price for clearing and burning was $9 per acre in 1951.

North Side Pumping Division farmers exterminated 1,600 acres of sagebrush by beating it with a little machine made principally for jobs like soil tillage, or sugar beet topping. · This machine has a rotating shaft that turns at about 1,800 revolutions per minute, to which are connected a large number of beating arms, pivoted where connected to allow a given amount of flexibility. The business-end of the arm has two rugged fingers, or side projections, making a formidable weapon or chopper.

The rotor shaft is turned by take-off power from the ordinary farm tractor to which the machine is attached. The little machine wades into the brush, twice as high as itself, and leaves a sickly stand of brush stubs behind it. A second trip will nearly finish it off to the ground surface. The "exhaust" from the machine is a cyclone of dust and brush fragments. The brush fragments resemble hogged fuel, but are not as fine as sawdust. This residue is scattered fairly even over the surface of the ground, and plowing turns it under. We found that the wood pulp would add to the humus of the soil, but requires heavier applications of nitrate fertilizer to break down the cellulose structure. The roots and stumps are somewhat of a hazard as they are not all covered by plowing. However, their existence did not seem to interfere extensively with subsequent farm operations. The present commerical machine should be made heavier and sturdier for sagebrush operations as some of the bearings and beater arms couldn't take the punishment. The machine works better in rocks than other clearing machines, but rocks should be avoided if possible.

All the methods of clearing give satisfactory results in planting and irrigating farms—depending, of course, on the individual who does the clearing. Two farmers using the same method and same machinery will not always produce the same results. In some cases sagebrush clogged corrugations, making irrigation less efficient the first time water was run through. After the first irrigation, very little trouble was encountered from the sagebrush until harvesting time. Farmers who were digging potatoes often had to stop and clean brush off the digger points, where brush left behind in the field had built up in front of the machine. The sagebrush had made its last defiant stand. # # #

NEXT MONTH

Reclamation's Golden Jubilee

Featuring the highlights of 50 years of progress by water users in the 17 Western States where reclaimed lands have been adding to the Nation's wealth since the Reclamation Act was passed on June 17, 1902.

In the June 1952 issue of the *Reclamation Era* and subsequent issues during Reclamation's Golden Jubilee Year, we will chart the progress made during the past half century in the varied and diversified activities connected with conserving and using water made available through the facilities of the Bureau of Reclamation, and the contribution to the Nation's welfare made by past and present pioneers, now represented by the third of a million settlers living in the Reclamation area.

Design for Modern Farm Living

(Continued from page 103)

of many organizations and individuals in the State of Washington who have contributed time, money and effort to commemorate the beginning of an irrigation area larger than Rhode Island, which will eventually total 1,000,000 acres, with about 13,000 farms.

A committee of five leading architects from the Washington Chapter, American Institute of Architects, designed the home, in association with the Extension Service of Washington State College.

Complete working drawings and specifications will be made available through county agents, the Extension Service and the Farmers' Home Administration, to prospective settlers of this million-acre project.

The Western Retail Lumbermen's Association of Seattle, working with its suppliers, other manufacturing and business interests, the Merchants of Moses Lake, and labor unions, will donate all the materials and build the Farm-in-a-day buildings. Cost of the house is estimated at $19,000 and the value of the completed farm is placed at $50,000.

# # #

May 20 Deadline for Yuma Mesa Farms

According to the Bureau's Yuma, Ariz., office the article in the December 1951 issue of the Reclamation Era regarding the public land opening on the Yuma Mesa of 27 new farm units brought a terrific response. An estimated 800 letters made direct reference to that article

May 20 is the last day for veterans of World Wars I and II, the Spanish American War, and the Philippine Insurrection to file their applications for these farms. This is the second public land opening on the Yuma Mesa. Application blanks and information may be obtained from the District Manager, Lower Colorado River District, Bureau of Reclamation, Yuma, Ariz., or Regional Director, Bureau of Reclamation, Boulder City, Nev.

The public announcement states that the 27 farms embrace an area of 4,030 acres and range in size from 113 to 160 acres. Our article in the December Era which contained preliminary figures showed a total of 4,051 acres with farms ranging from 116 to 160 acres. •

Last Call for Columbia Basin Farms in 1952

May 16 is the final day applications may be filed for the purchase of 32 farm units in the Franklin County area of the Columbia Basin project in the State of Washington. Veterans of World War II will have first preference in filing applications for the farms. All inquiries should be addressed to the Bureau of Reclamation, Ephrata, Wash.

The 32 farms vary in size from 48 to 153 irrigable acres and will sell for prices ranging from $1,091 to $7,298. Veterans and others applying for the farms must have had at least 2 years full-time farm experience after reaching the age of 15 and have assets of $4,500.

This is the final sale of Columbia Basin farms to be offered this year. A land drawing will be held at Othello, Wash., on May 31. •

New Wildlife Refuge in Arizona

Arizona's Game and Fish Commission, and the Department of Interior's Fish and Wildlife Service and Bureau of Reclamation, have worked out an agreement whereby hunters and fishermen in Arizona will benefit from the development of a new 5,000-acre resting and feeding ground for waterfowl at Mittry Lake, near Yuma. Ariz.

Mittry Lake is a body of water isolated from the Colorado River in back of the Bureau of Reclamation's Laguna Dam, and within the reservoir site. The Federal Government has leased 8 sections of this public land to the State Commission which at its own expense will construct inlet and outlet facilities for Mittry Lake to permit fresh Colorado River water to flow through the now stagnant lake and thus promote the growth of waterfowl food and permit the propagation of game fish in the area.

The agreement provides for the nonconsumptive flow of not more than 10 cubic feet of water per second to the lake from the Colorado River. The State Commission has agreed that the location and plans for the inlet and outlet structures be approved by the Bureau of Reclamation.

In approving the agreement for the Department of the Interior, Acting Secretary of the Interior Richard D. Searles stated that this was a striking example of the Federal policy for full recognition of recreational values in the development of the water resource conservation program in the Western States. •

ROUNDING UP THE RIO

by GARFORD L. WILKINSON,
Region 5 Headquarters
Amarillo, Tex.

TO KEEP THE RIVER IN BOUNDS new channels are being excavated. Above, a 6-yard dragline cuts a wide swath, followed by a 3-yard machine. *All photos for this article by Fred Finch, Region 5 photographer.*

THERE'S A BIG ROUND-UP down in New Mexico. A river—the Rio Grande—has been ranging too wide, too high and far from handsome, and a crew of top hands headed by John C. Thompson, Bureau of Reclamation Project Engineer, in Albuquerque, equipped with modern instruments supplied by McGinnes Brothers' Contracting Co. of Houston, Tex. are building corrals and "river guards" to keep it within bounds.

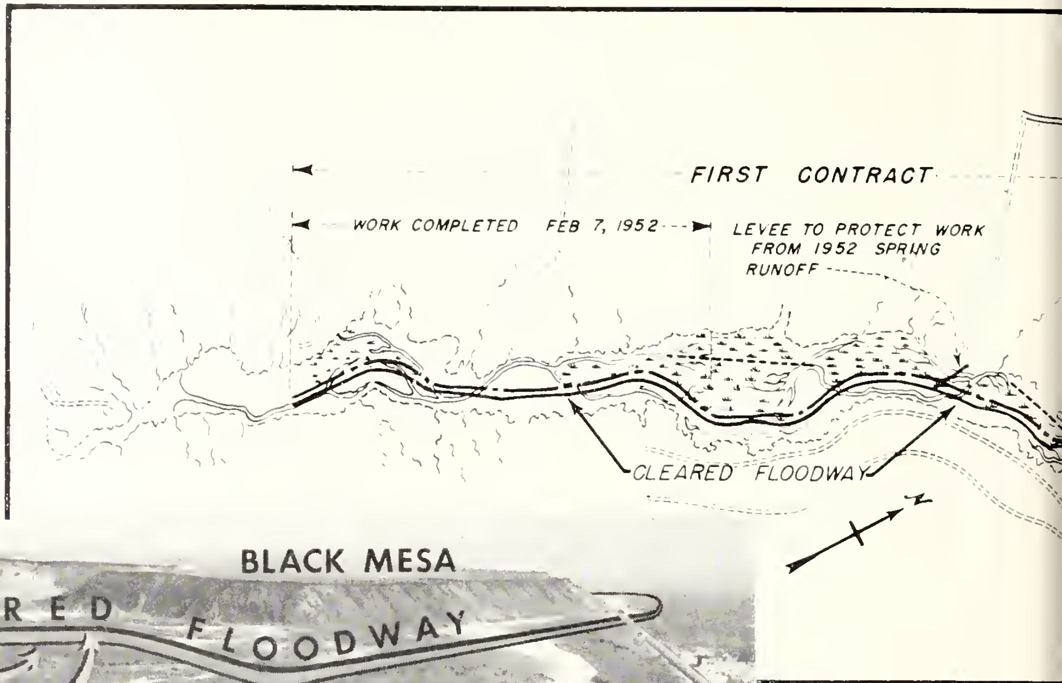
The white man's coming has resulted in many changes in the Rio Grande basin. The river, extending 1800 miles from the shadow of the great divide in Colorado to its mouth in the Gulf of Mexico, was and is a clear flowing stream in the mountain areas that are the source of most of its water. Below the mountains the river passes through many miles of desert area. Originally this area, with low and somewhat ephemeral run-off, contributed some sediment to the main stream. Today, with increased use of the basin lands for grazing and agriculture, run-off from the desert area has probably increased slightly, but the sediment dumped into the Rio Grande has increased a great deal. This, coupled with increased diversions of water in the mountain areas, has resulted in raising the bed of the Rio Grande until now it is higher than downtown Albuquerque, largest city in the State.

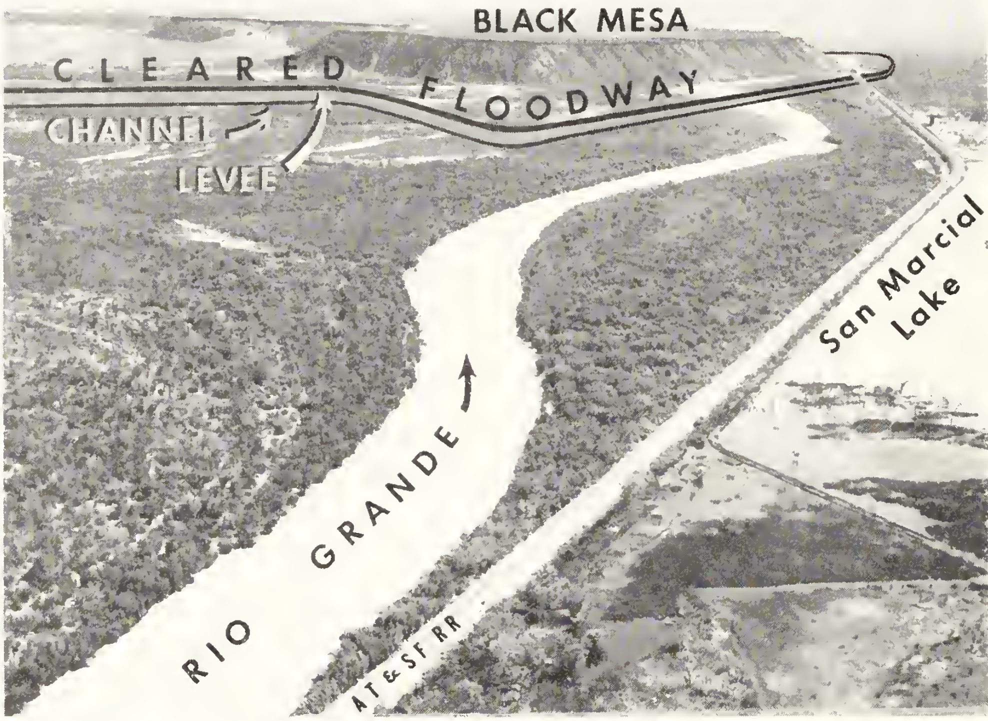
And when the old river runs out of bounds, it can be tremendously harmful to all who live near it.

Back in 1929, for example, swirling, muddy waters swept through the town of San Marcial, approximately 100 miles below Albuquerque. Today, San Marcial lies buried in sand and mud; its former inhabitants striving for new homes elsewhere.

The river serves three States and the Republic of Mexico. The round-up, or channelization work, is being conducted in New Mexico's vast Middle Rio Grande Valley, where the river is the major source of water, affecting the welfare of persons far downstream who irrigate the 156,000-acre Rio Grande project in Southeastern New Mexico and West Texas (in the vicinity of El Paso) as well as those in the Middle Valley's 80,000 cultivated acres, including about 20,000 acres tilled by Indians.

Twenty-seven years ago landowners in the Middle Valley organized a conservancy district to provide private financing for the construction of extensive river improvement works, including a storage dam on the Rio Chama, a tributary of the Rio Grande. The Rio Chama rises about 10 miles north of the Colorado-New Mexico line and its waters are stored in El Vado Reservoir in New





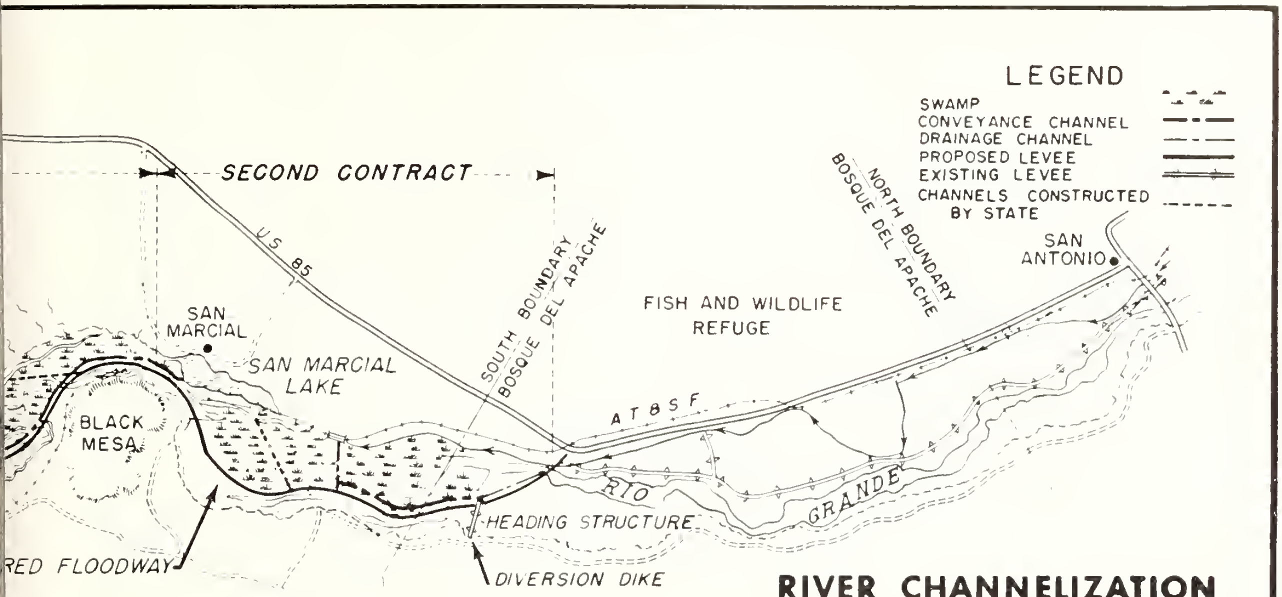
REROUTING THE RIO—The channel for the Rio Grande dug through the 30-mile-long swamp, is shown above, a line. A levee (solid black l the channel and mesa will f way" or "paddock" for the runs wild and washes out dike on the right side of t the left of old Fort Craig is sh temporary levee and emerge to take care of spring run- The four emergency ditches mer and fall by the Sta servancy District are also sh dashed lines. At left, an o the 2-mile-wide river flood p the inundated town of flooded in 1929. Map ob by Region 5, at right by Gro Washington, D. C.

Mexico. El Vado Dam was completed in 1935.

But the Middle Rio Grande Conservancy District's attempt to remedy the multiplying evils of the river were unsuccessful. Sediment raised the river bed and the under-ground water level. Additional farm lands were waterlogged and made unproductive. Vast swamps, infested with forest-like growths of salt cedars (tamarisk), appeared in the vicinity of old San Marcial. It is estimated that more than 140,000 acre-feet of water a year are consumed by useless vegetation in this one area alone. This large loss of precious water, charged under the Rio Grande Compact to the Middle Valley, contributes much to the continuing debt of water owed to downstream irrigators.

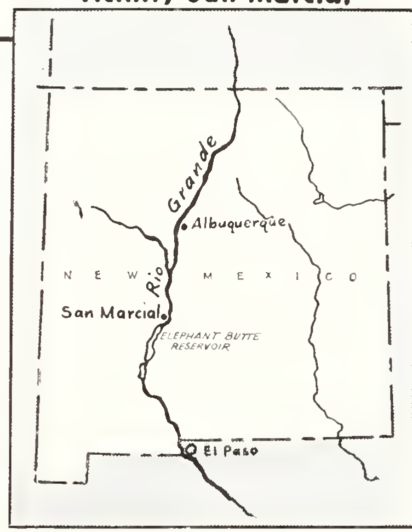
Faced with these major problems local officials and civic leaders, including the Middle Rio Grande Conservancy District, called in Federal agencies to look over the situation and design an operating plan that would restore the stream to its former usefulness.

Legislation authorizing the appropriation of funds for a joint program of irrigation, drainage, flood and sediment control by the Bureau of Recla-



RIVER CHANNELIZATION

Vicinity San Marcial



mation and the Army Corps of Engineers was signed by the President in 1950. Award of a construction contract for channelization of a 21-mile stretch of the Rio Grande above Elephant Butte Reservoir, the Rio Grande project's storage reservoir near Truth or Consequences, N. Mex., and execution of an agreement by water users in the Middle Rio Grande Conservancy District to repay the Federal Government for the repair and extension of the irrigation and drainage system of the district, was approved in September 1951 by Secretary of the Interior Oscar L. Chapman.

Channelization of the Rio Grande from the San Marcial swamp area to the narrows of Elephant Butte reservoir began last fall. About 21 miles of the channel will be constructed under the present million-dollar contract. The remaining 17 miles of channel will require another appropriation by Congress.

The whole 38 miles of the channel will extend from the Elephant Butte narrows through the San Marcial area northward in to the Bosque Del Apache Fish and Wildlife Refuge. Structures will be constructed to divert normal flows into the channel. A low, earthen dike, or levee, will be so constructed that whenever a head of water, too great for the channel to carry, comes rushing down the river, the dike will wash out and dump the excess water into a confined and cleared space formed by the channel levee and high ground east of the river. This 1,000-foot-wide floodway will handle flows up to 2,500 cubic feet per second during flood seasons and will protect the permanent channel.

Four emergency ditches were dug last summer and fall as a joint project of the State, the Elephant Butte Water User's Association, and the Middle Rio Grande Conservancy District. These ditches, which connect remaining sections of the old river channel, have speeded the flow of water into Elephant Butte Reservoir, and helped to drain the land in the area being channelized, thus making it possible for heavy construction machinery to operate in the area.

Last summer thousands of farmers on the Rio

"X" MARKS THE SPOT where the photo above was taken—an indication of the size of the 8 miles of State-constructed channels for the Rio Grande, representing $100,000 worth of State money. Last December the river was 6 inches deep in this area—too shallow for a boat, and too deep for wading.

Grande project faced imminent disaster. Their reservoirs, below the Middle Rio Grande area, were virtually dry and their fields, which in the previous year produced crops valued at more than $40 million, faced ruin. Although one of the worst droughts in the record history of the Rio Grande's watershed was the primary cause of the project's tragic shortage of water, the huge quantities of water that were being wasted in the Middle Valley's swamp area contributed greatly to the downstream problem.

In early February, water was flowing into Elephant Butte Reservoir at the rate of some 1,500 acre-feet a day—much more than at that time of the year for a number of years past. Credit for much of this flow was given to the emergency ditches dug last summer. Combined length of the ditches is about 8 miles, designed to carry about 1,000 cubic feet per second of water a day southward. Thus, the people in the Middle Valley and those farther south, on the Rio Grande project, are beginning to learn the value of the permanent channelization program now in progress.

The emergency ditches are likely to be damaged, possibly washed out, during a heavy flood. However, the permanent channel would carry safely about 2,000 cubic feet per second of water a day into Elephant Butte Reservoir. Unlike the emergency ditches, the permanent channel will be protected from floods by the cleared floodway, and its "self-operating" levee.

The round-up crew is keeping an eye on the weather.

In some areas, a record-breaking pile of snow, holding three times the normal amount of water, is piled up in the river's watershed. In its March snow report, the United States Weather Bureau said that with normal snow and rain about 1,400,000 acre-feet of water could come thundering down the Rio Grande. That would be about 130 percent of the average flow, and about three times the amount of water which flowed downstream during the preceding 12 months.

The possibility of flood depends strictly on what the weather does from now until the snow melts. Contemplated flood-control works on the Rio Grande will not be completed for several years. Meanwhile, the people in the Middle Valley, often thirsting for water, await what fate and the river have in store for them. The people, both rural and urban, have faith in the round-up, but this river is a maverick. # # #

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the Reclamation Era at your door, but we have to know where it is.

Jamestown Dam Under Construction

During the latter part of March 1952, the C. F. Lytle Co. of Sioux City, Iowa, was awarded the $1,868,862 contract for constructing Jamestown Dam, 1 mile north of Jamestown, N. Dak., on the James River.

This earthfill dam, 1,410 feet long and 110 feet high, is part of the flood control system on the Missouri River. Irrigation facilities are to be provided in the future. Funds for starting construction were made available shortly after the disastrous floods in the region last fall.

According to the contract, work should be completed in 800 days, or approximately 2½ years. •

Work Proceeds on Coachella System

In a little more than a year now, an additional 50 miles of buried pipeline and accompanying structures for the Coachella Branch of the All-American Canal System in California will be completed, according to the terms of the $1,598,798 contract awarded on February 14, 1952 to the R. V. Lloyd & Co. of Coachella, Calif.

The contractors will lay the precast concrete pipe, which is from 1 to 6 feet in diameter, construct collection boxes, box, pipe, bend, angle vent and meter stands and line meter wells, install gates, hoist valves, line meter tubes with meters, vent pipes and miscellaneous metal work. Turnouts are not included in the contract. •

Time and Money Saved at Folsom

With the award of a contract for the fourth large transformer for the Folsom Power Plant switchyard on the Central Valley project in California on March 11, 1952, the Bureau of Reclamation saved more than $76,000 and 6 month's time. The time and money were saved through awarding the $302,912 contract to the English Electric Co., the lowest bidder, and the only one stating that delivery of this autotransformer could be made within 730 days—the time required for gearing its installation to the kilowatt schedules submitted to Congress.

The dam and the power plant on the American River near Sacramento will, when completed, provide more than 160,000 kilowatts of vitally needed hydroelectric power capacity for domestic, municipal, industrial, and defense plant use in California. •

St. Vrain Canal Under Way

Two contractors, the Winston Bros. Co., of Monrovia, Calif., and Adler Construction Co., of Loveland, Colo., are working together on the $2,600,000 job of constructing the St. Vrain supply canal on the Colorado-Big Thompson project.

This 10-mile-long canal will run south from Carter Lake Reservoir to the St. Vrain River at Lyons, Colo., and will consist of 4 miles of unlined canal, 4 miles of concrete-lined canal, two 8.5-foot diameter horseshoe-shaped tunnels totaling $\frac{8}{10}$ths of a mile, a 1,700-foot long 8.5-foot circular siphon under the Little Thompson River, 2,400 feet of additional siphons, rectangular flume, chutes, conduits, siphon spillways, turnouts, and overchutes.

The contract, which was awarded on March 24, 1952, also includes the construction of timber bridges, and access and farm roads. Work is to be completed in about 2 years. •

Warne Speaks at Point Four Conference

William E. Warne, now Minister to Iran, formerly Assistant Secretary of the Interior, and Assistant Reclamation Commissioner, was a surprise speaker at the National Conference on International Economic and Social Development held in Washington, D. C. on April 7, 8 and 9.

Mr. Warne, who had been in Iran since November 1951, had returned briefly to the United States for business reasons, and was invited to appear before the conference during the Wednesday morning session along with Secretary of State Dean Acheson, Acting Director of the Technical Cooperation Administration Jonathan Bingham, Special Consultant to the Secretary of State Stanley Andrews, and Mutual Security Agency Assistant Director Clarence Decker.

Mr. Warne told of an Iranian area close to the Russian border, suffering from the effects of a 3-year drought, where a few hundred tons of seed and instruction in methods of seed selection and planting had resulted in a crop this year where there would have been widespread starvation.

The conference was attended by over 1,200 delegates from private industry, and both private and public national and international organizations gathered to take inventory of the Point Four program and increase its effectiveness in guaranteeing world peace and the future prosperity of the United States and the Free World.

Several references were made by prominent speakers to the importance of irrigation and power development in the Point Four program, and the success already apparent as a result of assistance like that rendered by the Bureau of Reclamation in training and making available technicians in these fields. •

AT THE CONTROLS of the outlet works of Horsetooth Dam when water was released for the first time in July 1951 are the author, J. M. Dille (at left) and South Platte River District Manager J. H. Knights of the Bureau of Reclamation. *Photo by N. T. Novitt, Region 7 photographer.*

HOW A CONSERVANCY DISTRICT WORKS

by J. M. DILLE, Secretary-Manager, Northern Colorado Water Conservancy District, Greeley, Colo.

Adapted from an address on January 17, 1952, during the Water Users Conference at which the Four States Irrigation Council was organized at the Region 7 headquarters in Denver, Colo.

Part 1—Assuring a Water Supply

For forty years I have been a manager of irrigation systems in northern Colorado and for the past 13 years or more secretary-manager of Northern Colorado Water Conservancy District, the contracting agency with the United States for construction of the Colorado-Big Thompson project.

The full story of the District would start 90 years ago, when, during the gold rush period in the 1860's, the first settlers built some small ditches to irrigate bottom lands along the streams.

However, the first major undertaking and one which blazed the trail for many later cooperative efforts was the Union Colony at Greeley.

In 1870 when the Denver Pacific was building the first railroad into Colorado from Cheyenne, these eastern people under a kind of cooperative society established themselves on a tract of raw prairie and with little knowledge of irrigation or even farming, worked out many basic irrigation problems with no precedents to guide them.

The history of this Colony is a heart-warming record of courage and persistence in the face of early failures and disappointments.

Their original solutions of irrigation problems included a theory of priority of right by use, laboriously worked out in their own way, but later enacted into State Law as the basis of the Colorado doctrine.

The success of this Colony, such as it was, was widely advertised by Horace Greeley in the New York Tribune and was largely responsible for the rapid settlement of the South Platte Valley during the 1870's and 1880's when most of the irrigation systems which now serve the area were conceived and built—the real reclamation program in the region, carried on entirely by local initiative and capital.

During the 1890's when it was realized that the streams were not as inexhaustible as originally supposed, came a period of reservoir construction to conserve the occasional surplus flows.

Later, after 1900, an optimistic decade brought on the building of a number of large canal and reservoir systems financed by the organization of irrigation districts.

The final result is that there are over one hundred separate systems now serving the 700,000 acres of irrigated land included in our Conservancy District. These range from small ditches covering a few farms to the large incorporated mutual systems serving 50,000 to 60,000 acres.

The principal difficulty over the years has been the limited and variable water supply in relation to the irrigated acreage.

The annual supply entering the District is composed of the mountain flow of the Poudre, Thompson and St. Vrain Rivers and Boulder Creek, plus the discharge of the South Platte River at Fort Lupton.

This supply has varied from only 420,000 acre-feet (in 1934) to a maximum of nearly 1,500,000 in several years since 1905. The average yield has been about 905,000 or just over 1 acre-foot per acre of irrigated land.

While return flows to the streams increase the amounts available, the main benefits from this source are on the lower reaches of the South Platte River so that the total average supply for the upper part of the District is barely 1½ acre-feet per acre. In many years it has been much less.

It is considered by most irrigation men that for the usual diversified crops on the average soils in this area about 2½ acre-feet per acre are necessary and that a large portion of this should be stored water subject to call for use in maturing late row crops of higher value. In recent years the natural trend toward the production of more of this type of crops has been limited by the short supply of dependable late water.

The above briefly outlines the reasons why the people of Northern Colorado have initiated and supported the program for the diversion of additional water from the Colorado River as the only method by which the economic foundation of the region can be stabilized and the future development assured.

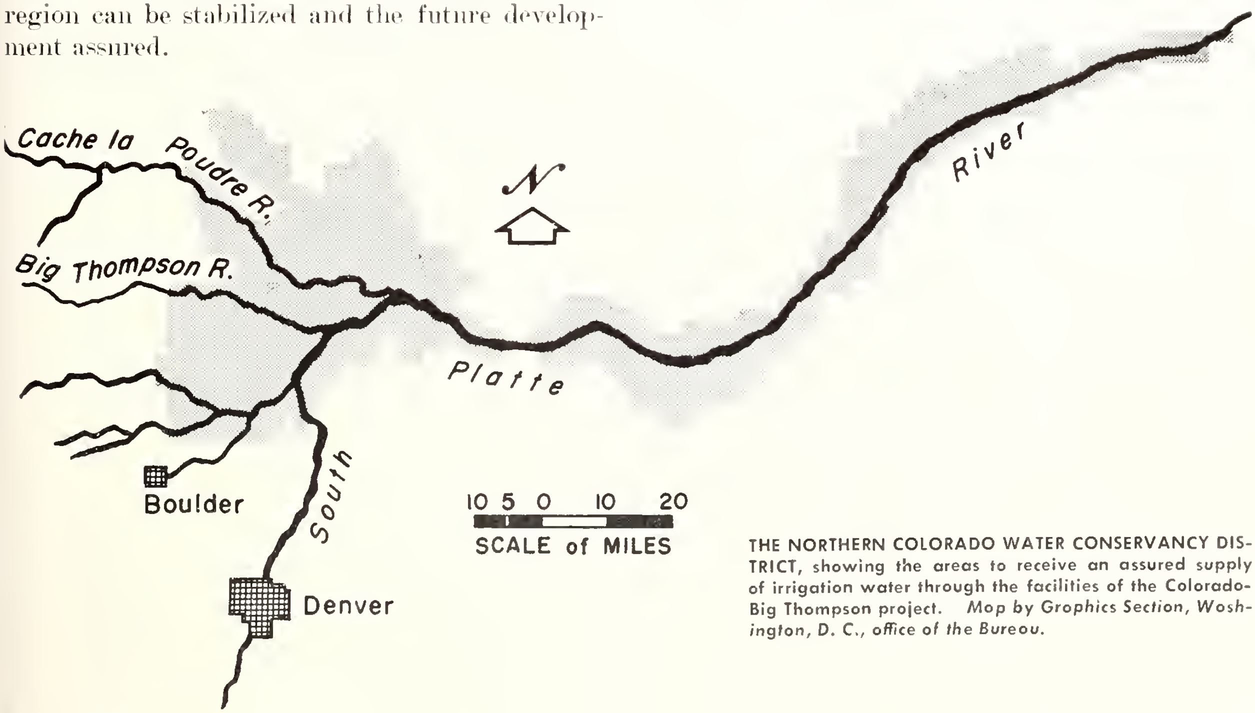
The idea of bringing water from the Colorado River has existed for over 50 years and numerous attempts were made to develop a practicable plan: but the present program was started in August 1933, when a group of men organized the Northern Colorado Water Users Association to determine, once and for all, whether a feasible plan were possible. A modest fund was donated by public-spirited agencies and individuals and a preliminary survey and a report was prepared under direction of R. J. Tipton, consulting engineer of Denver.

Briefly, this report concluded that it was feasible to divert about 300,000 acre-feet of water from the Colorado River and that the irrigation and power benefits would justify the cost.

In April 1934, the report was presented to a meeting of the representatives of the irrigation systems in the area with the result that a committee of 11 was appointed with instructions to use every effort to push the program.

Using the Tipton report as a basis, the plan was presented to our delegation in Congress and to Washington agencies with the result that in January 1935, Secretary Harold L. Ickes allotted $150,000 to the Bureau of Reclamation to conduct a complete survey and report on the feasibility of the proposed project.

(Next Month—Organizing the District)



THE NORTHERN COLORADO WATER CONSERVANCY DISTRICT, showing the areas to receive an assured supply of irrigation water through the facilities of the Colorado-Big Thompson project. *Map by Graphics Section, Washington, D. C., office of the Bureau.*

The Valley of the Milk River

(Continued from page 102)

Fork of the Milk River was completed in 1915 and storage water from Sherburne Lakes Reservoir was diverted to the Milk River in 1917.

When the Utah-Idaho Sugar Co. constructed a beet sugar factory at Chinook in 1925, some of the ranchers and farmers in the area who had been accustomed to irrigate only as a last resort started raising sugar beets, a rather unusual venture in the predominantly dry-farming area. More diversified crops began to make their appearance with the completion of Fresno Dam in 1939, providing facilities for storing water on the project during the winter, and putting an end to the enforced 2 or 3 weeks of delayed planting time in the spring when irrigation farmers had to wait for the ice to melt in Glacier Park and free the water for its journey from Sherburne Lakes to the Milk River project lands.

With the availability of stored water, irrigators on the Milk River project learned the value of improving their farming practices. Rough lands, a meandering river with high river banks, some heavy clay soils which warm up slowly in the spring and puddle and bake readily, require careful irrigation and drainage.

Since 1940, excellent crops of alfalfa, alfalfa seed, sweet clover, and some of the cereal grains have been produced indicating that the land, if properly handled, has a higher potential than past records would indicate.

The native blue joint hay produced on these lands has been a stabilizing influence in Northern Montana for many years, being highly regarded for livestock feeding by the residents of the area. However, the average per-acre yield of native hay is less than 1 ton while alfalfa hay, in 1950, averaged 2.5 tons per acre over the project area and 1.7 tons per acre on the heavier soils. Realizing they have a chance to double their yields, many of the landholders are abandoning their wild-flooding practices, and breaking up the native sod to establish a more profitable type of culture. Hay and forage produced on the project in 1950 totaled 54,000 tons and there were 20,000 acres of pastures, including 6,183 acres of beet tops. Crop census data for 1940 indicated 28,000 tons of hay and forage with 11,000 acres of pastures, showing an increase of practically 100 percent during a 10-year period when grain prices were at an all-time high.

The earlier unstable practice of raising hay and grain for market is gradually being replaced by a program which utilizes all potential feed on the land that produces it. Replacement of soil nutrients through livestock pasturing and feeding, application of commercial fertilizer, and plowing under of green manure crops is gaining more attention as the present program develops. Sugar beets are now the major "cash crop" successfully produced on the Milk River project. Feeding the beet tops to livestock, either by pasturing in the field or feeding in the feed lot, is becoming a common practice, improving income and aiding in retention of soil fertility. Growers are further using beet by-products through purchase of dehydrated pulp from the sugar beet factory at Chinook, Mont.

As the better soils are brought under intensified, diversified irrigation-farming practices, the holders of the heavier soils have become interested in developing new cultural practices on their lands and considerable progress has been made.

Ranchers in the area, who have acquired irrigated tracts, pasture their livestock on their range lands during the summer months but bring them to the valley lands for winter feeding. Thus dryland wheat farming, stock raising and irrigated agriculture are being combined to establish a most desirable type of operation.

These multiple-type operators, as well as many of the operators whose activities are confined entirely to irrigated tracts, are making livestock the basic factor in all their farming activities. The value of tame seeded pastures is gaining recognition in both types of operation and more acres are being utilized for this purpose each year. Further, good pasture mixes do well on some of the heavier soils thus offering another means of securing higher returns from the poorer lands. Although large acreages will undoubtedly be retained for production of native hay, the more highly developed lands will supplement the low yields on that acreage with higher yields and greater per-acre returns.

As the land development program continues, additional acres that have been idle for many years are being brought under irrigation. thus enhancing project income.

Many problems remain to be solved, but the Milk River project is beginning to realize its full potential of productivity.

(Next Month—A Milk River Ranch)

Recreation at Reclamation Reservoirs

Last January the first Federal-State agreement for administration of recreational facilities at one of the man-made lakes created by the Bureau of Reclamation in the Missouri River Basin was signed, turning over the control and maintenance of the reservoir and surrounding land at Bonny Dam to the State Fish and Game Department of Colorado. The agreement which will run for 25 years does not include the dam, caretaker's residence, and grounds. All recreational development by both the Bureau and the State has followed the plan drawn up by the National Park Service and the Fish and Wildlife Service.

A similar agreement was signed in February for State operation of the Heart Butte Reservoir in North Dakota, and an agreement for State operation of the recreational areas at Enders and Medicine Creek Reservoirs and Swanson Lake, the three reservoirs of the Frenchman-Cambridge Division in Nebraska, was awaiting formal confirmation as this issue went to press.

BONNY RECREATION UNDER STATE CONTROL—Signing an agreement for operation of the recreational features of Bonny Reservoir are (from left to right) Colorado's Gov. Dan Thornton, Avery A. Batson, Director of Region 7 for the Bureau of Reclamation, and Cleland N. Feast, Director of the Colorado Game and Fish Commission on January 25, 1952. Scene is the Governor's office, State Capitol Building. *Photo by N. T. Novitt, Region 7 photographer.*

In signing the first agreement for operation of Bonny Dam's recreational area, the Bureau of Reclamation's Regional Director at Denver, Colo., Mr. Avery Batson, pointed out that this is a perfect example of the cooperation that exists between the Federal Government and the States in the Missouri River Basin development. •

Summer Study of Northwest Resources

Oregon State College announces the 4th Institute of Northwest Resources to be held on the campus at Corvallis June 23 to July 5.

The 2-week session is open to all adults interested in conservation and development of natural resources. Three credits at the graduate level may be earned by qualified persons. Those not desiring credit are welcome to register as auditors but pay the regular registration fee.

The 4th Institute will emphasize recreational and forest resources of southwestern Oregon. From June 23 to June 26 members will meet on the Corvallis campus in seminar discussions of natural resources under the leadership of Prof. J. G. Jensen, Associate Prof. R. M. Highsmith, Associate Prof. W. G. Myatt and Asst. Prof. O. H. Heintzelman of the Department of Natural Resources. From June 27 to July 5 opportunity will be provided to observe recreational and forest resources of southwest Oregon, including the spectacular Oregon coast, the Rogue River country, the Redwoods, Klamath Falls, and Crater Lake. The party will travel by roomy sightseeing bus, under personal leadership of Professors Heintzelman and Jensen, with frequent stops for picture-taking and detailed observations in cooperation with local leaders.

Advance reservation is required and must be accompanied by a $30 transportation fee. All other expenses including housing and meals and college registration fee of $21 are paid directly by individuals.

For additional information and a printed folder of information, write to Department of Natural Resources, Oregon State College, Corvallis, Oreg. •

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You'll find the expiration date of your subscription on the address stamped on the back of your copy of the RECLAMATION ERA. If the number at the left-hand side of the address, directly beneath the number and street reads "6–52," for example, the last issue under your subscription will be the 6th month—June—of the year 1952.

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WATER REPORT

OUTLOOK FOR 1952 WATER SUPPLY OF THE WEST

by R. A. WORK, Senior Irrigation Engineer, and CLYDE E. HOUSTON, Irrigation Engineer, both of the Soil Conservation Service, United States Department of Agriculture.

FIFTY YEARS OF ORGANIZED LAND RECLAMATION has brought water and life to the latently fertile desert resulting in a productivity that it had never before known. Water has been the miracle worker in the hands of those who understood it, but its certainty of supply could not be foretold by a distant look at the mountains. Thus from the need to know "how much" came the science of snow surveying, and snow surveyors took their place in the long chain of those who are leading nature to produce a more bountiful harvest.

Snow surveys initiated by the Bureau of Reclamation in the Wyoming headwaters of the Snake in 1919, are the earliest snow surveys initiated by any governmental agency.

Foreknowledge of the water supply means much to the men who are bringing it to the farmers—as well as to the farmers themselves. The days of frosty toil and the hours of calculating snow figures—down through the years since these measurements were first taken—are now culminating in a greater accuracy of summer water supply forecasting at a time when the West needs it the most.

Snow surveyors who made their lonely treks into the frozen watersheds of Western States this winter have done so with pride in the realization that they too are contributing to the development of this great area.

The snow surveyors salute Reclamation with all best wishes on occasion of this Golden Jubilee, and have arranged a record-breaking snow crop for most of the western watersheds contributing to Bureau projects. On many snow courses from Canada to the southwestern United States, from the Pacific to the Rocky Mountains, snow surveyors report "more snow water than ever before measured." Only in southern Arizona and New Mexico does the 10-year drought continue. The following State by State inventory gives a more detailed accounting of irrigation season run-off prospects, as reported to the Soil Conservation Service [1] by the snow surveys.

ARIZONA—prospects for runoff into the reservoirs of the Salt and Verde Rivers are the best in the past 10 years. The watersheds of these rivers now store more water in snow than in any previous year of record. Soils on these watersheds are saturated.

The Verde River reservoirs should fill and spill before the middle of April. By the end of May an additional 150,000 acre-feet will flow past the gauging station at Horseshoe Dam on the Verde.

It is forecast that for April–June, inclusive, 500,000 acre feet of water will pass the gauging station at Roosevelt Dam. This should bring the reservoirs of the Salt River nearly to 90 percent capacity. With favorable weather conditions it is possible that these reservoirs may fill.

The outlook for runoff on the Gila River is not nearly as bright as on the other watersheds of the State. San Carlos reservoir in April first stored water only to about 13 percent of capacity. Runoff may bring this storage to no higher than 15 percent of capacity. Soil moisture conditions are good on the Gila watershed but there is not sufficient snow cover to insure a good runoff.

Runoff into the Little Colorado will be considerably above normal.

Storage in Carl Pleasant dam was at 75 percent of capacity, or about 136,000 acre-feet on April 1. It is possible that runoff may bring this storage to maximum of 150,000 acre-feet. Current irrigation requirements are keeping the storage down. Excluding San Carlos reservoir on the Gila River System, the State will enter the irrigation season with all reservoirs at or near capacity.

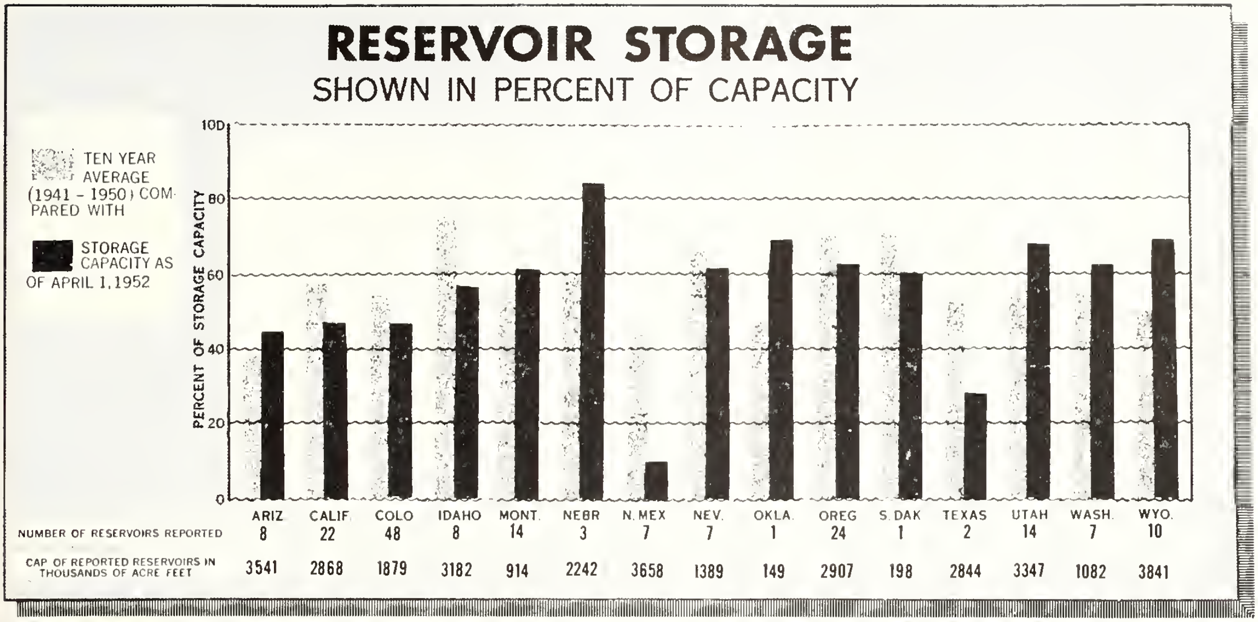
CALIFORNIA—runoff from snow melt in California, as indicated from April 1st snow surveys will be the greatest since snow surveys began 22 years ago. Only on the watershed above Shasta dam, among the major watersheds tributary to Sacramento Valley, is the forecast for less than the 1938 April through July flow. Runoff from the Upper Sacramento River watershed is expected to be about 92 percent of 1938.

On watersheds draining west from the central Sierra (Feather, Yuba, and American Rivers) April–July runoff is expected to be the greatest since 1890.

Sierra streams tributary to the San Joaquin Valley may produce flows that will cause local flooding of low-lying agricultural lands where the tributaries meet the main stem of San Joaquin River.

On the extreme southern watersheds of the Sierra, indicated runoff will be of such proportions that Buena Vista Lake and Tulare Lake basins will be flooded to approximately the same extent as in 1938. However, it is understood that as much as 300,000 acre-feet of space may be

[1] The Division of Irrigation Engineering and Water Conservation is the Federal Coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several Western States, irrigation districts, power companies, and others. The California State Division of Water Resources conducts and coordinates snow surveys in that State, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province.



Most State averages for reported reservoirs are for full 10-year period, but in a few cases reservoirs having shorter records are included. CALIFORNIA—does not include Millerton or Shasta reservoirs which have a combined capacity of 5,020,500 acre-feet, and whose combined storage on April 1st was 4,243,400 acre-feet. COLORADO—does not include John Martin reservoir (capacity 685,000 acre-feet) with April 1st storage of 12,390,000 acre-feet, nor Flathead Lake (capacity 1,791,000 acre-feet) with April 1st storage of 572,300 acre-feet; and Hungry Horse reservoir which stored 68,080 acre-feet on April 1st and will store up to 1,000,000 acre-feet this spring. NEVADA—does not include Lake Mead (capacity 27,217,000 acre-feet) with April 1st storage of 15,691,444 acre-feet. OKLAHOMA—new reservoir in 1945. WASHINGTON—does not include Roosevelt Lake (capacity 5,220,000 acre-feet) with April 1st storage of 1,700,000 acre-feet. WYOMING—does not include Boysen Reservoir with capacity of 820,000 acre-feet and April 1st storage of 152,400 acre-feet. (These are total capacities. The table on page 125 shows active capacity available for irrigation.—Ed.).

made available in partially completed Pine Flat reservoir upstream on King's River. If this should prove the case, in-flow to Tulare Lake could be material reduced.

All major reservoirs fed by Sierra streams are expected to fill before the end of the snow run-off period, even though some have been materially lowered in anticipation of large in-flows to come.

All of the above predictions, in common with those for other States, are based upon the assumption that near-normal temperatures and precipitation will prevail during the April–July period.

Colorado—water content of mountain snow on April 1, 1952, on 90 percent of the courses, exceeds all previous measurements since snow surveys were started in 1936. The summer flow of all streams will be much above normal. The flow of most streams will be higher than for any year since 1936 and the flow of some may set new records. These unusually high flows are expected from the Rio Grande in Colorado, and on the San Juan and Dolores Rivers in southwestern Colorado. The flow of all Colorado River tributaries in Colorado will probably exceed the last highest year which was 1941. The flow of the South Platte, Arkansas and their tributaries will be as high as for any year in the past 10 and may exceed this record if rainfall of normal or greater proportions occurs before or during the snow melt season.

Storage in irrigation reservoirs on the South Platte system is well above average. On the Lower South Platte, irrigation reservoirs are near capacity. On the Arkansas and Rio Grande drainages, storage in irrigation reservoirs is much below average and in many cases reservoirs are almost empty.

Soil moisture conditions over the State are good except in the Arkansas River Valley where soil moisture is fair to poor.

Idaho—all watersheds in Idaho have a heavy snow pack which assures excellent water supplies for irrigation and power generation within the State.

Snow at both high and low levels is well above average. Cool temperatures that have prevailed to date have prevented melt of all snow except that at the very lowest elevations. A few weeks more of cool weather could result in serious high water potentials on the Big Wood, Boise, Big Lost, Payette, Weiser, and Kootenai Rivers. Heavy volume flows are forecast on these rivers assuming normal melt conditions throughout the snow melt season. Several reservoirs have been lowered for maximum use in flood control.

Montana—April 1st snow measurements made over the Upper Missouri and Upper Columbia River basins generally indicate a very good water supply for irrigation this coming season. Snow cover of the Upper Columbia basin in Montana is appreciably above average even though the snow accumulation during March was below average.

However, on the Sun river basin, the water content of the snow is just slightly below normal, although not enough as to promise any serious shortage of later runoff.

Snow cover on the Upper Missouri River is about 140 percent of the past 16-year average.

Reservoir storage throughout Montana is very satisfactory.

Nevada—snow stored water is greater than ever before measured on most of the courses in Nevada. High elevation snow throughout the State is about twice normal, while low snow ranges from three to four times normal.

October through March streamflow along the Humboldt and Eastern Sierra is near normal. In these areas ground water levels are normal or above.

Summer streamflow forecasts throughout the State range from a minimum of 140 percent of normal to a maximum of 307 percent.

Reservoir storage on April 1 was about 60 percent of capacity and 90 percent of the past ten-year average. Storage in Eastern Sierra reservoirs is being decreased to furnish a cushion for the expected high summer flow.

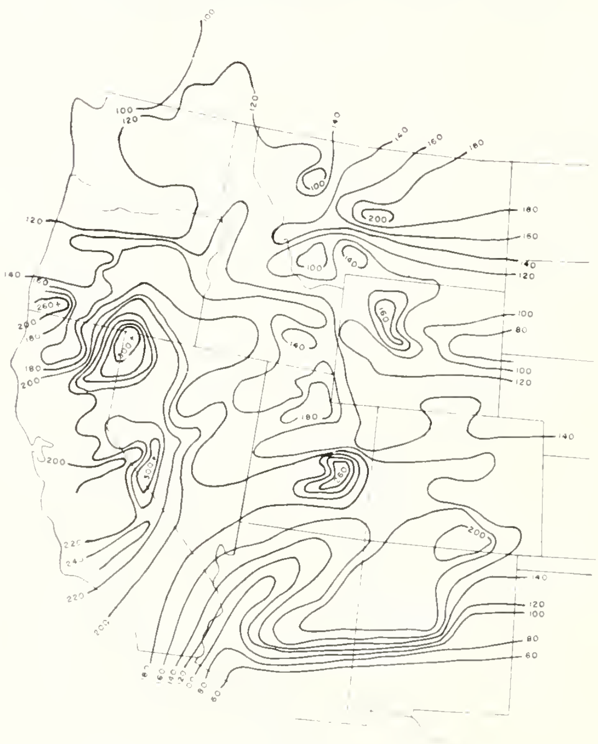
New Mexico—snow accumulation in northern New Mexico is very high near the Colorado-New Mexico line. The amount of snow in respect to normal decreases rapidly to the South. Near Santa Fe and to the west in the Jemez Mountains the snow cover is near normal. Summer stream flow will follow the same general pattern. All Rio Grande reservoirs are practically empty. Residual storage in Elephant Butte reservoir at the end of the coming irrigation season will probably be less than one-half capacity. Soil moisture conditions in valley areas are reported as fair to poor.

Because of the relatively high flow expected for the Rio Grande and its tributaries in San Luis Valley, the probability of extensive flood damage there is rather high. This is particularly true on the Conejos River where some flood damage occurs almost every year.

In view of the preparations that have been made to control the flow of the Rio Grande at Albuquerque, the probability of extreme flood damage will depend upon the strength of the levees. In other less well protected areas along the Rio Grande, damage may be expected.

Oregon—water supplies for 1952, based on mountain snows should be abundant as State-wide snow cover is 168 percent average. Snow cover below 5,000 feet is even greater in relation to average than the higher level snows. Streamflow for the April–September period should break many historical records on the following drainages: Owyhee, John Day, Harney Basin, Deschutes, Crooked, North Umpqua, Main Rogue, Applegate, Illinois, Wiliamson, Sprague, Deep Creek, and Chewaucan Rivers.

Extremes of high water with some record-breaking flows have already been received in many areas but the potential hazard remaining in the present snow cover is great and under adverse melting conditions could easily produce damaging flows in any of the above drainages.



PROSPECTIVE STREAM FLOW
April-September, 1952
Figures are percent of 1941–1950 Average

Reservoirs storage has improved considerably in the past month and is now satisfactory.

South Dakota—snow cover in the Black Hills area of South Dakota is well above normal for this date. Soil moisture conditions are reported as fair to good in irrigated areas. Current storage and prospective runoff is considered to be adequate for irrigation needs.

Utah—all parts of the State have an excellent water supply for the coming summer in snow storage on mountain watershed. Forecast run-off expressed as a percent of the April–September ten year (1941–50) average varies from 125 percent of normal on Ashley Creek in the Uintah Basin to 257 percent on the Price River. Since 55 of 69 snow courses having long time records have equaled or considerably exceeded previous record water content measurements, the great volume of snow water can be expected to produce record or near record peak flows on nearly all streams, with considerable damage to farmlands, homes and other structures in vulnerable areas. Where possible, reservoir storage is being reduced to allow a cushion for peak flows.

Reservoir storage varies considerably over the State. The reservoirs of the Weber-Ogden system held only 16 percent of capacity, having been drawn down so that they can reduce peak streamflows. In the Sevier and Beaver river reservoirs, storage is 42 percent of capacity and 52 percent of the 10-year average, reflecting the low water supplies of the last two years.

Average for all reservoirs in the State is 69 percent of capacity and 124 percent of the 10-year average.

Washington—water supply forecasts in Washington are good to excellent for the 1952 season. Relatively heavy volume flows are expected on the Lower Columbia, Spokane, and Okanogan Rivers. If these large volumes remain in the mountains until late in the snow melt season, damaging high water could result from a rapid snow melt.

The water stored in snow on the mountains in British Columbia, which furnish nearly half the water to the main stem of Columbia River, ranges up to 125 percent of normal on the East Okanogan. The remainder of Columbia Basin in the United States has a heavy snow pack which will contribute to high run-off. The combination of heavy fall precipitation and snow stored water are higher as of April 1st than in any other year of the 17-year period of snow recorded.

Wyoming—the snow water stored in the high watersheds of Western Wyoming varies from 26 to 46 percent above average. An excellent water supply is forecast for the Jackson Hole area and adjacent irrigated land in Idaho. The possibility of damaging high water in the Jackson bottoms if the snow melt run-off is delayed cannot be overlooked.

Snow water measured on the Green River watershed was slightly above normal and is probably the least above normal snow cover in the Rocky Mountain area.

Summer run-off of North Platte river will be very high. April–September flow of the North Platte at Saratoga will probably exceed 1,000,000 acre-feet. Because the available capacity of the North Platte reservoir system as of this date is about one-half of this amount, the whole system will probably spill this year for the first time since the system was completed. The flow of the Laramie River will also be high. Soil moisture conditions on the irrigated areas of the North Platte in eastern Wyoming and Western Nebraska are good.

Snow cover on the Wind River basin in Wyoming averages slightly below normal. Water supplied from this basin is not expected to be as great as during the past two years, but should not be much below normal.

British Columbia—snow situation this year throughout the Province is rather mixed. The possibility of flooding cannot be ignored and will depend upon the temperature and precipitation distribution during the snow melt season. # # #

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet) Active capacity [1]	Mar. 31, 1951	Mar. 31, 1952
Region 1	Baker	Thief Valley	17,400	18,100	(2)
	Bitter Root	Lake Como	34,800	20,000	13,600
	Boise	Anderson Ranch	464,200	329,800	70,300
		Arrowrock	286,500	167,700	19,600
		Cascade	650,000	900	110,800
		Deadwood	161,900	109,100	31,900
		Lake Lowell	169,000	157,600	148,200
	Burnt River	Unity	24,600	15,000	7,200
	Columbia Basin	F. D. Roosevelt	5,220,000	4,749,000	1,070,000
	Deschutes	Crane Prairie	50,000	53,000	47,000
		Wickiup	182,000	188,000	177,000
	Minidoka	American Falls	1,700,000	1,389,200	1,392,200
		Jackson Lake	847,000	459,600	520,000
		Lake Walcott	95,200	89,200	80,000
		Grassy Lake	15,200	13,200	13,200
		Island Park	127,300	115,000	74,800
	Okanogan	Conconully	13,200	7,600	8,400
		Salmon Lake	10,500	10,000	10,100
	Owyhee	Owyhee	715,000	715,000	531,200
	Umatilla	Cold Springs	50,000	50,000	49,600
		McKay	73,800	64,300	44,600
	Vale	Agency Valley	60,000	32,900	38,700
		Warm Springs	191,000	82,600	90,000
	Yakima	Bumping Lake	33,800	5,200	4,800
		Cle Elum	435,700	256,700	258,900
		Kachess	239,000	174,700	184,300
		Keechelus	153,000	65,900	86,100
		Tieton	197,000	106,200	123,100
Region 2	Central Valley	Millerton Lake	500,000	339,400	247,800
		Shasta	4,366,800	3,525,200	3,849,200
	Klamath	Clear Lake	513,300	139,300	156,800
		Gerber	94,300	57,600	26,200
		Upper Klamath Lake	524,800	441,300	323,500
	Orland	East Park	50,600	49,300	48,500
		Stony Gorge	50,000	51,000	48,900
Region 3	Boulder Canyon	Lake Mead	27,207,000	16,806,000	15,691,000
	Davis Dam	Lake Mohave	1,809,800	1,549,700	1,586,500
	Parker Dam Power	Havasu	688,000	605,700	600,900
	Salt River	Bartlett	179,500	6,000	156,000
		Horse Mesa	245,000	136,000	233,000
		Horseshoe	144,000	1,000	118,000
		Mormon Flat	57,800	54,000	52,000
		Roosevelt	1,381,600	5,000	682,000
		Stewart Mountain	69,800	48,000	50,000
Region 4	Fruit Growers	Fruit Growers	4,500	3,000	300
	Humbolt	Rye Patch	179,000	109,100	114,700
	Hyrum	Hyrum	15,300	10,300	10,400
	Mancos	Jackson Gulch	9,800	2,400	800
	Moon Lake	Midview	5,800	5,200	4,500
		Moon Lake	35,800	20,500	22,700
	Newlands	Lahontan	290,900	234,600	146,400
		Lake Tahoe	732,000	592,800	504,000
	Newton	Newton	5,400	5,100	3,500
	Ogden River	Pine View	44,200	10,200	3,200
	Pine River	Vallecito	126,300	27,100	26,600
	Provo River	Deer Creek	149,700	124,100	108,700
	Scofield	Scofield	65,800	32,200	33,800
	Strawberry Valley	Strawberry	270,000	141,500	153,300
	Truckee River Storage	Boca	40,900	19,400	2,700
	Uncompahgre	Taylor Park	106,200	51,100	55,500
	Weber River	Echo	73,900	48,200	13,300
Region 5	W. C. Austin	Altus	145,000	145,000	99,200
	Balmorhea	Lower Parks	5,900	6,600	6,400
	Carlsbad	Alamogordo	131,900	81,800	23,200
		Avalon	6,600	1,100	1,800
		McMillen	38,700	9,800	(2)
	Colorado River	Marshall Ford	810,500	47,100	21,500
	Rio Grande	Caballo	345,900	154,200	78,600
		Elephant Butte	2,197,600	255,200	19,100
	Tucumcari	Conchas	269,100	182,500	108,700
Region 6	Missouri River Basin	Angostura	92,000	32,000	41,000
		Boysen	560,000		152,400
		Heart Butte	68,700	111,900	60,700
	Belle Fourche	Belle Fourche	185,200	94,300	117,800
	Fort Peck	Fort Peck	11,400,000	8,389,200	7,821,500
	Milk River	Fresno	127,200	99,900	145,000
		Nelson	68,800	16,700	37,000
		Sherburne Lakes	66,100	30,500	(2)
	Rapid Valley	Deerfield	15,100	14,100	15,100
	Riverton	Bull Lake	155,000	79,500	61,200
		Pilot Butte	31,600	13,800	13,600
	Shoshone	Buffalo Bill	394,600	269,100	202,300
	Sun River	Gibson	105,000	80,600	66,900
		Pishkun	30,100	18,900	23,000
		Willow Creek	32,400	26,000	25,400
Region 7	Colorado-Big Thompson	Granby	467,600	46,000	201,900
		Green Mountain	146,900	54,800	77,000
		Horsetooth	151,700		68,700
		Shadow Mountain	1,800	1,600	1,400
	Missouri River Basin	Bonny	(2)		33,400
		Cedar Bluff	131,700		97,400
		Enders	36,000	9,100	30,400
		Medicine Creek	35,000	34,100	33,400
	Kendrick	Alcova	190,300	169,500	158,800
		Seminoe	993,200	191,700	502,800
	Mirage Flats	Box Butte	30,600	23,500	31,200
	North Platte	Guernsey	44,200	39,700	34,900
		Lake Alice	11,400	(2)	(2)
		Lake Minatare	60,800	25,400	28,200
		Pathfinder	1,040,500	963,300	937,000

[1] Available for irrigation.

[2] Not reported.

LETTERS

Thank You, Mr. Mercer!

BUREAU OF RECLAMATION,
D. F. C.
Denver 15, Colo., March 4, 1952.

DEAR EDITOR: Please accept my sincere thanks for the very nice writeup of my career which appeared in the February 1952 Reclamation Era. May I also congratulate you on the very fine appearance of the publication from an editorial point of view. Your selection and preparation of material is above reproach.

With kindest personal regards, I am very truly yours,

(S) WILLIAM H. MERCER.

Hail, Columbia!

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK,
NEW YORK 27, N. Y.,
GRADUATE SCHOOL OF BUSINESS,
February 27, 1952.

DEAR MR. STRAUS: Would it be possible to obtain from your Bureau five copies of the August 1951 issue of the Reclamation Era? As you will recall, this issue is devoted to the Central Valley Project of California. I should very much like to assign the various articles in that issue as required reading for my students in my course entitled "The Industries and Resources of the United States."

Since I have more than 40 students in the class, 5 copies of your magazine would give all of these individuals an opportunity to read the articles in the library. Whatever you can do for me will be greatly appreciated.

Sincerely yours,

HERMAN F. OTTE
*Associate Professor,
Economic Geography.*

We are very happy to learn that articles contained in the RECLAMATION ERA are being used as assignments in such a prominent institution as Columbia University.—Ed.

CROPS

RECLAMATION PAYOFF

California's "Sacramento Bee," issue of March 14, 1952, carried the following news item:

"A report of the Modoc County Agriculture Department shows the Tulelake section produced about 40 percent of the total agricultural income of the county both in 1950 and 1951, although it contains less than 12 percent of the total cropland.

"The difference is the Tulelake section is in a reclamation district. Could there be a more striking proof that the investment in reclamation projects pays off handsomely in increased agricultural production and in increased wealth?" ●

Crop Production Reaches New Peak

More than 16 million tons of foodstuffs, forage and fiber crops were harvested in 1951 from irrigated farms served by the Bureau of Reclamation.

The volume as well as the gross value of $654,019,527 established new high records for production from federally irrigated farms. This is the first time the total value of a year's production has gone over the $600 million mark.

While some of the increased value is attributable to higher farm prices it also reflects increased production per acre and additional acreage in cultivation. The 1950 crop was valued at $578,237,709. Total acreage in cultivation in 1951 was 5,410,439 compared with 5,189,463 the previous year. Average per acre value of 1951 production was $120.88 compared with $111.43 in 1950. The figures do not include the value of livestock which is normally an important part of diversified farm production on most family size irrigated farms in the West. Commissioner of Reclamation Michael W. Straus made it plain that the total represents the harvest not only from land receiving a full supply of irrigation water from federally constructed works but also land which receives a supplemental supply from this source. ●

Provo River Crops Worth a Million More Than in 1950

Preliminary crop report estimates from Utah's Provo River project—Region 4—indicate that the gross value of crops grown on that project during 1951 will top the 1950 value by over a million dollars, representing a 38-percent increase. In 1950 the gross value of crops was $2,895,000 while estimates indicate that the 1951 value will be in the neighborhood of $4,000,000.

This tremendous increase in value occurred because of favorable prices and yields in fruit crops, a principal part of the total. ●

FOREIGN ACTIVITIES

The Foreign Activities program of the Bureau of Reclamation continues to grow as the countries of the world realize the importance of water resource development. Assistance to foreign countries is provided without any cost to the Bureau of Reclamation. Since the first of the year Bureau of Reclamation technicians have been on the following foreign assignments:

LEBANON.—The staff for phase 2 of the Litani River project investigation has continued to build up in Lebanon, augmenting the two-man interim staff consisting of Mr. L. J. Snyder and Mr. Ralph Winchell of the Commissioner's office in Washington, D. C., who have been there since September. Now on duty at Litani are Mr. R. F. Herdman, project manager, formerly construction engineer at Yellowtail Dam, Mr. Sumner B. Foster, electrical engineer, from the Division of Design and Construction in Denver, Colo., Mr. Fred A. Houck, in charge of engineering design, also from Design and Construction, Denver, Colo., and Mr. M. R. Lewis, in charge of land use, formerly of the O & M staff in Washington. Lester A. Robb, irrigation engineer from Region 6, David H. M. Strong, engineering inspector, from Region 6, William A. Thompson, geologist from Design and Construction, Denver, Colo., Vern Meissner, materials engineer from Design and Construction, Denver, Colo., Frederick Keay, engineering draftsman from Design and Construction, Denver, Colo., M. R. Parrish, office engineer from Denver, Colo.; R. M. Hougen, electrical engineer from Denver, Colo., and R. F. Kaser, hydrologist from Region 3. The majority of these men have been accompanied by their families and report in glowing terms of the spacious apartments they have rented, the pleasant climate and the picturesque, old world atmosphere encountered in Beirut.

IRAQ.—Assistant Commissioner Wesley R. Nelson resigned in February to take a State Department position in Iraq as a member of the Iraq Development Board. In this position he will have responsibility along with five Iraqi and one British member of the Board to advise the Government on advantageous expenditures of its oil income in order to expand the economy of the country and improve its standard living. Mr. Nelson will be principally ncerned with the river basin development of Iraq in order that its great vers, the Tigris and the Euphrates, ay be applied to its fertile soil. Other nportant features in the control of iver are the elimination of annual disstrous floods and the generation of ydroelectric power for industrial exnsion. Mr. William H. Farmer, acmpanied by his family, also left for aq in March. Mr. Farmer, formerly Yakima, Wash., will advise on irrition practices and procedures in Iraq. n exceptional opportunity exists in aq for improvement of irrigation actices and in application of irrigaon water to prevent lands from becomg water-logged and unproductive cause of increased salinity.

Iran.—Mr. Anthony J. Perry is curntly engaged in a reconnaissance of e hydroelectric potential of Iran. He the forerunner of many more Bureau chnicians whose services have been gently requested in Iran by former ssistant Secretary of the Interior, illiam E. Warne.

Pakistan.—At the request of the chnical Cooperation Administration r a top-flight drainage engineer, Mr. harles R. Meierhofer, head of the oundwater and drainage branch of sign and Construction, Denver, Colo. ft the middle of March for a 30- to 60y detail in Pakistan to make recomendations concerning methods of reoving excess salts from the soil and help solve other problems relating the drainage and reclamation of exnsive areas of once-productive farmnd in Pakistan.

India.—The Central Water and wer Commission of India is one of e foremost irrigation organizations in e world. The exchange of technical ta and the degree of professional unrstanding and respect existing beeen the CWPC and the Bureau of clamation is most cordial. At the quest of the Government of India the chnical Cooperation Administration, rough its Point 4 program, is providg the funds for 6 Bureau of Reclamaon engineers to serve as advisors to e engineering sections of the CWPC. r. Clarence Rawhouser, formerly of e Dams Division in Design and Conuction, Denver, Colo. left in January r New Delhi to serve as advisor to e Dams Design Division of CWPC. r. Paul von der Lippe, formerly of the ructural and Architectural Division of Design and Construction in Denver, Colo., and a veteran of 3 years in Ceylon as advisor to the Ministry of Irrigation on the Gal Oye and other irrigation projects in that country, has gone to New Delhi as structural engineer advisor. Mr. von der Lippe was married during the middle of March in Copenhagen, Denmark, enroute to India. Mr. Clifford L. Mutch, former construction engineer for Bonny Dam, in Colorado, has gone to New Delhi as advisor on construction methods. Scheduled for departure in the near future are advisors on electrical engineering, mechanical engineering and concrete control.

In another field of technical assistance to India, Mr. David S. Stoner, head of Irrigation Operations for Region 2, is undertaking a reconnaissance of the possibilities of an extensive well-drilling program to be carried out in the area of the Ganges Plain and in the vicinity of Madras. It is hoped by means of approximately 2,000 large-capacity wells to increase the food production materially. On farms thus benefited, farmers will be able to raise two crops a year where only one crop would grow without irrigation.

Ethiopia.—Mr. Tom A. Clark and Mr. William H. Greenhaugh, both of Region 4, left early in April to make a reconnaissance and an evaluation of the potential river basin development at the head waters of the Blue Nile in Ethiopia.

Libya.—Mr. Hal. J. Jennings, formerly of Design and Construction in Denver, left early in April as the first member of a team of Bureau personnel which will advise on irrigation methods and undertake land classifications and horticultural advice and recommendations designed to increase the food production with the extremely limited quantities of water available for use in Libya. Libya is the newest country of the world, having been granted its independence from United Nations trusteeship at the beginning of this year.

Chile—Mr. Tom Ahrens, ground-water geologist and Mr. Robert H. Keummich, seismological engineer, both of Design and Construction in Denver, with Mr. Victor Pinneo, drill superintendent of Region 7 in Denver are all in Chile engaged in a program of exploring the ground-water resources of the Rio Elqui Valley.

Israel.—Mr. Harry Bashore, former Commissioner of Reclamation, spent the month of March in Israel as a consultant to that government on irrigation and related water development problems.

Costa Rica.—Mr. William D. Romig, hydrologist from Project Planning in Washington, D. C., and Mr. Darwin H. Jepson, geologist, of Billings, Mont., Region 6, left the United States early in March and are now in western Costa Rica making a study of possibilities for an irrigation development in the Tempisque River valley. Their work should be completed in about 60 days, in order to finish their assignments before the beginning of the rainy season. ●

RELEASES

New Maps Available

The Drafting Section of the Bureau of Reclamation has recently completed five new project maps. They are of the Belle Fourche project in South Dakota, the Grand Valley project in Colorado, the Savage Unit of the Missouri River Basin project in Montana, and the Shoshone project in Wyoming. A single map covering all Federal Reclamation projects in the State of Utah concludes the list.

All maps are in color. The Belle Fourche and Savage Unit maps are available in the small size only (10½" x 17"). The others are available in both small and large (21" x 34") sizes. Requests should be sent to the nearest Regional Director (see list on inside back cover of this issue) specifying name and size of maps desired. Single copies are available free to those who need them in connection with their work or studies. ●

POSTSCRIPTS

CORRECTIONS FOR COLUMBIA BASIN ISSUE

Please correct your April 1952 special Columbia Basin issue of the Reclamation Era as follows: on the full-page map at the beginning of the magazine the map legend for the shaded blocks now read "Irrigation to begin in 1952"—add "1953". On pages 96 and 97, the photo credits designate Ralph Bennett as a Region 1 photographer. Insert "Ephrata Bureau Chief of Wenatchee World." Thank you.

NOTES FOR CONTRACTORS

Contracts Awarded During March 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3567	Missouri River Basin, Nebr.	Mar. 26	One 27,000/36,000-kilovolt-ampere transformer with three 115,000-volt and three 13,800-volt lightning arresters and 1 current transformer for Gering substation.	General Electric Co., Denver, Colo.	$108,111
DS-3597	Missouri River Basin, S. Dak.	Mar. 21	One 12,000-kilovolt-ampere and one 15,000-kilovolt-ampere autotransformer each with 6 lightning arresters for Huron Mount Vernon substations, schedules 1 and 2.	Wagner Electric Corp., St. Louis, Mo.	102,732
DS-3597	do	Mar. 24	One 15,000-kilovolt-ampere and one 7,500-kilovolt-ampere autotransformer each with 6 lightning arresters for Sioux Falls and Watertown substations, schedules 3 and 4.	General Electric Co., Denver, Colo.	94,006
DS-3600	Missouri River Basin, Colo.-Kans.-Nebr.	Mar. 18	High-frequency AM radio equipment for Kansas River district, schedule 1.	American Electroneering Corp., Los Angeles, Calif.	10,300
DS-3607	Central Valley, Calif.	Mar. 11	One 80,000-kilovolt-ampere autotransformer with three lightning arresters for Folsom power plant switchyard.	English Electric Co., Ltd., New York, N. Y.	247,696
DS-3611	Fort Peck, Mont.	Mar. 24	One 750-kilovolt-ampere transformer with three lightning arresters, three 37.5-kilovolt-ampere transformers, and three 121,000-volt and three 9,000-volt lightning arresters for Dawson County substation, schedules 1, 2, and 9.	Electrical and Mechanical Supply Co., Inc., El Paso, Tex.	24,282
DS-3616	Missouri River Basin, Mont.	Mar. 11	Three metal-clad switchgear assemblies for Canyon Ferry power plant, schedule 5.	General Electric Co., Denver, Colo.	69,117
DS-3622	Palisades, Idaho	Mar. 31	160,000 barrels of bulk portland cement for construction of Palisades dam and power plant, schedule 1.	Idaho Portland Cement Co., Inkom, Idaho.	480,000
DC-3634	Columbia Basin, Wash.	Mar. 28	Painting for Grand Coulee Dam, right power plant, and water tank.	F. O. Repine Co., Salem, Oreg.	108,660
DS-3636	Colorado-Big Thompson, Colo.	Mar. 5	One 12-inch butterfly valve with operating mechanism and control system for pump-turbine bypass for Flatiron power and pumping plant.	Columbia Machine Works, Berkeley, Calif.	12,934
DS-3637	do	do	One control for 84-inch butterfly valve for penstock intake at Flatiron power and pumping plant.	Hardinge Mfg. Co., York, Pa.	11,300
DC-3638	Missouri River Basin, Mont.	Mar. 6	Furnishing and installing 1 electric elevator for Canyon Ferry Dam.	Gust. Lagerquist and Sons, Minneapolis, Minn.	33,321
DS-3639	Missouri River Basin, N. Dak.	Mar. 10	Four 5- by 6-foot high-pressure gates with four 140,000-pound hydraulic hoists, 6 conduit linings, and 4 gate hangers for outlet works at Jamestown dam.	Hardie-Tynes Manufactureing Co., Birmingham, Ala.	72,995
DS-3640	do	Mar. 26	Two 2,400-volt motor control equipment assemblies for Lower and Upper Saddle Gap pumping plants.	Ideal Electric and Manufacturing Co., Mansfield, Ohio.	34,178
DS-3642	Missouri River Basin, Mont.	Mar. 10	Steel structures for 115-kilo-volts switchyard at Canyon Ferry power plant.	Creamer and Dunlap, Tulsa. Okla.	26,246
DS-3644	Fort Peck, Mont.	Mar. 11	Two carrier-current relaying transmitter-receiver sets and one lot of unmounted meters, instruments, switches, and line protective and carrier-current relays for Dawson County and Miles City substations, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	15,876
DC-3646 and DC-3647	Missouri River Basin, S. Dak.	Mar. 5	Construction of Flandreau and Beresford substations	D. A. Gill Co., Inc., Sioux Falls, S. Dak.	78,057
DC-3650	Colorado-Big Thompson, Colo.	Mar. 7	Construction of earthwork, canal lining, and structures for Pole Hill Canal, Estes Park-Foothills power aqueduct.	Colorado Constructors, Inc., Denver, Colo.	200,843
DS-3654	do	Mar. 14	Eight bulkhead gates, one bulkhead, and one lifting frame for draft tubes, discharge tubes, and stilling basin at Flatiron power and pumping plant.	Thompson Pipe and Steel Co., Denver, Colo.	13,282
DC-3656	Missouri River Basin, N. Dak.	Mar. 25	Construction of Jamestown Dam	C. F. Lytle Co., Sioux City, Iowa	1,868,862
DC-3657	do	Mar. 24	Construction of earthwork, structures, tunnels, and canal lining for St. Vrain supply canal, schedules 1 and 4.	Winston Bros. Co., Monrovia, Calif.	2,268,292
DC-3657	do	do	Construction of monolithic-concrete siphons for St. Vrain supply canal, schedule 2.	Adler Construction Co., Loveland, Colo.	374,570
DC-3664	Columbia Basin, Wash.	Mar. 25	Terrazzo work in Grand Coulee power plants, pumping plant, machine shop, and dam.	P. Grassi and Co., and American Terrazzo Co., South San Francisco, Calif.	109,844
117C-134	do	Mar. 18	Lot grading, streets, parking areas, sidewalks and curbs, sewerage, water and street lighting systems at Grand Coulee Dam.	George V. Nolte and Co., Bellingham, Wash.	146,941
117C-137	do	Mar. 3	Landscaping O & M Headquarters sites and Ephrata office building, schedules 2, 3, 4, and 5.	Krause Nursery, Spokane, Wash.	18,917
200C-191	Central Valley, Calif.	Mar. 17	Constructing and modifying turnouts, station L-300 to station 4535, Delta-Mendota Canal.	Artis and Griffin, Inc., Bakersfield, Calif.	50,061
200C-193	do	Mar. 19	Constructing cross fences, gates, guard posts, Delta-Mendota Canal.	H. Sykes, Patterson, Calif.	36,991
601C-24	Shoshone, Wyo.	Mar. 7	Buried asphaltic membrane lining, Heart Mountain Canal, station 1332+67 to 1376+45.	Long Construction Co., Inc., Billings, Mont.	18,917
701S-234	Missouri River Basin, Kans.	Mar. 21	Aerial and topographic mapping of reservoir and project lands.	Ryall Engineering Co., Little Rock, Ark.	72,234

Construction and Materials for Which Bids Will Be Requested by July 1952

Project	Description of work or material
Cachuma, Calif.	Construction of 18- by 65-foot concrete Lauro control house and a open 140- by 34-foot concrete pit for control valves; and installation of chlorinating equipment, 36-inch and 48-inch steel pipe, valves, and meters, and 500 feet of 154-inch diameter buried steel pipe for Lauro dam outlet works.
Central Valley, Calif.	Construction of about 14 miles of 340 to 278 cfs capacity main lateral and 20 miles of 85 to 15 cfs capacity sublaterals, near Madera, Calif. All laterals will be earth lined, vary in bottom width from 6 to 20 feet and require appurtenant reinforced concrete structures consisting of drops, checks, road crossings, timber bridges, siphons, and turnouts.
Central Valley, Calif.	Constructing radio reporting rain and snow gages in northern Central Valley drainage area.
Do	Subsurface exploration of Tehama-Colusa Canal.
Colorado-Big Thompson, Colo.	Salida and Gunnison substations located near Salida and Gunnison, Colo., require constructing concrete foundations, erecting steel structures, installing 115-kilovolts switching equipment at Salida substation and electrical equipment, including one 5,000-kilovolt-ampere, 3-phase transformer bank with load ratio control and one 750 kilovolt-ampere, 3-phase transformer at Gunnison substation. Construction of a concrete block shop-garage building at Gunnison.

Construction and Materials for which Bids Will Be Requested by July 1952—(Continued)

Project	Description of work or material
olorado-Big ompson, Colo.	Construction of a temporary switchyard; dismantling of existing wood structures and replacing with steel structures; and reinstallation of electrical equipment, near Kremmling, Colo.
Do	Conversion from 69- to 115-kilovolt construction and addition of overhead ground wire to the Brush-Yuma-Wray transmission line. Present structure spacing is for 115-kilovolt transmission.
Do	Local control, supervisory control, and telemetering equipment for Pole Hill power plant.
olorado River Front Work and Levee System, Nev.-Calif.-Ariz.	Construction of protective works for wild game refuge along Colorado River near Needles, Calif.
olumbia Basin, Wash.	Installation of two 65,000-horsepower, 720,000-gallons-per-minute pumps for Units P5 and P6 in Grand Coulee pumping plant; installation of plumbing fixtures, miscellaneous metalwork, including doors, louvers, handrailing, ladders, grating, and covers; and related electrical installation in Grand Coulee dam, pumping plant, and power plant.
Do	Construction of about 8 miles of 13.2-kilovolt, 3-phase, wood-pole transmission line between Bonneville Power Administration's Ringold substation and Ringold pumping plant, and plants at laterals PE47R and PE51 on Potholes East Canal.
Do	Construction of about 3 miles of 13.2-kilovolt, 3-phase, wood-pole transmission line between Bonneville Power Administration's Quincy substation and Babcock pumping plant, West canal lateral W35.9.
avis Dam, Ariz.-Nev.	Erecting steel structures, installing electrical equipment, and constructing control house at Prescott substation near Prescott, Ariz.
Do	Three 161-kilovolt disconnecting switches for Buckeye substation.
Do	Five 115-kilovolt oil circuit breakers and fourteen 115-kilovolt disconnecting switches for Oracle substation.
Do	One 8,000/10,000-kilovolt-ampere unit substation and one 115-kilovolt disconnecting switch for ED-4 substation.
Do	One 8,000/10,000-kilovolt-ampere unit substation and one 115-kilovolt disconnecting switch for Maricopa substation.
den, Wyo	Construction of Little Sandy diversion dam on Little Sandy Creek 40 miles above confluence with Big Sandy Creek near Farson, Wyo. The dam includes a 70-foot long, 4-foot high rock weir, 225 feet of earth dike, 0.5 mile of 150 cubic feet per second canal, and canal headworks structure.
klutna, Alaska.	Two transformer and two governor and lubricating oil storage tanks for Eklutna power plant.
Do	Two generator protective equipment cubicles, including lightning arresters and capacitors, for surge protection at Eklutna power plant.
Do	One 6.6 delta to 12.47-kilovolt grounded wye, 750-kilovolt-ampere power transformer for Eklutna power plant.
rand Valley, Colo.	Construction of concrete cutoff and rock chute at Badger Wash, Book Cliffs soil and moisture conservation area, 20 miles northwest of Grand Junction, Colo.
Missouri River Basin, Nebr.	Construction of 7,500-kilovolt-ampere Ogallala substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the government; and erection of a 16- by 20-foot control house. The substation is to have one 7,500-kilovolt-ampere, 3-phase transformer, one 115-kilovolt bay, and three 34.5-kilovolt bays.
Do	Construction of 10,000-kilovolt Chadron substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the government. The substation is to have three 3,333-kilovolt-ampere transformers, one 115-kilovolt bay, and two 34.5-kilovolt bays.
Missouri River Basin, N. Dak.	Construction of three Central North Dakota radio stations for the operation and maintenance of power facilities soon to be placed in full operation.
Missouri River Basin, Wyo.	Construction of about 3,500 feet of 34.5-kilovolt, 3-phase, single circuit and 4.16-kilovolt, 3-phase, double circuit, 60-cycle, wood-pole transmission line from switchyard at Boysen power plant to the vicinity of the existing construction substation, and about 1,000 feet of 34.5-kilovolt single circuit river crossing in the vicinity of Boysen dam.
Parker Dam Power, Ariz.-Calif.	Construction of four-room school building, 4,500 square feet in area, at Parker Dam Government camp.
Riverton, Wyo.	Construction of a permanent check near Wyoming tunnel, construction of Wyoming lateral structures and Cottonwood drains.
San Diego Aqueduct, Calif.	The San Diego aqueduct's second pipe line is to be parallel to the present aqueduct between San Jacinto regulating reservoir, near Hemet, Calif., and the San Vicente reservoir near San Diego. This contract for the northern 31 miles of 95 cfs capacity line requires furnishing and laying 9 miles of 75-inch diameter, 14.4 miles of 60-inch diameter, and 8.5 miles of 48-inch diameter precast, concrete pressure pipe, and constructing vent structures, manholo, and blowoff structures. The 75-inch diameter pipe is to be non-cylinder, and the 60- and 48-inch, non-cylinder and cylinder.

OUR BACK COVER and the maps on pages 101 and 106 are based upon a photograph of a relief model of the United States by Raisz and Brown, reproduced with the permission of the copyright owners, Kittredge and Coolidge.

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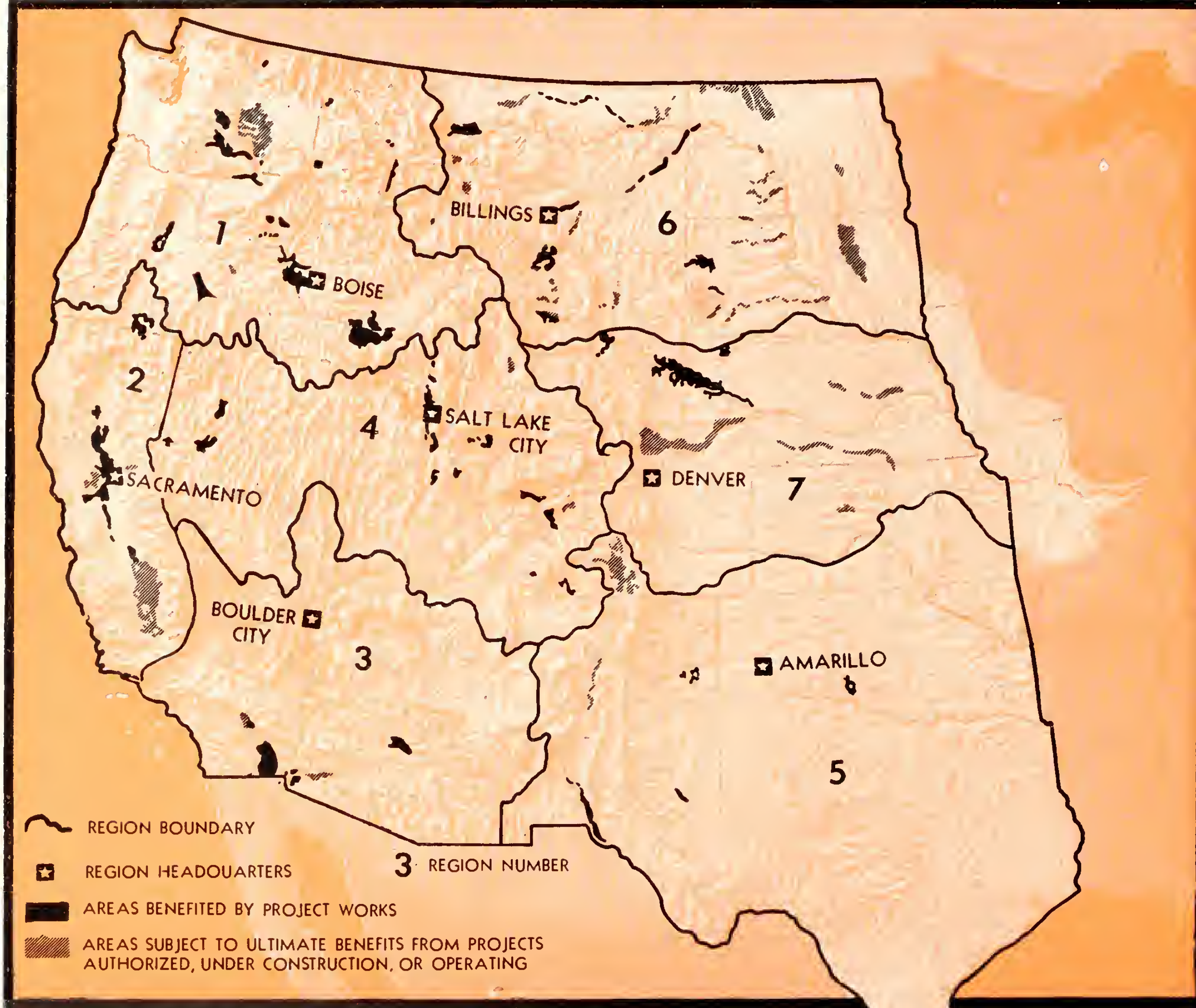

THE RECLAMATION AREA

The Reclamation ERA

June

1952

Official Publication of the Bureau of Reclamation

The Reclamation ERA

June 1952

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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

Reclamation's Golden Jubilee

June 17, 1902, to June 17, 1952

FIFTY YEARS AGO, the then President of the United States of America, Theodore Roosevelt, signed the Reclamation Act of June 17, 1902. So far as we can determine, there were no photographs of President Roosevelt actually signing the act. The photo on the cover was, however, taken in 1902—the occasion was the signing of the Thanksgiving proclamation, appropriate enough in spirit for the many celebrations now in progress by westerners benefited through the developments of the past 50 years. The Grand Coulee commemorative stamp went on sale on May 15, 1952, as part of the Columbia Basin celebration of Reclamation's Golden Jubilee Year.

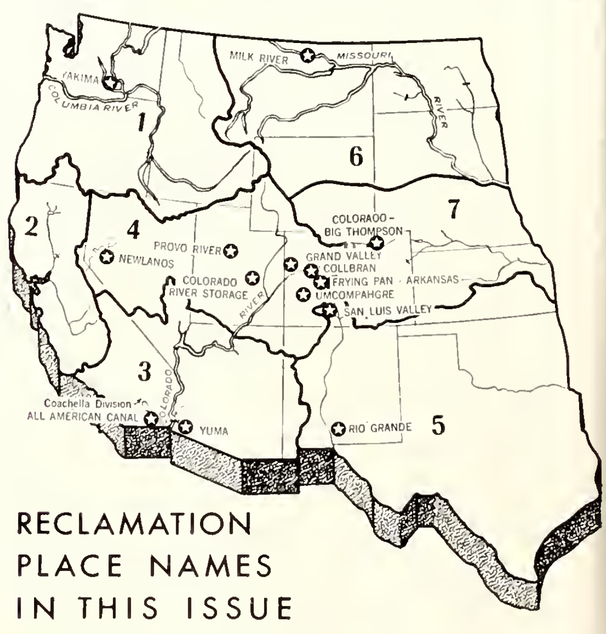
35 YEARS AGO IN THE ERA

MORE FOOD FOR OUR ALLIES

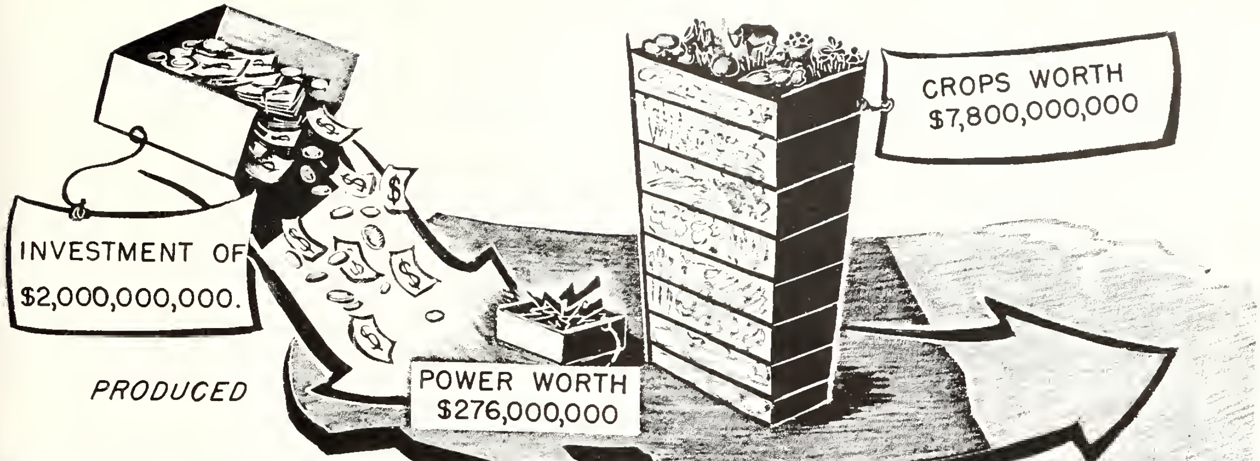
America's first great duty in the present conflict is to help feed her allies. The devastation of war has coincided with a period of low crop production the world over due to natural causes. Serious shortages exist or are threatened.

Now is the time for the Government reclamation projects to justify themselves. What matters a few dollars in costs here and there if a million otherwise barren acres are brought into active service against the terrible submarine; if 10,000,000 bushels of grain, 2,000,000 tons of forage, and 4,000,000 bushels of vegetables are added to the channels of food supply from newly created sources?

(From page 258 of the June 1917 issue of the Reclamation Record, predecessor to the Reclamation Era.)



RECLAMATION PLACE NAMES IN THIS ISSUE



Reclamation Returns—1902-1952

A Report to the Stockholders on a Fifty-Year Investment

ON JUNE 17, 1902, FIFTY YEARS AGO, President Theodore Roosevelt signed the Reclamation Act, and the people of the United States and their Government embarked on a partnership venture for "the development of waters for the reclamation of arid and semiarid lands" in the West.

Under the initial Reclamation Act, a Reclamation Fund was set up to finance the necessary construction and operation of these water resource development projects, using the receipts from the sale and disposal of public lands. In later years, other funds have been invested, until in Reclamation's Golden Jubilee Year 1952, the Reclamation investment amounts to a little over 2 billion dollars.

In this, and subsequent issues of the Reclamation Era throughout the Golden Jubilee Year, we shall report how this investment has turned out. "The people interested are entitled to know the facts," said the late Senator Thomas H. Carter of Montana, Chairman of the United States Senate Committee on Irrigation and Reclamation of Arid Lands, on March 3, 1911. With this thought in mind, we report the following status of the Reclamation investment as of June 1952.

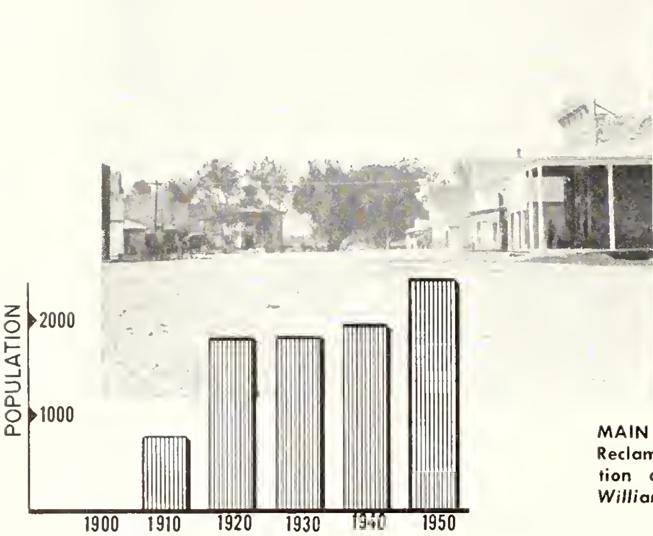
After half a century of teamwork in handling western water resources, the people of the West have raised 7.8 billion dollars worth of food and fiber on projects served by water provided through the Reclamation program. Since March 1906 when the first hydroelectric power was generated on a Reclamation project at a temporary plant on Arizona's Salt River project, 276,706,000 dollars worth of hydroelectric power has been produced at plants built and operated by the Bureau.

Federal taxes paid by the beneficiaries of Reclamation projects are now estimated to aggregate over 2.5 billion dollars—more than the combined construction costs for all Reclamation features, which include more than 125,000 family-sized farms representing more than 6¼ million irrigable acres to which either supplemental or full water service has been extended though Bureau-built works.

The first five projects were authorized in March 1903, less than a year after the Reclamation Act was signed. These were the Salt River project in Arizona; the Truckee-Carson project in Nevada; the Uncompahgre project in Colorado; the North Platte project in Nebraska and Wyoming, and the Milk River project in Montana.

Fittingly, on the next page, we inaugurate our Golden Jubilee year with a report on the first Reclamation project to receive water as a result of Federal participation in western water resource development.

1903



1952

MAIN STREET—FALLON, NEV., as it appeared in 1903, 1 year after the Reclamation Act was signed, and as it appears after 47 years of irrigation development. ***Both photos submitted through the courtesy of Williams-McNish, Fallon, Nev., photographers.***

NEWLANDS—First in Service

More than 5 million dollars a year—from a desert area once completely barren and considered absolutely worthless.

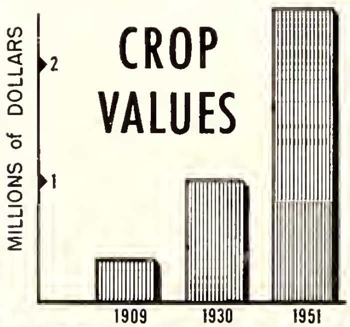
Not a gold strike, nor an oil boom. Farmers and ranchers on the Newlands (formerly Truckee-Carson) project in Nevada earned that amount in 1950, according to the Fallon Standard, Churchill County Nevada's weekly newspaper.

They tapped water—the first to flow on western lands as a result of Government investment, construction, and participation in the Federal Reclamation program.

In 1919, this project, first called Truckee-Carson, was renamed Newlands, in honor of the late Senator Francis G. Newlands of Nevada, known as the father of the act which made the project possible.

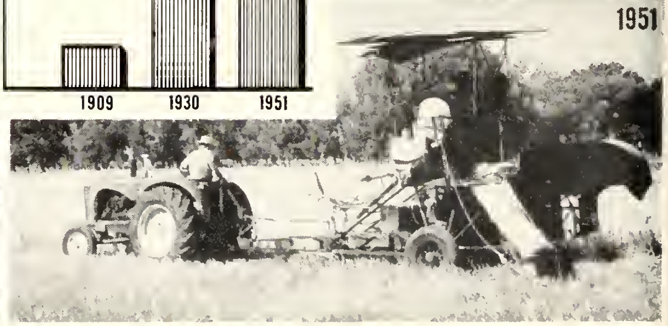
Since April 1905 when the first water, caught behind a Reclamation-built diversion dam on the Truckee River, flowed through canals to the waiting dry lands of the project, water users have produced crops worth $56,845,526. Crops alone do not tell the whole story of the return on the Newlands investment. Of the 5 million dollars of farm income earned in 1950, only $2,053,000 was derived from the sale of crops. The remainder

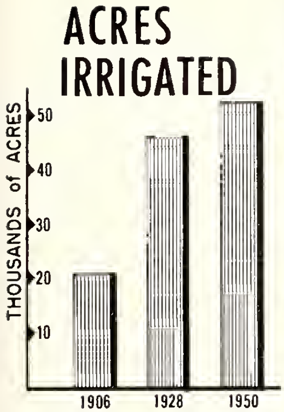
1912



WORTH $335,000 according to the first crop report in 1909; 21 years later crops were valued at $1,000,900, and 42 years later, $2,456,000. At left, harvesting sugar beets on the Wheeler homestead in 1912 or 1913. Below, harvesting oats at J. A. Williams Ranch (*Photo by Williams-McNish*).

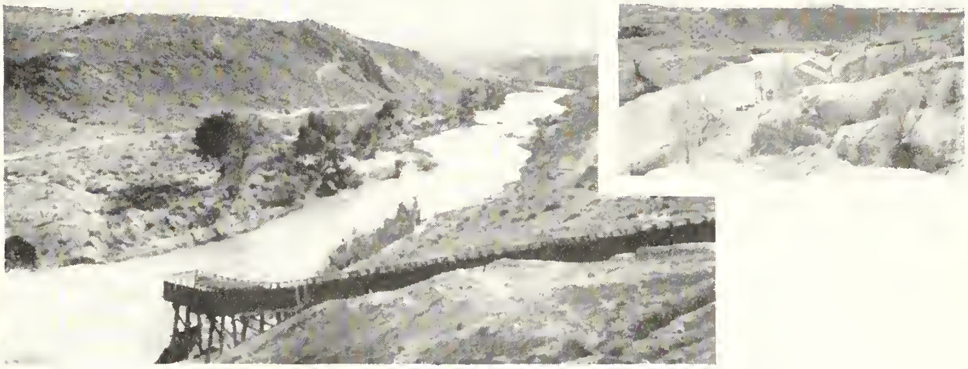
1951





1908

1952



CONCRETE REPLACED WOODEN STRUCTURES. The number of irrigated acres increased from 20,784 in 1906, to 46,085 in 1928 and 58,893 in 1950. At left the old wooden chute from Truckee Canal *(photo by S. R. Marean)*. Inset, Lahontan Dam and Power Plant. *Photo by H. Smith Richards, Region 4 engineer.*

came from the sale of livestock and livestock products. In other words, for every dollar's worth of crops, Newlands project farmers and ranchers earn almost a dollar and a half from their dairy and beef cattle, sheep, hogs, poultry, milk, butter, and eggs.

Livestock from many western ranches is shipped to Newlands to be topped off on the rich, green alfalfa and other feed and pasture of the project. The project is the most productive area of Churchill County, ideal for livestock raising, due to the mild winters, year-round pasture and tuberculosis-free climate.

Water users of the Newlands project have also paid direct to the Government, in cash, more than three-fourths of the amount charged them for Reclamation construction in accordance with Reclamation Law. They have never been behind on their installments of the $3,281,999.35 reimbursable cost. In actual figures they have repaid $2,478,893.07.

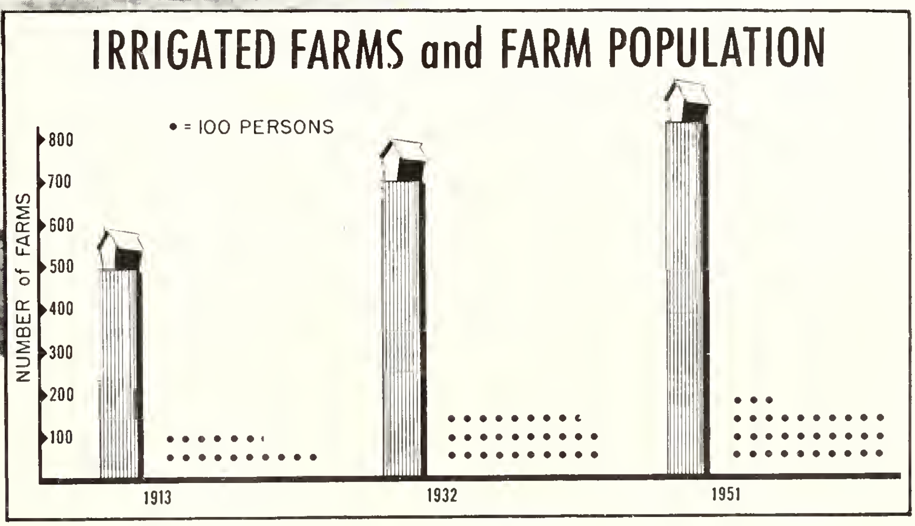
In 1927 the Truckee-Carson Irrigation District, then being financially and technically qualified to operate and maintain the project, took over the works. Today, the Bureau of Reclamation serves as a legal, technological, and financial adviser, standing by to render assistance when necessary.

In dollars and cents, Newlands can be considered a sound investment. As a pioneer project, it also paid off in "know-how," as lessons learned at New-

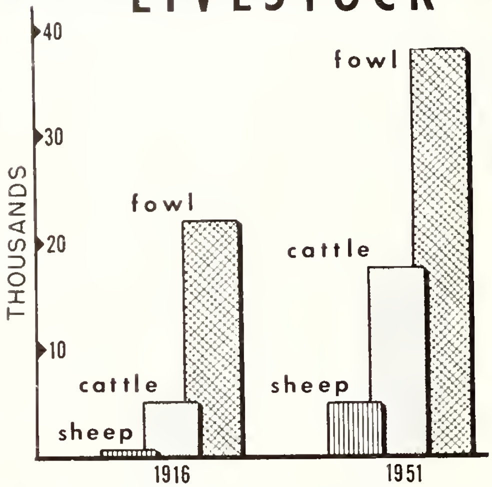
1905

1952

FAMILY-SIZED FARMS—In 1913, only 494 farms and 1,635 people on the project. By 1932, 700 farms and 2,883 people, and in 1951 about 3,300 people and 838 farms. The Old Oar Ranch near Leeteville about 1905, and the same place (now the Ken L. Ogden Ranch) today.



LIVESTOCK



THE BIG SUCCESS STORY AT NEWLANDS—The first livestock census to include dairy and beef cattle in 1916, shows 4,633 cattle, 191 sheep and 22,024 fowl and turkeys; for 1951, 17,668 cattle, 4,968 sheep and 37,864 fowl and turkeys. *Early scene at Thomas Dolf Ranch photographed by S. R. Marean. Newlands feed yard in 1951 photographed by Williams-McNish.*

lands and other early projects benefited many projects which followed.

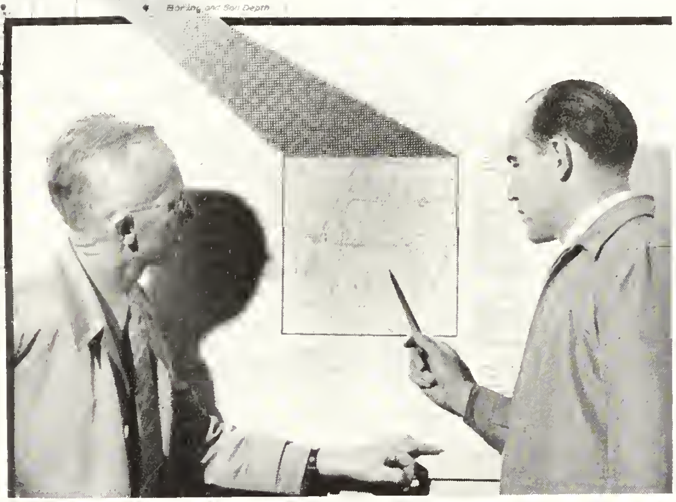
A man who ought to know, Stanley R. Marean, who served Reclamation so well for 26 years that he was given a Meritorious Service Award in 1949, points out that the Newlands project had all of the problems encountered by most of the other early Reclamation ventures. Marean moved to Fallon and began working on the project on April 10, 1906. He was the first full-time watermaster in 1907, and when the Government turned the project over to the water users in 1927 he worked for them as hydrographer, watermaster, and general trouble shooter until 1934. After working on the Humboldt, Nev., and Minidoka, Idaho, projects, he retired voluntarily in 1949 and now lives in Reno, Nev. Marean explains that the early project leaders bumped into many problems without the benefit of previous experience, but overcame most of the major ones.

Public lands in the Truckee and Carson River watersheds were withdrawn from all forms of public entry immediately after the Reclamation Act was passed in 1902 thus preventing speculation on land grants. However, as on most other projects at that time, homesteaders could purchase the right to gain title on from 40 to 160 acres of land for a filing fee of from $8 to $32. No previous farming experience, cash reserves, livestock, or equipment were necessary. As a result of the experience gained from the bitter disappointments in the Newlands and other early projects, Reclamation Law has been amended so that those who embark upon the adventure of transforming raw desert or sagebrush land into productive family sized farms have the necessary prerequisites for success: farming experience, and enough cash to get off to a good start. In certain cases, some of the assets may be in livestock and equipment useful in developing an irrigated farm.

The new settlers were eager to get the new land into production, and stripped huge areas of its desert vegetation. The lands became seriously eroded. Some parts of the project resembled a dust-bowl. Farmers often had to replant crops three or four times in a season and ditches were sometimes blown full of sand overnight. Careful land preparation and conservation practices have been developed to eliminate such conditions through the years.

Land classification was in its infancy when the Newlands project was being developed. Many farms were abandoned due to the existence of alkali in some areas. Even now, some of the best

(Please turn to page 154)



THEN AND NOW—TEN TO ONE.—The map at left, made in 1915, covers 10 square miles, and furnishes information only on the soils in the area. Below, the authors (Poulson at left, Swarner at right) look at a modern land classification map on which detailed information on one square mile is charted. *Photo by Phil Merritt, Region 1 photographer. Map from the Special Report on the Silver Lake project, Lahontan Basin, by the Reclamation Service in 1915.*

THE EVOLUTION OF LAND CLASSIFICATION

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Boise, Idaho, Region 1

Part five in a series of articles on soils and land classification

WHAT CAN THE LAND PRODUCE? This question has always been the chief concern of man. Even as a hunter and nomad, we suspect, long before he began to domesticate animals and till the soil, he had his difficulties in correctly evaluating land resources. But no doubt his headaches became more acute and lasting as he gave up or was forced to give up his more nomadic life in quest of game, fruits, and seeds and began planting crops, becoming more directly dependent on the soil for his livelihood. From observation he probably had gained a good knowledge of where natural vegetation thrived and game was most abundant. Such sites were natural settings for his home and his cultivated crops. In time, as his family tree expanded and his holdings grew, he learned the broad uses of the better soils and the limitations of the inferior ones. Thus in this primitive environment began the first inventory of soil resources, a practice which still continues and which, with its more sophisticated scientific terminology and techniques, is known as land classification.

The pioneers who first gazed upon the high mountains, the vast plains and valleys of the West were guided in their land selection by the undisturbed trees of the mountains and valleys, the ungrazed, unplowed grasslands of the plains, and the sparse shrubs of the desert, but few scrutinized the characteristics of the soils supporting this growth. As early as 1861 the Mormons, who pioneered in irrigation in the West, sent a party from Salt Lake City into the Uintah Basin to determine the feasibility and desirability of irrigating those lands. The contrast between this area and the fertile valleys that they were already farming led them to discourage development of the new section.

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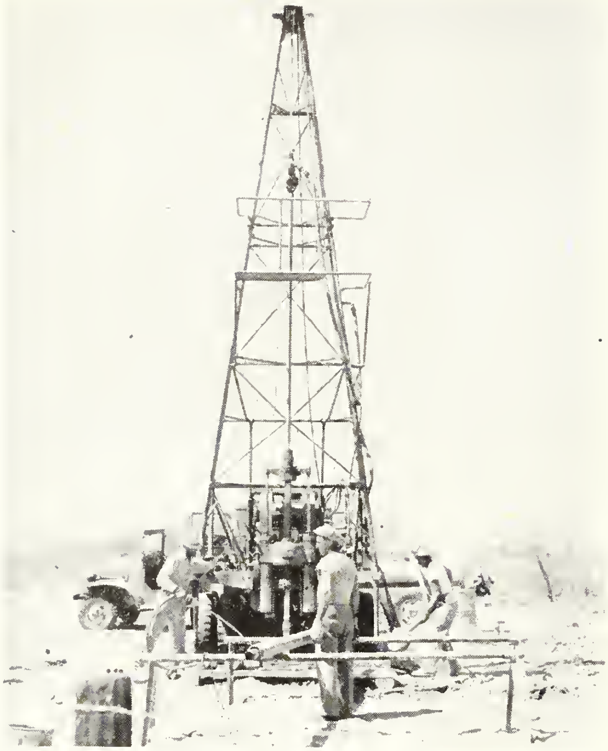


THE PROBE—At top, the hydraulic rotary drill and coring rig used to extract samples and dig observation wells at 42 sites in Coachella. Below, a Coachella Valley County Water District employee installs a piezometer by means of the jetting process. *Top photo submitted through the courtesy of the United States Salinity Laboratory, Riverside, Calif.*

Coachella Drainage Investigations

Part 2

Investigating the Underground

by J. S. REGER, Hydraulic Engineer, Region 3

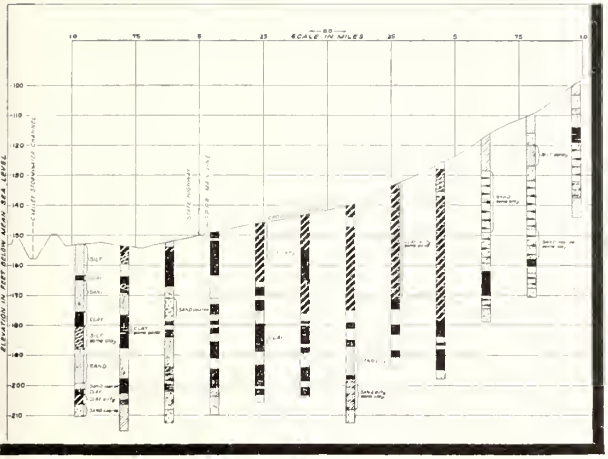
EDITOR'S NOTE: In part one of this series, the people of the valuable Coachella Valley, who had been pumping water from a dwindling underground water supply, are about to receive an additional supply carried from the Colorado River through the Coachella Branch of the All-American Canal and piped to 78,500 acres in the Coachella Valley. Mindful of the dangers of waterlogging, they form a four-way organization known as the Coachella Valley Cooperative Drainage Investigations in 1945 to prevent and combat future drainage difficulties.

INFORMATION ON THE UNDERGROUND WATER in the Coachella Valley is not too easy to get.

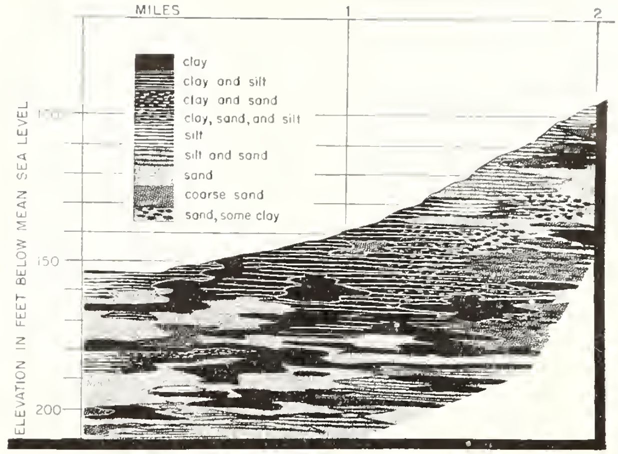
Drainage investigations are not new to the valley, but the idea of starting a drainage investigation before the problem becomes acute is almost, if not entirely, unique in the history of irrigation in the Western States.

The first job of the investigators was to find out what the underground floor of the valley looked like, and where the water was. There were no adequate data on the materials underlying the valley, the location and extent of all ground water bodies, the type of water body, position and slope of the water table, variations in pressure heads, seasonal fluctuations of the water table and ground-water quality.

From what they knew about the characteristics of the Coachella Valley, the investigators decided that nothing short of a detailed study of all physical conditions affecting drainage would do the job. Millions of years ago the area had been tossed and turned, flooded and burned dry. After the valley had settled down, the winds blew for centuries, lakes and rivers came and went. Like other desert fill areas, the strata are very irregular in distribu-



THE LOGS—A typical profile of logs obtained by the jetting rig in Coachella, showing variations in strata.



THE UNDERGROUND—A typical cross-section of the Coachella Valley. *Drawing by Shirley Briggs, Washington, D. C.*

tion and thickness, similar to glacial drift. The underground could not be charted like areas with a different geological history, where the strata lie in more or less orderly layers.

After studying all the data and information available, the technicians on the drainage investigating committee decided to sink some small observation wells in strategic spots in an attempt to probe the underground and force it to give up some of its secrets. They carefully located 42 sites along a 2-mile "grid" (or charted area) and with the aid of a hydraulic rotary drilling rig supplied by the Bureau of Reclamation, started drilling the wells in March 1948. Three employees of the Coachella Valley Water District and a four-man crew and driller from the Bureau drilled, cored and completed the 42 wells in 43 working days. The holes were 6 inches in diameter, averaging 80 feet deep, although depths varied from 40 to 110 feet below the surface. As each hole was drilled, a core-barrel attachment removed cylinders of the subsurface material, each one a sample of the condition of the underground as far down as the well penetrated. A 2-inch inside diameter casing, or pipe, perforated with ¼-inch holes at the lower 5 feet, and in some cases the lower 10 feet, was inserted in each drilled hole and packed with gravel for the entire depth.

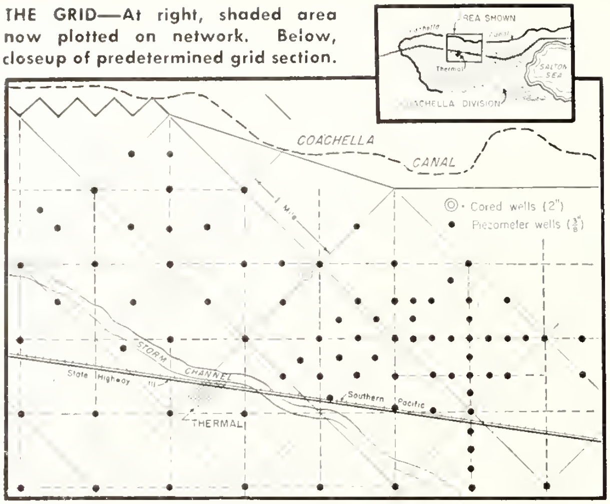
The 600 or so samples taken from the drill holes were analyzed and a sample log, or description of each well supplementing the notes taken by the driller, was added to the information available to the investigating committee. By June 1948 the first ground water observations had been obtained from these wells.

As had been suspected, there was no uniformity, or shred of similarity between the situations unearthed by any of the wells. Underground conditions might be entirely different 100 feet away from a well in any direction. The investigators would need hundreds of wells of varying depths to get enough information to help solve the problem.

Any known method of drilling such a large number of observation wells would be too expensive, even for the worth-while purposes of the investigations. The cooperating engineers, however, remembered using piezometers, slim (three-eighths inch in diameter) jetted self-casing wells for groundwater obvervations. As the only drawback was the lack of a portable rig for large scale operations, the engineers got together, and designed and constructed a light weight, mobile rig by the summer of 1948. Those who are interested in the technical details of this operation are referred to the article entitled, "Techniques for Drainage Investigations in Coachella Valley, Calif.," by J. S. Reger, resident drainage engineer of the investigation; A. F. Pillsbury, associate professor of irrigation, University of California; and R. C. Reeve and R. K. Petersen, associate agricultural engineers, Regional Salinity and Rubidoux Laboratories, U. S. Department of Agriculture, in Agricultural Engineering, Vol. 31, No. 11, pp. 559–564, November 1950.

The rig, which includes a water tank and pump to supply the jetting pressure, is towed by a specially equipped four-wheel-drive truck—a necessity for traveling over the seemingly impossible desert terrain.

THE GRID—At right, shaded area now plotted on network. Below, closeup of predetermined grid section.



The jetting method of drilling and casing small diameter observation wells is simple and inexpensive. New techniques developed during the course of the Coachella Investigations have overcome many former obstacles and have resulted in several improvements in the jetting method.

Two men can operate the easy-to-handle jetting operation. They attach the 3/8-inch pipes, or piezometers, to the water tank hose, set the pipe upright on the designated well-site, turn on the water pressure, and as one man takes his notebook or drilling log and jots down a report on the oozed-out substrata as the piezometer drills downward, another uses the operating handle to force the pipe through tough materials which otherwise might not be penetrated. Believe it or not, this operating handle also aids the driller in logging the materials encountered—an experienced operator can tell by the "feel" of the handle whether the piezometer is jetting through silt, clay or sand, and whether it is coarse or silty. An innovation by the cooperating engineers at Coachella is a "self-measuring" device—a revolving tape which measures the depth below the surface to which the drill pipe has penetrated, making it possible to record changes in the underground strata within about an inch—or one-tenth of a foot. They also "grease" the pipe with a commercial drilling "mud" which helps to penetrate coarse materials and keep the drilling water flowing evenly to the surface along with the "effluent" or ejected material. Thus the jetted piezometers, as they are installed, furnish valuable and necessary information on the subsurface conditions which have so much to do with the way the water behaves under the surface. They continue their usefulness by remaining in place as multiple-purpose ground water observation wells.

The investigators left nothing to chance. They tested this newly acquired substrata detecting ability of the piezometers by training a two-man crew, familiar with the method of drilling wells by the jetting process, in methods of accurately logging the encountered subsurface material. Here again, the importance of planning a program paid off in dollars and cents. Without their knowledge, the two crew members were subjected to a test probably unheard of in drainage engineering research. They were sent to drill wells, by means of jetting process, at locations within 10 feet or less of the larger wells which had been drilled and cored by means of the hydraulic rotary drilling rig. The crew spent months of hard work in the field, often during summer temperatures exceeding 120°. When their drill logs and field estimates were compared with the laboratory analyses of the core samples from the first 42 rotary-drilled wells, the investigators were satisfied that the jetting process of drilling wells was accurate enough for detailed drainage investigation purposes.

(Next Month—Using the Evidence)

Dana Templin Passes

Dana Templin, veteran Reclamationist and former Superintendent of the Minidoka project, Idaho, passed away on July 29, 1951. Mr. Templin joined the Bureau of Reclamation as a Junior Engineer at Burley, Idaho, then headquarters of the Minidoka project, in 1908. He worked on this project continuously until his retirement in 1939, probably a record for length of service by a Bureau employee on a single project.

Mr. Templin was a native of Kokomo, Ind., and received his degree in Civil Engineering from the University of Kansas in 1893. He is survived by two sons, Neal S., and Ernest H., and a grandson.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

EARLY-DAY PIONEERS' descendants dedicate the oldest continuously used ditch in Colorado. At left, A. J. Hamman of Colorado A&M College; Delfino Salazar, direct descendant of one of original locators of ditch; Dr. Charles A. Lory and Dr. William E. Morgan, President Emeritus and President, respectively, of Colorado A&M. (Note old plow and yoke used to dig first ditch.)

COLORADO'S 100 YEARS OF IRRIGATION

by CLIFFORD H. STONE

Director of the Colorado Water Conservation Board

Denver, Colorado

Colorado's Irrigation Centennial was observed on April 8, 9, and 10, 1952.

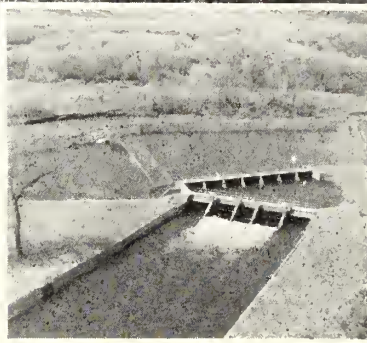
A monument, carrying an appropriate plaque, was placed at the headgate of the San Luis People's Ditch in the San Luis Valley. This ditch has a priority date, the oldest in Colorado, of April 10, 1852, and it has been in continuous use since that time.

With the exception of one farm, all of the land irrigated by this ditch is now operated by direct descendents of the men who built it 100 years ago. The Spaniards who located this ditch brought with them the legal concept of the appropriation of water for agricultural purposes in arid regions. This influence, together with other factors, gave birth in Colorado to the priority of appropriation doctrine of water law. They, and settlers in other parts of the State, initiated a system of water law which is now expressed in the constitution and statutes of the State.

The John Hatcher Ditch on the Purgatoire River, a tributary of the Arkansas River, was constructed in 1846, but, because of the troubles which these early irrigators had with the Indians, it was only intermittently used prior to the early 1860's. Other water diversions from the Arkansas River in Colorado were made near Fort Bent in 1832, but were used only a few years. In 1841 water was diverted from the Arkansas River for irrigation of land near the present site of Pueblo, Colo. These diversions were abandoned in 1854.

These earliest irrigators, and those who came to Colorado during the next three decades, were able to construct by individual effort the ditches which were the least expensive and easiest to build. Then came a period when farmers banded together through associations and ditch companies to construct larger structures, the cost of which was beyond the financial ability of individual farmers. During this latter period irrigation had its greatest expansion in Colorado.

The Federal Reclamation Act of 1902 initiated the present era of water development in Colorado. This era typifies a third period when it is recog-



PRESENT-DAY PROJECTS in Colorado. Above, irrigated orchards of the Grand Valley project. At upper right, Vallecito Dam and Reservoir of Pine River project. At lower right, modern headworks of the Rio Grande Canal, San Luis Valley, with its electrically operated, automatically controlled gates. Nine Reclamation projects have been or are being built in Colorado.

nized that material irrigation expansion in the West can be accomplished only through Federal financing. Also, in this period when the final pattern of basin-wide development is being cut, it is necessary to recognize the interest of the Federal Government in water utilization and control. At the same time it is understood that the integrity of State water law and the rights and interests of the States in such development shall be preserved.

During the 100 years since the San Luis People's Ditch was built, irrigated acreage in Colorado was expanded from a few hundred acres to the third largest found in any Western State—about 3 million acres in 1950.

An indication of the economic value of agriculture in Colorado is shown by the 1950 estimate of the cash income from farm marketings for the State in 1949. This estimate shows gross crop sales of $245,286,000. This figure includes returns from crops raised on dry land, but it must be noted that the returns from dry lands fluctuate greatly from year to year, depending upon rainfall, whereas, the production from irrigated land in the State is fairly constant. In any year, irrigated land production in the State is far in excess of that from dry lands. Agriculture in Colorado is closely allied with livestock production. In addition to crop returns, the cash income in Colorado from livestock and livestock products in 1949 was estimated at $280,847,000.

During the first 35 years of the Federal Reclamation program (1902 to 1937), only two Federal water development projects were constructed in Colorado: Uncompahgre, authorized in 1903, and Grand Valley, started in 1912.

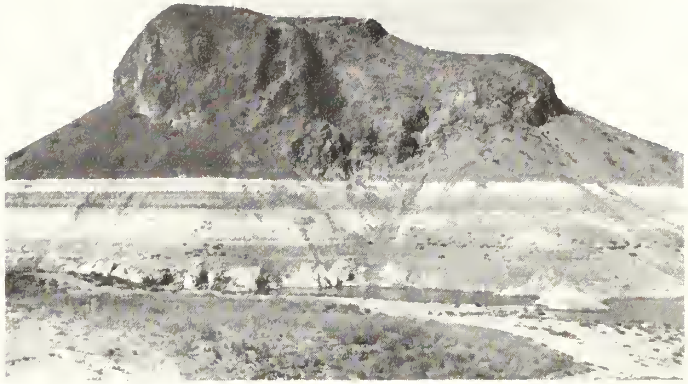
Commencing in 1937, after the creation of the Colorado Water Conservation Board, Federal water development in Colorado has advanced rapidly through the authorization and construction of numerous large and small projects.

Congressional authorization is presently being sought for the Fryingpan-Arkansas project, the Colorado River Storage project and participating projects, the Collbran project, and amended authorization to include additional features for the Paonia project which is partially contructed.

The Colorado River Storage and participating projects will provide for comprehensive development of the Upper Colorado River Basin in the States of Colorado, New Mexico, Utah, and Wyoming. It will make available hold-over storage to enable these States to meet their obligations under the Colorado River Compact for delivery of water at Lee Ferry for use in the Lower Basin, and, at the same time, to make full use of the 7,500,000 acre-feet of water a year allocated by the compact to the Upper Colorado River Basin. In addition, this extensive plan of development will include numerous units for the beneficial use of water. This project plan was made possible by the Upper Colorado River Basin Compact which became effective on April 6, 1949.

(Please turn to page 140)

ELEPHANT BUTTE IN 1946, after the Rio Grande project's water supply started to decline. *Photo by C. W. Kapus of Region 5.*



ELEPHANT BUTTE IN 1951, showing clearly the high-water mark, and the almost nonexistent water supply with which Rio Grande farmers "made do." *Photo by Labon Backer of Region 5.*

Defeating the Rio Grande Drought

by RALPH BRISTOL

Regional Operation and Maintenance Supervisor Region 5 headquarters, Amarillo, Tex.

FIFTY YEARS OF SERVICE to users of water made available through the facilities of the Bureau of Reclamation are exemplified by this story of cooperation between the people and their Government. On April 30, 1952, project employees of the Rio Grande were given a Unit Citation for this outstanding public service in harmony with the highest standards and best traditions of the Bureau of Reclamation and the United States Department of the Interior.

IN THE EARLY 1940's the two large storage reservoirs of the 155,000-acre Rio Grande project in New Mexico and Texas were full and running over. Precious quantities of irrigation water spilled and flowed down the Rio Grande, unneeded and unused.

By contrast, last summer thousands of project farmers faced imminent disaster. The reservoirs were virtually dry, and crops valued at millions of dollars were threatened with destruction.

For the first time in the 34 years since the project was built by the Bureau of Reclamation, water users faced a ruinous drought.

The outflow of water from storage had been exceeding the inflow for several years.

The inflow had averaged 659,300 acre-feet for the years 1943 through 1950.

Outflow for the same 7 years averaged 791,400 feet annually.

For nine straight years the amount of water entering Elephant Butte Reservoir had been below the all-time average, based on records from 1895 through 1950. This average was 1,075,300 acre-feet.

For hundreds of years, life in the Rio Grande Valley has depended on the river that heads up in Colorado's Rocky Mountains, meanders south through New Mexico and then flows generally southeastward to form the international boundary between the United States and Mexico.

And then, in 1951, the grand old river failed to deliver the one paramount source of all life.

The problem had been several years in the making. The watershed of the river, stretching for hundreds of miles to the Alp-like peaks of the Rockies, had been receiving far less than normal amounts of snow and rain.

Project water users and their neighbors in the towns and cities learned as never before that the river has the power to enrich or impoverish.

To say that the people in the area were worried and concerned about the plight in which the historic Rio Grande had left them is a gross understatement of fact. To say that some persons in the area did not practice intolerance and point accusing fingers would also be an understatement. But in a very large measure, the people who were affected by the failure of the water supply displayed patience, a high sense of honor and a genuine willingness to cooperate with others in finding a solution to the problem.

The story of how the effects of the drought were overcome is one of wise planning, cooperation, and hard work.

The Elephant Butte Irrigation District in New Mexico and the El Paso County Water Improvement District No. 1 in Texas, comprise the Rio Grande project proper. Farther downstream in Texas, the Hudspeth Irrigation District, which irrigates about 18,000 acres, has a Warren Act contract, and obtains water in excess of the Rio Grande project's needs. Last summer, the farmers in this area also faced complete loss of their crops to drought and the scorching sun and winds.

In March 1951, the project's storage reservoirs contained less than 300,000 acre-feet of water—the lowest in project history. No replenishment was in sight. The project needed 730,000 acre-feet for its own use and an additional 60,000 acre-feet for delivery to the Republic of Mexico under treaty agreement.

The project's predicament had not materialized without warning. As a matter of fact, L. R. Fiock, project manager, who had been employed on the project continuously since 1913, and many of the pioneer water users, were familiar with the watershed's long-range weather pattern; they foresaw the approaching shortage as early as 1946. From that time on Mr. Fiock and officials of the two districts had conserved their treasure to the greatest extent possible. They also drew up plans to meet the impending emergency.

When it became painfully apparent that project farmers would have only half as much water in 1951 as in any previous year, the project manager and the District boards began putting their previously planned strategy to work. The basic problem called for stretching the available water supply as far as possible and doubling its efficiency. Farmers cooperated fully. They set aside some fields for fallowing; planted crops which require a minimum amount of water, and drilled approximately 700 wells to supplement surface supplies. Irrigation deliveries reduced waste at every point. As new problems arose, the water users, their representatives and project officials met to decide jointly what to do about the mounting crisis. For example, one measure employed by the emergency squad involved the use of project canals and laterals to convey well water to the fields of farmers who owned the wells and also to the fields of neighbors without ground-water facilities.

With only 50 percent of the usual water supply, members of the Elephant Butte and El Paso districts raised 45 million dollars worth of crops in 1951—3 million dollars more than the year before.

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100 Years of Colorado Irrigation

(Continued from page 138)

Measured by the size of physical facilities, cost and benefits, the Colorado-Big Thompson Federal Reclamation project overshadows all others which thus far have been undertaken in the State. It is expected this project will be substantially completed in 1953. None is more spectacular in design and plan of operation.

Since the Colorado Irrigation Centennial featured a ditch in the San Luis Valley which has been in continuous operation for one hundred years, it seems appropriate to make special mention of recent project development in that area. The Platoro Dam on the Conejos River was completed last year and will store water in 1952. It is one of two units of the authorized San Luis Valley Reclamation project which will provide irrigation and flood control benefits. The Rio Grande Canal Water Users Association has recently installed, at an approximate cost of $105,000, which was fully paid from its fund when construction was completed, improved headworks for the Rio Grande Canal. Five electrically operated and automatically controlled radial gates regulate the depth of the water in the canal within one-fourth of an inch. The total length of this canal and its laterals is 210 miles and there are 125,000 acres of land irrigated by it.

The headwaters of four major river basins lie in Colorado: the Colorado, the Rio Grande, the Arkansas, and the Platte, tributary to the Missouri. As a result, water produced in the high mountains of Colorado flows out in all directions into adjoining States and beyond. For this reason, Colorado, for many years, has been concerned with programs relating to basin-wide development and the adjustment of interstate water relations. The State is a signatory to eight interstate water compacts. These compacts, together with decrees of the Supreme Court of the United States, cover all major rivers of the State and some of their tributaries.

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THE DITCH DOES IT.—On one side of the East Main Canal in Yuma Valley, valuable citrus groves. On the nonirrigated side, worthless desert. *Photo by Ben Glaha, Region 2 photographer.*

Yuma, Arizona... ...an investment that makes cents !

LOCAL ACCOMPLISHMENTS OF AN IRRIGATION DEVELOPMENT MEASURED IN TERMS OF NET INCOME

by ROY D. GEAR, Economist, Operation and Maintenance Division, Region 3, Boulder City, Nev.

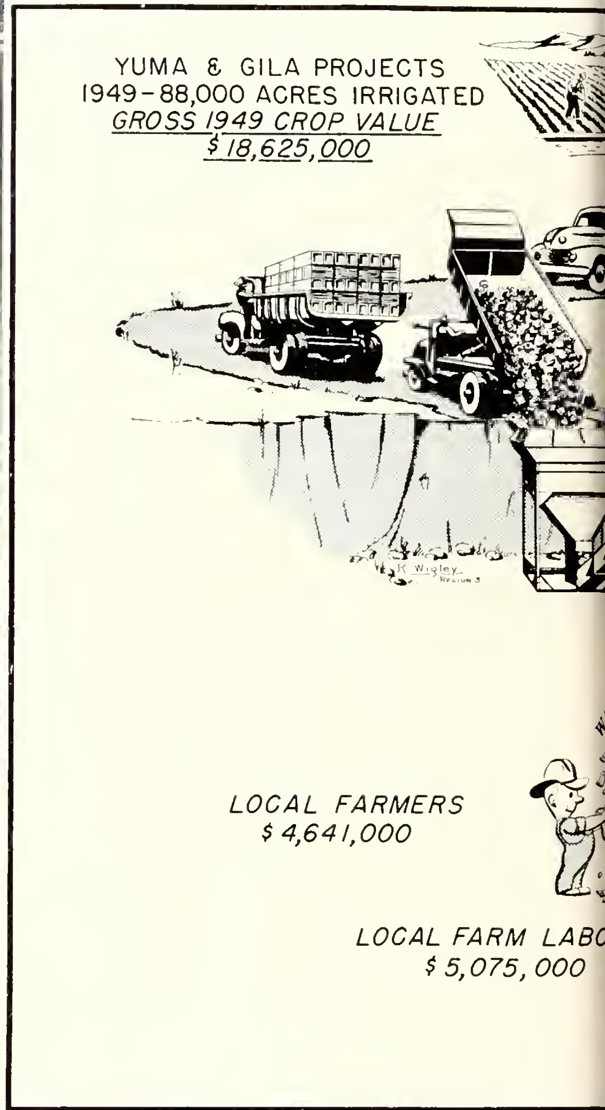
To TRAVELERS CROSSING THE PARCHED DESERT of southwestern Arizona on U. S. Highway 80, the fabulous area served by the Bureau of Reclamation's Yuma and Gila projects comes as a sudden and amazing relief. Here, surrounding the city of Yuma, is a 90,000-acre irrigated paradise that will expand to 185,000 acres within a few years as additional water is made available for development.

The traveler might well say, "Fortunate indeed are these farmers, to reap such a bountiful living from man-made irrigation projects." But something more important which the traveler does not realize is that for every person living on an irrigated farm, seven others maintain a decent standard of living in the surrounding towns.

Agricultural production is made possible by irrigation, as rainfall averages only 3 to 4 inches annually. It is the primary industry responsible for the bulk of the economic activity of the area. Without it, Yuma would be only a maintenance station on the hot, burning desert, serving the Southern Pacific Railroad, the only rail artery through the region, and the highway travelers.

A report just completed by Region 3 of the Bureau of Reclamation, "Evaluation of Local Irrigation Accomplishments, Yuma and Gila Projects' Trade Area," shows that from the gross crop value of $18,625,000 for calendar year 1949 farmers and farm laborers derived $9,716,000 net income. The year 1949 was selected for study because of the availability of census data. Net income to local businesses and nonfarm workers in that year amounted to $16,945,000. This latter figure was due entirely to the irrigation development, since income created from other sources such as tourists, mining, transportation, and pensions, was deducted. In other words, for every $1 of net income received by the basic agricultural industry of the area, an additional net income of $1.74, indirectly attributable to agriculture, accrues to local supporting business establishments and their employees.

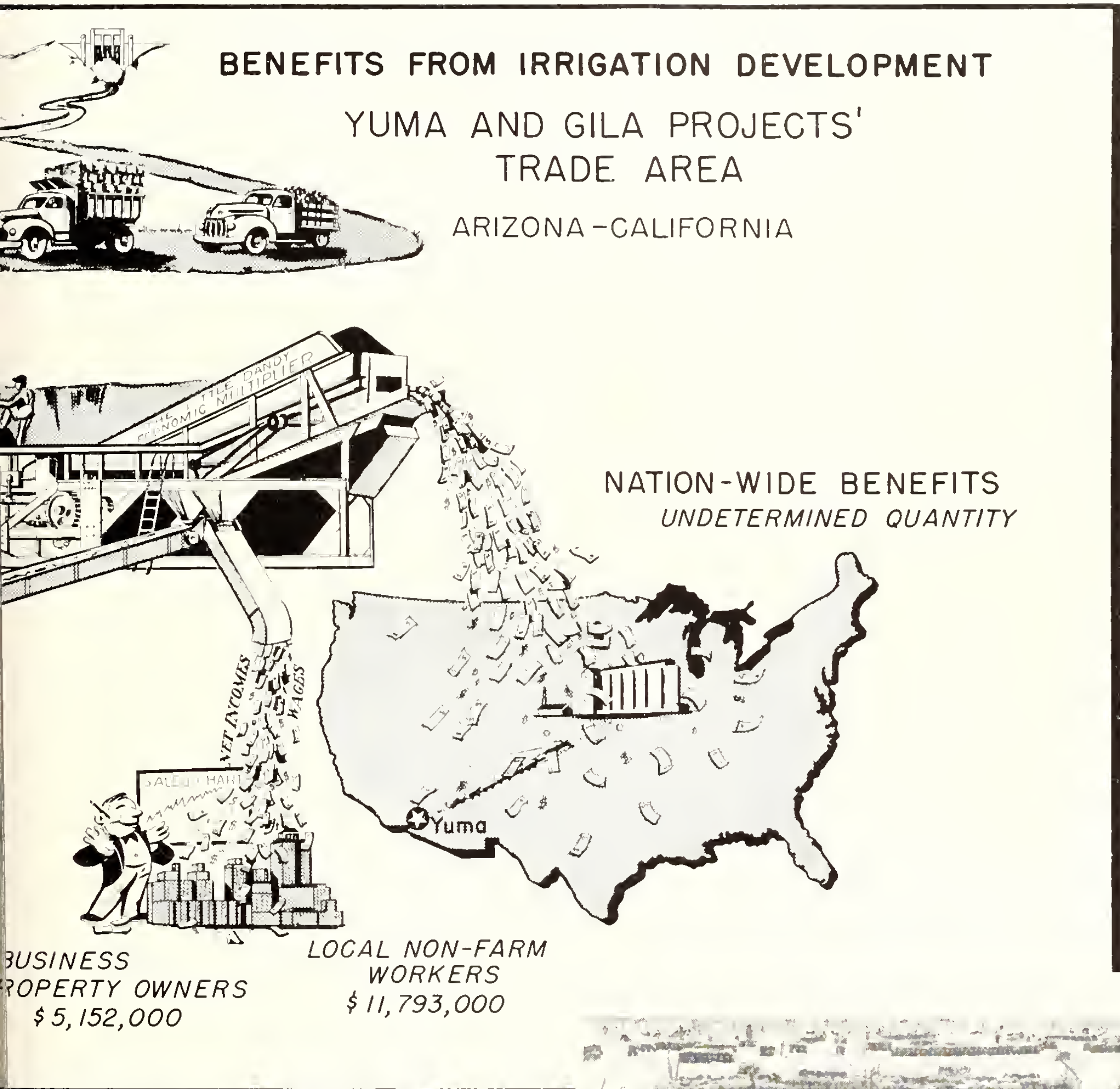
ALONG RECLAMATION ROAD—Fruit and vegetable p at the Yuma Mesa Fruit Grower's Association citrus p shed (at left), winter feeding and lambing for Wyoming at Yuma-Mesa (lower left), picking cantaloupes, and h ing onions in the Yuma Valley (lower right)—all ent the "Little Dandy Economic Multiplier" (below).



It must be kept in mind that the foregoing figures represent only the measurable local accomplishments. Benefits from Reclamation extend throughout the Nation, but are difficult to measure dollar-wise. For instance, farm machinery comes from eastern or midwest manufacturers, which in turn depend on submanufacturers and suppliers of raw products. Transportation companies, insurance companies, wholesalers, and financiers also enter into the economic activity connected with getting the machinery from the manufacturer to the ultimate tiller of the land. In the other direction, additional activity is created as farm products leave the local area in freight cars, bound for processors, manufacturers, wholesalers, and retailers. Ultimately, they reach the consumer, sometimes as fresh vegetables for table use in New York, or as oil from the castor bean to lubricate a jet engine in the skies over Korea.

In 1949, the year covered by the study, 20,420 carloads of farm commodities were shipped out of the area. A large share of the shipments consisted of winter and early spring vegetable crops bound for all parts of the United States. The local payroll connected with the icing activities alone amounted to over $100,000, which may be attributed solely to the irrigation development.

Shipment of winter vegetables from the Yuma and Gila projects during the year of study included 4,000 carloads of cantaloup, 6,350 carloads of head lettuce, and 3,700 carloads of other vegetables. Over 1,000 cars of citrus fruit also were shipped. Approximately 90 percent of all vegetables shipped from the Yuma area are consumed east of the Rocky Mountains, with a portion going to Canada. Seed crops are marketed throughout the country, but virtually all of the out-shipments



of hay, livestock, grains, and other miscellaneous crops are routed to southern California.

The rail in-shipments from all parts of the United States during the same period for farm supplies, including machinery, fertilizers, insecticides, seed, box shook (crate lumber), and livestock, totaled 1,732 cars, which accounted for only about 50 percent of rail freight unloaded at Yuma. Quantity of truck freight, a highly significant item, was not determined.

Approximately 85 percent of the irrigated area in Yuma County in 1949 was within the Yuma and Gila projects' trade area. It has been estimated that for the same year, the Federal Government reaped a harvest of $6,155,000 in Federal taxes of various kinds from Yuma County. Of this amount, slightly over $1,000,000 was individual income taxes paid by farmers.

The investment of Federal funds required to build the projects is being repaid without interest by the farmers, despite the fact that they receive just slightly in excess of one-third of the local benefits. It might be more fitting were the traveler to say, "Fortunate indeed are these local business operators, to be located within the trade area of an irrigation project."

Other accomplishments of irrigation such as benefits from improved community welfare, stabilization of the regional economy, security of project settlers, and an increased number of opportunities to earn a livelihood were not measured in the Yuma-Gila project study.

The Yuma project is one of the major irrigation developments in the area at the present time with 58,000 acres of land under irrigation. It is one of the oldest Reclamation projects. Water was first delivered in 1907.

The Gila project is one of Reclamation's newest, with approximately 33,000 acres under irrigation last year. With full development, 40,000 acres will be irrigated on the Yuma Mesa Division and 75,000 on the Wellton-Mohawk Division, where Colorado River water is being used on a portion of the acreage this year. The major influence of the Gila project on the local and national economy has not yet been felt—it will be reflected primarily in the years ahead.

Evolution of Land Classification

(Continued from page 133)

During the past half century, however, significant progress has been made in this country by various Federal and State agencies in developing methods and techniques for soil and land classification. Classification of land in the Federal Reclamation program began with the passage of the Reclamation Act of 1902, at which time only about 9 million acres of the 700 million acres of arid and mountainous land west of the 100th Meridian were irrigated through private initiative and cooperative effort. However, the value and permanency of this contribution to national expansion and wealth had been demonstrated by pioneering development and encouraged the passage of laws for Federal sponsorship of irrigation projects. Without this sponsorship, further irrigation development would have been rather hopeless because of the increasingly difficult engineering and financial problems involved in water conservation and use on a large scale.

With the passage of this act came also the Federal responsibility of making certain that lands of the right quality be served with water. It was no longer possible to make random selection of land for irrigation.

The earliest land classification under Reclamation law was on a geological basis alone—a basis which has since proved far from adequate. Little recognition was given to the soil as a natural body, that is, as a chemical, physical and organic medium for growth. A few years before the passage of the Reclamation Act, the United States Department of Agriculture, under the direction of Milton Whitney of the Bureau of Soils, initiated a program of soil classification for defining and mapping the important soil types in this country. For agronomic purposes, these soils were largely identified by their relationships to geological data, although surface textures were recognized in the unit of classification. Mapping units were given geographical names, which together with texture and geological origin of parent material, gave rise to the soil series and type. Soil mapping has continued to the present time, and the mapping units of soil types and phases are also based on many

(Please turn to page 154)

How a Conservancy District Works

TO FIRM UP THE WATER SUPPLY for areas like the one above near Loveland, Colo., the Colorado-Big Thompson's features, like Olympus Dam (inset) are nearing completion. Farm photo by Clarence B. Haney, Region 7 photographer. Photo of dam by Skeets Calvin.

by J. M. DILLE, Secretary-Manager
Northern Colorado Water Conservancy District

Adapted from an address, January 17, 1952 during the Water Users Conference at which the Four States Irrigation Council was organized at the Denver Federal Center, Denver, Colo.

Part 2—Organizing the District

AS A MATTER OF INTEREST, I might say that when northern Colorado people first contacted the Bureau, Hoover Dam, the first large power project, was not yet completed; Grand Coulee was just starting and other large developments we hear so much about now were still a dream or in the planning stage. A project, like ours, to furnish a supplemental water supply to a large already developed area, was considerably different from anything the Bureau had previously undertaken.

Also, the general plan of diverting a large amount of water from the Colorado River watershed and distributing the costs and benefits over this area, presented a great many difficult problems.

The Bureau report, a 2-year job, proposed a project to divert an average of 310,000 acre-feet annually, with reservoirs, tunnels, canals, distribution ditches, power plants, and power lines to compose a complete project for both irrigation and power.

The people of the west slope were apprehensive that the project would conflict with their use of water and future development, and organized a protective association. A number of meetings were held in Western Colorado and in Denver which finally resulted in complete understanding and in agreements which protected the western slope interests. Those policy agreements were later included in Senate Document No. 80, Seventy-fifth Congress.

In 1936 when it became apparent that the report of the Bureau would be favorable, it was realized that some special form of entity was necessary to contract with the United States, guarantee repayment of construction costs, and operate the completed project for the largest benefit to the area.

The wide differences in present water supplies throughout the District indicated the need for a water distribution plan that would be elastic and perhaps largely voluntary on the part of each user.

Also, it was believed that some part of the cost should be borne by the general public as a reflection of the benefits to the general prosperity from increased and stabilized water supply. These and many other considerations indicated that some form of conservancy district might be the answer.

After many months of effort, all of the ideas were incorporated in a bill providing for the organization of State Water Conservancy Districts which was presented to the 1937 Session of the General Assembly.

This bill passed without objection and became law in May 1937. In May 1938, the Supreme Court of the State rendered an unanimous opinion in a "Quo Warranto" proceeding upholding the constitutionality of the act.

The act is lengthy, but in brief it provides for the organization of conservancy districts by any district court upon petition of a required number of property owners. The board of directors is appointed by the court.

The board appoints officers, has power to acquire and hold property, appropriate water, enter into contracts, levy taxes and assessments, allot water, and generally, to administer the business of the district.

As a reflection of indirect benefits, the board may levy taxes on all real and personal property but not to exceed one-half mill during the construction period of the project nor to exceed one mill thereafter except in case of default or deficiency when an additional one-half mill is permitted. The collection of all taxes and assessments is made by the various county taxing officials and then remitted to the district.

Perhaps, to those of you from other States of the Missouri Basin, our financial plan of obtaining some contribution from all general taxpayers within the district may offer at least one method for covering such costs as are beyond the ability of water users to repay.

In the case of our own district, it is estimated that the one mill tax on property will provide fully one-fourth of the annual income required to meet the repayment installments and other obligations of the district.

I may say that so far, during the construction period of the project, the district organization has operated satisfactorily. With a levy of only three-tenths of a mill instead of the five-tenths permitted by the law, the district has maintained a modest organization to cooperate with the Bureau of Reclamation in every way we can and to prepare for operation of the project.

There was practically no objection whatever to the plan for a mill tax on all property. Even the large taxpaying corporations and utilities recognized the equity of the tax.

As the justification for the tax is based entirely on the theory of "indirect benefits," with no relation to any ability to supply water, the question arose as to how to define the boundaries of the district. As a practical solution, the boundary follows the closest section lines outside the irrigated area although the extent of certain indirect benefits beyond this area is problematical.

The act further provides procedures for allotting water to individuals, municipalities, and irrigation districts and for collecting special assessments for the use of such water. The board has the power to contract with the United States for construction of works when authorized by an election of property owners.

During the summer of 1937, the association laid out the boundary lines of the proposed district and circulated petitions to the District Court of Weld County for the formation of the district.

No protesting petition was presented and on September 20, 1937, the court held the hearing required by the law and issued a decree establishing the Northern Colorado Water Conservancy District. (Please turn to page 149)

FROM SINGLE TO MULTIPLE PURPOSE PROJECTS—The author, J. M. Dille, in 1910 (lower left) while Superintendent of the Empire Reservoir near Fort Morgan, Colo. At lower right, Dille inspects a Colorado-Big Thompson siphon, about 30 years later. *Photographers unknown.*

The Valley of Milk River

Part 2—A MILK RIVER RANCHER

by PARKER E. HEIKES, Associate County Extension Agent, Malta, Mont.

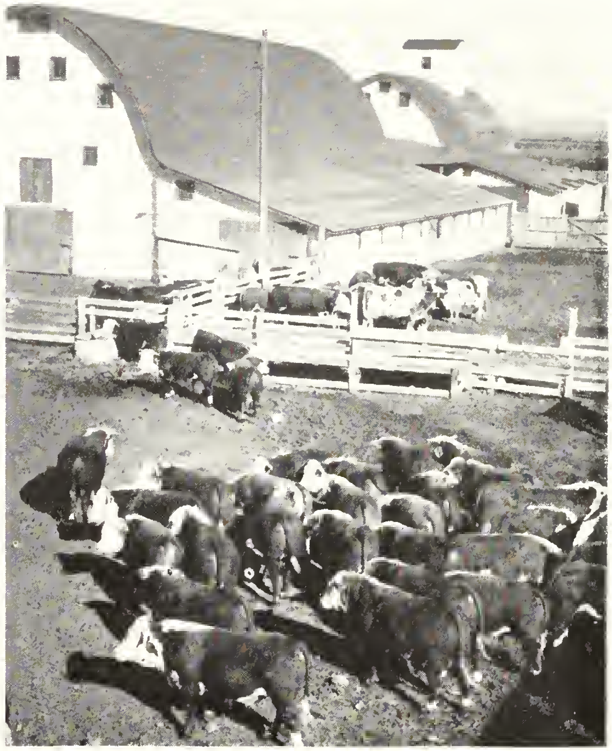
AFTER THE FLOOD—Arrow points to the Steve Holman farm, as it looked on April 6, 1952, snug and safe behind its ramparts of dirt. People laughed at Holman when he began building high dikes in anticipation of heavy spring runoff. The water came to within 6 inches of the top of his dikes. *Photo submitted by the Milk River project.*

THE OLD TIMERS OF THE MILK RIVER VALLEY in Montana will now refer to the flood of "52" as the one to remember.

Settlers often boasted of having seen the "Muddy Milk" fill the valley from hill to hill, but this year's flood will put an end to the arguments about which was the highest, the flood of 1906, 1923, 1939, or 1952. The melting snow water which covered nearly 90 percent of the irrigation project in April of 1952 reached the highest level on record.

Steve Holman, who came to Montana from Illinois in 1913, had experienced several floods during the years on his irrigated farm near Dodson, and because of foresight and hours of hard work, he was able to keep the water out of his buildings, and prevented thousands of dollars of loss.

Most stockmen check and clean the snow from the spillways of their stockwater dams before the spring runoff. While doing this, Steve realized how much runoff there might be. This was several weeks before the river reached its crest. The runoff had already started in the Havre area to the west, and Fresno Dam was full and spilling over, when Steve, after considerable study and thought, started building dikes around his build-



STEVE HOLMAN, advocate of improved irrigation practices. *Photo taken October 1951 by Donald H. Demarest, former Region 6 photographer.*

ings and feed lots. Because the land near his buildings was either frozen or wet, he had to haul dirt for nearly 1 mile. Many people passing by thought he was crazy for building such high dikes. In the beginning he planned to build them high enough to withstand 2 feet more water than in 1939. But he changed his plans as flood news began coming in. He hauled dirt with a caterpillar tractor and scraper for 3 days. For six 24-hour days, he used two similar sets of dirt moving machinery. When the flood reached its crest, his dikes had 6 inches of freeboard.

Although there is still some water on his farm land, he is quite optimistic about the future. There will be some silt deposits and the river has done some washing but he believes that 80 percent of his alfalfa will survive even though the water covered it completely for nearly 3 weeks.

The extent of damage to farms on the project is yet impossible to determine, but it is certain it will be great. Several farmsteads now have river channels between the house and barn. Farm land has been either badly eroded or covered with silt. Alfalfa fields and pastures have been either washed or smothered out. Some farm ditches are completely leveled. Drain ditches will need repair.

Steve Holman believes his loss will be small but only because he foresaw the water that was to come and started preparing early.

Holman raised his family of eight children on a dry land homestead, 6 miles north of Wagner, Mont. While there he farmed nearly 1,000 acres annually, mainly dry-land wheat with some oats and barley. Because of his past experience in Illinois, where his father did considerable livestock feeding and followed a general livestock type of farming, Steve turned to raising purebred Hereford cattle early in his farming career. He purchased his first purebred Hereford cows from his brother, who was still living in Illinois, for $275 a head.

Due to his expert judgment of cattle and his devoted interest in general agricultural development, Steve has probably done as much as any one individual to improve the livestock industry in the Milk River area. Holman's stock is of high quality and has been purchased by stockmen throughout the Western States for commercial and show purposes. At the present time he is running approximately 750 head of Hereford cattle, most of them purebred. Although there is a constant outside demand for his breeding stock he frequently sells to local small farmers and stockmen and thus improves the general grade of livestock and helps many new stockmen get started.

Even while dry-land farming, Steve was constantly looking to the irrigated valley for much of his winter feed. It was not until 1927 that he left the dry-land homestead and moved to his present location near Dodson. Before this time he had leased irrigated land in the Dodson area to raise hay for winter feeding.

In its undeveloped condition Holman's irrigated land was extremely uneven, as is much of the better land in the Milk River Valley, and very difficult to irrigate. His irrigation system was very inefficient, mostly general flooding with a few dikes to help pond the water. By this method much of his land was over irrigated and the efficiency of water use was extremely low.

EFFICIENT IRRIGATION—MAXIMUM PRODUCTION—Below, sheep on fall pasture in irrigated alfalfa field at Milk River. At right, fields are properly leveled and prepared on the Steve Holman farm. The equipment comes in handy for flood control. *Both photos by Donald H. Demarest, former Region 6 photographer.*

Development costs for this type of land are quite high, but the investment has paid off in more ways than one.

Without the three caterpillar tractors and the rather complete line of land-leveling and dirt-moving equipment which he had bought to develop approximately 450 acres of the irrigated land he and his four sons own in the Milk River Valley, Holman might not have been able to save his farm buildings during the flood.

Originally, they bought the equipment to attain more efficient irrigation, as they thoroughly recognize the value of irrigation and land development.

Holman keeps this equipment in operation throughout the frost-free season. There is constant demand for his equipment, by neighbors and other irrigation farmers, and he does some work for friends as a neighborly gesture and to help develop the irrigation project. The results and observations of his farming operations have been invaluable in stimulating irrigation interest and assisting in the development of the irrigation project. The Dodson area has long been recognized as one of the most developed and prosperous portions of the Milk River project.

When asked what he considered the most important steps leading up to his present success as an irrigation farmer, Steve said "Developing my land for fast efficient irrigation and combining livestock with my irrigation farming operations." He is a strong believer in soil fertility and puts considerable value in his livestock merely for maintaining this fertility with resultant high crop production. He believes there is little use in going to the expense of irrigation development, if soil fertility is forgotten. Although the Milk River project borders stock and range country throughout its length, Steve believes that irrigated pastures can and will compete very favorably with the less valuable range land.

While his livestock herd and feed requirements were small, Steve followed a more intensive type of farming. He has had sugar beet yields averaging 18 tons per acre and has also raised some potatoes and corn. Now it requires nearly all of his irrigated land to produce the necessary feed for his Herefords. Most of his hay land is in high-producing alfalfa. However, he still feeds some native bluejoint hay. It is not uncommon for his alfalfa yields to average more than 4 tons per acre from two cuttings. He also considers that 100 bushels per acre for oats is a normal yield.

Steve, together with his sons, is considered one of the largest operators in the Milk River area, and is respected and admired by other farmers and stockmen. His present success is the result of hard work and faith in the future. He has proven to many less optimistic settlers that the Milk River project has almost unlimited opportunity for the farmer who has a wholehearted interest in irrigation and a willingness to work and learn. He is constantly planning for the future and believes that his sons and grandsons will have opportunities equal to, if not greater than, his and that they, through proper management, hard work, and faith, may live a happy and prosperous life under irrigated agriculture in the Milk River Valley.

(Next Month—A Milk River Farmer)

How a Conservancy District Works

(Continued from page 146)

After the district was organized and the first directors appointed by the court in 1937, the next big step was the negotiation of a contract with the United States.

At that time most Reclamation projects had been for the development of new land and the problems involved in a supplemental water project were new and complex.

Very briefly, a contract was finally drafted, approved by an election of over 8,000 taxpayers, and executed in July, 1938.

This contract described the 34 features designed to constitute a power and irrigation project for the diversion of 310,000 acre-feet of water from the Colorado River.

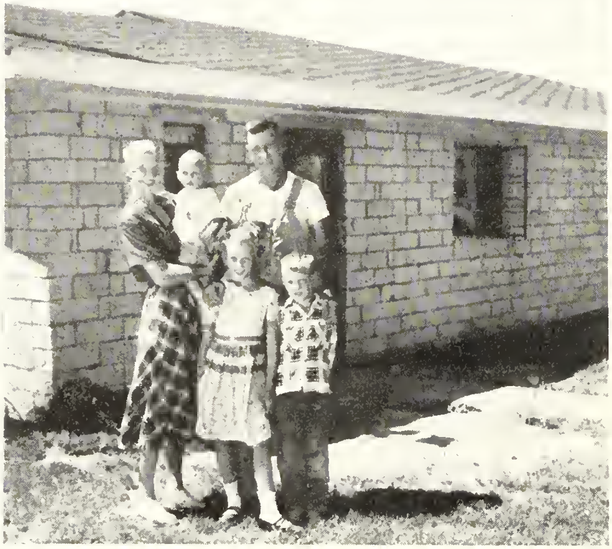
These features will collect and store the water on the westrn slope, divert it through the 13-mile tunnel, pass it through several power plants along the 2,900-foot fall down the eastern slope and store it in two large reservoirs in the foothills for delivery into our local streams by the district.

For the final use of the water for irrigation and domestic purposes, the district is to repay $25,000,000 in forty (40) scheduled annual payments beginning when the project is completed and the water is available.

The power features and revenues are retained by the Government to defray the balance of the construction cost.

Operation and maintenance costs will be divided equally on so-called "joint" features.

(Next Month—Managing the District)



"WE BUILT OUR OWN HOUSE."—At upper left, the GI tent they lived in for a while. Above, everybody helps. At immediate left, the Burns family: Patty and Joey standing out in front, their mother, Mary Ann (holding the "chosen" son), and their father, John Burns, who proudly says . . .

"THIS IS MINE"

by JOHN J. BURNS, Homesteader, Yakima project, Wash., as told to Stan Rasmussen, Region I Photographer

PHOTOS BY RASMUSSEN

A MAN WHO OWNS LAND has a share in the wealth of America.

The way I look at it, everything this country has is based on its resources. When you speak of wealth you're thinking of what this old earth has to offer. I believe that sincerely and that's why I put in for the Roza homestead drawing back in 1947. A guy would have to believe as I do to come out here for a gamble on a piece of sagebrush land.

It's a lot more than that, too. But let me start at the beginning when we pulled in here on June 17, 1947. We built temporary living quarters out of a GI tent we bought for $30. We wanted something a little better than just a tent so I constructed a sturdy floor and some sidewalls to the thing. That kept our household appliances up out of the dirt. The total cost of that home was about a hundred bucks.

I have the foresight and fortitude of my wife Mary Ann to thank that we didn't give the whole thing up. I worried about the kids. Patty was three at the time and Joey was only 13 months and boy, was it dirty! Well, anyway, that was our home for the next 5 months.

During that time we managed to build a pumice-block house and get a well dug. You never saw a happier bunch when the first water came gurgling up out of that pipe. We had been hauling water by the tubful on our old truck from a neighbor's place a quarter of a mile up the road. Not just a little water either. We had to haul enough to water four cows besides taking care of the washings and the Saturday night baths.

Financially, we didn't make much headway that first year. From our crops we realized a clear profit of $90. We had spent $2,800, of which $1,700 had gone for machinery and equipment. And there were a couple of outstanding loans, too, one for a thousand on the house and another for $1,600 that the FHA loaned us to dig the well.

You're probably wondering how we kept going. Well, being a vet I qualified for GI schooling offered the homesteaders, and in my case it paid \$93.75 a month. It sure came in handy that first winter, too, because it was a rough one. We had a blizzard here and it stayed at three below for a spell. A bunch of our banty chickens froze to death and we had to bring our cat and dog into the house to keep them alive. They were so frozen up we had to scrape the ice off them. In the spring one of the cows came with a calf which developed pneumonia and we had to keep it in the house for awhile, too. Like I was saying, "Things were rough."

Even with troubles like that we did quite a bit better on the crops that second year. Our gross profit ran a little more than \$5,000, of which we put out about \$3,200 for expenses. That left us a net of approximately \$100 per month for the year. That's how it looked on the books but actually it didn't work out that way. In July Mary Ann went to the hospital to have a baby that didn't live. Things were pretty rough for her, too, for about 6 weeks. They were giving her transfusions about as fast as she could take them. That siege cost us a neat \$1,200 in hospital and doctor bills, or just about all the money we made that year.

In 1949, things started to take a gentle turn for

"THANKS TO MY WIFE."—Burns believes his wife's foresight and fortitude were responsible for his perseverence. Above, she helps out with the farming. At upper right, Burns explains, "I was raised on a dry farm so I didn't know much about farming with a shovel." At right, Patty and Joey (barely visible behind the tub) help with the wash.

Our second year on the homestead was a little more profitable. We paid off the loan on the house with \$850 we got from 6 acres of dry beans and \$250 hay money. We had 25 acres of canning peas contracted which didn't pay off too good, though. Only half of that 25 acres had been laid out correctly. As a result we were trying to run too much water up hill. We saw that it wasn't working so we got out there with buckets and tried to save the peas but we lost them anyway.

I was raised on a dry farm over in the Palouse country so I didn't know anything about farming with a shovel. That same spring, I tried to irrigate a piece of ground with an open ditch when I should have been using a flume. It kept breaking out and I stuck with it for three sleepless days and nights before I gave in and bought the flume.

the better. We put in about 50 acres to peas, cantaloupe, alfalfa, and corn ensilage. Our gross profit was roughly $5,000 with $3,000 for expenses which left us a net of a couple of grand. We put $860 of that back into 1,300 feet of concrete pipe to improve our irrigation system. That's the year we proved up and got the little paper that said the homestead was ours.

The next year is the one that we're really proud of. We grossed $11,168. Oh yeah, about a thousand of that was earned by Mary Ann down at the hospital. She's a registered nurse and she went to work to get back some of the money we had put into that place. But even at that we did about $10,000 dollars worth of business here. Around $7,500 of that went for expenses and we ended up with a net of $2,612. I built a pumice-block machine shed that fall, 52 by 30 feet, for about 500 bucks. And we put in another 1,700 feet of concrete pipe to the tune of $1,140. You see, what I'm doing with that pipe is pumping some of my waste water back to high ground and using it again.

That brings us up to '51. We had a bad time with 20 acres of beans we raised; only got 218 sacks. But luckily there was a good side, too. From 18 acres of alfalfa we harvested 17,000 pounds of seed when cleaned. At 45 cents a pound you could say that we were making hay. That seed crop carried the rest of the farm around on its back. Next season I'm going to plant 31 more acres to alfalfa so the following season I'll have about 50 acres producing seed. This was a good year. We grossed $9,331 and our expenses were $4,901. That left us a pretty fair net profit. Just to add to that good fortune, the Roza Irrigation District is burying about a quarter of a mile of concrete pipe lateral and I'll be able to irrigate six more acres next season that have been dry up to now. But even better than that is little Dennis Patrick Burns, a young Irishman we adopted from the Catholic home in Seattle. From the looks of him he's going to be a big help around here one of these days.

Well, that's how we're homesteading on the Roza. We've learned a lot about running an irrigated farm in the last 5 years. And most of it came to us the hard way. Such as learning to operate flexibly. If a farmer doesn't change his plans in a hurry to cope with the bad breaks like the weather or a market going out at the wrong time, he's going to take a beating.

And we found that the Bureau of Reclamation's minimum requirement of $3,000 for moving on is low by about $2,000. It should be more like $5,000 and not more than half of that in farm equipment. But that battle is behind us. Right now it gives me a pretty good feeling to look over my bank financial statement. It reads: Assets $32,000. Liabilities $4,000. We came up here with $900 cash and with little or no credit. When it comes to loose cash, though, my pocket feels just about as empty now as it did then.

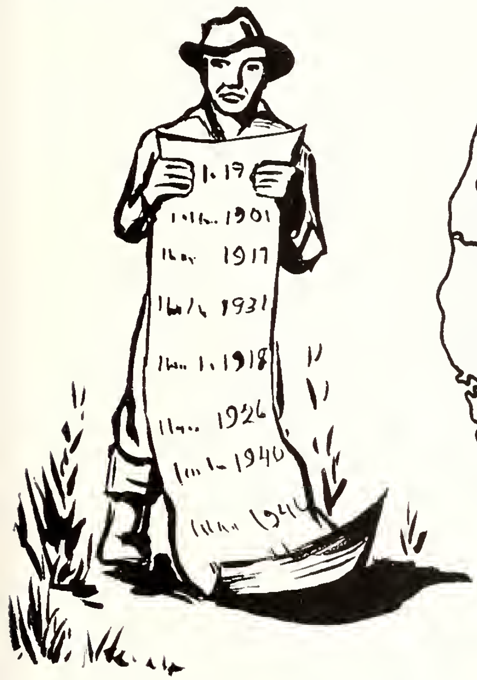
But, you know, when I'm out walking across those plowed fields, every once in awhile I reach down and grab a handful of soil, just like Scarlet O'Hara did in "Gone with the Wind," and while I'm enjoying the good feel of it, I say to myself, "This is mine." ###

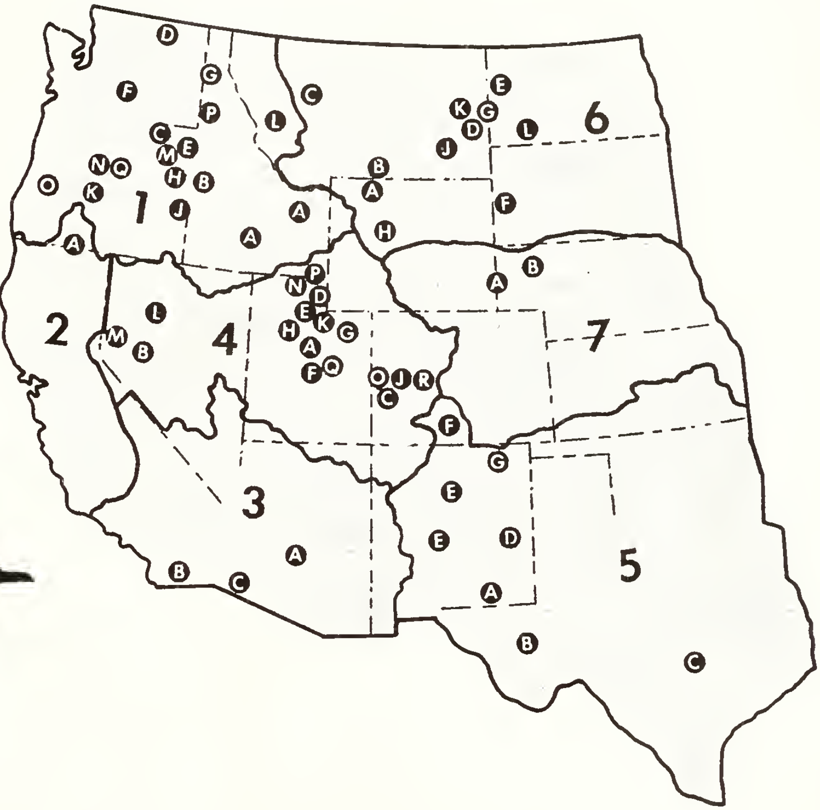
"A GOOD YEAR—The alfalfa seed crop carried the rest of the farm around on its back."

WE, the WATER USERS, Operate These Reclamation Projects

The policy of the Department of the Interior and the Bureau of Reclamation has been and continues to be one of encouraging the water users to operate their own distribution systems as soon as the project area has reached such a stage of development and settlement that local water users' orgnizations can safely assume the responsibility. The Bureau of Reclamation is responsible for the return of the investment of the United States, and transfer of Government property to an organization is dependent on that organization being well managed, well financed, and willing to take over operation.

The map above, and the table below show 87 projects, divisions of projects, or features of projects which have been turned over to, or operated continuously by, the water users since the Bureau started operating.





Region and Symbol	Project	Date of Transfer
1-A	Minidoka—Gravity Div.	1917
	Minidoka—S. Pumping Div.	1926
	Minidoka—Gooding Div.	1933
1-A	Minidoka—Upper Snake Div.	(1)
1-B	Boise—Arrowrock Div.	1926
	Boise—Notus Div.	1922
1-C	Umatilla—East Div.	1926
	Umatilla—West Div.	1926
1-D	Okanogan	1929
1-E	Baker	1932
1-F	Yakima—Kittitas Div.	1934
	Yakima—Sunnyside Div.	1945
	YakimaTieton Div.	1947
	Yakima—Kennewick Div.	(1)
1-G	Rathdrum Prairie—Hayden Lake	(1)
	Rathdrum Prairie—Post Falls	1949
1-H	Vale	1949
1-J	Owyhee	1952
1-K	Arnold	1952
1-L	Bitter Root	1952
1-M	Burnt River	1952
1-N	Deschutes	1952
1-O	Grants Pass	1952
1-P	Lewiston Orchards	1952
1-Q	Ochoco	1952
2-A	Klamath—Langell Valley Div.	1926
	Klamath—Bonanza Springs	(1)
	Klamath—Lower Klamath Lake	(1)
	Klamath—Pumping Div—(Grove)	(1)
	Klamath—Pumping Div—(Enterprise)	(1)
	Klamath—Pumping Div—(Shasta View)	(1)
	Klamath—Pumping Div—(Malin)	(1)
	Klamath—Pumping Div—(Sunnyside)	(1)
	Klamath—Pumping Div—(Van Brimmer Ditch)	(1)
3-A	Salt River	1917
3-B	All American Canal—Imperial Div	1947
	All American Canal—Coachella Div	[2] 1949
3-C	Yuma—Valley Division	1951
4-A	Strawberry Valley—High Line Canal	1916
	Strawberry Valley—Mapleton Lateral	1918
	Strawberry Valley project	1926
4-B	Newlands	1926
4-C	Uncompahgre	1932
4-D	Hyrum	1936
4-E	Ogden River—Ogden R.	1937
	Ogden River—S. Ogden	[2] 1951
4-F	Sanpete—Ephraim Div.	1937
	Sanpete—Spring City Div.	1941
4-G	Moon Lake	1938
4-H	Provo River—Deer Creek Div.	(1)
	Provo River—Aqueduct Div.	[2] 1951–52
4-J	Fruitgrowers	1940
4-K	Weber River	1940
4-L	Humboldt	1941
4-M	Truckee Storage	1942
4-N	Newton	1948
4-O	Grand Valley—Garfield Gravity Div.	1949
	Grand Valley—Orchard Mesa Div.	(1)
4-P	Scofield	1949
4-Q	Preston Bench	1951
4-R	Paonia	(1)
5-A	Carlsbad	1949
5-B	Balmorhea	1951
5-C	Colorado River—Marshall Ford Dam	(1)
5-D	Fort Sumner	(1)
5-E	Middle Rio Grande	(1)
5-F	San Luis Valley—Conejos Div.	(1)
5-G	Vermejo	(1)
6-A	Shoshone—Garland Div.	1927
	Shoshone—Frannie Div.	1930
	Shoshone—Willwood Div.	1949
6-B	Huntley	1928
6-C	Sun River—Greenfields Div.	1931
	Sun River—Fort Shaw Div.	(1)
6-D	Lower Yellowstone	1932
6-E	Buford-Trenton	1944
6-F	Belle Fourche	1949
6-G	Savage	1950
6-H	Riverton—Midvale Div.	1951
6-J	Buffalo Rapids—1st. Div.	(1)
	Buffalo Rapids—2d. Div.	(1)
6-K	Intake	(1)
6-L	Missouri River—Dickinson Unit	(1)
7-A	North Platte—Fort Laramie Div.	1926–27
	North Platte—Interstate Div.	1926–27
	North Platte—Northport Div.	1926–27
7-B	Mirage Flats	1951

[1] Operated by the water users from the beginning.

[2] Water users take over as structures are completed.

NEWLANDS—First in Service

(Continued from page 132)

farms have spots of poor soil, but the Omnibus Adjustment Act of 1926 helped this situation by reducing the project area to include only those lands which could produce. The project now includes 72,000 irrigable acres. Other projects have benefited from this experience, and the complete land classification of all proposed developments gives each settler a working inventory of the type of land he is getting.

The first water was delivered from simple diversion structures. Water supplies would start dwindling sharply after the first of July. This problem was solved when the desert bed of ancient Lake Lahontan, dry since prehistoric times, began to fill behind Lahontan Dam, completed in 1915. Carson River, behind the 162-foot-high, 5,400-foot-long dam, was backed up 28 to 30 miles, creating Lahontan Reservoir. This reservoir, which also receives water from Lake Tahoe and Truckee River via a 31-mile diversion canal, can hold approximately 290,000 acre-feet of water, releasing it as needed into the river channel and diverting it 5 miles below the dam for delivery to ranches through a 600-mile system of canals and laterals. Lahonton Reservoir has never yet failed the ranches of the project, although there were three close calls during the limited storage years of 1924, 1929, and 1931. However, enough water was delivered to help assure a harvest.

Thanks to the foresight of the Newlands project planners, the possibilities for incidental power production at Lahontan Dam were not overlooked. A hydroelectric plant, which now has a capacity of 1,640 kilowatts, was completed in 1911, 4 years ahead of the dam. As a result, the city of Fallon now purchases its power from the Truckee-Carson Irrigation District, the revenues aiding materially in project cost repayment. In 1949, the District installed two diesel generating plants at the dam, having an installed capacity of 2,000 kilowatts, bringing the total power plant capacity to 3,640 kilowatts. The project water users formed local improvement districts and constructed power lines over which electricity hums to most of the farms.

In 1900 nobody knew much about Fallon, Nev. Nobody lived there. Today, Fallon has an ultramodern high school, municipally owned telephone, water, and sewer systems, a swimming pool, and plans for a large municipal airport.

Recently, the trade area of Fallon was selected by agricultural scientists as the basis of a study to attempt to measure in dollars and cents the direct and indirect benefits accruing from irrigated agriculture in an area where little or no agricultural production is possible without irrigation. The study disclosed that 172 businesses established in the Fallon area enjoyed a gross income of $12,363,300 in 1948, as compared with a $3,192,000 crop value—not counting the values from livestock and livestock products.

Even without the wealth-producing value of livestock at Newlands, reclamation has thus created a commonwealth in the area adding 15 million to 20 million dollars a year to the economy of Nevada and the Nation, starting practically from scratch since the turn of the century.

No wonder they call it the "Newlands Act of 1902" in Nevada! ###

Evolution of Land Classification

(Continued from page 144)

identifying soil characteristics. For instance, the Roswell sandy loam and Pecos sand were recognized and mapped in the Pecos Valley, New Mexico in 1899—one of the first surveys made. In the same year the Salt Lake Valley was mapped and the Salt Lake and Jordan series established. Many areas were mapped throughout the West in the following years and wherever available, these surveys were used as an aid for evaluating land for irrigation. So far, about 3,000 soil series have been identified and named, and within these series are many more soil types and phases.

However, as irrigation projects grew in size and complexity under the Reclamation Service established in 1907 (becoming the Bureau of Reclamation in 1923) land classification continued to increase in importance along with the need to discover better ways to determine the suitability of land for development. The standards for classification were constantly improved with new developments, particularly in the field of soils. To further this objective, the aid of Federal and State agricultural agencies engaged in soils investigations and research was solicited. Committees were appointed from colleges, agricultural experiment stations, and other sources to review, appraise, classify, and otherwise evaluate land in relation to reclamation suitability.

The Fact Finders Act of 1924 was even more specific about land classification. The act charged the Secretary of the Interior with the responsibility for making certain that the irrigable lands on each new project and new division of a project were classified with respect to their capacity under a proper agricultural program to support a farm family and pay water charges, and further, that different construction charges should be set against different land classes. Subsequent legislation, and especially the Reclamation Project Act of 1939, re-emphasized and expanded the above responsibilities to include reconsideration of land classification on existing projects in relation to the present productivity of the lands and their capacity to repay construction costs as shown by experience.

The present system of land classification has been in effect since 1924 when it became essential for the Bureau of Reclamation to set up its own land classification program supervised by its own personnel. It was initiated and developed over a period of several years with the cooperation of several members of the Department of Agriculture who were assigned to the Bureau of Reclamation at that time and has been continuously improved since then. It has for its specific objective the determination of the extent and degree of suitability of lands for sustained irrigation farming. Physical land features are evaluated not only in terms of productive capacity of the soils, but of the equally important economic considerations of costs of development and production. The procedures, techniques, and standards have been developed particularly for evaluating lands in arid and semiarid regions on the basis of long experience and continued study on irrigation projects. This classification, therefore, provides definite, sound, and relatively permanent basic data which are essential in solving economic and engineering problems in land reclamation.

(Next Month—What Class Land?)

NOTES FOR CONTRACTORS

Contracts Awarded During April 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3571	Davis Dam, Ariz.-Nev.	Apr. 11	Four 5,100-kilovolt-ampere power capacitor equipments for Tucson substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	$161,726
DS-3617	Colorado-Big Thompson, Colo.	Apr. 8	One 30,000-kilovolt-ampere synchronous condenser with control equipment for Gering substation.	Westinghouse Electric Corp., Denver, Colo.	326,146
DC-3619	Columbia Basin, Wash.	Apr. 10	Construction of earthwork and structures for Potholes East canal and Pasco wasteway.	Phil McInnis and Henry George & Sons, Spokane, Wash.	562,216
DS-3622	Palisades, Idaho	Apr. 29	9,000 tons of bulk pozzolan for construction of Palisades dam and power plant, schedule 2.	Combustion By-Products Co., Chicago, Ill.	13,500
DS-3623	Cachuma, Calif.	Apr. 25	2,700 tons of bulk pozzolan for construction of Tecolote tunnel, schedule 2.	Airox Co., Los Angles, Calif.	35,802
DS-3641	Missouri River Basin, S. Dak.	Apr. 30	Three 8,333-kilovolt-ampere transformers for Watertown substation, schedule 1.	Pennsylvania Transformer Co., Cannonsburg, Pa.	110,345
DS-3641	Missouri River Basin, S. Dåk.	do	One 69,000-volt voltage-regulating transformer and one current transformer for Watertown substation, schedules 2 and 7.	General Electric Co., Denver, Colo.	61,884
DS-3645	Missouri River Basin, S. Dak.	do	Three 8,333-kilovolt-ampere transformers for Huron substation, schedule 1.	Pennsylvania Transformer Co., Cannonsburg, Pa.	110,345
DS-3645	Missouri River Basin, S. Dak.	do	One 69,000-volt voltage-regulating transformer and one current transformer for Huron substation, schedules 2 and 7.	General Electric Co., Denver, Colo.	61,884
DS-3648	Central Valley, Calif.	Apr. 15	6 pier noses for turbine draft tubes at Folsom power plant	General Metals Corp., Oakland, Calif.	10,600
DS-3651	Missouri River Basin, S. Dak.	Apr. 30	One 6,000-kilovolt-ampere transformer for Sioux Falls substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	53,505
DS-3651	Missouri River Basin, S. Dak.	do	Two 115,000-volt and one 34,500-volt horn-gap switches and four 115,000-volt and six 34,500-volt disconnecting switches for Sioux Falls substation, schedule 5.	Schwager-Wood Corp., Portland, Oreg.	14,933
DS-3652	Columbia Basin, Wash.	Apr. 29	One 2,500-volt motor-control equipment assembly for Ringold pumping plant.	Lexington Electric Products Co., Inc., Newark, N. J.	20,141
DS-3653	Eklutna, Alaska	Apr. 18	Three 10,000/13,000-kilovolt-ampere transformers with lightning arresters for Anchorage substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	125,228
DS-3655	Central Valley, Calif.	Apr. 28	Three 230,000-volt circuit breakers for Elverta substation, schedule 2.	Brown Boveri Corp., New York, N. Y.	155,260
DS-3655	Central Valley, Calif.	Apr. 29	Nine 230,000-volt disconnecting switches for Elverta substation, schedule 3.	Schwager-Wood Corp., Portland, Oreg.	47,069
DS-3658	Columbia Basin, Wash.	Apr. 17	One 4.16-kilovolt motor-control switchgear assembly for Babcock pumping plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	56,425
DS-3661	Missouri River Basin, Mont.	Apr. 24	1 control board and 1 annunciator relay cabinet for Canyon Ferry power plant, schedule 1.	Kirkhof Electric Co., Grand Rapids, Mich.	37,400
DS-3661	do	Apr. 17	One 1,500-kilovolt-ampere station-service unit substation for Canyon Ferry power plant, schedule 2.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	28,005
DS-3661	Missouri River Basin, Mont.	Apr. 28	One alternating current board and one direct current control and distribution board for Canyon Ferry power plant, schedule 3.	Montana Electric Supply, Billings, Mont.	11,769
DC-3662	Central Valley, Calif.	Apr. 10	Construction of 162,000-kilowatt Folsom power plant and appurtenant works.	Guy F. Atkinson Co., South San Francisco, Calif.	5,772,960

Contracts Awarded During April 1952—Continued

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC-3665	Columbia Basin, Wash.	Apr. 3	Drilling holes for right riverbank investigation at Grand Coulee Dam.	Lynch Bros., Seattle, Wash.	$13,36
DC-3666	Cachuma, Calif.	Apr. 18	Construction of concrete pipelines and structures for Carpinteria section of South Coast conduit, schedule 2.	Ventura Pipeline Construction Co., Ventura, Calif.	232,20
DC-3666	do	do	Construction of concrete pipelines and structures for Carpenteria section of South Coast conduit and Sheffield control room, schedule 4.	ABC Construction Co., Inc., and R. J. Daum Construction Co., Norwalk, Calif.	1,471,95
DS-3668	Central Valley, Calif.	Apr. 3	Anchor bolts for 40- by 24-foot radial gates at Nimbus dam	Schmitt Steel Co., Portland, Oreg.	16,37
DC-3669	Columbia Basin, Wash.	Apr. 11	Construction of earthwork, pipelines, and structures for area P-3 laterals and sublaterals, Potholes East canal laterals.	Goodfellow Bros., Inc., Wenatchee, Wash.	226,55
DC-3670	Columbia Basin, Wash	Apr. 25	Construction of earthwork, pipelines, and structures for area E-4 laterals and sublaterals and county road relocation, East Low canal laterals, schedule 1.	Cherf Bros. Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.	954,14
DC-3672	Eklutna, Alaska	Apr. 9	Construction of 26 miles of Eklutna-Anchorage 115-kilovolt transmission line.	Wiggins Construction Co., Anchorage, Alaska	434,42
DC-3674	Columbia Basin, Wash.	Apr. 10	Construction of Ringold pumping plant, discharge pipelines, and lateral pipeline for the pumping plant and appurtenant works, lateral PE-47, area P-8.	Otis Williams and Co., Helena, Mont.	183,16
DC-3675	Palisades, Idaho	Apr. 18	Construction of Palisades dam and power plant and relocation of roads.	J. A. Jones Construction Co. and Charles H. Tompkins Co., Seattle, Wash.	29,180,34
DC-3678	Central Valley, Calif.	Apr. 3	Construction of earthwork, concrete lining, and structures for Tulare Main canal, Friant-Kern canal distribution system.	Thomas Construction Co., Fresno, Calif.	21,24
DC-3679	Davis Dam, Ariz.-Nev.	Apr. 18	Construction of 69-kilovolt Davis switchyard and transformer circuit.	George E. Miller, Long Beach, Calif.	59,44
DC-3681	Missouri River Basin, Nebr.	Apr. 23	Construction of earthwork and structures for laterals 3.4 to 27.8, inclusive, and sublaterals on Cambridge lateral system, schedule 3.	Claussen-Olson-Benner, Inc., Holdrege, Nebr.	472,16
DC-3682	Klamath, Oreg.	Apr. 29	Construction of earthwork and structures for Lost River channel improvements, West canal enlargement, and W-1 lateral, Langell Valley.	McKinnon Construction Co., Sandy, Oreg.	214,36
DC-3683	Gila, Ariz.	Apr. 25	Construction of earthwork, concrete canal lining, and structures for Mohawk canal; and Radium Hot Springs flood protection system.	Marshall, Haas and Royce, Belmont, Calif.	766,37
DC-3690	Missouri River Basin, Wyo.	Apr. 22	Construction of 4.3 miles of Guernsey Tap-Guernsey 115-kilovolt transmission line.	American Electric Co., Caldwell, Idaho.	64,59
DC-3692	Central Valley, Calif.	Apr. 9	Reinforcement of south levee for San Joaquin river crossing of Shasta-Tracy 230-kilovolt transmission lines Nos. 1 and 2.	Basalt Rock Co., Inc., Napa, Calif.	66,67
DC-3693	Missouri River Basin, Nebr.	Apr. 18	Construction of drainage well and test shafts at Enders dam	Layne-Western Co., Omaha, Nebr	16,04
DC-3708	Columbia Basin, Wash.	Apr. 28	Construction EL25A wasteway and pumping plant for area E-2, East Low canal laterals.	McWaters and Bartlett, Boise, Idaho.	30,17
117C-145	Columbia Basin, Washington		Lining repair, West Canal, station 1+28.2 to station 345+98	Cherf Brothers Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.	68,48
200C-194	Central Valley, Calif	Apr. 1	Warehouse for Folsom power plant	daRoza and Ribal, Inc., Monterey, Calif.	108,18
200C-173A	Klamath, Oreg.-Calif.	Apr. 7	Construction of pumping plants "R" & "S"	George R. Stacy, Tulelake, Calif.	110,43
600C-86	Missouri River Basin, S. Dak.	do	Construction of two warehouses, offices, and vehicle storage buildings and sewage disposal and water-supply systems for Phillip and Armour substations, schedules 1 and 2.	Rand Construction Co., Rapid City, S. Dak.	82,83
600C-86	do	do	Construction of warehouse, office and vehicle storage building and sewage disposal and water-supply system for Sioux Falls substation, schedule 3.	Henkel Construction Co., Mason City, Iowa.	46,25
600C-86	do	Apr. 2	Construction of sewage disposal and water-supply systems and warehouse, office, and garage and storage buildings for Watertown substation, schedule 4.	McGrann Brothers Construction Co., Watertown, S. Dak.	106,06
601C-20	Shoshone, Wyo	Apr. 23	Clearing portion of Heart Mountain Government Camp Area	Studer Construction Co., Billings, Mont.	12,17
605C-16	Buffalo Rapids, Mont.	Apr. 21	Gate Valves, O'Fallon Creek channel change and additional canal and wasteway structures, schedules 1 and 3.	F. L. Flynn and Co., Billings, Mont.	31,89
605C-16	do	do	Gate Valves, O'Fallon Creek channel change and additional canal and wasteway structures, schedules 2, 5 and 6.	Ray E. Thompson Construction Co. and Lloyd Loekrem, Billings, Mont.	15,30
703C-238	Missouri River Basin, Colo.	do	Construction of Julesberg substation	George W. Shelp, Rawlins, Wyo.	17,73

Construction and Materials for Which Bids Will Be Requested by August 1952

Project	Description of work or material
Central Valley, Calif	Turbine draft-tube bulkhead gates and accessories for Folsom power plant.
Do	Two 6,500-gallon and two 2,000-gallon oil storage tanks for Nimbus power plant.
Do	Three vertical-shaft, motor-driven 100 c. f. s. pumping units at 25- to 33-foot head for plants Nos. 1, 2, and 3; and one vertical-shaft, motor-driven 96 c. f. s. pumping unit at 52-foot head for plant No. 4 on the Contra Costa canal.
Do	Landscaping and constructing operating roads at Tracy switchyard and pumping plant.
Colorado-Big Thompson, Colo.	Construction of a temporary switchyard; dismantlin of existing wood structures; and reinstallation o electrical equipment for Green Mountain switch yard, near Kremmling, Colo.
Do	Addition of 10,000-gallon septic tank, complete wit effluent line and drying bed, to existing system a Green Mountain Government Camp about 15 mile south of Kremmling, Colo.
Colorado River Front Work and Levee System, Calif.	Design and fabricate a heavy-duty steel hull tugboa capable of a 13,500-pound cable-pull, with max mum draft of 4½ feet loaded, for towing a dredge o the Colorado River, near Needles, Calif.

Construction and Materials for Which Bids Will Be Requested by August 1952—Continued

Project	Description of work or material
Colorado River Front Work and Levee System, Calif.	Furnishing and erecting a 50- by 100-foot prefabricated steel shop and welding building at Needles, Calif.
Columbia Basin, Wash.	Construction of 3 miles of 13.2-kilovolt, 3-phase, single-circuit, wood-pole transmission line between Bonneville Power Administration's Quincy substation and Babcock pumping plant, West canal lateral W35.9.
Do	Removal of existing compressor building in industrial area at Coulee Dam; construction of a 30- by 35-foot concrete block structure with builtup roofing to house existing compressor; revisions to existing piping; and construction of access road and grading around the site.
Do	Furnishing and installing heating and ventilating equipment at Grand Coulee pumping plant, and insulating materials to prevent water and drain piping from freezing.
Do	Horizontal-shaft centrifugal-type motor-driven pumping units for lateral area E-5 as follows: Three 45 c. f. s. units and three 13.7 c. f. s. units at 47-foot head, and two 8 c. f. s. units at 86-foot head for Warden plant and relift plant; three 24 c. f. s. units at 56-foot head for EL-63.1 plant; one 9 c. f. s. unit at 60-foot head for EL-63.1E plant; two 7 c. f. s. units at 56-foot head for EL-61.7 plant; and two 8 c. f. s. units at 66-foot head for EL-61 plant, all on East Low canal.
Davis Dam, Ariz.-Nev.	Erecting steel structures for the 34.5-kilovolt installation at Yuma substation.
Do	Erecting steel structures and installing power transformer and switching equipment for the 13.8-kilovolt installation at Tucson substation.
Eden, Wyo	Construction of 0.4 mile of 475 c. f. s. earth-lined Means canal; enlargement and rehabilitation of 6.5 miles of Eden canal to 300 c. f. s. capacity, part of which is to be lined; construction of 2 miles of 20 to 5 c. f. s. Eden canal laterals; and relocation of 0.35 mile of 670 c. f. s. Dry Sandy Creek channel, about 44 miles northwest of Rock Springs, Wyo.
Eklutna, Alaska	Two 115,000-volt power circuit breakers and seven 115,000-volt air-break switches for Eklutna switchyard.
Do	Two 3,000-gallon and two 1,000-gallon oil storage tanks for Eklutna power plant.
Do	Two vertical-shaft, turbine-type sump pumps with capacities of 2.5 c. f. s. at 17-foot head, one horizontal-shaft, centrifugal-type fire protection pump with a capacity of 400 g. p. m. at 200-foot head, and one gear-type oil pump with a capacity of 20 g. p. m. at 100 p. s. i. pressure for Eklutna power plant.
Do	Main control board, distribution boards, and battery chargers for Anchorage substation.
Gila, Ariz	Construction of 13.6 miles of unreinforced concrete lined laterals and sublaterals for unit 2 of Mohawk distribution system near Roll, Ariz. One main lateral is to be 90 c. f. s. maximum capacity and several laterals and sublaterals are to be 45, 30, and 15 c. f. s. capacities with a minimum of 15 c. f. s. Work includes 110,000 cubic yards of excavation and construction of concrete turnouts, checks, check drops, siphons, and a timber bridge.
Hungry Horse, Mont	Construction of a section of relocated east side Forest Service telephone line about 50 miles southeast of Columbia Falls, Mont.
Kendrick, Wyo	One 65 c. f. m. and one 375 c. f. m. air compressors, 100 p. s. i. pressure, and one 8 c. f. m. portable air compressor, 350 p. s. i. pressure for Alcova power plant.
Do	Construction of Oregon Trail reinforced concrete drain inlet structure on Casper canal, and concrete check for lateral 218, about 10 miles west of Casper, Wyo.
Do	Construction of 13.8-kilovolt addition to Laramie substation, including placing concrete foundations, erecting structural steel, erecting a 20- by 20-foot prefabricated metal control house, and installing and connecting all electrical equipment furnished by the Government. The substation additions will have a 13.8-kilovolt bay, an auxiliary bus structure, two 115-kilovolt disconnecting switches, and three 115-kilovolt lightning arresters.
Missouri River Basin, Mont.	Completion of Canyon Ferry dam and power plant, consisting of installing embedded and nonembedded parts of three 23,500-horsepower turbines and three 16,667-kilovolt-ampere generators; miscellaneous metalwork; electrical equipment in power plant; erecting switchyard steel and installing equipment on roof of power plant; and constructing elevator tower on dam.
Missouri River Basin, Nebr.	Construction of 7,500-kilovolt-ampere Ogallala substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the Government; and erection of a 16- by 20-foot Government-furnished control house. The substation is to have one 7,500-kilovolt-ampere, 3-phase transformer, one 115-kilovolt bay, and three 34.5-kilovolt bays.
Palisades, Idaho	Two 10,000-gallon and two 1,200-gallon oil storage tanks for Palisades power plant.
Do	Furnishing and installing four 30,000-kilovolt-ampere, 164 r. p. m., vertical waterwheel-driven generators with generator surge protective equipment assemblies for Palisades power plant.
Provo River, Utah	Placing 26,000 cubic yards of riprap on unprotected sections of river banks along 10-mile reach of Provo river channel above Deer Creek reservoir.

United States Department of the Interior, Oscar L. Chapman, Secretary

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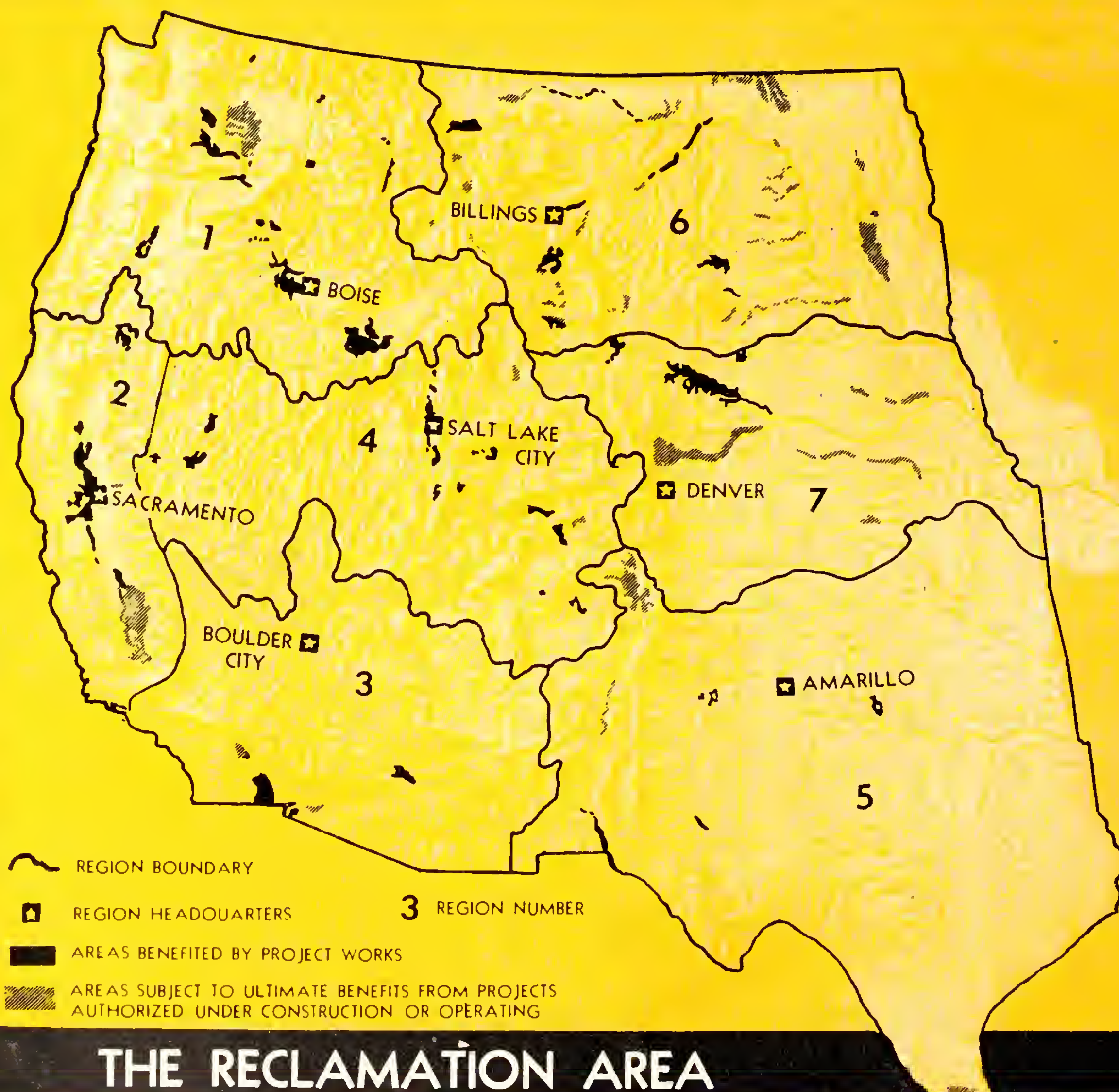

THE RECLAMATION AREA

The Reclamation ERA

July

1952

Official Publication of the Bureau of Reclamation

The Reclamation ERA

Reclamation's Golden Jubilee *1902-1952*

July 1952

Volume 38, No. 7

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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

THE TOWN OF ST. THOMAS

WAGON WHEELS emerged as the waters of Lake Mead were drawn down to accommodate an expected record flow of the Colorado River this spring. About 17 years ago residents of St. Thomas moved out ahead of Lake Mead waters that began rising in 1935 and covered the town in 1937. The Federal Government reimbursed the residents for their land and moving costs. On Easter Sunday, 1952, former residents gathered at the site for a reunion, some families spreading their lunches on the cement floors of their old homes. *Photo by Mark Swain, Boulder Canyon project photographer, Region 3.*

35 YEARS AGO IN THE ERA

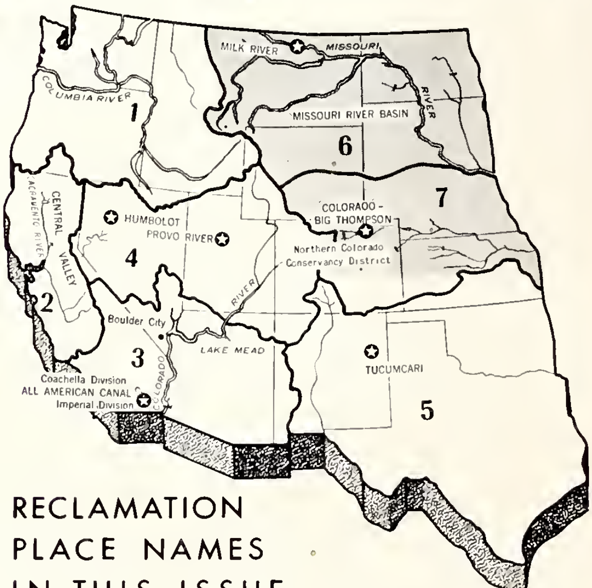
PLANNING THE FARMSTEAD

The arrangement of the farmstead is just as important to the farmer as is the arrangement of the factory to the manufacturer. Manufacturers are planning with the view of reducing labor and costs. They are learning to start raw material in one end of a building and bring a finished product out the other end with never a backward movement or a moment's delay in the procedure.

Now that thousands of men will be taken from farms to do the Nation's work in war, time and labor will be the big items on the farm for some years to come. If you are planning new buildings, plan them for efficiency and locate them for efficiency. Plan them just as if every day in the year would be a busy day when every minute of time and every step is valuable.

Plan well, for planning takes but a short while and you will use your farmstead constantly for many years.

(From article entitled, "Hints From a Practical Farmer" by I. D. O'Donnell, supervisor of irrigation, page 329 of the July 1917 issue of the Reclamation Record, predecessor to the RECLAMATION ERA.)



RECLAMATION PLACE NAMES IN THIS ISSUE

RECLAMATION WAS READY.—Scenes of Tucumcari shortly after the water tank exploded. Arrows point to Bureau of Reclamation equipment. *Two photos at top by Leo Rarabaugh, LeDeane Studio, Tucumcari, N. Mex., photo below by Paul W. Ball, Bureau of Reclamation.*

A Tribute From Tucumcari

by WALT ROGAL, Editor, Tucumcari Daily News, Tucumcari, N. Mex.

It was 4 a. m., December 13, 1951. Tucumcari, N. Mex., a city of 9,000 persons, lay asleep. Two minutes later there was a rumble of crashing structures, pierced by screams of injured and frightened people. The city's water storage tank had collapsed without warning, dumping nearly two million gallons of water into the densely populated west end of the community. Homes were splintered, swept from their foundations. Four persons were killed, six injured.

Failure of a vertical weld in the 30-foot high, 100-foot diameter steel storage structure instantly released a 6,500-ton torrent of water upon the adjacent area. Twenty-four buildings, including many homes, were completely demolished or damaged in a four-block area. Loss was estimated

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at $750,000. Ten minutes after the alarm sounded, Bureau of Reclamation men and machinery were on the way, ready, willing, and able to help in Tucumcari's time of trouble.

Within a few weeks, almost all physical signs of the tragedy had been obliterated. Families who were made homeless by the catastrophe had been housed elsewhere and the city returned to its normal functions. But no community ever completely forgets incidents of this kind. The sympathy for those who lost loved ones and for those who sustained injuries is unremitting. And the stories of heroism, the accounts of instantaneous response of neighbors who gave unselfishly of their time and goods for the benefit of those in distress, are long remembered.

In the predawn hours that followed the collapse of the storage tank, city police, county officers, firemen, gas company officials, National Guardsmen, Red Cross and Salvation Army workers, city employees, and hundreds of ordinary citizens were giving all possible aid to those residing in the area of destruction.

RIO GRANDE EMPLOYEES CITED FOR SERVICE

On April 30, 1952, water and reclamation officials from West Texas and New Mexico joined in a ceremony marking the presentation of certificates of award and a unit citation from the Secretary of the Interior for outstanding service (see article, "Defeating the Rio Grande Drought" in last month's issue). Photographed during the ceremony, from left to right, standing: F. D. Postle, irrigation superintendent, Ysleia branch Ysleta, Tex.; John L. Gregg, treasurer-manager, Elephant Butte irrigation district, Las Cruces, N. Mex.; W. H. Gary, board chairman, Elephant Butte irrigation district; Labon Backer, chief, power operations, Elephant Butte, N. Mex.; E. S. Mayfield, irrigation superintendent, Las Cruces branch, Las Cruces, N. Mex., and N. B. Phillips, Manager, El Paso County water improvement district No. 1, El Paso, Tex. Sitting: L. R. Fiock, project manager of the Rio Grande project, El Paso, Tex.; H. E. Robbins, regional director, Amarillo, Tex., and W. F. Resch, assistant project manager Rio Grande project, El Paso, Tex. *Photo courtesy of the El Paso Herald Post.*

JANUARY 7, 1952.

MR. RAY J. LYMAN,
Project Manager,
U. S. Bureau of Reclamation,
Tucumcari, N. M.

DEAR MR. LYMAN: On behalf of Mayor Clyde Dickinson, members of the city Commission and the city of Tucumcari, N. Mex. I wish to acknowledge with sincere appreciation the accomplishments of your organization during the tragic disaster created by the collapse of the Tucumcari water storage tank on December 13, 1951.

Your generous and immediate response to the urgency of the situation in providing men and equipment coupled with the outstanding leadership and direction of Mr. Ed Cerny greatly minimized the proportions of the accident and enabled the city to restore the water and power services so essential to the well-being of our community.

The U. S. Bureau of Reclamation is indeed fortunate to have the management of their Tucumcari project in such capable hands and the city of Tucumcari is grateful for the able assistance rendered.

Yours very truly,

J. A. FLEMING, *City Manager,*
City of Tucumcari, N. M.

One of the major roles of unselfish service was performed by the Tucumcari project office of the U. S. Bureau of Reclamation. Previously a great many persons in Tucumcari probably had failed to recognize that agency as an integral part of the community's life. A functionary phase of the Federal Government, yes, but a very aloof one. Many Tucumcari citizens spoke of the Bureau of Reclamation in terms of the regional office. The "bosses" were in Amarillo or far-off Washington, D. C. The project office was believed to be merely a guardian of a Federal trust in the 42,000-acre irrigation project constructed by the Bureau. But Tucumcarians learned differently.

Bureau of Reclamation employees, including engineers, were among the first to arrive in the distressed section of the city. Ray J. Lyman, project manager, responded to the appeal of city engineer Bert Ridling by having Ed Cerny, one of his assistants, on the job with a collection of heavy machinery en route to the stricken area within 10 minutes after the alarm had been sounded.

Eleven pieces of Bureau equipment, including dump trucks, a truck hoist, acetylene cutting devices, a road maintainer, two heavy duty power wagons, and a 93,000-pound dragline were clearing away the debris before the sun broke through the early morning shroud-like, murky clouds.

The task that confronted Bureau of Reclamation forces was not a simple one. In those early hours before daylight, live electric wires threatened the lives of the workers. No one knew if broken gas mains were discharging explosive fumes. The possibility of damaged buildings collapsing upon the relief workers added to the known dangers.

Into the middle of the demolished area plunged the Bureau of Reclamation employees. Directed by Cerny, equipment and crews were dispatched to given areas. Hours later, streets that had been covered with shattered homes, broken glass, furniture, electric meters, transmission and telephone wires, were cleared to traffic. And all this had been accomplished without a scratch to any of the volunteers.

Today, the Bureau of Reclamation, from its local office to the headquarters of the Commissioner at Washington, D. C., is keenly aware of the damaging effects of the water storage tank's collapse in December. This agency, helpful in disaster, will do all that it can to help Tucumcari find a solution to its water problems.

The ties between the city and the Bureau, knitted more closely as a result of the Tucumcari disaster, are expected to be further strengthened. Since the life-blood of any community is an abundant supply of water, the people of Tucumcari and the Bureau of Reclamation may be able to join forces to develop a much-needed supply for present and future use. ###

Chapman Honored on 19th Year of Public Service

More than 200 long-time friends and well wishers paid tribute to Secretary of the Interior Oscar L. Chapman during a luncheon at the Willard Hotel on May 2, 1952, on his nineteenth anniversary of his connection with the Department of the Interior, having taken office as Assistant Secretary of the Interior on May 4, 1933.

Joel D. Wolfsohn, Assistant to the Secretary, read a congratulatory telegram from the President of the United States at the luncheon, presided over by Dale E. Doty, Assistant Secretary for Public Land Management. Tributes to Secretary Chapman were paid by Senator Joseph C. O'Mahoney, Chairman of the Senate Committee on Interior and Insular Affairs; and Representative Michael J. Kirwan of Ohio, Chairman of the House Appropriations subcommittee on Interior. National Park Service Director Conrad L. Wirth reviewed the highlights of the Secretary's 19 years of service with the Department.

The occasion was linked closely with Reclamation's fiftieth anniversary or Golden Jubilee by a telegram read by Assistant Reclamation Commissioner Goodrich W. Lineweaver. The telegram was signed by United States Senator Ernest W. McFarland of Arizona, United States Representatives John R. Murdock and Harold A. Patten of Arizona, Undersecretary of the Interior Richard D. Searles and Commissioner of Reclamation Michael W. Straus who were participating in the Reclamation Jubilee in Arizona. It read:

From the State of Arizona, which owes so much of its growth and prosperity to the things your Department has done for the people of the West, we send you greetings and congratulations on your nineteenth anniversary as a public servant of Cabinet rank.

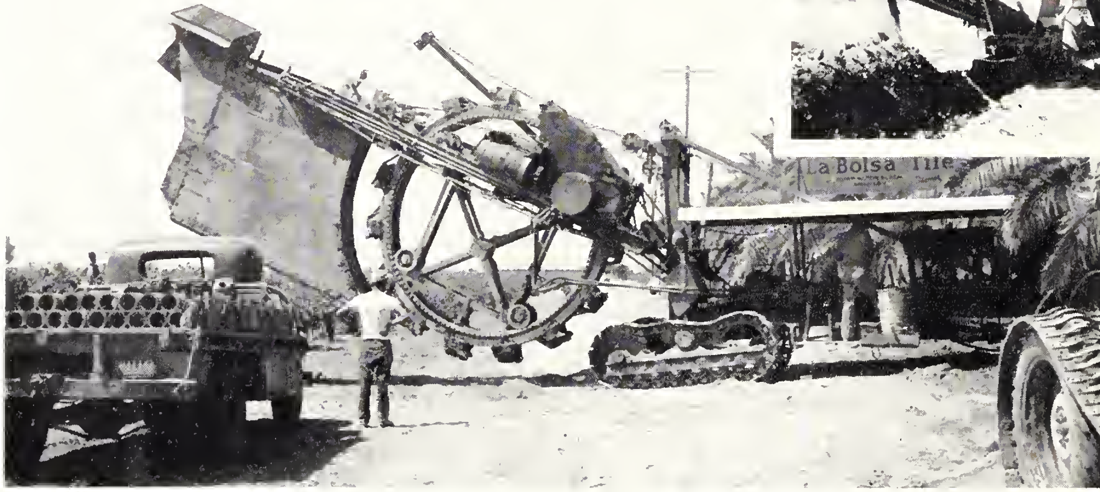
You have carved out a new record unique in the annals of American Government as Assistant Secretary of Interior, as Under Secretary of Interior, and now as Secretary of Interior you have served as a Cabinet officer longer than any other American. You have been a tower of strength and a constant source of inspiration and wisdom for two great American Presidents over these past 19 years. You are the only member of the official family of our beloved late President, Franklin Delano Roosevelt, who has withstood the ravages of nearly two decades of the most difficult times our country has ever seen.

It is doubtful that we shall ever see in our time or perhaps for generations to come a record of unbroken public service of such high rank, such unremitting devotion, and such marked success as yours.

The Arizona celebration of Reclamation's Golden Jubilee, included the dedication of Arizona's first 82,500 kilowatt generator at Hoover Dam, delivery of the first irrigation water to the Wellton-Mohawk project (representing the largest project to be authorized and constructed since the end of World War II), and recognition of the Salt River project as a major Reclamation development. A mammoth pageant "The Mask of the Yellow Moon" at Phoenix, Ariz., in which a cast of 3,000 people enacted the story of Reclamation in Arizona to the music of the Valley of the Sun Suite, was presented. The music was written specially for the occasion by Ferde Grefe, famed composer of the Grand Canyon Suite.

Secretary Chapman, who was accompanied to the luncheon by Mrs. Chapman, responded by praising the Department's progress in conservation and development of the Nation's natural resources.

Coachella Drainage Investigations



ALL-IN-ONE OPERATION.—Drain tile can be installed at the rate of 300 to 400 feet an hour, down to 7½ feet below the ground with this 50-foot-long, 30-ton machine from Huntington, Calif. It digs the trench, places gravel, lays the tile, covers it with impregnated paper, places gravel over the paper and backfills the trench. One worker remains in the "shoe" to set the tile in the gravel-lined trench, as another worker lowers the tile sections to him in this assembly-line operation. Photo above shows the machine in action in the Coachella Valley. *Photos by Kirby Hester, Bureau of Reclamation*

PART 3—USING THE EVIDENCE

by J. S. REGER, Hydraulic Engineer, Coachella Division, All-American Canal System, Coachella, Calif.

EDITOR'S NOTE: Parts 1 and 2 described the subsurface situation in the Coachella Valley, and the methods used by the four-agency Coachella Valley Cooperative Drainage Investigations to obtain information on the underground water and strata of the valley, including the use of piezometers, or self-casing, jetted and self-sinking wells, which not only furnish reliable data on the substrata, but remain in place as multiple purpose observation wells to detect the movements of ground water.

COACHELLA VALLEY NOW HAS over 700 "informants" on underground water activities.

In addition to the 42 two-inch wells originally installed by the hydraulic rotary drilling method, at well-calculated spots on a predetermined grid system designed to cover the entire valley are the tiny 3/8" piezometers, sticking up about 2 or 3 feet above the surface, and probing from 18 to 140 feet into the ground. More are being added daily. If placed end to end, these piezometers would reach more than 8 miles below the earth's surface. These wells cost about 20 cents a foot to install, as compared with the cost of about $2 a foot for the cored wells drilled with the hydraulic rotary rig.

All of the Coachella drainage investigations are keyed to the observation wells. The investigators have plotted and designed 200 miles of surface profiles at approximately right angles to the steepest slope of the valley floor, with respect to the two principal axes of the coordinate grid system on which the wells are plotted. Thus they have a complete picture of the terrain.

As soon as they receive the graphic logs of each observation well, the investigators add these data on the subterranean conditions to the surface profiles, which gives them both surface and subsurface information on master charts—some of which resemble large rolls of wallpaper, due to the space required to indicate the information clearly and accurately. Because water tables fluctuate, they plot information about water levels on prints or transparencies.

The Coachella Valley Water District hires a full-time "well reader" who patrols the "network," reads the electrical indicator which shows the water level in each well, makes a record of each reading, and turns the information over to the investigators for study or action as necessary. Each well has its own designation so it can be located and related to the master charts, profiles, transparencies, and maps. Whenever a well records an unusual fluctuation of the water table, whether a rise or decline, it is automatically termed a "key well" and more frequent observations are made.

During the 4 years the investigations have been actively in progress, an estimated 10,000 ground water observations have been made and recorded.

All this information is used to keep track of Coachella Valley's underground water. It has already paid dividends as a "trouble shooter" before trouble occurred.

A group known as the Technical Committee, consisting of one member from each of the four cooperating agencies, meets quite often to study technical details, or to take emergency action. For example, in February 1949, less than a year after the first wells had been installed, the resident engineer and other members of the Technical Committee noted that a drainage problem was arising in a 700-acre area in the eastern part of the valley. In places, the water table had risen to less than 3 feet below the ground surface. The committee members decided to discover the cause and prescribe a remedy.

Surface profiles for this area were already plotted and ready for use, as was the coordinated grid system for additional wells in the observation network when needed. The members of the committee realized that the potential danger threatened adjoining land and located wells to observe conditions in a 1600-acre study area involving the "trouble spot." The Water District's jetting crew went into the area and installed 89 of the 3/8" wells. The "well reader" kept a close watch on the wells, recording the water level as soon as the wells had been jetted, making another reading before irrigations, during irrigations and after irrigations. The resident engineer used the information to prepare a water table contour map. Water District draftsmen helped plot the direction of flow of the ground water, the gradient or slope of the water table, and the characteristics of the subsurface materials, according to the logs of the jetted wells. By showing the surface contours on this same map, the depth to water at any location in the area could easily be calculated. Logs of the jetted wells were plotted on the previously prepared surface profiles, thereby affording a convenient method for studying the subsurface materials.

This area, which had previously been irrigated with pumped water, had been receiving a supplemental supply of water from the Colorado River since 1948. The ground water contour map showed a ground water mound under the irrigated area, and other information pointed to the conclusion that this was a semiperched underground water body which could be drained with a buried tile system.

Under the four-way agreement the combined members of the Investigations (Water District—University—Salinity Laboratory—Reclamation

PUTTING THE DATA TO THE TEST.—At left, below, a recent meeting of the technical committee. Left to right, R. W. Austin, junior drainage engineer, and R. C. Reeve, drainage and irrigation engineer, both from the United States Salinity Laboratory, Riverside, Calif.; J. S. Reger, hydraulic engineer, Bureau of Reclamation; A. F. Pillsbury, associate professor of irrigation, University of California, Los Angeles, Calif., and J. R. Spencer, drainage engineer, Coachella Valley County Water District, Coachella, Calif. Not present when picture was taken was L. O. Weeks, deputy chief engineer, Coachella Valley County Water District. At right, below, R. C. Reeve at U. S. Salinity Laboratory, Riverside, testing Coachella Valley soils. *Photo at right, courtesy of U. S. Salinity Laboratory.*

Bureau) decide upon the most feasible method to correct any particular drainage problem and then recommend that method to the District, which is free to accept or reject the recommendation for any reason. In this case the District wholeheartedly approved the recommendation and the tile system was installed during February 1950. By July 1950 the water levels were from 1 to 3 feet lower than they had been a year before. Furthermore, there was a great improvement in the general appearance of the soil and the crops, mostly grapes and dates.

This is only one example of several drainage problems which have been and are now being solved before the ranch owners suffer any crop damage.

Another example of foresight on the part of the Investigators was that of obtaining samples of local ground water before Colorado River water arrived. The investigators knew that some of the local ground waters which had been used for irrigation purposes were high in sodium percentage and low in salt. Colorado River water, however, is just the opposite, being low in sodium and moderate in salt. This would affect drainage as Colorado River water would penetrate the soil faster than the local water. Fortunately, the original 42 wells were installed in time to furnish samples of the local ground water before it could become intermingled with the river water, thus affording an opportunity for scientific study of the "before and after" effects of the arrival of Colorado River water in the valley.

As additional data are obtained, evaluated and interpreted, detailed physical conditions which affect drainage in the valley are becoming more evident day by day. Other phases of the investigations include special studies relating to infiltration rates of irrigation water, salt removal methods, spacing of drainage tile lines, and the effectiveness and construction of drainage wells in the valley.

The investigations have aroused a considerable amount of interest among Federal, State, and private agencies. A private corporation, probably the largest of its kind in the world, recently sent two of its representatives to Coachella to study the method of attack and the techniques involved. This concern was embarking on a multimillion dollar agricultural undertaking in a foreign country in which drainage would apparently become a problem. A nationally known water well development concern has expressed a genuine interest in certain techniques.

The real worth of the program, however, lies in the fact that over 20,000 acres have already been saved from the threat of a rising water table and a serious drainage problem. The sentries have been posted, and the strategy board is alerted. The underground is on the spot, all due to a bold cooperative adventure on the part of public service agencies interested not only in developing, but in maintaining, the irrigated agriculture of the West. ###

Imperial Irrigation District Operates All-American Canal

The Imperial Irrigation District, on May 1, 1952, assumed operation and maintenance of the diversion and desilting works on the California side of the Imperial Dam, main All-American Canal, and the common section of the Coachella Canal to Riverside County line in California under the terms of a supplemental contract between the district and the Bureau of Reclamation executed March 4, 1952.

The Bureau of Reclamation will continue to operate and maintain the sluiceway sections of Imperial Dam and works at the Arizona end of the structure which serve as diversion and desilting facilities for the Gila project. It will also operate turnouts serving the Yuma project in Arizona. •

Flatiron and Pole Hill Near Completion

Secretary of the Interior Oscar L. Chapman announced the award of the contract to complete the Pole Hill power plant and Flatiron power and pumping plant to the Eagle Erection Co. of Shoshoni, Wyo. on May 9. These are the last major power features of the Colorado-Big Thompson project which will supply irrigation water for 615,000 acres of land and 183,700 kilowatts of hydroelectric power to a critically power short area. Work on the Pole Hill plant was to begin early this month and be completed in about a year. The Flatiron job will get under way in mid-September, to be finished in a year.

The first integrated operation of the vast Colorado-Big Thompson project was initiated in ceremonies at Loveland, Colo., last month on June 17, the Fiftieth Anniversary of the signing of the Reclamation Act. •

C. PETRUS PETERSON. *Photo courtesy Townsend Studio.*

Reclamation's Hall of Fame

Nomination No. 13

C. Petrus PETERSON

PRESIDENT OF NRA

by **MARCELLA ALLEN, Region 7 Headquarters, Denver, Colo.**

C. PETRUS PETERSON, THE NEW PRESIDENT of the National Reclamation Association, is a big man physically, a big man in his own home town and State, and a big man among the "water boys," as he calls them.

Born of Swedish parents on a farm in Polk County, Nebr., he did not speak English until he started to public school. He was slated to be a preacher and attended the old Luther Academy in Wahoo, Nebr., then Augustana College at Rock Island, Ill., where he received an A. B. degree. He then decided to be a lawyer, and graduated from Law College in the University of Nebraska in 1909. In 1946 he was called back to Augustana to receive an LL. D. From this same College, Oscar L. Chapman, Secretary of the Interior, earlier was given the same honor.

For a couple of years he practiced law in Wahoo, then went into partnership with C. O. Whedon, the first general counsel of the Bankers Life Insurance Co., Lincoln, Nebr. When Mr. Whedon died, young attorney Peterson became the next general counsel for the firm, which position he has held ever since.

Senator Peterson served two terms, 1915–17, in the Nebraska House of Representatives, one term, 1919, in the Nebraska Senate. He was a member of the Nebraska Constitutional Convention in 1919–20.

Shortly after Nebraska adopted the nonpartisan unicameral legislature (so-called because it consists of one chamber of legislators) he served for four terms, 1941–43–45–47, and was speaker in 1945. He became a member of the Nebraska Legislative Council, during which time he served as chairman on the controversial water diversion subcommittee. He also became a member of the Nebraska Commission on Inter-governmental Cooperation in 1941 and is still serving in that capacity. He was vice president and chairman of the board of managers of the council of State governments, and continues to be a member. It was he who steered the council into studying the problem of ultimate management of the great Missouri River Basin development.

During the 1943 session of the legislature, the Central Nebraska Public Power and Irrigation District had a bill introduced to allow diversion of water from one river watershed to another. Tri-county, as the district is familiarly known, had built a whole project on the proposition that Platte River water could be diverted onto rich table lands lying between the Platte and the Republican Rivers. A suit was filed against the district to keep them from taking water out of the Platte onto that part of the table land that might be part of the Republican watershed. Somewhat unexpect-

(Please turn to page 175)

WHAT CLASS LAND?

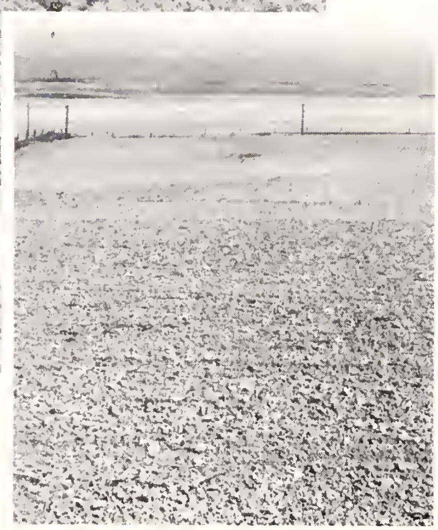
by H. N. WATENPAUGH, Reclamation Economist, Region 1, Boise, Idaho

Part 6 in a Series of Articles on Soils and Land Classification

No reputable businessman starts a new enterprise without first determining the possibilities of success. In doing this, he uses various yardsticks—population figures, building permits, and supply and demand charts. The Bureau of Reclamation does essentially the same thing. One of the many yardsticks is the land classification which was tailor-made for Reclamation needs and which is also of aid to you as a farmer on a Reclamation project.

Briefly, the land classification establishes, under the specific organization of a Federal Reclamation project, the extent and degree of the suitability of land for sustained irrigation farming.

When understood and properly used, this yardstick can be an indication to you of the relative success of your operations. This yardstick has



CLASS ONE.—Above, easy to irrigate, deep productive soil, can grow large variety of crops. CLASS TWO—At immediate left, rather steep slope makes handling water difficult if erosion is to be prevented. CLASS THREE—Lower left, rolling topography makes it difficult to irrigate, increases water use and operational expenses. Limited to hay and pasture crops. *Photos above and at lower left by Phil Merritt, photo at immediate left by Stan Rasmussen, both Region 1.*

no claim to infallibility, but it is the best that experience has developed. A man of average ability located on land classified as irrigable should have no difficulty in making a comfortable living, but to do this, especially on the land that just makes the grade, his farm size and organization must be right. If you are doing better than the yardstick measures for your land, you are no doubt making better use of your natural resources, or your farm organization and management practices are superior to those which are normally expected. This assumes, of course, that you had at the beginning of your farming operations only average personal opportunities and that you have not had unusual financial aid or personal expenses. If you are not doing so well, perhaps you had better check up and see if your farm enterprise is the right size or your operations efficient, or perhaps your land should be reclassified.

Land classification is used by the Bureau in all phases of its activities—from initially measuring the land's suitability for use in a new project, through indicating the desirable land use during development and operation, to serving as a base for renegotiating contracts on established projects.

Because of the above personal and Bureau uses, it is good business for you to know in more detail

CLASS FOUR—At right, shallow or heavy soils not too profitable for general crops can be used for permanent pasture. CLASS FIVE—Below, waterlogged, but with good soil, and can be drained. If drained, this land would be classed not higher than three because of the cost of leveling. CLASS SIX—Lower right, sandy and hummocky—"nonarable." Would require too much water, cost too much for leveling, wind erosion would be hard to control, and crop production limited. ***Photo at right by Stan Rasmussen, photos below and at lower right by Phil Merritt, both Region 1 photographers.***

just what your classification purports to do and of what it consists. The Bureau classification is an interpretation of the land's physical capabilities into its economic possibilities. It takes into consideration the productive capacity of the land, farm development and production costs, as well as the costs of constructing, developing, and operating the project. In the process of classification by the Bureau, all the above factors, insofar as possible, are considered concurrently and the process kept fluid. Only in this way can the best end results be obtained. The following gives a pictorial concept of how irrigable land is determined.

Specifically, the classification is designed to answer the question: can the land or can it not, under a sustained irrigated agriculture, and when farmed in adequate units and when properly provided with the essential improvements of leveling, drainage, irrigation facilities, and the like (1) meet all production expenses, including irrigation operation and maintenance costs, (2) provide a reasonable return on investment, (3) repay its share of the cost of project facilities, and (4) provide a satisfactory level of living for the farm family?

The above is a long sentence, with a lot of when's, where's, and provided's, but if the land can do these things, it is "arable" and its irrigation is considered. If it does not meet this definition, the land is "nonarable" and should not be irrigated. The classification goes further, however, than just making this determination between arable and nonarable lands. It places the lands into six classes, according to their varying suitability for irrigation under the project's specific organization. Only classes 1, 2, 3, and 6 are in order of economic productive capacity. Classes 4 and 5 are reserved for special purposes. Now what is the meaning of each class used?

Lands suitable for a wide variety of crops—are placed in classes 1, 2 and 3 if they meet the other requirements for "arability" indicated above and to be discussed briefly later. Class 1 are the better of these lands and class 3 are those just meeting the requirements. Farms of the different

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classes, however, will provide comparable farming opportunities if properly managed in units of adequate size and if land values and related considerations are maintained in proper balance.

Class 4 lands are called "limited arable" because they may prove or have proved to be feasible for irrigation only under a special use. The reasons may be that they are only suited for use as pasture, but are desirable in the farm unit or project because they can be used efficiently with better lands; or thye are suitable for fruit production because they may have unusually good air drainage and market conditions are favorable; or, if there is a demand for small acreages, as is the case around most large cities, intensively worked, poorer quality land may be used for suburban purposes. Lands placed in class 4 may actually be more desirable for irrigation than classes 1, 2 and 3 as their special use or adaptability may make them economically more profitable to farm or own than other lands. They do, however, present specific problems which must be carefully studied before a determination is made as to their "irrigability" and then they must be used in accord with their capability.

The use of class 5 in the classification is an ingenious device to protect you as a farmer. If, for example, land is in need of project drainage or flood protection, it is placed in class 5 and charges are not made against it until the required reclamation is completed. Also this class is a useful tool in project planning for, if a question arises regarding a piece of land's suitability for inclusion in the project, it is tentatively classed as 5 until the problem is solved. In other words, class 5 contains suspended land. Only when the limitation is removed is it considered as arable land or suitable for irrigation.

If the problem is not corrected in a fixed period, the land is classified as class 6 and, therefore, should not be farmed under irrigation within an organized project. True, an exceptional farmer may successfully farm some of these class 6 lands, but, under the succeeding farmer, or under long-time production, they would be a burden to the project if included as irrigable. In fact, the better lands would support them.

In last month's article "The Evolution of Land Classification," my colleagues, E. N. Poulson and L. R. Swarner explained the early trail blazing which was done in working out the relation between land quality and reclamation feasibility, and how men of outstanding reclamation experience ascertained that, if irrigation is to succeed, the land must meet certain requirements. Naturally the degree of success, other things being equal, is in proportion to the increased quality of the land above these minimum requirements.

For instance, it was found in most areas that land with less than 18 inches of good free-working soil of a fine sandy loam texture or coarser was not likely to succeed under permanent irrigation farming. Lands with more than 12 percent slope are limited in crop adaptability, subject to erosion hazards and also present difficult production problems, and therefore are bad risks. Again, lands with high water tables are associated with limited crop adaptation, quality and yield, thus reducing their suitability for sustained, profitable farming. Lands affected with high water tables are also apt to go out of production because of "salting up." A set of these relationships has been worked out by the Bureau for the main land factors and are used as a general guide for the classification of the land. On each project, however, these relationships are refined, with the cooperation of the State agricultural colleges and the Department of Agriculture, to reflect specific local conditions.

Men familiar with the soil know that one set of specifications does not fit all conditions, and that modifications are necessary from project to project. The general specifications referred to do, however, form a solid foundation upon which to work, and keep the classifications throughout the Bureau uniform. Most important of all, they do represent years of experience.

(NEXT MONTH—HOW LAND IS SURVEYED)

THAT THE VALLEYS MAY PROSPER is the ultimate aim of the Northern Colorado Water Conservancy District. The Warburg cherry orchards and cornfields in the Big Thompson Valley, east of Loveland, Colo., are typical of the rich farming areas which are to receive water when they need it from the other side of the Divide. *Photo by N. T. Novitt, Region 7 photographer.*

How a Conservancy District Works

by J. M. DILLE, Secretary-Manager
Northern Colorado Water Conservancy District

Adapted from an address, January 17, 1952 during the Water Users Conference, at which the Four States Irrigation Council was organized at the Denver Federal Center, Denver, Colo.

Part 3—Managing the District

Under the terms of the contract with the Bureau of Reclamation, and the provisions of the conservancy district act, the district has worked out a water distribution program and repayment plan that will assure full and prompt repayment of construction charges and, we hope, will satisfactorily distribute the costs and benefits among the people of the district.

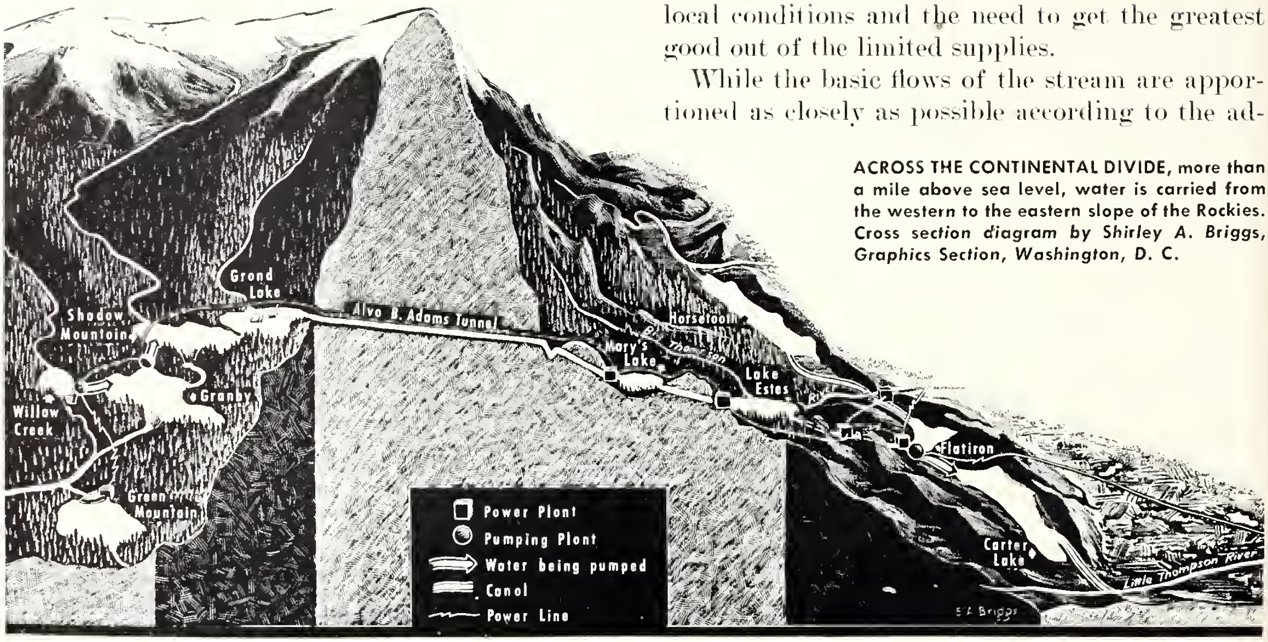
As previously stated, we expect to divert an average of 310,000 acre-feet of water per year from the Colorado River headwaters. Thus in our water user contracts, we define the acre-foot as being one three-hundred-ten-thousandth (1/310,000) of our annual supply. Most of the 310,000 acre-foot units of water have already been allotted by firm contracts at an annual assessment rate of $1.50 per acre-foot, a figure that the users decided they could pay.

Without going into detail, I may explain here that part of the project water is allotted to municipalities, part to several irrigation systems in blocks, but that most of it will be allotted to individual farms according to the petitions of the owners.

In order to properly control these individual allotments, the district has compiled a case history, as it might be called, of the present water supply of every farm in the area, based on the average water value of the stock, acreage, reservoir rights or pumping plants attached to the farm.

Allotment of water on the petition is thus usually limited to an amount that will total 2.5 acre-feet per acre, headgate diversion, including the present supply. This is done to prevent speculation and to spread the benefits as widely as possible.

There will probably be a total of about 2,700 separate allotment contracts when the water is all allotted. Each contract specifies the stream into which the allottee's water is to be delivered—the



local conditions and the need to get the greatest good out of the limited supplies.

While the basic flows of the stream are apportioned as closely as possible according to the ad-

ACROSS THE CONTINENTAL DIVIDE, more than a mile above sea level, water is carried from the western to the eastern slope of the Rockies. *Cross section diagram by Shirley A. Briggs, Graphics Section, Washington, D. C.*

Cache la Poudre, Big and Little Thompson and the St. Vrain Rivers.

From the point in the stream into which the district delivers the water, it will be the responsibility of the State officials and of the management of the system serving the allottee, to deliver the water to his land. The district has no desire nor in fact any authority to interfere on the streams or in the various distributing systems; but we are anxious to help set up a practical system that will assure the proper delivery of the water.

Of course the operation of all systems as far as diversion and delivery of water is concerned, is definitely tied in to the administration of the State engineer, the division engineer and the water commissioners in the several water districts. These officials distribute the daily flows of the streams according to the court decrees, supervise the transmission of reservoir and exchange water in the streams, inspect for safety the numerous reservoirs and keep records of all stream discharges and canal diversions.

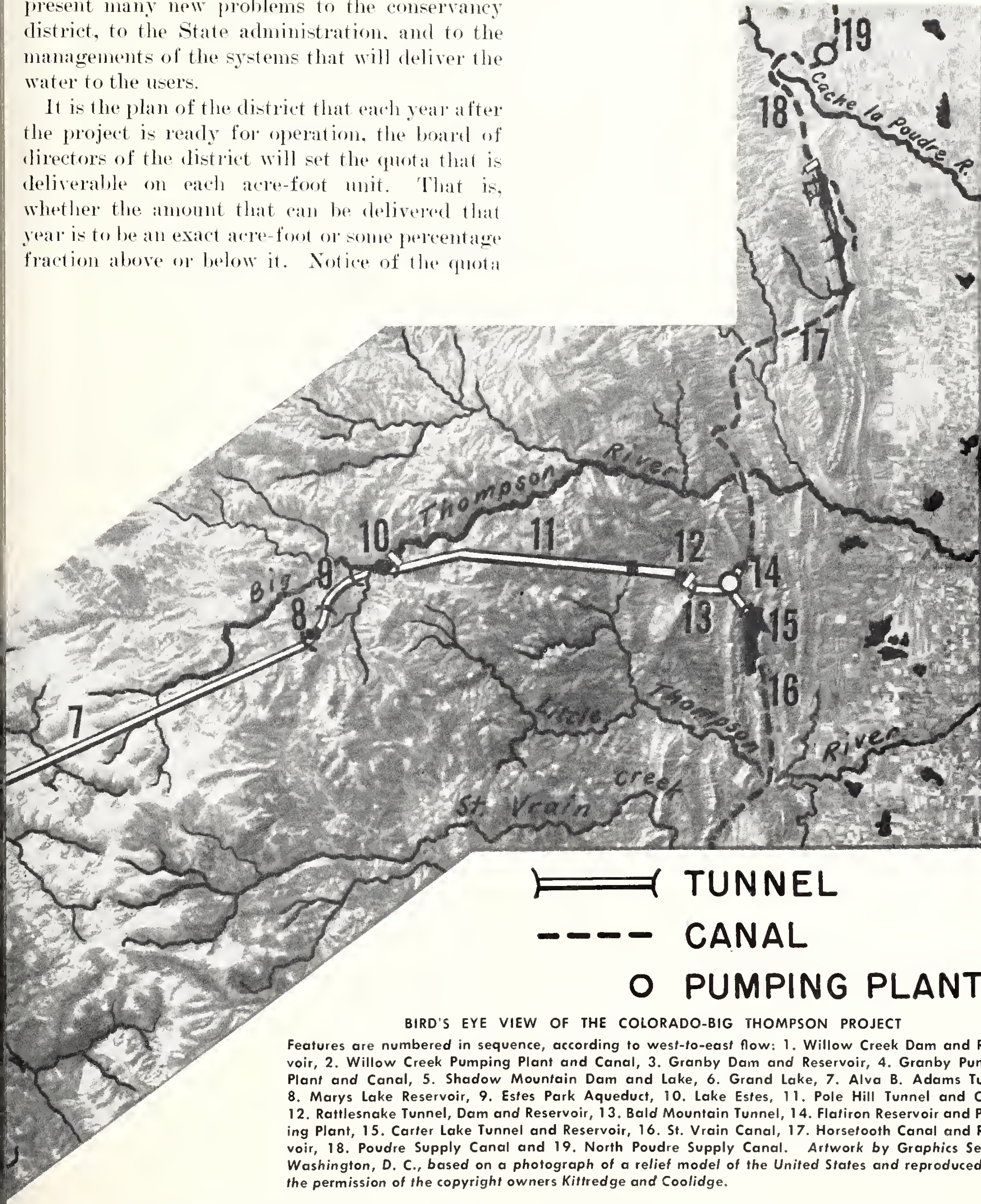
It may be mentioned here that the distribution of stream flows, strictly in accordance with decrees, does not always provide the greatest beneficial use of our water supplies, largely because some owners of early appropriations are often inclined toward a "dog in the manger" attitude and use more than they actually need merely because they are legally entitled to it.

Over the years, the administration in the various water districts has also developed to fit the judicated decrees, the system of handling exchange water, reservoir flows, carriage losses, and the methods of operation and recording have been built up to suit local needs.

Consequently, it can be seen that the bringing in of around 300,000 acre-feet of new water will

present many new problems to the conservancy district, to the State administration, and to the managements of the systems that will deliver the water to the users.

It is the plan of the district that each year after the project is ready for operation, the board of directors of the district will set the quota that is deliverable on each acre-foot unit. That is, whether the amount that can be delivered that year is to be an exact acre-foot or some percentage fraction above or below it. Notice of the quota



BIRD'S EYE VIEW OF THE COLORADO-BIG THOMPSON PROJECT

Features are numbered in sequence, according to west-to-east flow: 1. Willow Creek Dam and Reservoir, 2. Willow Creek Pumping Plant and Canal, 3. Granby Dam and Reservoir, 4. Granby Pumping Plant and Canal, 5. Shadow Mountain Dam and Lake, 6. Grand Lake, 7. Alva B. Adams Tunnel, 8. Marys Lake Reservoir, 9. Estes Park Aqueduct, 10. Lake Estes, 11. Pole Hill Tunnel and Canal, 12. Rattlesnake Tunnel, Dam and Reservoir, 13. Bald Mountain Tunnel, 14. Flatiron Reservoir and Pumping Plant, 15. Carter Lake Tunnel and Reservoir, 16. St. Vrain Canal, 17. Horsetooth Canal and Reservoir, 18. Poudre Supply Canal and 19. North Poudre Supply Canal. *Artwork by Graphics Section, Washington, D. C., based on a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.*

will be sent to each allottee and lists of the lands, the owners, and the attached quota under each ditch system will be furnished the management of the system and the responsible State officials.

A full program of necessary measurement stations and recording devices on west and east slope streams and project canals has been agreed upon by the State engineer, the conservancy district, and the Bureau of Reclamation. A special division engineer is now permanently located at Loveland

IN CONFERENCE with Mr. Robert S. Leighton, secretary-manager of the Pershing County Water Conservation District, managing farm operations on the ranch, or at home in Lovelock, Ruth Ruddell, typifies the modern women of the West. *Photos submitted through the courtesy of Robert S. Leighton, in photo at left.*

WOMEN OF THE WEST

The Lady President—Ruth Ruddell

She's a lady of no small talents. Ruth Ruddell, handsome, capable director, three times vice president, and twice president of the board of directors of the Pershing County Water Conservation District, is as much at ease presiding at a board meeting as she is doing the honors as a dinner hostess (for which she is noted) or inspecting beef cattle, bossing a fence repair job, or making a decision at a headgate regarding water deliveries on the Humboldt project in Nevada.

No wonder, for she was born on the ranch which she now operates, comes from a family which pioneered irrigation in the Lovelock Valley, and knows what she is doing. Although she handles several man-sized jobs, everyone agrees she's "quite a lady."

For years she helped her father run the farm, and upon his death she carried on in the family tradition, taking a lead in project affairs and operating the farm at a highly efficient level.

Miss Ruddell believes that women can play a big part in the success of irrigated farms by keeping up with all modern developments in irrigation farming. "Read," she says, and "take an active part in organizations dealing with farm activities."

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and plans are being developed for a more modern and adequate system of records and reports on stream flows and diversions in the water districts that will handle project water.

Here it might be mentioned that as the present original supplies are doubled by return flows and reuse, it is expected that the new water, about 40 percent of our present average original supply, will increase the return flows proportionately.

Under our repayment contract, this water is claimed by the United States for the use of the district which may recapture and use it or allocate it to ditches on the basis of their decreed priorities.

For all practical purposes, it will become a part of the streams and subject to use by present appropriators.

Our repayment contract expressly gives preference to irrigation over power uses.

With increasing demand for power and multiplied administration and construction costs, perhaps this is unavoidable.

While our district directors take a keen interest in the power side of the project and the benefit it will also be to the area, they are not power people and are content to leave the decisions on power problems to others.

She herself was interested in the Pershing County Water Conservation District, first organized as the Lovelock Irrigation District in 1926. The original organization was named for the city of Lovelock which in turn was named after her grandfather, George Lovelock, the original settler in 1862 on the property which she now owns.

President Ruddell thinks that women should take a more active part in district, community, and county affairs as women are able to put more concentrated effort into public affairs which can be well coordinated with the necessary assistance to the husband in his management of the farm.

Asked what were the most important qualifications for membership on a board of directors, she said, "A good general knowledge of the district in regard to its functions and, particularly, its financial structure. But most important is a willingness to give considerable time to the duties of the Board for very little monetary compensation."

The most important aspect of Reclamation, according to this experienced, thoughtful, farmerette-executive, is the need for "more efficient use of our irrigation water, through improved irrigation systems and methods."

She is an ardent conservationist and takes a keen personal interest in new and improved methods of weed control, irrigation, drainage, and farm management practices which add to the fertility and productivity of project lands. Her constant aim is to increase the income and welfare of the water users and the project in general.

Seepage is one of the principal problems that gives her concern. Caused primarily by inadequate distribution facilities and lack of a satisfactory drainage system, this problem has a more determined antagonist in Miss Ruddell. She has been very active and instrumental in obtaining the assistance of the Bureau of Reclamation in investigating and planning adequate distribution and drainage systems and in launching a water users program of drainage construction. Under her leadership, the district leased lands to provide summer pasture for livestock owned by the water users. Water users can thus carry more livestock of their own to utilize hay and grain otherwise consumed by transient livestock owned by non-project stockmen or exported to other areas. By feeding their own livestock rather than selling the forage, the water users boost their farm income and soil fertility.

All in all, the people of Lovelock have good reason to be proud of their third generation pioneer woman, and one of the very few lady presidents in the West. ###

EDITOR'S NOTE: With this issue the RECLAMATION ERA begins a series of articles on present-day pioneer women of the West. There are many unsung heroines on Reclamation projects today, whose experiences and observations can add new values to the store of knowledge regarding the winning of the West through wise conservation and use of water resources.

We hope our readers will contribute to this series. Send photographs, articles, or information to the RECLAMATION ERA, code 460, United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C. A free subscription for one year is awarded for each published article. Manuscripts should be submitted in duplicate, double spaced. Photos should be glossy prints, accompanied with description of topic, names of places, persons, name of photographer and date taken.

I think you would probably be interested to know that our relations with the multitudinous personnel of the Bureau have been most satisfactory and we have found these men, as a rule, capable and conscientious. If there is sometimes a gap between the somewhat theoretical approach of the Bureau men and what we think is our more practical slant on a mutual problem, we laboriously and finally work out some agreeable solution.

It is now 16 years since the movement to get a better water supply was started and about 13 years since our district was organized and we made our contract with the Government. We old-timers wonder if we will see the job completed. Nevertheless, those of us who have been connected with the project since its inception in 1933, firmly believe that in spite of the years of delay, the increased cost, and all the other difficulties, the project is still a sound and justifiable undertaking.

We have a lot to learn yet, not only in the administration and management of our systems and water supplies, but most important, perhaps, in the application of water on our soils and crops. We can use too much water if we have it, or apply it, at the wrong time.

So we need careful thinking, more knowledge, plenty of hard work and all the mutual cooperation possible if the fullest use of the water supplies of Northern Colorado is to be eventually reached and we do our best in helping feed a hungry world.

The Valley of the Milk River

Part 3—Milk River Farmers

by PARKER E. HEIKES, Associate County Extension Agent, Malta, Montana

On the Milk River project, the man on the smaller irrigation farm plays an important, lasting and beneficial part in the ultimate development of the irrigated area.

The success of the farmer on a small unit depends on how he handles his soil and water resources. In general he makes much better use of them than the large landowner.

Bill Sudbrack has been recognized for some time as one of the more progressive farmers on the Milk River project. He came to this country from Germany in 1923 and settled on his present farm in the South Wagner area in 1938. Since that time he has increased the value of his 99-acre farm from $6,600 to its present value of approximately $30,000. In addition Bill has two tractors, sugar beet equipment, potato equipment, and a general line of farm machinery which he values at $10,000. For the past 5 years his gross income has averaged $11,000 or more per year.

Bill follows a rather diversified type of farming. His crop rotation includes each year approximately 20 acres of sugar beets, 30 acres of alfalfa hay, 10 acres of feed grain, 4 acres of potatoes, and 17 acres of irrigated pasture. For 14 years, through proper soil management, liberal use of fertilizers, and general good farming, his sugar beets have average 15 tons per acre.

Bill has about 30 head of beef cows, and 15 dairy cows. In addition to the dairy products used in the home, he sells about $2,100 worth of milk and cream locally to the Malta Creamery. His 17 acres of irrigated pasture was seeded to a Huntley mixture at the rate of 10 pounds per acre, and usually is not irrigated more than twice during the season. He keeps 7 acres of this pasture for emergency but usually cuts it for hay. In the

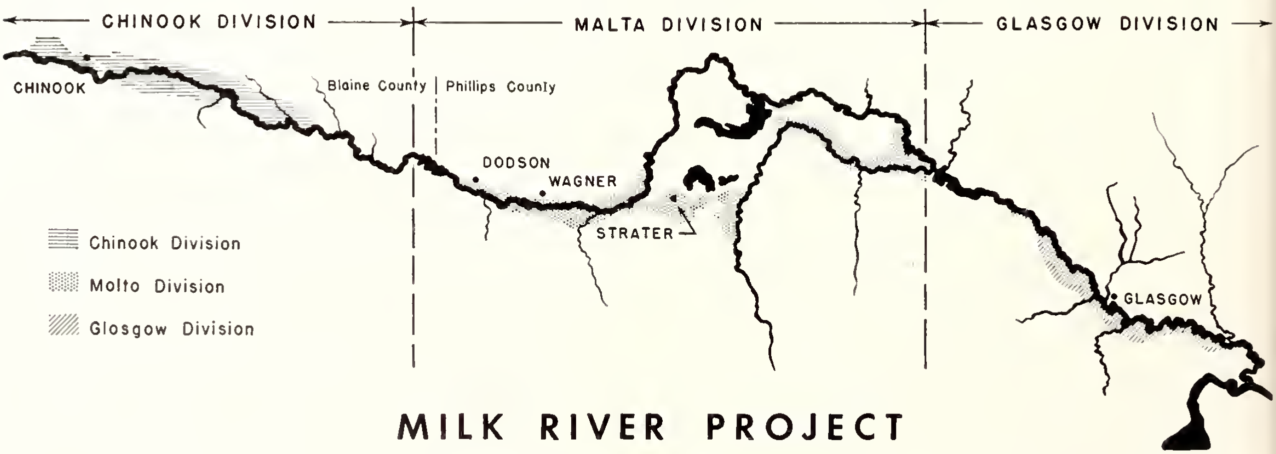
Editor's Note: Although storage facilities on the Milk River project were filled during the Milk River floods in April, many of the farmers will face a water shortage due to damages to irrigation systems.

Many individual farm irrigation systems have been damaged almost beyond repair, while many acres of the most highly developed land has been rendered unproductive as a result of erosion or deposit by the flood waters.

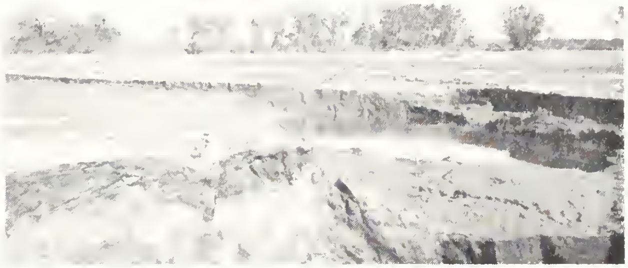
Of the three water users referred to in this article, Bill Sudbrack has suffered the greatest loss. Land which he leveled last year for this year's crop must be releveled before it can be irrigated. His alfalfa and excellent pastures failed to withstand the prolonged inundation. He faces a big task in rehabilitating his land, and like many other water users with small acreages will be handicapped by lack of income since his only crop prospect will be feed grains.

Tom Simanton and Jim Sintler fortunately escaped the major flood and should produce a normal crop this year, due to repairs made on the Dodson South Canal.

WHERE THE MILK RIVER FLOWS—Three districts of the Milk River project use stored and diverted water to raise crops and livestock. Main irrigation structures of the Milk River project were shown on the map appearing on page 101 of the May 1952 Reclamation Era. *Map below by Margery Updegraff, Washington, D. C., staff.*



WASHOUT.—The John Hasler Farm in the South Wagner area after the April 1952 flood. The end of the farm ditch is the only source of water for the north 60 acres of his farm. *Milk River photos.*



ERODED FIELD.—The Homer Lotton farm, near Dodson, after the flood. The field was leveled and developed for irrigation in August 1951 for about $100 an acre. It will cost about $50 more to get it back in condition.

early spring when the growth is heaviest, he grazes the 30 beef cows and calves on the irrigated pasture until about May 10th. These are then turned onto dry range land for the remainder of the season, and the 15 dairy cows graze on the 10 acres during the summer.

In Bill's opinion, the successful irrigated farm on the Milk River project must have enough dry grazing land, in addition to the irrigated, to handle 25 or 30 beef cows. Enough feed grain and hay should then be raised on the irrigated land to winter the cows and fatten the calves that are to be sold. He believes too, that more emphasis should be put on maintaining soil fertility, through the rotation of crops and the use of manures and commercial fertilizers. Bill has very little faith in dryland farming either as a means for a stable income, or as a supplement to the irrigation farm income.

Anyone who thinks that farming does not require study and technical knowledge should talk to Tom Simanton, one of the more successful farmers in the Strater area. Tom has proved that study of soil conditions and plant growth is very important for the maintenance of high crop production and general successful irrigated farming.

Tom believes that soil temperature is quite important, both in the spring to obtain suitable crop stands and during the summer growing season for normal plant growth. For this reason he plows in the fall, to keep the soil porous, thus reducing deep frost penetration and helping the soil to warm earlier in the spring. He never irrigates in the fall as he believes it makes the soil colder in the spring and delays spring germination. Tom sometimes waits until June for a sign of some weed growth, when he assumes that the soil is warm enough for seeding.

Tom's careful and intensive farming and his abundant use of manure and commercial fertilizers to maintain soil fertility have resulted in high crop yields.

In 1932, Tom had the highest tonnage per acre for sugar beets in the Chinook factory district—24 tons per acre. In 1948 a field of oats which had been fertilized with manure and phosphate produced 125 bushels per acre.

His usual production of high quality alfalfa hay is approximately 200 tons which he feeds on his own farm. During the past winter, he fed about 210 range cows, some of his own and some contracted. By marketing his feed through livestock, he estimates that he is selling his hay for approximately $40 per ton.

During the 1950 season, 6,505 acres were irrigated by private pumping systems on the Milk River project, which obtained water for irrigation both from the Milk River and Bureau of Reclamation canals. The farms irrigated by pumping averaged 91.61 acres, and grossed an average of $64.56 per acre.

Jim Sintler, who also lives in the Strater area, irrigates approximately 77 acres by using a 7½-horsepower three-phase electric motor driven vertical lift pump which delivers 1,500 gallons per minute. His power costs average approximately $1 per acre for the irrigation season.

Jim purchased his Strater area farm in 1943. The soil in this area is quite fertile, having a sandy

MAKING HAY on the Tom Simanton farm (at right). Each pile weighs about 700 pounds. Tom rakes it green to make it easy to stack and leaves it to cure, losing very few leaves. At lower right, pumping water to higher land on the Everett Boucher farm near Hinsdale, similar to Jim Sintler's irrigation methods. Below, siphon tubes are becoming popular on the Bill Sudbrack farm in the South Wagner area for irrigating row crops.

loam which responds well to irrigation. Most of the land was uneven and needed some leveling before efficient irrigation is possible. During May 1951, Jim leveled 11.6 acres, at a cost of $54.83 per acre, and seeded the field to oats and alfalfa.

His crop rotation is built around a combination of approximately 30 acres of alfalfa hay, 20 acres of feed grain, 22 acres of sugar beets, and 3 acres of irrigated pasture. For the past 5 years he has averaged 13.1 tons of sugar beets per acre. Jim also raises about 350 acres of dryland wheat in addition to his irrigated farm.

Jim believes that every irrigated farm in the Milk River area should center around some type of livestock feeding operation to use the feeds produced on the farm rather than selling them as a cash crop. As he believes every small farm needs a cash crop, Jim has always raised between 20 and 25 acres of sugar beets. He also uses sugar beets or some kind of row crop in his crop rotation to control weeds and to maintain soil fertility.

According to the 1950 project census, the average irrigable acreage per farm unit on the Milk River project was 181.03 acres. However, many of the large holdings are made up of temporarily suspended class 5 land which is quite low in productive capability. On the average farm, water was actually delivered to 86.21 irrigated acres. Most of the land on the smaller farm units is quite fertile and if managed, farmed and irrigated properly will produce enough for the average farm family to live comfortably. The average gross income in 1951, on 33 farms in Phillips County was $5,678. In addition, farmers on these units, which were developed by the Farmers Home Administration, either owned or leased 38.15 acres of dry crop land and 326.18 acres of dry grazing land.

Although farmers on the 80- or 100-acre farm units on the Milk River project do not produce the big gross income, the way they farm and build up the community is conducive to a permanent type of irrigated agriculture. The farmer on a small irrigated farm must be an excellent judge of market trends, weather conditions, soil and plant relationships, the irrigation requirements of various soils and plants and of general soil fertility and its maintenance, if his farm is to be a permanent source of income. ###

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the RECLAMATION ERA at your door, but we have to know where it is.

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C. PETRUS PETERSON

(Continued from page 163)

edly, the Supreme Court of Nebraska decided in favor of the complainant on the basis of an interpretation of what constitutes a "watershed."

Engineers hastily surveyed the disputed table lands to see in which direction the water would run, if there were any water to run. The net result is that on one side of the road the water is supposed to run to the Platte, and on the other side of the road it is supposed to run to the Republican. To the eye of the bystander there appears no difference except the abundance of the crops on the irrigated or so-called "Platte River drainage" side.

Water, or the lack of it, makes for fights. This was no exception. Tempers rose, and the dispute carried through the entire season of the unicameral legislature until the problem was passed on to the legislative council for "study," thus enabling the embattled legislature to adjourn.

Senator Peterson, then serving as chairman of the banking, commerce, and insurance committee, was chosen to take over this hot potato for the simple reason that he lived outside of the disputed area, and had taken no part in the legislative fight!

If the legislators had hoped to bury the question, they reckoned without the chairman. He took the issue directly to the people, and set up the first series of legislative council hearings throughout the State where people who could otherwise not afford to come to the State capitol were enabled to appear before the committee.

For over a year these hearings were held. The meetings were jammed with emotional people. Engineers with charts and dissertations got up and talked endlessly about why the water could or could not be put on this or that side of the road. Lawyers supported them with long citations as to why the water should or should not be put on this or that farm. It was all very unconvincing to the dried-out farmer on the table land. It was just as unconvincing to the farmer in the Platte Valley in whose memory the drought years were still vivid. He felt that his birthright was being argued away. All the time three million acre-feet of water were flowing out of the mouth of the Platte River every year. "Surely," said Senator Peterson, "sensible people can arrive at a better solution than this."

During that year the senator worked harder than he did when he worked his way through college. He read stacks of books, listened to hundreds of people. Week-ends and evenings were spent studying. When the final report of the legislative subcommittee was drafted, there was attached to it an impressive bibilography. The odd part about it was that Senator Peterson had actually read it. The report was accepted unanimously by the legislative council. In effect, the report recommended that the lands of the Platte Valley be developed first. If subsequent study indicated that enough water was available, it could be used outside the watershed. The unicameral legislature, however, has never passed a diversion bill.

Still unsatisfied, he took to the road. A most accomplished speaker, he took every opportunity to talk about water. Few maps of the Missouri Basin had yet been printed. The senator provided himself with some yard-square sheets of paper and a map stand, and sketched off the location of the rivers and the irrigable land, as any chalk artist might do. He carried so much paraphernalia to meetings that he jokingly said all he needed to be a pack mule was long ears.

When reclamation leaders sought to create a Nebraska Reclamation Association, it was Senator Peterson who was asked to present the motion to create such a body. This he did in January of 1944, before an irrigation meeting called by the Omaha Chamber of Commerce. It had been a dry, windy fall, and fear of another drought hung heavy on the State. Over 600 people packed the hall the day the association was born.

Senator Peterson went on the board of the newly formed association in 1945, and became its second president in 1946, serving for 2 years.

After this he became the Nebraska Director of the National Reclamation Association, served as Treasurer for 1950, and last fall he was elected president at the annual meeting in Amarillo, Tex.

Senator Peterson is an ardent supporter of a program to develop the maximum amount of hydroelectric energy in connection with water storage projects. He does not believe in the exclusion of private power companies. He believes in "private business," says he wants more "private business," but that the way to get it is to have all the power both private and public resources can produce.

In his own State, he is known as the "Great

Compromiser," not of principle, but of detail. He maintains that all life and particularly all legislation is a matter of compromise. "We are all selfish," says the senator, "and public welfare is the combined selfishness of the greatest number."

This, then, is the man who now heads the National Reclamation Association. He lives with his wife, Vera, in a new ranch-style house at 1909 South Thirty-third, in Lincoln, Nebr. He is the father of three brilliant daughters, Breta (Mrs. David Dow of Lincoln), Vera Mae (Mrs. Bertrand Mitchell of Houston, Tex.), and Patty (Mrs. Robert Larson of Wichita, Kans.). Each daughter has two children.

To quote a legislative reporter in the unicameral legislature one day, "Senator Peterson looks and acts like a United States Senator ought to!" ###

Salt Lake Pipeline Payment Breaks Precedent

Recently the Metropolitan Water District of Salt Lake City, Utah, made its first annual payment of $310,000 on the Salt Lake Aqueduct, and new terminal reservoir, to the Bureau of Reclamation, boosting the district's total payments to date on the aqueduct division of the Provo River Project to more than $500,000. The district made a voluntary advance payment of $200,000 last summer, believed to be without precedent in Reclamation history (see article entitled, "The Salt Lake Aqueduct," on page 12, January 1952 RECLAMATION ERA).

KEEPING AHEAD.—J. A. Nelson (at right) water district controller, hands over the $310,000 payment on the Utah water project to Ernest O. Larson, Bureau of Reclamation Regional Director at Salt Lake City, Utah. Lane W. Adams, water district treasurer at center.

During a brief ceremony in Salt Lake City at the Bureau's office, J. A. Nelson, water district controller said, "Without the water supply made available by these works, there could be no increase of industry and population in the community, nor could the present population be supported in security."

Mr. Ernest O. Larson, Regional Director of the Bureau, representing the Secretary of the Interior, received the check and said, "This shows the results of excellent cooperation between the people and the Government in getting a job done that was large enough to require Government help and yet necessary for future growth and security of the area. It also signifies the fact that reclamation projects are 100 percent repayable under reclamation law." He further pointed out that the Salt Lake aqueduct represents the first instance wherein a municipality has participated to such a large extent in making a Federal Reclamation project possible, and paid special tribute to members of the water district's board of directors. (Photograph of members of the board appears on page 45 of the February 1952 issue.) ●

Corbin Named Boulder City Manager

Secretary of the Interior Oscar L. Chapman appointed Harold N. Corbin, former City Manager of Porterville, Calif., to the position of City Manager at Boulder City, Nev., early in April this year.

Under this arrangement Boulder City, a Federal Government town since 1931, will become a self-governed community, incorporated under the laws of the State of Nevada. Secretary Chapman initiated the action for changing the status of the town in July 1951. First municipal elections in the city's history were held in November 1951, when residents voted on a special committee to make recommendations regarding election of the city manager. They also voted for representatives on an advisory council to assist the city manager in administration of municipal affairs.

The city manager will develop a municipal organization and devise a city budget, accounting and operating procedures, and arrange for the transfer of utilities, facilities, shops, and properties from the Boulder Canyon project to the municipal administration. ●

Golden Anniversary Tree Grows at Nation's Capitol

An American Elm, carefully selected from the Missouri River basin, was dedicated and presented to the United States, to commemorate Reclamation's Golden Jubilee year, by the Greater North Dakota Association on April 29, 1952.

The Reclamation tree replaces the famous George Washington Elm which was removed 2 years ago, having exceeded the usual 125-year life span of its species.

Henry H. Westlie, president of the GNDA, opened and presided over the presentation ceremonies, stating that it was a rare occasion and great privilege for a private citizen from an outlying State to preside at a function in the National Capitol Grounds. He introduced executive secretary Leroy Pease who stated that North Dakota, in common with 17 Western States, has especial reasons for marking the golden anniversary of reclamation, among them the fact that Henry Clay Hansbrough, a North Dakota Senator, was one of the sponsors of the Relamation Act, and Theodore Roosevelt, who signed the act was at one time a resident of North Dakota. Mr. Pease said, "Roosevelt was a firm believer in the conservation of water, soils, and forests. His talks, writings, and messages were largely responsible for the early conservation and reclamation legislation which was approved by the National Congress. Reclamation has meant more to the national economy than all of California's gold, Colorado's silver and Arizona's copper. It is appropriate therefore, that North Dakota commemorate this golden anniversary of reclamation so as to properly pay tribute to the great leaders who brought this legislation into being."

Assistant Commissioner Goodrich W. Lineweaver represented the Bureau of Reclamation during the ceremony, terming it "an occasion of great significance in the history of Reclamation." He said, "From the time Senator Hansbrough became instrumental in the founding of Reclamation, North Dakota and reclamation have made great progress, and will continue to do so as long as we have such support and hearty cooperation as evidenced in the pleasant observance here today."

Mr. W. A. Fredericks, architect and horticulturist, represented Mr. David Lynn, the architect for the Capitol, and accepted the tree on behalf of the Government. He stated that the George Washington Elm had been one of the largest and most magnificent trees on the Capitol grounds, measuring $5\frac{1}{2}$ feet in diameter at the base. He expressed the hope that the Reclamation tree would grow to the might and majesty of its illustrious predecessor.

AT DEDICATION CEREMONIES Leroy W. Pease, executive secretary (at left), and Henry H. Westlie, president of the Greater North Dakota Association, turn the first shovelsful of earth. From left to right: United States Representative Fred G. Aandahl of North Dakota; Mrs. Aandahl; Pershing Boe, administrative assistant to Senator Young; R. J. Hughes, past president, GNDA; United States Senator Milton R. Young; Frederick J. Frederickson, GNDA; Patricia M. Byrne, personal secretary to Senator Young; Edward D. Frye, assistant to Representative Aandahl; Mrs. Fred J. Frederickson; F. A. Irish, treasurer, GNDA; Louise Finke, secretary to Representative Aandahl; Becky Bergesen, assistant secretary to Representative Aandahl, and Ruth F. Sadler, editor, Reclamation Era. *Photo by Abbie Rowe—Courtesy National Park Service.*

Climaxing the ceremony, officials of the GNDA, Senator Milton R. Young, Representative Fred G. Aandahl, members of their staff, and Assistant Commissioner Goodrich W. Lineweaver, shoveled earth around the roots of the tree, signifying its acceptance, the culmination of its 1,600-mile journey from 2 miles south of Mandan, N. Dak., and the fact that it could now take root in the Capitol grounds. ●

WATER REPORT

By the first of June, the possibility of serious floods over most of the West had faded. Run-off was high in Utah and Nevada with accompanying damage, largely in the vicinity of Salt Lake City, Utah, but in the northwest, conditions were such that melting was orderly with no major floods developing. This was also the case in the Colorado River basin and other western basins. The discharge of the Rio Grande at Albuquerque, N. Mex., has not exceeded 10,000 c. f. s. and probably will not exceed that amount. This is a disappointment to those anticipating high run-off to Elephant Butte Reservoir.

Almost without exception run-off, as reported by the Geological Survey, was normal or better during May. The exception was south central Texas where the drought continues. Run-off was well above average in most of California, Arizona, and Idaho, over all of Utah and Nevada and from part of Oregon, Montana, Wyoming, Colorado, New Mexico, North and South Dakota, Nebraska, and Kansas.

Reservoir storage was most satisfactory. Shasta Reservoir filled for the first time. Salt River project storage was much above average as was the case with storage for the North Platte and Kendrick projects. Much project storage was being filled as flood threats receded and flood control space became less necessary. Except for the Carlsbad project and possibly the Rio Grande project the situation looks good.

A résumé of the outlook by regions as of the first of June follows:

REGION 1.—Water supply for Bureau projects uniformly good or better. Reservoirs which had been drawn down for flood control were filling. Storage in Lake Roosevelt increased over 1,000,000 acre feet. Filling dead storage at Potholes Reservoir began.

REGION 2.—There was spill from both Millerton and Shasta Lakes as run-off continued above normal. Shasta filled during May and storage increased at Millerton. Storage in Upper Klamath Lake largest in last 10 years. Seasonal inflow to Orland project reservoirs continued to be above normal with reservoirs full.

REGION 3.—Storage in Lake Mead increased almost 3.5 million acre feet during the month with basin precipitation subnormal during May. Salt River project reservoirs continued to gain storage. Storage largest since 1943 and considerably above average.

REGION 4.—Outlook for water very good or better over whole of region. Where possible, reservoirs were operated for control of flood run-off during May.

REGION 5.—Only W. C. Austin project had favorable outlook. Tucumcari supply adequate but storage was lowest since 1941. Rio Grande project had 339,000 acre feet in storage but Rio Grande run-off was disappointingly low. Outlook for Carlsbad project was poor with only about 21,000 acre feet in storage.

REGION 6.—Outlook for water very good throughout region. Storage will be above normal with exception of Keyhole Reservoir.

REGION 7.—Water supply of region was uniformly excellent. Storage for North Platte and Kendrick project much above average and reservoirs may spill. ●

CROPS

Coachella Tomatoes Peak Crop

Tomatoes on the Coachella Division of the All-American Canal project in California had an average per acre value of $2,500 in 1951 as compared with $2,234 in 1950. This looms as the most valuable crop grown on Bureau projects as the annual crop report nears completion. During 1951 tomatoes valued at $2,167,500 were grown on 867 acres as compared with $1,052,081 worth grown on 471 acres in 1950. ●

LETTERS

Thank You, CB&Q!

CHICAGO, BURLINGTON & QUINCY RAILROAD CO. TRAFFIC DEPARTMENT,
200½ Farnam Street,
Omaha, Nebr.

MAY 14, 1952.

DEAR MRS. SADLER: Thank you very much for the marked copy of the RECLAMATION ERA, March 1952, reporting the Water Users Conference or Four States Irrigation Council, held in Denver, on January 16–17, 1952.

I enjoyed the meeting immensely and feel it was one of the most constructive sessions of its kind that I have been privileged to attend.

This department is a long-time, devoted reader of the ERA. I wouldn't be surprised if we have one of the most complete files of the publication among your subscribers. Much credit goes to you for the excellence of the magazine.

Sincerely,

VAL KUSKA,
Agricultural Development Agent.

Reclamation and Human Welfare

Dr. Wilbur L. Powers, consulting engineer in Athens, Greece, former head of the soils department at Washington State College, sent us the following transcript of some remarks he made recently at a dinner in Athens, which we are reprinting here as a matter of interest to our readers, and as proof of the widespread concern regarding soil, water, and reclamation. Incidentally Dr. Powers is now on his way to Baghdad, Iraq, where he will undoubtedly continue his efforts in behalf of peaceful development of the world's natural resources.

"Soil and water are the two great renewable natural resources. The mines may be dug out and the forests depleted or cut down, yet the increasing populations must continue to be fed, and the world's land surface gets less than 30 inches annual precipitation, which, especially in the warmer climates, is very unevenly distributed. So it is the mission of reclamationists to help liberate our lands from flood, erosion and drought. This is in line with the declared policy of the United Nations. If for two or three decades resources and skills could be devoted to peaceful development the people could be largely relieved from hunger and want.

"The reclaimable lands and unused water resources are mainly located in young alluvial valley and delta areas. These are the deep, permeable, unleached, and fertile soils that can, when developed, supply the mineral rich vitamin carrying food stuffs needed.

"Back of our daily bread is the wheat and it comes from the soil. The soil has supported and must continue to pport all life. It is a basis of value r it is not readily carried away or ırned up.

"The water is a daily need of almost ery living thing. It is the "white-al" that yields hydroelectric power lift the load from labor's back.

"Reclamation and good, soil-conserva-on practices make the least amount land sufficient for the support of one mily, a condition that makes for peace d security."

Congratulations from the NRA

Congratulations to whomever de-rves the credit for getting "The Four ates Irrigation Council" together in enver January 16 and 17, as written in the Reclamation Era for March pages 66 and 67. From the stand-int of public relations, it seems to e this is one of the best things ever ne.

Sincerely,

William E. Welsh,
Secretary-Manager.
National Reclamation Association

Region 7 officials in Denver say the ter users deserve the credit. So—ke a bow!—Ed.

Gophers Get Around

Bridgeport, Nebr.,

Dear Sir: In two separate publica-ons of the Reclamation Era within e last year there were articles relative gopher control using cyanide gas. I ned my copies to another farmer, and in turn to another, so that by now we e unable to locate the gopher poison-g articles.

Would you please, if it is possible, nd me duplicate copies of the "Era" ntaining the cyanide gas-gopher con-ol articles.

Sincerely,

Edwin S. Kimmel.

We are glad to send the extra copies, d if information like this is worth a llar to your farmer friends, perhaps ey would like to make sure of having eir own copies and getting similar formation by subscribing to the RA.—Ed.

RELEASES

clamation in the United States

Alfred R. Golzé, Director of Programs d Finance, Bureau of Reclamation, s authored a recent book entitled eclamation in the United States," as rt of McGraw-Hill's Civil Engineering Series. This volume, of approximately 480 pages, profusely illustrated with photographs, charts, and graphs, was designed to provide material for college courses in engineering and economics relating to reclamation and to provide reference material for research or review of the reclamation programs of the United States.

Of particular interest to water users are the chapters on land settlement, operation and maintenance policies and procedurés, and a factual account of the repayment laws and procedures from 1902 to the present.

Director Golzé has covered the past, present, and future of Reclamation, starting with the ancient Mesopotamian Code of Khammurabi and concluding with a chapter of multipurpose operation and river regulation in the western United States. The book covers, in an easy-to-read and comprehensive manner, the policies, procedures, and practices of the Bureau of Reclamation; the laws, lands, investments, returns, administration, and economics of the Reclamation program, and explains the evolution of the program to the present time and its relationships with other Federal, State, county, and private organizations.

The book can be purchased for $8 at bookstores or from McGraw-Hill Book Co., 330 West Forty-second Street, New York 36, New York.

"Water in the West" Goes Global

The Bureau of Reclamation film "Water in the West" has been selected by the State Department to represent U. S. Government documentary films at the Edinburgh Film Festival, the principal international annual film competition.

This film had previously been selected as a United States entry at the International film competition held in Bombay in February.

Films from some 30 nations will compete for the prizes at Edinburgh. A preliminary competition will be held in London this summer, with a second elimination competition to be held in Edinburgh. Only films which survive these two eliminations will be shown at the Festival itself between August 17 through September 7.

Sixteen millimeter prints may be borrowed for noncommercial showing free of charge by writing to the Commissioner's office or any Regional Reclamation office, the borrower to pay shipping charges both ways.

Reclamation Street—26,000 Miles Long

This illustrated multilithed publication contains a first-hand account of the Commissioner's observation on Asian irrigation and power programs and a map insert delineating his inspection tour of India, Pakistan, Thailand, and many other areas which required him to travel the 26,000 miles mentioned in the title. The May and June 1951 issues of the Reclamation Era carried a condensed version of this tour under the same title. Copies of the more detailed 50-page account may be obtained free of charge by writing to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C.

New South American Periodical

The other day we received from our good friend Dr. Luis J. Medina (see article entitled, "Two-Way Street" on p. 78 of the April 1951 issue) a handsome new periodical entitled, "Agronomia Tropical." It is issued quarterly, contains about 98 pages with numerous illustrations, and can be obtained at a subscription rate of $6 a year.

Those who read Spanish and are interested enough in South American irrigation and agricultural methods to wish to subscribe should write to the Instituto Nacional de Agricultura, Maracay, Venezuela.

New Livestock Films

"Cattle Country" and "Western Sheep" are the titles of two new 16-millimeter technicolored films with sound tracks showing the latest developments in livestock management in the West, including range management, ranch layout, disease prevention, and handling for market.

For information about obtaining these films for showing at schools, colleges, meetings, and other gatherings, write to Joe W. Jarvis, Supervisor of Agricultural Development, Union Pacific Railroad Co., 1416 Dodge Street, Omaha 2, Nebr. The films run about a half hour each.

NOTES FOR CONTRACTORS

CONTRACTS AWARDED DURING MAY 1952

Spec No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3641	Missouri River Basin, S. Dak.	May 16	One 115,000-volt circuit breaker for Watertown substation, schedule 4.	Pacific Oerlikon Co., Tacoma, Wash.	$21,5
DS-3645	...do.	...do...	One 115,000-volt and one 69,000-volt circuit breaker for Huron substation, schedules 4 and 5.	Pacific Oerlikon Co., Tacoma, Wash.	32,2
DS-3651	...do...	...do...	Two 115,000-volt circuit breakers for Sioux Falls substation, schedule 3.	Pacific Oerlikon Co., Tacoma, Wash.	43,0
DS-3659	Colorado-Big Thompson, Colo.	May 1	One 7,500/9,375-kilovolt-ampere autotransformer with 6 lightning arresters for Beaver Creek substation, schedule 1.	Moloney Electric Co., St. Louis, Mo.	46,6
DS-3659	...do...	May 2	One 115,000-volt circuit breaker for Beaver Creek substation, schedule 2.	Allis-Chalmers Mfg. Co., Denver, Colo.	27,3
DS-3659	...do...	May 8	One 46,000-volt circuit breaker for Beaver Creek substation, schedule 3.	Pacific Oerlikon Co., Tacoma, Wash.	10,7
DS-3667	Davis Dam, Ariz.-Nev...	May 27	3 lots of supervisory control and telemetering equipment for E.D. 2, E.D. 4, and Coolidge substations.	Westinghouse Electric Corp., Denver, Colo.	16,0
DS-3671	Kendrick, Wyo...	May 2	One 1,000-kilovolt-ampere station-service unit substation for Alcoa power plant, item 1.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	24,9
DS-3676	Eklutna, Alaska...	May 5	One 40-ton traveling crane for Eklutna power plant...	Ederer Engineering Co., Seattle, Wash.	38,0
DS-3677	Missouri River Basin, S. Dak.	May 29	One 2,800-kilovolt-ampere, one 1,200-kilovolt-ampere, and one 600-kilovolt-ampere deicing transformers for Fort Randall switchyard, schedule 1.	Queensboro Transformer and Machinery Corp., Crystal Springs, Miss.	21,7
DC-3680	Missouri River Basin, Nebr.-Kans.	May 9	Construction of earthwork, concrete canal lining, and structures for Courtland canal, schedule 5.	J. A. Terteling and Sons, Inc., Boise, Idaho	1,420,2
DS-3684	Colorado-Big Thompson, Colo.	May 2	2 controls for 84-inch butterfly valves for Flatiron power and pumping plant.	Rucker Co., Oakland, Calif.	13,1
DS-3685	Columbia Basin, Wash.	May 23	4 horizontal-shaft centrifugal-type pumping units for PE-51, PE-56, and PE-60 pumping plants, Area P-8, Potholes East canal laterals, items 1 and 3.	Food Machinery and Chemical Corp., Los Angeles, Calif.	20,1
DS-3688	Eklutna, Alaska...	May 2	2 vertical-gate-shaft-type governors for regulating speed of two 25,000-horsepower hydraulic turbines for Eklutna power plant.	Woodward Governor Co., Rockford, Ill.	58,6
DS-3689	Cachuma, Calif...	May 9	2 lots of chlorination equipment for Ortega and Carpinteria control stations, South Coast conduit.	Everson Mfg. Corp., Chicago, Ill.	17,9
DC-3691	Colorado-Big Thompson, Colo.	...do...	Completion of Pole Hill power plant and switchyard and Flatiron power and pumping plant and switchyard, and installation of equipment in Carter Lake pressure tunnel valve shaft, Estes Park-Foothills power aqueduct.	Eagle Erection Co., Shoshoni, Wyo.	1,097,3
DS-3694	Eklutna, Alaska...	May 13	One switchgear assembly for Eklutna power plant...	General Electric Co., Denver, Colo.	54,1
DS-3697	Central Valley, Calif...	May 22	Two 9,400-horsepower vertical-shaft hydraulic turbines for Nimbus power plant.	S. Morgan Smith Co., York, Pa...	488,5
DS-3699	Kendrick, Wyo...	May 29	One main control board extension, one graphic and auxiliary control board, and one telemetering receiver-watt recorder for Alcova power plant.	E. A. Pedersen Co., Omaha, Nebr.	35,9
DC-3701	Columbia Basin, Wash...	May 20	Construction of earthwork, pipelines, and structures for area W-8 laterals, sublaterals, and wasteways, West canal laterals.	Otis Williams and Co., Helena, Mont.	581,3
DS-3703	Central Valley, Calif...	May 29	One 12,500/16,667-kilovolt-ampere transformer for Nimbus switchyard.	Pennsylvania Transformer Co., Canonsburg, Pa.	60,2
DS-3705	Colorado-Big Thompson, Colo.	...do...	1 main control board and 1 annunciator cabinet for Pole Hill power plant, schedule 1.	Wolfe and Mann Mfg. Co., Baltimore, Md.	15,4
DS-3705	...do...	...do...	1 supervisory control and telemetering board, 1 supervisory control and telemetering panel, and 1 lot of carrier transmitting and 1 lot of carrier receiving equipment for Pole Hill power plant, schedule 2.	Control Corporation, Minneapolis, Minn.	21,6
100C-141	Boise, Idaho...	May 21	Construction of 3 residences and garages...	Hairl Bivins, Caldwell, Idaho...	18,3
100C-142	Palisades, Idaho...	May 12	Grading and utilities for community facilities at Palisades...	Brennan Construction Co., Pocatello, Idaho.	64,5
117C-141	Columbia Basin, Wash...	May 13	Street lighting and power and control cable installations...	Coulee Dam Electrical & Repair, Coulee Dam, Wash.	17,4
600C-91	Missouri River Basin, N. Dak.	May 14	Custer Trail and Devaul substations...	Northolt Electric Co., Grand Forks, N. Dak.	33,1
604C-26	Missouri River Basin, Mont...	May 8	Clearing areas 7, 8, 9, and 10, Canyon Ferry Reservoir...	Pennington Constr. Co., Ft. Collins, Colo.	155,9
703C-238	Missouri River Basin, Colo...	May 28	Construction of Julesburg substation...	George W. Shelp, Rawlins, Wyo...	17,7
703C-243	Kendrick, Wyo...	May 27	Oil handling equipment at New Casper substation...	Landon Construction Co., Casper, Wyo.	11,1
701C-244	Missouri River Basin, Nebr...	May 21	Partial demolition of Consumers' Public Power district, diversion dam, relocation of Lost Creek and removal of timber bridge.	Winslow Constr. Co., Englewood, Colo.	13,1
701C-245	Missouri River Basin, Colo.-Nebr.	May 20	Exploratory ground water wells and test holes, Frenchman Creek Basin.	Layne-Western Co., Omaha, Nebr.	17,8
701C-247	Missouri River Basin, Colo.-Kans.	May 9	Miscellaneous protective works and river control section for Bonny Dam.	Cass Co., Contractors, Ogolala, Nebr.	50,5

Construction and Materials for which Bids Will Be Requested by September 1952

Project	Description of work or material
Cachuma, Calif	Construction of 500- by 280-foot concrete-lined Ortega reservoir located north of Summerland, Calif.; 340-foot square concrete-lined Carpinteria reservoir located northeast of Carpinteria; 18- by 49-foot reinforced concrete control station buildings, and chlorination houses; and installation of chlorination equipment, 30- and 24-inch steel pipe and 1,400 feet of 30-, 24-, and 18-inch concrete pipe.
Central Valley, Calif	Furnishing and erecting antenna tower and mounting antenna, constructing concrete block radio hut-ment, and installing standby gasoline motor-driven generator for station at Mt. Vaca.
Do	Extension of Ivanhoe irrigation district laterals on the Friant-Kern canal distribution system near Ivanhoe, Calif., involves excavating and backfilling 4.8 miles of pipe trenches; furnishing and laying 3.8 miles of 12-and 15-inch concrete irrigation pipe; and laying 1 mile of 12-inch Government furnished concrete irrigation pipe.
Do	Eighteen 40- by 24-foot radial gates and 75,000-pound hoists for Nimbus Dam.
Do	Six 10.5- by 12.07-foot fixed wheel gates, frames, and accessories for Nimbus power plant.
Do	One indoor, 5,000-volt, 1,200-ampere, metal-clad switchgear assembly for Nimbus power plant.
Do	One 480-volt unit substation for Nimbus power plant.
Do	One 7,500/9,375-kilovolt-ampere, 13.8-kilovolt to 4,160-volt, 3-phase transformer for Folsom switchyard.
Colorado-Big Thompson, Colo.	Construction of a 200-foot inlet structure for Aspen Creek siphon, including installing a 20-foot Parshall flume, breaking into present inlet structure and installing 4- by 4-foot gate, 5 miles southwest of Estes Park, Colo.
Columbia Basin, Wash	Construction of the Othello development farm about 10 miles southeast of Othello, Wash. Work consists of 1 three-bedroom frame residence and 4 frame buildings, septic tank, water mains, walks, and gravel driveway.
Do	One 600-volt station-service control center for Babcock pumping plant.
Davis Dam, Ariz	115-kilovolt switching equipment for ED-5 substation.
Do	Three 40,000/13,333-kilovolt-ampere, 154/34.5/4-kilovolt, single-phase power transformers for Gila substation.
Do	One 28,667/35,833-kilovolt-ampere, 230/115/12.5-kilovolt, 3-phase, power transformer and one 25,000-kilovolt-ampere, 115-kilovolt, 3-phase, regulating transformer for Prescott substation.

Project	Description or work or material
Kendrick, Wyo	Extension of lateral No. 256, including furnishing and laying 1,000 feet of 18-inch precast-concrete pipe, constructing 6,000 feet of extension to open lateral, and constructing a wasteway structure 4 miles Southwest of Casper, Wyo.
Middle Rio Grande, N. M.	Excavation and improvement of 17 miles of Rio Grande drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
Missouri River Basin, Kans.-Neb.	Erection of antenna towers, construction of buildings and modification of existing buildings for establishment of a Kansas River District radio communication system.
Missouri River Basin, Mont.	Completion of Canyon Ferry dam and power plant, consisting of installing embedded and nonembedded parts of three 23,500-horsepower turbines and three 16,667-kilovolt-ampere generators; miscellaneous metalwork, architectural finishes, and electrical equipment in power plant, erecting switchyard steel and installing equipment on roof of power plant; and constructing elevator tower on dam.
Missouri River Basin, S. Dak.	Distribution boards and battery chargers for temporary Oahe substation.
Missouri River Basin, Wyo.	Installation of 115-kilovolt circuit breaker and related switching equipment and steel supports for the Lovell-Thermopolis bay in the Thermopolis substation, and installation of drainage system for the control building at Thermopolis, Wyo.
Provo River, Utah	Placing 26,000 cubic yards of riprap on unprotected sections of river banks along 10-mile reach of Provo River channel above Deer Creek reservoir, about 13 miles northeast of Provo, Utah.
Riverton, Wyo	Construction of concrete drop structure and two control structures in Wyoming canal's Cottonwood drain to control maximum runoff to 110 cubic feet per second capacity.
San Diego Aqueduct, Calif.	Construction of 31 miles of 95 cubic feet per second capacity San Diego aqueduct's second pipeline from Hemet, Calif., to Rainbow, Calif., near San Diego, parallel to the present aqueduct between San Jacinto regulating reservoir near Hemet and the San Vicente reservoir near San Diego. Work consists of furnishing and laying 9 miles of 75-inch, 14.5 miles of 60-inch, and 7.4 miles of 48-inch inside diameter precast-concrere pressure pipe; constructing incidental structures; and installing meter, valves, power-operated gate, and small piping. About 700,000 cubic yards of excavation are involved. The 75-inch diameter pipe is to be noncylinder, the 60- and 48-inch, noncylinder and cylinder.

United States Department of the Interior, Oscar L. Chapman, Secretary

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

"But don't go near the water"

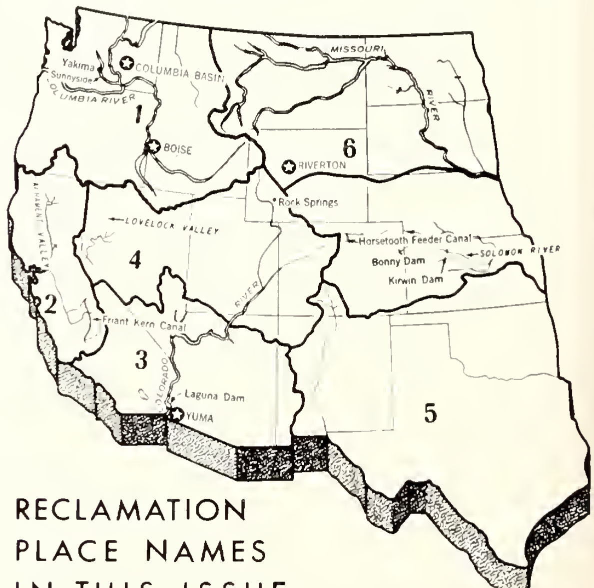
Here is a use for irrigation water on the Belle Fourche project in South Dakota that does not appear on the water user's contract. The young fry had better read Sam Larsen's story on the next page to understand why the project superintendent frowns on this practice.

35 YEARS AGO IN THE ERA

PLAYGROUNDS ON RECLAMATION PROJECTS

On many of our projects opportunity for rest and recreation is offered by the natural and artificial lakes which serve as reservoirs for conserving the floods. The creation of these storage basins by the construction of huge dams in canyons and natural depressions has produced a number of beautiful and charming lakes, the utilization of which is becoming more general each year by the farmers and town folks. In some cases these resorts already have attained a national reputation and are visited by tourists from all parts of the country.

(From an article by C. J. Blanchard, statistician, on page 375 of the August 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA).



RECLAMATION PLACE NAMES IN THIS ISSUE

by S. T. LARSEN, Operation and Maintenance Liaison Representative, Design and Construction Division, Denver, Colo.

LOOKS SAFE?—*Even in this peaceful, Boise, Idaho, setting lurks the ever-present danger of deep water, although there are no structures nearby. Photo by B. D. Glaha, Region 2 photographer.*

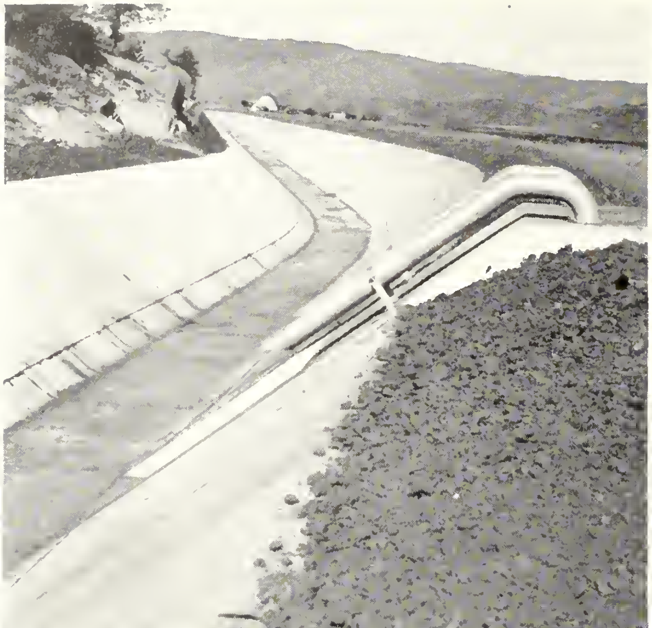
"YOUR HUSBAND HAS JUST DROWNED in the canal!"

Would you, Mr. Wateruser, want your wife to receive such a message? Let us hope that she never does. But that's the kind of message which Mrs. Reuben Younkin, wife of a settler on the Bureau of Reclamation's Riverton project in Wyoming, received one day last summer.

The Younkins, Mr. and Mrs. and their two young sons, moved to the Riverton project in March 1950, after Mr. Younkin had been awarded a homestead in the drawing for veterans. They immediately set to work at the almost discouraging task of making a farm and home out of a piece of raw land. Their first year's work on their homestead saw them rewarded with a good crop and a modest home and they were full of plans and hopes for the future.

But in one moment of unwariness the brightest prospects can be dashed to bits. Mr. Younkin was not willfully negligent. Like many others he just did not realize the hazards which existed. By pointing out some of the dangers lying in wait for the unwary, in and about irrigation canals, we may reduce the number of accidents and the attendant suffering. This article, the first of three on canal safety, takes up the risk of swimming in canals.

On July 18, 1951, Mr. and Mrs. Younkin had been to Riverton and were a little late in getting back home for the bountiful noon meal Mrs. Younkin's mother had prepared. As the meal was about over, we can visualize a neighbor dropping in, mopping his face and neck.



BEWARE OF THE VACUUM!—At left, note the rectangular opening in front of the pipes. When water in Colorado-Big Thompson's Horsetooth Feeder Canal rises above normal, the siphon spillway goes into automatic operation, and a vacuum, strong enough to suck a man into the spillway, is created. Above, currents around check structures (like this one on the Sunnyside Canal, Yakima project, Wash.) are extremely dangerous. *Photo at left by A. E. Thompson, above by S. T. Larsen.*

"Boy, is this day a scorcher—what I wouldn't give for a good swim about now!"

"You've sure come to the right place," said Reuben. "I was just thinking myself how good that water would feel. I should irrigate my alfalfa this afternoon but I can still get that done if we go right away and make it a quick one. It's only a couple of miles to a swell place up on the canal where I used to go swimming last summer. The water is good and deep for diving."

"Well, what are we waiting for?"

And so the two friends were off.

The "swimming hole" to which they proceeded was the back water above a check chute structure on the Wyoming canal, which is quite large at this point. During the preceding summer, however, there had not been much water flowing through the canal because only a few of the new farm units were being irrigated. What the men failed to realize was that now, even though the pond above the check looked about the same as it had a year earlier, the volume of water moving through the canal had been increased several-fold, and as a consequence some very strong currents were moving near the check.

Mr. Younkin was caught in one of these currents. In spite of being a strong swimmer, he was swept through the check opening.

He caught hold of the structure as his friend rushed to help him. But the force of the water was too great—it swept him down the chute to the stilling pool. There his body was recovered some hours later.

There has been a lot of speculation as to what might have contributed to the tragedy and what might have been done to have prevented its loss, sorrow, and hardship. Some think that Mr. Younkin may have been seized with a cramp that prevented him from saving himself. Whether or not that is true, we do know that currents near structures are often so strong that it is useless for any man caught in them to struggle against them. If the canal bank had been posted with "No Swimming" signs it is quite likely, in this case at least, the drowning might have been prevented. While the posting of canal banks is an important part of any safety system, this in itself is no guaranty of prevention of accidents. Because no normal person wants to drown, we feel that the surest way to prevent such accidents is to educate the people of the community to appreciate the very real dangers in wait for anyone venturing into an irrigation canal.

Most drownings on irrigation systems have been due largely to the fact that the victim was ignorant of the dangers. On another project, four people drowned together by being swept into an automatic siphon spillway, a structure designed to protect a canal from washouts by removing a lot of water in a hurry when the water surface of the canal rises above a certain level. The victims were swimming near the siphon without having the least idea of how dangerous it was. The water surface rose enough to cause the siphon spillway to go into operation suddenly, sucking up a large volume of water from the canal and discharging it down the wasteway. Probably never knowing what force hit them, the swimmers were pulled into the siphon by the current and lost their lives. In this case, there were "No Swimming" signs on the canal bank but the combination of desert heat and the enticing water overcame any qualms of conscience these people might have had over breaking a Government "No Swimming" regulation.

Another place of great unsuspected danger for the inexperienced person on irrigation systems is the concrete lined canal. The sides do not look very steep, nor does the water look very deep to the novice who wants to get across. If he is so foolish as to try such a crossing, he finds that he is trapped by deep water and wet concrete sides as slippery as glass. If he is lucky enough to reach an escape ladder in time, he may get out alive. But the chances are against him.

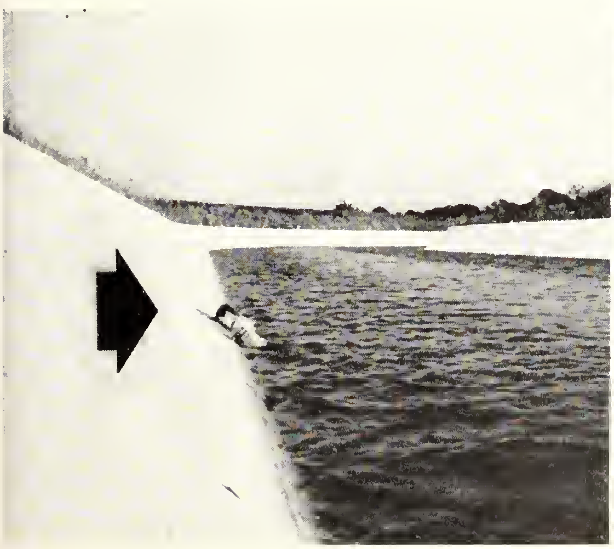
Knowing of the existence of all of these hazards to the public, and we have mentioned just a few, the Bureau of Reclamation is trying first of all to educate the public in recognizing the dangers inherent in all irrigation systems. To that end presentations are being made through the press, radio and schools. We want the people to realize that we are not being merely officious in forbidding them the use of canals as swimming holes, but are primarily interested in their safety and welfare.

Knowing that educational programs alone are not enough, we have been installing heavy fencing around the most dangerous locations to make it very difficult for any person to get himself into trouble. We have also installed signs warning of specific, as well as general, dangers.

Since there will always be those who manage to get into trouble in spite of what others may do to keep them out, we have placed numerous escape devices such as escape ladders, safety nets, safety floats, grab lines, etc. in our canals, particularly near dangerous structures. These devices will be described and illustrated in a subsequent article.

We find that the likelihood of accidents increases with the increase in size and depth of the canals, with the increase in the number of structures and with the increase in density of population. Consequently we go to the greatest lengths in the installation of safety devices in those places where we feel that the likelihood of accidents is greatest. In spite of all we can do, the safety of any person is pretty much in his own hands. So the next hot day when you are "simply dying" for a swim in the canal, don't do it. STAY ALIVE BY STAYING OUT. ###

YOU CAN'T CLIMB A CANAL BANK LIKE THIS ONE!—Frank Bryan's 12-year-old son shows how impossible it is to sove yourself from this situation. ***Friant-Kern Canol, Centrol Valley project photo by C. Kepner.***



WHERE YOUNKIN DROWNED.—The upstream end of the stilling pool on the Riverton project in Wyoming into which Reuben Younkin wos swept and drowned. Concrete baffles increosed the hazard of turbulent water. ***Photo by S. T. Lorsen.***

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YUMA POWER WAGON

REPAIR SHOP ON WHEELS.—At left, lifting a gate assembly with power hoist, before placing it in concrete takeout. Above, Sam (at right) and his helper loading the gate.

by HARRY S. RIDDELL, Project Manager, Yuma County Water Users' Association, Yuma, Ariz.

We call it "Sam's Power Wagon."

In reality, it is a standard power wagon, incorporating ideas of our shop crew, and operated by Sam Neahr, heavy duty field mechanic. This power wagon is a complete mobile machine shop, used for all sorts of trouble shooting in addition to the regular work of installing gates and gate frames in concrete checks and turnouts.

This mobile machine shop is powered by a 110-volt power plant, used principally in running a one-fourth horse power drill and grinding machine. It is also equipped with an acetylene torch, a winch on the front end used in connection with a boom, an **A** frame over the body of the car supporting a traveling crane, a combination vise and drill, drums of welding gas and a number of tool boxes with tools of every description. A spare tire is carried on top of the **A** frame.

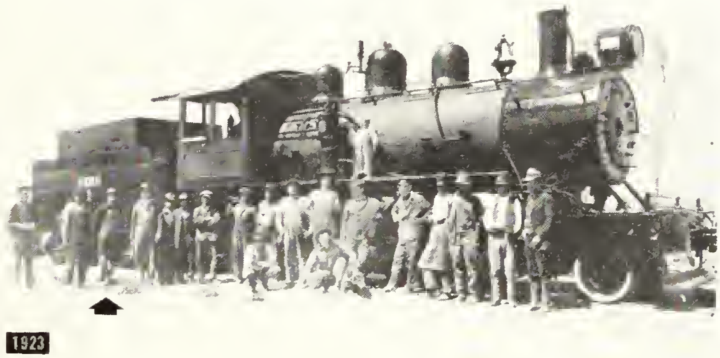
Farm turnouts and lateral checks on this project are poured in steel forms developed by the Bureau of Reclamation. When the water users took over the operation of the Valley Division of the Yuma project from the Bureau of Reclamation on July 1, 1951, a supply of check and turnout forms were turned over with other equipment. A regular construction crew pours these concrete structures and later strips the forms. As soon as the forms are stripped, Sam appears with his power wagon and backs up to the new gate and gate frames already hauled to the job or, in some cases, he lifts it from the bed of the power wagon with his chain hoist.

Once the gate is hanging from his overhead carrier which extends out over the back of the power wagon, the wagon is backed up to the structures and the gate and frame lowered into the well of the turnout or check. If the terrain is such that the power wagon cannot get close enough to the structure to place the gate with the chain hoist, the boom is taken from the **A** frame where it is carried and assembled on the front end of the power wagon. With the winch on the front end, the gate assembly is hoisted and swung in place. After the gate is in the well, the torch comes into play to enlarge any holes in the frame that do not fit over the receiving bolts in the concrete well face. If new holes are needed in the gate frame, the electric drill is put into use. Possibly the gate does not fit snugly on the gate seat at some point. If the seat is low, it is built up with the welding torch and dressed down with the power grinder. If a spot is high, it is ground down to grade. The gate or gate seat is ground and buffed until it is a perfect fit.

After the gate frame is securely bolted and concrete is plastered around the frame to make a tight joint, the job is complete except for putting a lock nut and washer on the gate stem so the gate cannot be forced past center of the closing point on the gate seat. After the gate is properly seated and centered, the extra gate stem above the gate wheel is cut off at the top of the wheel and a washer slipped over the stub. The gate stem is then drilled, the hole threaded and a washered lock nut is screwed in the end of the stem. This construction will not permit the gate stem to be lowered through the gate wheel and the gate cannot go past the center line of the gate seat. It will, however, allow the gate to be raised. In this manner, the gate can never go below center and no amount of pressure on the wheel will bow the stem and pry the gate away from the frame.

In operating the gates, sticks or debris may enter the gate, causing it to leak. If the person operating the gate happens to be anyone other than the zanjero (ditchrider), or another experienced operator, it will be his natural instinct to put more force on the wheel. This causes even greater leakage. The gate cannot close any tighter on account of the obstruction, so something has to give. It is usually the gate stem—as more force is applied, it buckles away from the face of the concrete and slants the gate away from the gate seat. When the obstruction is finally removed, the stem has obtained a perpetual bend. One of Sam's jobs is to take off such a gate and stem, straighten the stem, rerun the threads and replace the gate with Sam's device that permits the gate to be lowered only to the proper elevation. The lock nut instead of the gate stem withstands any additional strain.

With his power wagon, Sam can go anywhere at anytime, on-load all his supplies and equipment up to two and a half tons per unit, off-load at the job site and make all necessary repairs. Many times, it is cheaper and more efficient to haul heavy equipment and parts in trucks to be delivered at the site but, if necessary, Sam's power wagon can pick up, deliver and install. ###



SAM NEAHR—HEAVY DUTY MECHANIC.—Sam wastes neither time nor motion. At upper left, he is oiling the dinky engine used to haul riprap for Laguna Dam. Sam started as a pipe fitter and fireman, but shortly thereafter became a locomotive engineer, even though under age, when he proved his superiority over a certain self-styled engineer who ran the dinky through a trestle and piled it into a hole. Sam continued as a locomotive engineer until 1935. Arrow points to Sam (above) before one of the 60-ton engines used to haul riprap for the Colorado River levee. Sam saved the Government so much time and money through his efficiency on this job that he was given right-of-way over the other trains and engineers. Between 1935 and 1951, Sam was chief plumber, machine shop worker, and heavy duty mechanic for the Bureau. At left, Sam, near the door of his power wagon, talking to his helper, as he continues to serve the water users.

SAM NEAHR, born in Yuma, Ariz., in 1891, is a natural-born engineer, mechanic and efficiency expert.

During his 44 years with the Bureau of Reclamation, he has handled everything from a 60-ton locomotive to a water faucet.

He started work at the age of 15 for his father who managed the Government grocery store at the site of Laguna Dam. He then worked for the J. G. White Co., until the Reclamation Service took over the job in 1907 and Sam started to work for the Government. In 1951 he retired on a pension, but not from work. Without losing a shift, he went to work as a heavy duty mechanic for the Yuma County Water User's Association where he now operates the Yuma power wagon, along with other jobs. He is a man who is happy in his work and looking forward to many more years of usefulness. •

FELIX KARRER, author of the accompanying article, for which the photos were submitted through the courtesy of the Sacramento Municipal Utility District, California.

STRETCHING SHORT WATER

by FELIX KARRER, Farm Power Advisor, Sacramento Municipal Utility District, Sacramento, Calif.

Agriculture in Sacramento County is a $50,000,000 business, a major source of income to our population. For this reason its problems are important to the entire community. Water, and its availability for irrigation, are of critical importance, and the slow but regular decline of the water table in this area is a matter of real concern. Under present conditions, the re-use of waste water is important from a conservation standpoint, entirely aside from its economic advantage to individual farmers, and the publication of this study should be a valuable contribution to the public welfare.

Very truly yours,

RAY C. GEIBERGER,
Sacramento County Farm Advisor,
Agricultural Extension Service.

WATER HAS BEEN CALLED THE LIFEBLOOD of California agriculture. Certainly the availability of water, and the cost of distributing this water, are major factors affecting farm production and profits.

In the area served by the Sacramento Municipal Utility District, the recirculation of runoff or waste water [1] has become important both as a means of conserving water and of reducing irrigation costs.

In most cases, water can be recirculated at substantially lower cost per acre-foot than the original cost of pumping it from the ground. The lift is small compared to the average well lift. Power costs are generally lower, as is the initial investment required for the low-lift pump installation as compared to the cost of a well pump of corresponding capacity.

[1] RIGHT TO THE USE OF WASTE WATER.—A farmer in California has the right to re-use the waste water from his own land, provided the water is recovered before it leaves his property. Questions concerning the right to the use of waste water occurring in California natural channels or drains should be referred to the State Division of Water Resources, Public Works Building, Sacramento.

Such recirculation systems operate in one of three ways:

(1) Pumping from a low-end collecting basin into a "high-line" ditch.

(2) Pumping from a drainage cut back to the main ditch.

(3) Pumping from a low-end collecting basin into the main pipeline system.

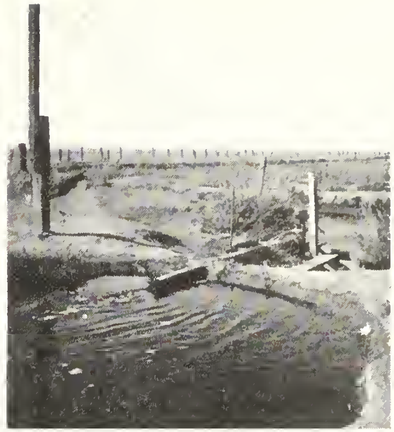
Regardless of the method used, the recirculation of waste water brings a number of benefits in addition to the cost-advantage previously mentioned.

These are:

(1) WEED CONTROL. Standing water on pasture land encourages objectionable water grass and plant infestation which will displace good pasture grasses.

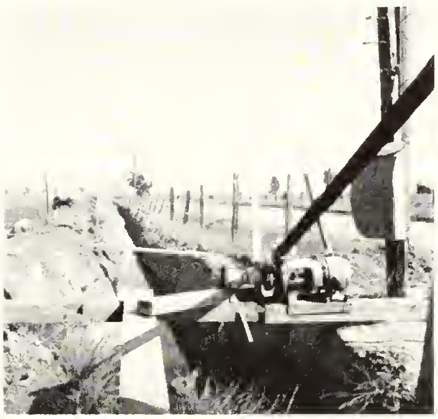
(2) MOSQUITO CONTROL. Standing water quickly becomes the breeding ground of mosqui-



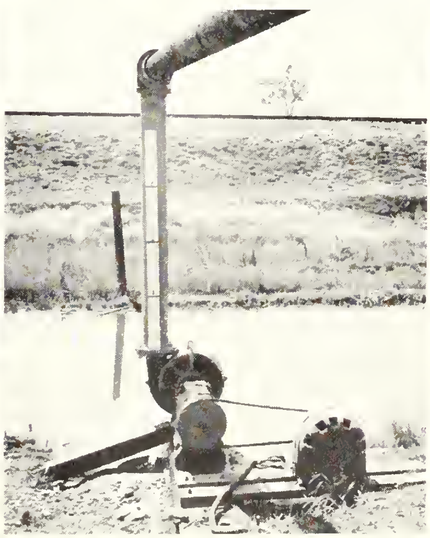
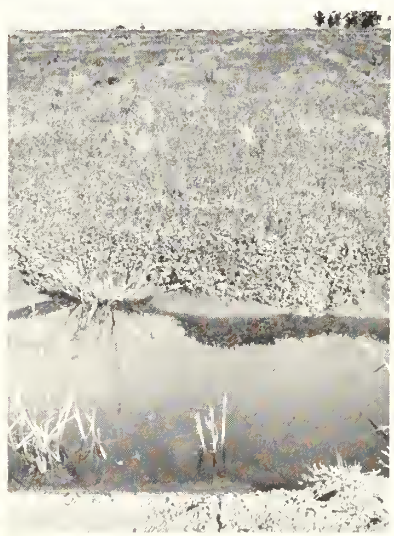


PUMPING FROM COLLECTING BASIN to high-line ditch. Photo at left, long shot; at center, closeup. Photo at right, the ditch end of this operation.

FROM DRAIN TO MAIN DITCH.—At immediate right, water is pumped into the main ditch. At far right, the drain ditch, with water that is going to be used over again.




FROM COLLECTING BASIN TO PIPE LINE SYSTEM.—At lower left, a long shot, and at center a close up of the motor and pump. At lower right, an example of how drainage leaves ladino pasture practically free from weeds.

TEST RESULTS OF 8 RECIRCULATION PUMPS

Pump No.	Motor hp	Type [1] pump	Head in ft. water to water	Capacity, gallons per minute	Effic. in percent wire to water	Kwh/ac ft. low lift plant	Kwh/ac ft. reg. well plant	Initial invest. low lift plant (approx.)	Initial invest. reg. well plant (approx.)
1	½	P	1.5	285	18	8.7	80	$250	$1,000
2	40	C	19.7	4,500	50	41.5	80	1,500	----------
3	5	P	3.7	1,940	35	10.9	80	1,000	2,500
4	5	C	9.0	475	22	42.0	115	200	1,400
5	3	C	4.6	115	3.5	126.0	113	250	900
6	5	C	9.7	350	12	82.0	160	50	1,200
7	5	C	6.7	470	12	55.2	109	50	1,400
8	7½	P	5.5	3,350	39	14.4	80	1,200	----------

[1] P—denotes propeller pump.
C—denotes centrifugal pump.

REMARKS:

1. Pumps Nos. 2 and 4 are centrifugal pumps V-belt driven. These are the only centrifugal installations where an attempt was made to fit the pump to the specific pumping condition by decreasing the rotative speed through proper pulley diameters. By this means the maximum efficiency of the pump is realized under a head condition similar to that encountered in the field.

2. Pumps Nos. 5, 6, and 7 are direct connected centrifugal pumps, the latter two previously used in lifting against a head of 40 to 50 feet. This explains the low efficiency of 12 percent for the low lift application, since no attempt was made to reduce the speed. Pump No. 5 was a new pump, but was designed for a head condition of 110 feet. The corresponding low efficiency of 3½ percent is proof of the misapplication of this otherwise efficient unit. Recirculated water in this case is more expensive in kilowatt hours per acre foot than is the water pumped from the well, even though the respective lifts are 4.6 feet and 60 feet.

3. The three propeller pumps operated against very low heads, and with the exception of pump No. 1, the velocities in the discharge pipe were high. Since the velocity head was not credited to the pump in the calculations, the efficiency of these units is less than normal. Propeller pumps, or high specific speed pumps, are to be recommended for low-lift applications because of their high efficiency in handling large volumes of water against low heads.

4. Pumps Nos. 6 and 7 are driven by 5 horsepower three-phase motors. Many such units became available when, due to the dropping water table, deep well turbines were installed in the irrigation wells. This explains their low cost in this area.

toes. Aside from the human element, mosquitoes will plague livestock, in time reducing their production.

(3) Road protection. Standing water can, by means of underground percolation, soften roadbeds to the point where expensive repairs are necessary.

(4) Flood control. When drainage ditches are inadequate, recirculation may prevent the flooding of the farmer's own or neighboring fields. Such flooding has resulted in several law suits in the Sacramento Municipal Utility District area.

The choice between the three general types of recirculation systems will obviously depend on local conditions. Where a pipeline can be installed economically, recirculation and distribution by this means eliminates the maintenance of ditches and drainage cuts.

In planning any system, it is particularly important that the amount of available water be carefully estimated, and the capacity of the pumping plant determined accordingly.

It is equally important that the pumping plant be selected, or modified, to handle the low-lift assignment efficiently. The tabulation above gives the performance, cost, and efficiency-ratings on eight installations in this area. The wide variation in efficiency (from 3½% to 50%) is explained in the accompanying remarks. It will be obvious that substantial savings can be realized from the modification of centrifugal pumps when they are to be used in recirculation systems.

Information and specific data can be obtained from pump dealers, from the Agricultural Extension Service, or from the Utility District.

The district fully recognizes agriculture's important contribution to the economic welfare of the Sacramento area, and has, in addition to the advisory services made available to all customers, provided special services to its rural customers. The planning of recirculation systems comes in this category.

Adapted from the pamphlet entitled, "The Use of Waste Water for Irrigation" and reprinted through the courtesy of the Sacramento Municipal Utility District.

RUTH BUDD, PRESIDENT of the ???

LAURA COCHRANE, SECRETARY-TREASURER of the ???

WOMEN OF THE WEST

A Reclamation Role for Wyoming Women

by RUTH BUDD, President, newly formed, as-yet-unnamed, Women's Auxiliary of the Wyoming Reclamation Association

SOME PEOPLE MAY THINK THAT RECLAMATION is purely a man's business, without interest for women. As the wife of a cattle rancher who has served two terms as president of the Wyoming Reclamation Association and on interstate compact commissions, I have attended enough meetings with him to find myself definitely interested in Reclamation and its vital problems and implications for the West. There are plenty of other women similarly interested.

The idea of forming a women's auxiliary of the Wyoming Reclamation Association was presented several years ago. No action was taken, however, until last fall when the State Association president, Mr. Breck Moran, of Cody, put the suggestion in motion and the women's auxiliary of the Wyoming Reclamation Association was organized

PRESIDENT'S MESSAGE

As president of the Wyoming Reclamation Association, I am most grateful to our ladies for their interest and work in founding a women's auxiliary. May it grow and prosper!

It is, after all, appropriate that the first women's auxiliary of a State reclamation association should arise in Wyoming. It was in Wyoming that women first achieved the franchise; first elected a woman State governor.

There is good reason behind such developments, for it is on the frontier rather than in settled civilizations that the capabilities of women and their contributions stand out most clearly and unmistakably.

Mrs. Joe Budd of Big Piney, our auxiliary's first president and author of the accompanying article, Mrs. Ben Cochrane of Lander, its first secretary-treasurer, and the other women who formed our auxiliary, have started something. I am confident that their organization and work will contribute vigorously to the progress of Reclamation.

BRECK MORAN, President,
Wyoming Reclamation Association.

during the convention in Rock Springs, Wyo., on October 1, 1951.

For many years the Wyoming Reclamation Association had been considered a man's organization, even though wives of the members had always been included in the invitations and notices of meetings. In recent years, the number of women accompanying their husbands to these meetings had been increasing, and it was thought the time had arrived to plan an active organization for the ladies, in conjunction with regular meetings.

Accordingly, a luncheon was planned for the women who had accompanied their husbands to the Rock Springs convention. At this luncheon the women's auxiliary was born.

The women present elected Mrs. Ben Cochrane of Lander, wife of the Fremont County State association director, as secretary-treasurer. They honored me by electing me president. The organization was formed in a temporary fashion to await more complete organization this fall at the 1952 State Reclamation Association convention at Wheatland. At this time we plan to draw up and adopt a constitution and bylaws.

We decided the auxiliary should be primarily a social group to promote a more consistent attendance for the association as a whole, and to furnish entertainment and social activities for those ladies who find it enjoyable to attend the meetings with their husbands.

Aside from the social angle, however, there are other good and, in my opinion, more important reasons why women should be encouraged to attend the sessions of the Reclamation Association.

Only by means of meetings where ideas on regional and local problems can be discussed, exchanged and argued can development take place. There the reports should not be limited to the ears of men alone, for a conversational knowledge of the problems at hand can do much toward assuring a friendly and close family relationship. And why should not a wife acquaint herself with the plans and projects which affect her future as well as her husband's?

All of us have worked at some time or another with church groups, community clubs and civic organizations to raise money to improve our schools, churches, libraries and medical services—thinking first of our children. We wish to support the Reclamation movement for the same reasons. For, in the actual progress of Reclamation, women and children are the principals who will actually be the most benefited.

Reclamation projects, whether they be on a large or small scale, will promote the growth of any community, because more land brought under cultivation means more families on the land and more townspeople to serve them. Greater productivity of the land means higher tax valuations, and, as a result, better schools, churches, hospitals and roads. Such community progress tends toward a better rounded social and cultural life, more and better opportunities for children and adults alike—in short, better homes with closer family ties.

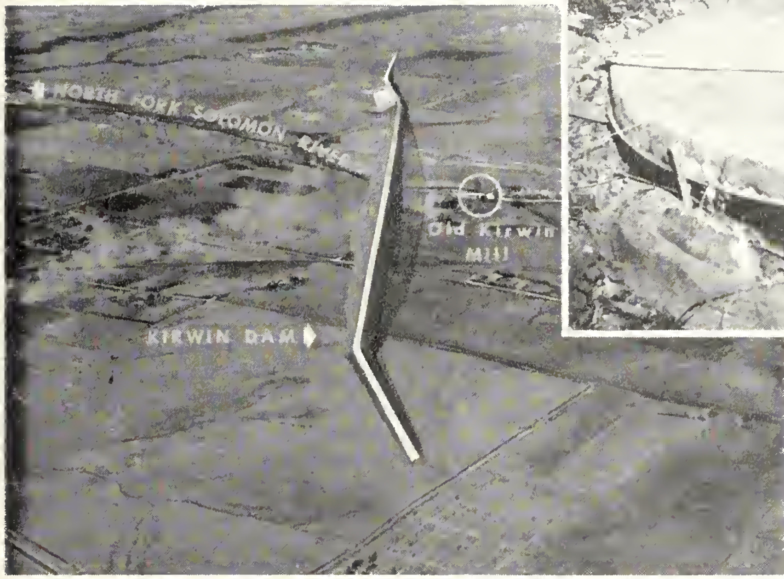
Because Reclamation holds an interest for both men and women, the joint attendance at Reclamation meetings can be prompted by the women's desire to attend, which is often the determining factor for the attendance of the men. Besides, there is no easier way to form or renew acquaintances across the State, for a convention makes for a friendly relationship between the wide and varied interests of the State.

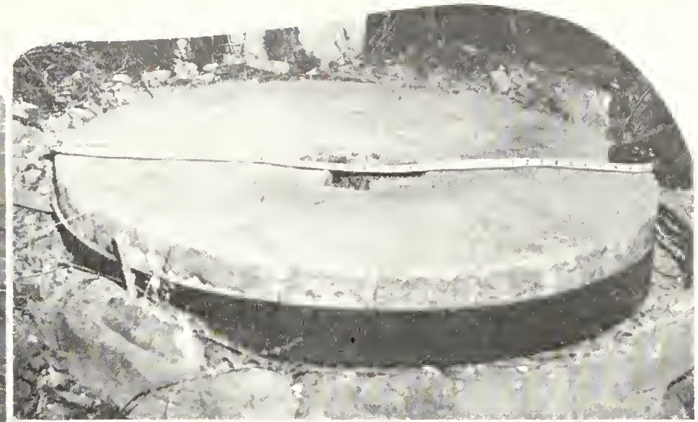
And that is one of the reasons why the name for our women's auxiliary has been left undecided, though a few facetious names have been suggested by the men, such as Weeping Willows, Water Witches, and Water Lilies.

The contest opens the doorway to a larger attendance, which is one purpose of our organization. It is our fervent hope that enough interest is created in this year's convention so that our women's auxiliary will become a potent factor in furthering the aims of Reclamation in our Wyoming. ###

TEN DOLLARS for a Title for The Ladies!

FOR WOMEN ONLY.—Send your suggestions for appropriate names for this newly formed woman's organization to Earl T. Bower, second vice president and Wyoming director of the National Reclamation Association, Worland, Wyo., who is arranging a contest to select a name for this group at the annual State meeting in Wheatland in September. Mr. Bower is furnishing the prize money, $10, to the person who suggests the name selected. All entries must be postmarked no later than midnight August 31, 1952. The contest is limited to residents of Wyoming.





TWO SYMBOLS OF PROSPERITY—The gristwheel of the past (above) and the dam of the present (at left). *Both photos by John N. Berg, Region 7 photographer. Artwork at left by Washington, D. C., Graphics Section, based on artist's conception of dam by M. H. Willson, Denver Federal Center, Denver, Colo.*

KIRWIN at the CROSSROADS

by GLENN E. THOMAS, Office Engineer, Kirwin Dam, Kans.

Solomon River, in Northwestern Kansas, is going back to work again.

On March 27, 1952, the people of the Solomon Valley flocked to Kirwin, where an old mill symbolizes an early era of prosperity due to water-resource development, to watch the start of a new job for the Solomon River, the beginning of Kirwin Dam.

Kirwin, Kans., was once the center of a busy trading area in the valley due to a large on-the-farm population which made good use of the river's water resources for turning grist mills to grind the farmers' grain. It has been off the beaten track for many years, a quiet village whose many empty business buildings and homes, and the crumbling foundations of buildings long since gone, gave mute evidence of its prosperous past.

One of the town's remaining citizens, John M. Gray, a former merchant, banker, surveyor, and State senator, looked to the Solomon River to bring greater prosperity to the farmers in the valley again and new life to the towns along its banks. Largely through his efforts, a movement was started to interest the Bureau of Reclamation in investigating the irrigation possibilities of the Solomon Valley.

Then came the disastrous floods of 1951, resulting in more than $16,000,000 damages in the Solomon River Basin and much greater losses in areas farther downstream—Topeka, Kansas City, and St. Louis.

As a result of this emergency, and previous investigations made of the area, in November 1951, the Congress of the United States made funds available to start building Kirwin Dam—one of the trio of flood barriers on the Solomon River. Kirwin Dam on the North Fork, Webster on the South Fork, and Glen Elder on the main stem, were authorized under the Flood Control Act of 1944 as part of the Missouri River basin project.

During its heyday, Kirwin had 3 churches, a school, an opera house, 5 hotels, 2 restaurants, 4 livery stables, 2 banks, 2 printing houses, a slaughterhouse, brewery, flour mill, and about 30 other establishments where people could buy or sell dry goods, groceries, hats, boots, shoes, furniture, drugs, lumber, and hardware. Kirwin became the site of a Federal land office, adding to its popularity as a place where pioneers could get the latest news on homesteads, or settle matters about land claims.

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The Atchinson & Denver Railroad, now known as the Central branch of the Missouri Pacific, reached Kirwin about 1879, increasing the town's importance as a center of activity in the upper Solomon River Valley.

Later the main line of the Rock Island was built through the upland area to the north. Droughts discouraged many of the early settlers. Large scale mechanized farm operations replaced the family-sized farm and the population dwindled. With better rail facilities, farmers began sending their grain to markets in the eastern part of Kansas and the old water-powered mills were gradually abandoned. The county seat towns along the Rock Island replaced the river-bank towns as principal trade centers of the area.

In the pioneer era the Solomon Valley, with tree-lined stream banks, and rich alluvial soils, green with grass and growing crops, presented a striking contrast to the treeless expanse of prairie sod uplands. The thick buffalo grass on the uplands prevented erosion. Held by the grass the rains soaked into the soil and emerged in the valley as clear spring water. Crude dams were thrown across the channel of the spring-fed stream to provide water power for grist mills.

These early attempts to harness the Solomon River met with many difficulties. Floods frequently washed out the crude dams. During drought periods careful husbanding of the meager streamflow was necessary. As the water was released from the mill ponds of upstream mills, each miller in turn stored the flow until there was enough water to operate his mill for a short run.

One of these mills was built at Kirwin in 1872 by William H. Skinner. The mill stones or burrs for the grist mill were imported from France, and the first dam was constructed by laying trees in the channel with the limbs upstream, weighing them down with earth and rocks.

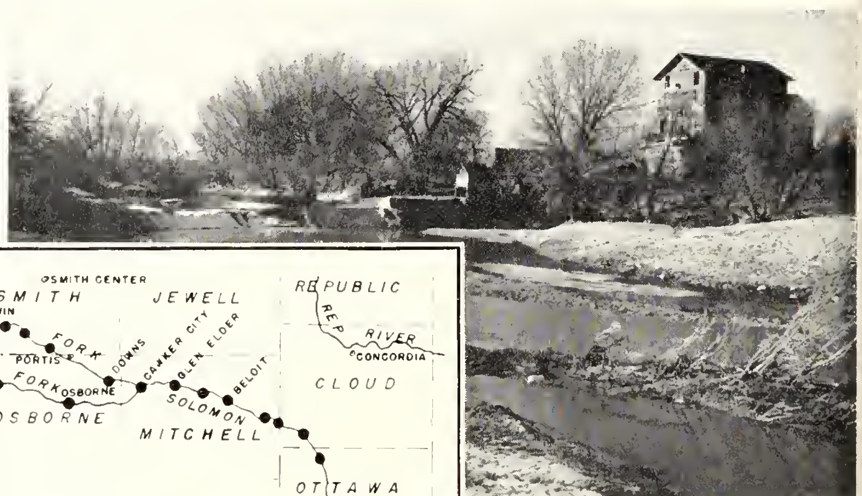
Floods frequently washed out the brush dam which gradually evolved to a rock-filled log crib and later to a concrete-faced log and masonry dam. The operators, Skinner and Adams, sold the mill to two of the Jackson brothers in 1882.

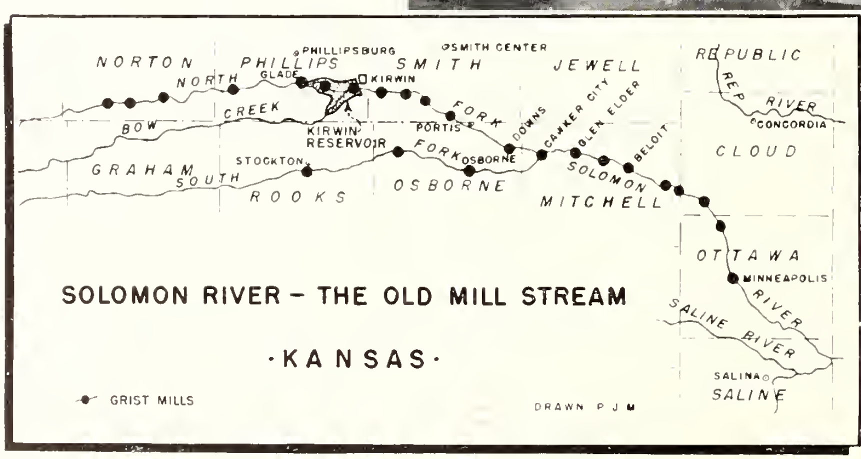
The Jacksons replaced the old millstones with roller-mill equipment, adding a gasoline engine in 1898 when there was not enough water in the stream to run the water wheel. From that time, the mill operated 24 hours a day during the busy season.

During the first world war the mills along the Solomon shipped flour to Europe, the Jacksons making a gift to the Belgians of a carload of flour from the Kirwin mill. So important was flour from the Solomon River Valley to the war effort that enemy agents burned several of the mills down to the ground.

The old Kirwin mill, which played such a big part in winning a world war and Kirwin's former

PIONEER WATER RESOURCE DEVELOPMENT on the Solomon River. Map drawn from information furnished by Clyde M. Jackson, owner of the old Kirwin Mill (at right) now making way for Kirwin Dam. *Photo by John N. Berg, Region 7 photographer.*





PRESENT-DAY DEVELOPMENT UNDER WAY.—Above, H. E. Robinson, Kansas River District Manager, opens the "dirt-moving ceremonies" at Kirwin Dam, Kansas, March 27, 1952. At right, Clyde Jackson holds an empty flour sack, left over from the time when a large on-the-farm population patronized his and the other mills along the River. Jackson and Homer Phillips, Kirwin Dam Field Engineer, are working together to bring the "good old days" back to the Valley. *Photos by John N. Berg, Region 7.*

prosperity, will make way for the structure which is to win the war against flood and drought and bring prosperity again to the Solomon River Valley. Clyde Jackson, former operator of the mill and the last of the Jackson family who operated water-powered mills at Cawker City, Downs and Kirwin on the North Fork of the Solomon and Osborne and Stockton on the South Fork of the Solomon, is tearing down the old mill, its timbers still sound after well over a half century of service.

Kirwin is becoming an important crossroads town again. Its business buildings are being remodeled and occupied. Empty residences are now filled, and the busy sound of saw and hammer is heard as houses are being built for construction workers yet to come. This is but a forerunner of the real prosperity that will come to this section of the Solomon Valley when the irrigation system is completed and Solomon River, the old Mill Stream, goes to work again.

This time the river will not be turning the water wheels of grist mills. Held back by Kirwin Dam, which will span the valley from rim to rim, the flood waters will be stored and used to irrigate 11,500 acres of rich valley land. Periodic droughts and intermittent floods will no longer plague this beautiful valley.

With an assured supply of water for crops, the valley farmers can engage in intensive agriculture, planting for maximum production every year. Livestock operators over a wide area will be secure against feed shortages, such as occurred in the dismal 30's, when untold thousands of starving cattle were shot down in western Kansas feed lots.

The vision of progressive Solomon Valley residents such as John M. Gray of Kirwin, coupled with modern engineering knowledge, will create an economy of abundance resulting in better business, increased population, and greater economic stability in the area.

The dam, a rolled earthfill structure about 119 feet above streambed and with a crest length of more than two miles (11,300 feet, to be exact) will have a concrete spillway on the right abutment, and outlet works to provide for river and irrigation releases. The lake formed behind the dam will bear little resemblance to the old mill ponds. As has been the case in other areas, where large man-made lakes appear, fishing, hunting, swimming, boating, wildlife refuges and other conservation benefits and recreational opportunities never before known in northwest Kansas will accrue to the Solomon Valley where the people have learned the value of wise water resource development.

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HOW LAND IS SURVEYED

FROM THE AIR.—Aerial photographs such as this, when rectified to appropriate scale, make excellent base maps for land classification. *Photograph courtesy of Pacific Aerial Surveys, Inc., Seattle, Wash.*

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Boise, Idaho, Region 1

Part 7 in a series of articles on soils and land classification

To serve satisfactorily all demands for evaluating land, three types of land classification of various intensity for specific purposes have been established; namely, reconnaissance, semidetailed, and detailed. The reconnaissance and semidetailed types are designed to provide preliminary information in project investigations. The detailed classification provides information for project authorization, development of the final plan for projects going into construction, or for the reappraisal of operating projects.

An objective of the land classification is to make field delineations on base maps of adequate scale and detail to serve the specific purpose for which they are intended. In reconnaissance and semidetailed work, the map scales are respectively 2,000 and 1,000 feet equals 1 inch. Topographic maps on a scale of 400 feet equals 1 inch and having a 2-foot or less contour interval are used as the base maps in detailed surveys, as well as enlargements of aerial photographs. Early difficulties of adjusting and assembling the material to a final map of accurate scale and satisfactory reproduction have been largely overcome.

In detailed classification, examination of soil and land features are made at relatively close intervals of about 200 yards or less and land class separations are shown in as much detail as practical. Thus, full detailed information as to the character of the soil and land features on all parts

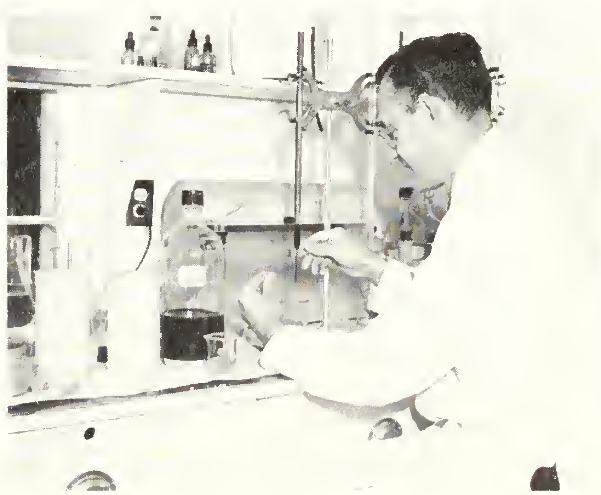
ON THE GROUND.—Special machines carve cylinders of undisturbed soil for analyses or to observe soil characteristics and permeability, especially in relation to drainage. *Photo courtesy of Oregon State College.*

of the individual tracts or farm units is obtained. Soil and subsoil conditions, topography and drainage are studied in detail for the purpose of land appraisal, laying out the canal distribution system, outlining a drainage program and planning project development.

A great many of the land class delineations are coincident with easily discernible features, such as change of slope, type of vegetation or prominent soil characteristics. However, in order to properly evaluate surface soil and subsoil conditions and to substantiate the judgment of the land classifier, sufficient borings or pits are made in representative areas. The borings and pits are generally extended to at least 5 feet and occasionally to 10 feet or more. Careful observations are made and samples are taken of the profile by sections on the basis of changes in texture, structure and profile development. Laboratory tests are performed on the samples. Various field tests are also made, such as for infiltration rate. The intensity of the examinations and sampling vary with the intensity of survey and variability of soil conditions. It ranges from a few samples each square mile in a reconnaissance survey to at least one for each 40-acre tract in detailed surveys. More are taken where salt concentrations are common, where land drainability appears difficult, or where soils have questionable water retaining properties.

If there are questions about the textures of the soil, for example, in relation to moisture, laboratory analyses are made to determine the size particles that make up the soil. It may be necessary to make measurements of the moisture-holding capacity by use of special instruments that permit measurement of soil moisture under various tensions created by pressure or suction. In addition, many other physical measurements on water conductivity of soil and the stability of the soil under leaching may be necessary.

Determination of lime or total carbonates are



IN THE LABORATORY, soils of proposed projects are subjected to chemical analyses. Vernon G. Bushnell, soil scientist, at work in his Region 1 laboratory. *Photo by Phil Merritt, Region 1.*

made by use of acid. The salinity or salt content and alkalinity or pH are determined mainly by routine electrolytic methods. Additional electrolytic and chemical procedures in the laboratory are used when necessary or desirable for sodium and other determinations.

The time necessary and costs involved in making field tests and laboratory analyses are trivial in comparison with the purposes they serve and project failures which may be avoided by the data obtained. Additional and perhaps more significant information is obtained through demonstrated experience in the general husbandry of similar soils, more refined field or plot experiments and other research. The Bureau of Reclamation depends largely on such information for evaluating the organic and mineral fertility deficiencies, as well as other deficiency factors that can be readily corrected by agronomic practices. The laboratory and field procedures are correlated with field responses and former experiences and utilized in extending practical knowledge of land capabilities to areas of undetermined suitability for continuous, profitable irrigation. The standards and procedures for land classification have been developed on the basis of experience on irrigation projects.

When all field and laboratory determinations have been made, final land class designations are assigned to the individual delineated tracts and, by appropriate symbols, the reasons for this classification are shown on the map. Most, if not all, of the soil testing data and profiles are also shown on the maps. Thus, the basic information is directly available for use at all times.

The information supplied by land classification maps and reports serves many purposes and the data are as important to the success of a Reclamation project as water supply data and engineering design. The data are used for the determination of project size and irrigable areas, water requirements, irrigation and drainage systems, land development, land appraisal, payment capacity, project benefits and costs, establishment of assessments, size of farm units, and proper land use.

Next Month.—Land Classification and Irrigation Structures.

SUNNYSIDE PAYS OFF

A PICTURE MAY BE WORTH 1,000 WORDS. These pictures represent over two million dollars paid back to the United States Government by successful reclamation farmers on the Sunnyside Division of the Yakima project in the State of Washington.

THE "SUNNYSIDE OF LIFE" in the reclaimed West. Successful irrigation farming made possible a celebration on the Sunnyside Division of the Yakima project in the State of Washington on June 19, 1952, when Assistant Reclamation Commissioner Goodrich W. Lineweaver (at left in photo at upper right) accepted two checks from H. E. Alexander, President of the Sunnyside Valley Irrigation District, and said, "Paid in Full." These checks marked the final and total repayment of about $2 1/4 million advanced for the construction of irrigation facilities in the Valley as part of the Federal investment in the reclamation of the West. The John Golob farm in the photo at upper left is typical of the security and success of the Valley. Farmer Reichert is the industrious worker carefully cultivating a field of sugar beets, one of the major irrigated crops developed as a result of Reclamation. *Both photos by Stan Rasmussen, Region 1 photographer.*

Tall Wheat Grass

TALL WHEAT GRASS—*Agrophyron elongatum*, in a field north of Manti, Utah, on the Sanpete project. *Photo by W. H. Hirst.*

EDITOR'S NOTE: We are indebted to Paul K. Gardner, Editor-Publisher of the Lovelock Review-Miner, Lovelock, Nev., and Mr. F. A. (Gus) Momberg, Superintendent of the Nevada-Nile Corporation, Lovelock, Nev., for their cooperation in furnishing the material upon which this item is based.

TALL WHEAT GRASS may not be the the last word in pasture plants, but so far it has proved to be outstanding for permanent pasture, hay, and reclamation of salty and alkali ground in Nevada.

Paul Gardner, editor-publisher of the Lovelock Review-Miner, Lovelock, Nev., says that tall wheat grass grows an inch a day in the Lovelock area, but although the grass grows 7 or 8 feet tall, its greatest pasture value comes when it is short and succulent. Gardner claims that tall wheat grass may partially supplant alfalfa hay, as it permits various methods of handling, and the fact that it can be used as pasture or combination of pasture and harvesting makes it very attractive to ranchers.

However, he also points out that the long-stemmed grass presents some difficulties, particularly when planted in 3-foot rows for seed. Matured grass must be cut and left to dry, and when picked up by a combine, its length causes all kinds of difficulties. So far, as little as 2 acres a day can be threshed. Lightness of the seed also causes some trouble in catching it during the harvesting process.

Gus Momberg, Superintendent of the Nevada-Nile Corporation, Lovelock, Nev., believes that in a number of years a still better grass will be developed. A graduate of the University of California at Davis, he has the scientific attitude, plus a vast amount of experience, and when it comes to tall wheat grass he has tested it on levelled, irrigated, salt free, salty and alkali soils in the Lovelock Valley. He reached the accompanying conclusions only after 3 years of testing plus analyzing information contained in 40 letters received from United States Agricultural Experiment stations in different parts of the country, including reports on special tests by Colorado A. and M.

TALL WHEAT GRASS AS A PASTURE PLANT

1. Very vigorous grower and heavy producer. The better the land the higher the yields.
2. Palatability fair to good, depending on growing conditions and management.
3. Under irrigation on moderately salty, to soils up to 1.50 percent salt, will out-yield any known grass for the area.
4. Provides earlier and later pasture than other grasses if rested in late summer and fertilized, reducing corral feeding.
5. Will provide an income while reclaiming salty land if drainage is provided.
6. In quality is comparable to other grasses cut at same stage of maturity.
7. Dense plantings provide more leafy forage than sparse stands.
8. Produces seed easily and volunteers and reseeds itself readily.
9. Should be tried under varied conditions of grass and hay production along the Humboldt River bottoms, and compared with present forage as well as other deep-rooted grasses, such as Pubescent, Intermediate Wheat Grass, Smooth Brome, etc.
10. With the inroads of Halogeton, and reduction of range carrying capacity, by law and nature, the only "out" for the cattle producer in northern Nevada, besides range improvement, is to eliminate the wiregrass, willows and sagebrush in the river bottoms and replace them with good forage, provided there is a maximum of water control instead of the present free flooding.

Livestock producers and farmers in the intermountain area first heard of this tall wheat grass in 1948. A bunch grass, selected from importations of various wheat grass seeds from south-

R. J. Walter, Jr., Receives Gold Medal and Distinguished Service Award

R. J. (Rudy) Walter, Jr., construction engineer for the Bureau of Reclamation at Grand Island, Nebr., was presented with a gold medal and the certificate for Distinguished Service Award by Commissioner Michael W. Straus at the Bonny Dam dedication on May 31. The medal and award, the highest employee commendation given by the Department of the Interior, were presented in recognition of his flood warning (see October 1951 issue of the Reclamation Era, p. 215) to the residents of Hays and Ellis, Kans., in June 1951 when his efforts resulted in keeping property damage to a minimum and preventing any loss of life.

AWARD FOR WALTER—R. J. (Rudy) Walter being presented with Distinguished Service Award by Reclamation Commissioner Michael W. Straus during Bonny Dam dedication. Left to right, Betty Wisdom, Shirley Jean Isham, Elaine Raile, Straus, Walter and Shirley Shaffer. ***Photo by John N. Berg, Region 7 photographer.***

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western Siberia, it is long-lived, withstands cold and drought, and its chief merit lies in its ability to become established and yield well in saline or alkali soil. If planted between November and May at elevations of 4,000 to 5,000 feet, it will make a stand in salty land while the weather is cool to frosty. If planted in late spring or early summer, it will, of course, have trouble overcoming excess salt when the temperature and surface soil evaporation is high.

In forage production under moisture conditions of 15 inches or more, it has outyielded other known grasses on good soils. In liveweight grain tests at the Colorado A. and M. experiment station in 1949 and 1950, tall wheat grass outyielded other grasses from 10 to 50 percent. This trial was on good soil with 15 inches of rainfall. Average liveweight gains per acre for the two-year period were 154 pounds. Similar results were also obtained at the Wyoming experiment station.

In 1951, the Nevada-Nile Corp. at Lovelock pastured 1.3 acres of tall wheat grass which had been planted the previous year. This parcel was cut for hay on June 1, July 15 and August 25, besides being pastured during this period. The hay production was close to 3 tons per acre. On September 10, four steers averaging 727 pounds per head were put on the acreage and pastured until October 31. They gained an average of 1.8 pounds per head each day, totaling 92 pounds after shrinkage. During the entire season, from June to October, livestock gained 368 pounds or 283 pounds per acre on the 1.3 acre pasture. Weaners were pastured from October 31 to December 15 when the field was still green but growth of the grass had stopped. Tall wheat grass could have been pastured from May 1 to December 1 with 2 or 3 head per acre and still leave some hay for cutting. A conservative estimate of liveweight gain for the season would be over 500 pounds per acre. Part of this 1.3 acre pasture was in salt grass in 1949, when it was planted to tall wheat grass, which has become established in the salt grass and will gradually take over that area.

Horses readily consume the hay, and after seed threshing, wheat grass straw is as good or better than overmature meadow hay for wintering cattle. The protein of hay cut at Lovelock in June 1951 was 11.7 percent.

The Nevada-Nile Corp., where there is a considerable acreage of saline soils now provided with drain ditches, is planting over 1,500 acres of the grass, which will provide plenty of good forage during the next few years while the land is being leached. After leaching, the land will be well provided with organic matter as the roots of this grass go down more than 8 feet. ###

Golden Jubilee Baby Arrives

Reclamation's Golden Jubilee Baby, a girl, was born on June 5 to the Donald D. Dunn's at Yakima, Wash. Dunn was the veteran selected by the Veterans of Foreign Wars to receive the Farm-in-a-Day on the Columbia Basin project (see Design for Modern Farm Living on page 103 of the May 1952 issue of the Reclamation Era).

The Dunn baby is the recipient of a multitude of gifts donated in the course of the Farm-in-a-Day program including a gold plated No. 2 irrigator's shovel presented by the National Reclamation Association, complete layette, toys, a baby steer, and a Moslem prayer rug. Additional details on the Dunns and Baby Dunn will appear in forthcoming issues of the Era. •

Sacramento Canals OK'D

Secretary of the Interior Oscar L. Chapman, early in May, approved the Bureau of Reclamation's finding of feasibility on the Sacramento Canals unit of the Central Valley project of California, and forwarded it to State and Federal officials for comment and review. The canals were authorized by Public Law 839, Eighty-first Congress, which required submittal of Secretary's finding of feasibility to the Congress prior to initiation of construction of the canals. (See Canals for Sacramento Valley on p. 138, Reclamation Era, July 1951.)

This addition to the Central Valley project would provide irrigation water for 205,000 acres along the Sacramento River in Tehama, Colusa, and Butte Counties. Water for the Sacramento Canals unit would be made available by diversion of Trinity River surplus water. The plan involves distributing approximately 660,000 acre-feet of water a year through three main canals from the Sacramento River. They are the Corning Canal, the Tehama-Colusa Canal, and the Chico Canal.

In addition to the main canals, distribution and drainage systems will be needed to deliver water from the canals to the farm headgates and to carry off unused water. •

Yuma Mesa Farms Go to 27 Lucky Vets

At Yuma, Ariz., on June 3, during a drawing by members of local veterans organizations, 27 war veterans won first consideration to be awarded a family sized farm on the Yuma Mesa later this year. The drawing was held publicly in the Mary Elizabeth Post School and was directed by a committee representative of homesteaders who settled on the Yuma Mesa in 1948.

All told, a total of 4,111 vets of World Wars I and II, the Spanish-American War, and the Philippine Insurrection applied for the farms which comprise an area of 4,030 acres and range in size from 113 to 160 acres.

The applicant priority list contains a total of 162 names. If for any reason the settlement board, consisting of Stephen R. Blake, chairman; William A. Steenbergen, secretary and representative of the Bureau of Reclamation; Gerald Didier, and R. H. McElhaney, disqualifies one or more of the 27 top priority applicants, others on the 162 name list will be considered for farms in the order their names were drawn.

Ian A. Briggs, land use and settlement chief of the Bureau's Region 3, served as master of ceremonies, and operation and maintenance supervisor of the region, A. B. West, read a message from Acting Commissioner G. W. Lineweaver wishing the prospective settlers success in their new homesteads. •

LONG ODDS faced the 4,111 veterans who tried for one of the 27 homestead farms on the Yuma-Mesa Division of the Gila project in Arizona. The Operations Division Staff of the Bureau at Yuma, Ariz., is busy capsuling the names of the entrants prior to the drawing June 3. Left to right: George Gamard, Fern Wilses, Evlyn McGill, William A. Steenbergen, Ralph Habden, Rita Gonzales, Robert Coutchie, Maurice N. Langley.

WELCOME, STRANGER!

"ALL NATION'S DAY" AT EPHRATA, WASH. Flags of 25 nations, and the International Flag of Good Will on the right, were displayed to promote world peace and better understanding among the nations of the world. Delegates to the International Reclamation Conference represented a billion people from foreign lands. Left to right are: Lt. Walker, General's Aide; Dr. D. A. FitzGerald of the Mutual Security Agency; Sirmen Kurtcebe of Turkey in the background; Gen. H. R. Bowman, Commanding Officer of the Larson Air Base; Amin Hamza of Iraq in the background; Senor Salvadore Aquilar Chavez of Mexico; Columbia Basin Festival Princess June Edgar of Pasco; M. N. Bhattarai of Nepal; M. N. Samii of Iran; Donald Dunn, the Nation's most worthy veteran who was given the Farm-In-A-Day on the Columbia Basin project; United States Reclamation Commissioner Michael W. Straus; National Reclamation Association President, C. Petrus Peterson; United States Representative Walt Horan of Wenatchee, Wash.; Columbia River District Manager H. A. Parker; United States Representative Hal Holmes of Ellensburg, Wash., and Frank Banks, builder of Grand Coulee Dam.

Water users of the West played host to visiting reclamation dignitaries from Pakistan, Formosa, Australia, Mexico, India, Iran, Canada, Iraq, Japan, Ethiopia, Brazil, Panama, Vietnam, Cambodia, Thailand, Turkey, Venezuela, Colombia, Nepal, El Salvador, Philippines, Burma, the Dominican Republic, and Lebanon during the International Reclamation Conference from May 27 through June 22, and it would be difficult to state whether the domestic or foreign participants gained the most from the experience.

IN NO OTHER PLACE IN THE WORLD can farmers work under better conditions said the foreign conferees as (1) they saw how crops were grown, (2) marveled at modern distribution methods and nearby markets, and (3) were amazed at mechanical food processing.

The visitors got first-hand information on how people live, worked and played in the reclamation area, and the residents and United States participants in the conference got first-hand information about the far-flung corners of the globe, learning many things which do not appear in the geography books or current journals. Things that they had taken for granted all their lives attained greater value and dimension as contrasts were revealed with conditions elsewhere. All those who came in contact with the conference members gained valuable information and a fresh appreciation of the American way of life.

In the course of the tour, the conferees attended a demonstration of "democracy at work" at a

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meeting of the Terrace Heights Grange, Yakima, Wash., and saw first-hand how the people play their part in forging local, State and national policy.

They watched irrigated crops as they were harvested, processed, and shipped off to market, saw farm machinery in the making, were invited into private homes, visited schools and churches, were honored at a Boy Scout circus and last, but not least, learned to square dance in the best Western tradition.

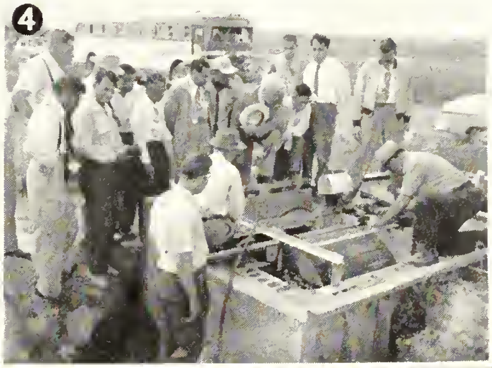
Almost like a homecoming was the visit of Julian A. Buendia, Irrigation Chief for the Philippines who worked as a trainee on the Yakima project in Washington when the main canal of the Kittitas Division was being built in 1927 and 1928. He was amazed at the development he saw. The size and the speed with which the project had developed impressed him, but more than that he could hardly believe the greenness of the once barren lands and the cities where small communities existed during his former visit.

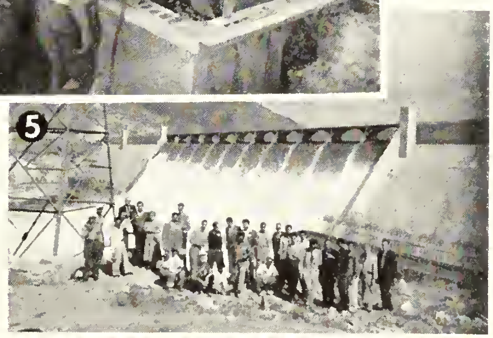
As one of the major problems the delegates face in their own reclamation programs is the instruction of potential users of the projects, the foreign experts were particularly interested in the county extension agent system that puts an expert within telephone reach of the farmer, and the land grant college system that ties in teaching, research and in-the-area farmer education. Myo Han of Burma said, "In no other place in the world can the farmer work under better conditions." He was particularly struck by the close work of the extension service with the project farmers and claimed a similar system would work wonders for the farmers in his country.

The distinguished representatives from foreign lands were extremely interested in our modern financial institutions. They visited a Yakima bank where services to the borrower and depositor were explained, as well as the system of credit ratings, interest on various types of loans, employee incentives and many other things unheard of in their countries. The low interest rates on loans astounded them, many of them pointing out that in their countries the rates were as high as 50 percent.

Huynh Van Diem, Chief Engineer of Vietnam's Department of Public Works, said he had expected that the large numbers of agencies involved in the Columbia Basin project would make it much more difficult to complete and operate. However, after the conferees attended a meeting of the Columbia Basin Inter-Agency Committee at Othello, they saw how the cooperative arrangements worked, and came away with ideas for similar organizations in their own countries which would insure local control of the giant projects now under way.

The typical comment of the visitors about Yakima, the Columbia Basin, Grand Coulee Dam and the United States in general was, "So big!"





"SO BIG!"—but the biggest thing was the hospitality, said the visitors as (4) they saw how we keep weed seeds out of Yakima's Roza canal, (5) how we "do the impossible" at Grand Coulee Dam, (6) learned during study periods how democracy works, (7) had a taste of 4–H Club work, and (8) square danced with "the wonderful people" of the Terrace Heights Grange.

But one of the biggest thing about the United States, according to Rochanasiri Warindr, Administrative Chief of the Royal Irrigation Department, Bangkok, Thailand, was its hospitality. "I feel highly impressed by the friendliness of the people. Everywhere I go, it is 'welcome, welcome, welcome.' I won't forget to tell my people about this when I return home."

Chances are his people and many people throughout the world were learning about this at the time. The Voice of America was sending broadcasts every hour on the hour during the Columbia Basin festival to countries all over the world. Some of the Columbia Basin settlers got into the act, which featured interviews with basin folks. Little Yvonne Tschirkey of the Pasco Unit stood entranced as she listened to her father, Robert Tschirkey, speak a Swiss dialect as the State Department broadcast relayed the story of the celebration around the globe.

The tour started in Spokane, Wash., with a Chamber of Commerce luncheon attended by 300 businessmen, where the foreign reclamation observers began to learn the true meaning of the Western greeting, "Welcome, stranger!"

Later, a hospitality committee made up of the leading citizens of Spokane honored the group at a dinner where Elwood Ball, chairman of the committee, keynoted the theme of the Conference when he said, "Through an exchange of ideas, more neighborliness, and a better mutual understanding, we are taking an important step toward world peace."

The conference coincided with the Columbia Basin project's celebration of the first water to be turned on to the irrigation farmlands from behind Grand Coulee Dam, and the June 17 Golden Jubilee celebration at the Colorado-Big Thompson project, embraced a seminar at Yakima, Wash., and concluded with study tours and seminars at the Reclamation Engineering Center, in Denver, Colo.

All Nation's Day was held on May 29 at Ephrata, where a "Little World's Fair" was set up in an airport area, and a color guard from Larson Air Base carried the flags of 25 nations and the International Flag of Good Will during the Flag ceremonies. On that day Mutual Security Agency's Assistant Administrator D. A. FitzGerald termed Grand Coulee Dam one of the outstanding accomplishments of man and reminded his listeners that people in many parts of the globe contributed to its achievement. He stated that before the turn of the century, representatives of the United States were sent to other countries to study their methods of irrigation, land reclamation and water resource development and have continued these studies through the years. In a spirit of gratitude and cooperation, he said, the United States has embarked upon the present Point Four program, of which the International Reclamation Conference is a part.

The 27 foreign visitors, each an influential reclamation official in his own country, represented about a billion people over the globe. The month-long series of technical conferences and study tours was spearheaded by the Office of Foreign Activities of the Bureau of Reclamation with financial and moral support by the Mutual Security Agency and the Technical Cooperation Administration. Expenses of the observers were paid out of foreign aid funds, although no amount of money could have bought the cordial reception given to the visitors by the people of the West, the United States Senators and Representatives, high ranking cabinet officials, State officials and prominent reclamation authorities from all over the United States who participated during the tour.

Jose Guinaraes Duque, Irrigation Department Chief of Agricultural Industries Services from Brazil evaluated the conference at its conclusion by saying, "Here in the Western United States we have seen the amazing job you have done to develop your natural resources, and I am certain that we, too, can learn much and, I hope, accomplish a great deal more because you have shown us that nothing is impossible." ###

Palmer and Wallace Honored

William R. Palmer of Cedar City, Utah, and William R. Wallace of Salt Lake City, Utah, received honorary doctorates from the Utah State Agricultural College on June 9. Mr. Palmer is a well-known historian and an authority on Indian lore and culture in the State of Utah. He has been active in irrigation district affiairs and has been an occasional contributor to the Reclamation Era (see Utah's "Water Courts," November 1947 issue, page 233). Mr. Wallace has long been an irrigation leader in Utah and throughout the West. He was also a member of the Utah Water Storage Commission for over 2 decades and is a representative of the Board of Directors of the National Reclamation Association. •

LETTERS

Spirit of Good Will

Attorney General Edmund G. Brown of California recently wrote us as follows regarding his article entitled "More Water for More People" which appeared in the March 1952 issue:

"I hope that I can be of some constructive force in my State and Nation. Some of these problems are not easy, but I am sure that if everyone approaches them in the spirit of good will much can be accomplished."

Texas Testimonial

In a recent letter to Commissioner Michael W. Straus, Judge Oscar C. Dancy of Brownsville, Cameron County, Tex., had this to say about the Era. "I have just received the June copy of the Reclamation Era. I haven't had time to read very much of it, but it is just wonderful, and I shall 'steal' a great deal of 'thunder' for my next speech over the radio, from said issue."

Thank you, Judge Dancy, and I hope that you will continue to find the Era helpful in your forthcoming talks. Ed.

RELEASES

New Canyon Ferry Folder Available

A new illustrated folder on the Canyon Ferry Unit of the Missouri River Basin project is now available to the general public. In addition to a number of halftones and two linecuts the folder contains statistical data relative to the Unit. Copies may be had without cost by writing to the Regional Director, Bureau of Reclamation, Billings, Mont.

Straus' Lectures Translated Into Arabic and Spanish

A recent monograph "Natural Resources Development" by Commissioner of Reclamation Michael W. Straus has achieved university text status in three languages.

The monograph is a series of 16 lectures by Commissioner Straus before the Latin-American Training Center in Santiago, Chile, last year under the auspices of the United Nations Food and Agriculture Organization. It has since been compiled in booklet form and, in addition to English and Spanish editions, has now been translated in Arabic for use in Iraq, Iran, Lebanon, Syria, and Egypt.

The request from the University of Wisconsin was for a supply of the booklet for classroom use in a course on government and natural resources. Other colleges and universities plan similar utilization which particularly deal with administration and execution of resource development programs based on the American Reclamation program. Copies of the monograph are available free of charge upon request of our office.

Free Heating Information

The Kilbury Manufacturing Co., has available to readers of the Reclamation Era, free of charge, catalogs on forced-air electric heaters for homes, office, and factory. The address is 14529 Hawthorne Blvd., Lawndale, Calif.

New Maps Available

The drafting section of the Bureau of Reclamation has just completed five new project maps. They are of the Buffalo Rapids, Huntley, Intake, and Milk River projects, all in Montana, and the lower Yellowstone project in Montana and North Dakota.

All maps are in color and are available in the small size only (10½ by 17 inches). Requests should be sent to your nearest regional director (see list on inside back cover of this issue) specifying the name of the map or maps desired. Single copies are available free to those who need them in connection with their work or studies.

Canal Lining Booklet Available

The Bureau of Reclamation has been conducting a lower cost canal lining research program during the last 6 years and the findings to date have been published in a 70-page booklet entitled "Canal Linings and Methods of Reducing Costs."

The booklet points out that at the 25 percent seepage rate on unlined canals and laterals in 1949, the 3,900,000 acre-feet of water lost on 46 Federal projects would have been more than adequate to irrigate an additional million acres of land. Lower cost linings have already resulted in more than $5 million in water savings and increased values in irrigated western farms on Reclamation projects.

The characteristics of the various linings, costs, and application are discussed in detail in the publication which may be obtained for 25 cents per copy. Write to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., or Chief, Supply Field Division, Bureau of Reclamation, Denver Federal Center, Denver, Colorado.

Reclamation Reservoirs Pay Extra Dividend

A new illustrated booklet describing how the Bureau of Reclamation is contributing to fish and wildlife conservation and providing recreation for more than 6,500,000 people in a year's time, with economic benefits amounting to $37,000,000 annually, has just been issued. It includes a directory of fish and wildlife and recreational facilities at 103 of the Bureau's reservoirs, located on 49 Reclamation projects. A limited number of copies are available to the public upon request to the Commissioner's Office in Washington, D. C., or to any one of the Bureau's seven Regional Offices.

The report, containing 63 pages, was prepared at the request of Representative John R. Murdock, of Arizona, Chairman of the House Committee on Interior and Insular Affairs, who has introduced a Resolution to have the report printed as a House Document.

WANTED!

Missing copies and volumes of the Reclamation Era's predecessors—the Reclamation Service's and Bureau of Reclamation's official publications.

Program for Supervising and Consulting Engineers and Experts (the first official publication of the Reclamation Service)
- Vol. 1, No. 1, March 1905.
- Vol. 1, No. 5, April 21, 1907.
- Vol. 1, No. 115, June 3, 1907.

Monthly Bulletin
- Vol. I, 1908 and 1909 (entire set).

Reclamation Record
- Vol. 3, 1912 (entire set).
- Vol. 4, 1913 (entire set).

If you have any of the above, please send them to The Reclamation Era, Code 460, United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

Needed—30 Million Kilowatts in Three Years

During the fifth conference of the Electric Utility Advisory Council, held on December 6, 1951, attended by representatives of all phases of the private and public electric utility industry, the 31 members present stated that they were planning to increase the generating capability of the Nation by approximately 30 million kilowatts in 1952, 1953, and 1954. According to James F. Fairman of the Defense Electric Power Administration, this proposed electric power expansion would improve the power supply situation on the basis of present load estimates, but any new loads of large size now developing and not included in these estimates could completely wipe out this gain. During 1951, he said, generating capacity went up 7 million kilowatts, but power requirements went up 7½ million kilowatts, and the results of using up the margin between supply and demand were reflected in unfavorable conditions in several parts of the country. He cited in particular the Pacific Northwest where it became necessary to interrupt 100,000 kilowatts of aluminum production for nearly three weeks. Genuine improvement in that area, he said, depends upon the completion of projects which are not due to come into service until 1954 and 1955. •

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NOTES FOR CONTRACTORS

Contracts Awarded During June 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contra[ct] amoun[t]
DC-3555	Missouri River Basin, Wyo.-Mont.	June 27	Construction of 46 miles of Lovell-Yellowtail 115-kv transmission line.	C-L Electric Co., Pocatello, Idaho.	$445,[illegible]
DS-3653	Eklutna, Alaska	June 10	Five 34,500-volt circuit breakers for Anchorage substation, schedule 2.	Westinghouse Electric Corp., Denver, Colo.	54,[illegible]
DS-3677	Missouri River Basin, S. Dak.	June 18	Eight deicing air-switch assemblies for Fort Randall switchyard, schedule 2.	Schwager-Wood Corp., Portland, Oreg.	30,[illegible]
DC-3696	Central Valley, Calif	June 6	Furnishing and installing two 7,500-kilovolt-amper vertical-shaft generators for Nimbus power plant.	Elliott Company, Jeanette, Pa.	464,[illegible]
DS-3702	do	June 9	One 1,000-kilovolt-ampere station-service unit substation for Folsom power plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	32,[illegible]
DS-3707	Kendrick, Wyo	June 10	Two indoor switchgear assemblies for Alcova power plant	Westinghouse Electric Corp., Denver, Colo.	34,[illegible]
DC-3710	Columbia Basin, Wash	June 6	Construction of earthwork, asphaltic membrane lining, and structures for area W-6A laterals, sublaterals, and wasteways, West canal laterals.	Cherf Bros. Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.	1,031,[illegible]
DC-3711	Central Valley, Calif	June 11	Construction of earthwork, concrete pipeline, and structures for lateral 25.6 on the Contra Costa canal distribution system, Contra Costa County water district.	Stolte, Inc., Oakland, Calif	167,[illegible]
DC-3713	do	June 18	Construction of Nimbus dam, power plant, and appurtenant works.	Winston Bros. Co. and Al Johnson Construction Co., Monrovia, Calif.	6,067,[illegible]
DC-3715	Columbia Basin, Wash	June 30	Installation of two 1,350-cubic feet per second vertical-shaft, centrifugal-type pumps for units P5 and P6 in Grand Coulee pumping plant; and miscellaneous metalwork and electrical installations in Grand Coulee Dam, power plant, and pumping plant.	Eichleay Corp., Mt. View, Calif.	525,[illegible]
DC-3717	Parker Dam Power, Ariz.-Calif.	June 19	Modification of turbine draft-tube stop logs for Parker power plant.	Western Iron and Metal Co., Los Angeles, Calif.	20,[illegible]
DS-3718	Central Valley Calif	June 23	One lot of embedded metalwork for 40- by 24-foot radial gates at Nimbus Dam.	Valley Iron Works, Yakima, Wash.	91,[illegible]
DC-3720	Missouri River Basin, Kansas-Nebr.	June 25	Construction of earthwork and structures for Franklin Canal and drains, schedules 2, 3, and 4.	Bushman Construction Co., St. Joseph, Mo.	1,201,[illegible]
DC-3723	Davis Dam, Ariz.-Nev	June 25	Completion of gravel fill and metalwork for Davis Dam and power plant, schedule 2.	George E. Miller, Long Beach, Calif.	58,[illegible]
DC-3723	Davis Dam, Ariz.-Nev	June 27	Concrete, architectural finishes, and plumbing for Davis Dam and power plant, schedule 1.	Jack Willson, Downey, Calif	235,[illegible]
DC-3732	Fort Peck, Mont	June 30	Construction of Dawson County substation and connecting transmission lines; an office building and warehouse adjacent to Dawson County substation; power distribution line; and additions to Williston substation.	Northolt Electric Co., Grand Forks, N. Dak.	179,[illegible]
DC-3733	Eden, Wyo	June 27	Construction of earthwork and structures for Means and Eden Canals, and channel changes and wasteway.	Young and Smith Construction Co., Salt Lake City, Utah.	514,[illegible]
100C-143	Palisades, Idaho	June 12	Construction of administration building for community facilities	J. H. Wise & Son, Inc., Boise, Idaho.	169,[illegible]
200C-198	Klamath, Oreg.-Calif	June 16	Earthwork and rehabilitation, southwest (No. 2) sump dikes	George R. Stacey, Tulelake, Calif.	64,[illegible]
200C-199	Central Valley, Calif	June 24	Erosion control for Tracy Pumping Plant	Justice-Dun Co., Oakland, Calif.	25,[illegible]
200C-200	Central Valley, Calif	June 24	Drilling holes and constructing drains for slope stabilization on Contra Costa, and Ygnacia Canals.	J. N. Pitcher Co., Daly City, Calif.	10,[illegible]
300C-35	Parker-Davis, Ariz.-Calif.-Nev.	June 13	Construction of residences at Parker Dam Government camp	Pritchett Construction Co., Farson, Wyo.	115,[illegible]
400C-29	Grand Valley, Colo.	June 16	Badger Wash chute	Cecil B. Shaffer, Fruita, Colo	16,[illegible]
601C-22	Shoshone, Wyo	June 10	Six miles of closed drains on Heart Mountain Division	Long Construction Co., Billings, Mont.	52,[illegible]

Construction and Materials for Which Bids Will Be Requested by October 1952

Project	Description of work or material
chuma, Calif.	Construction of 500- by 280-foot concrete-lined Ortega Reservoir located north of Summerland, Calif.; 340-foot square concrete-lined Carpinteria Reservoir located northeast of Carpinteria; 18- by 49-foot reinforced concrete control station buildings; and installation of chlorination equipment, 30- and 24-inch steel pipe and 1,400 feet of 30-, 24- and 18-inch concrete pipe.
ntral Valley, Calif	Construction of two 5,000- cubic feet per second capacity radial gate concrete check structures on the Friant-Kern Canal near Orange Cove, Calif. Both structures include 100-foot long inlet and outlet transitions and require about 900 cubic yards of concrete.
Do	Extension of Ivanhoe irrigation district laterals on the Friant-Kern Canal distribution system near Ivanhoe, Calif., involves excavating and backfilling 4.8 miles of pipe trenches, furnishing and laying 3.8 miles of 12- and 15-inch concrete irrigation pipe; and laying 1 mile of 12-inch Government-furnished concrete irrigation pipe.
lumbia Basin, Wash.	Construction of 0.5 mile of 2 to 5 cubic feet per second capacity distribution system for part-time farm units in Block 41, lateral area E-2 on East Low Canal near Moses Lake, Wash.
vis Dam, Ariz.	Erecting additional steel structures for Prescott substation near Prescott, Ariz.
Do	Installation of unit substation, electrical equipment, steel structures, and construction of concrete foundations at Maricopa substation near Maricopa, Ariz.
lutna, Alaska	Two 25-kilovolt-amperes, 7,200 to 120/240-volt, single-phase transformers and two 17-kilowatt, 113-volt, resistor units for Eklutna power plant.
ndrick, Wyo.	Realining 1,700 feet of laterals 256–55R and 256–74L, 600 feet of which is to be earth-lined; constructing 700 feet of lateral and wasteway, riprap drainage inlet structure, one concrete drop, two weirs, two turnouts, and two checks about 10 miles west of Casper, Wyo.
Do	Dismantling 25 miles of 34.5-kilovolt Seminoe-Sinclair transmission line, extending from 3 miles south of Seminoe Dam to 2 miles northwest of Sinclair, Wyo. Materials are to be salvaged and returned to the Government at Sinclair.
Middle Rio Grande, N. Mex.	Construction of channel headquarter buildings at San Marcial, N. Mex. Included are a three-bedroom 34- by 42-foot concrete block dwelling, a 40- by 100-foot office warehouse, a 12- by 24-foot concrete block storage building, and an 8- by 10-foot concrete block pump house.
Do	Excavation and improvement of 17 miles of Rio Grande drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
Missouri River Basin, Kansas-Nebr.	Preparation of a district headquarters office building at McCook, Nebr. which involves remodeling a 14,000 square foot brick building into an office building and constructing a 2,000 square foot, 1-story addition with a basement of the same floor area. The contractor will be required to furnish most of the materials; construct footings, foundations and concrete floors for several other buildings to be erected under other contracts; grade entire area, and install water and sewer lines to all buildings.
Missouri River Basin, Wyo.	Excavate, load, haul and truck-spread 5,000 cubic yards of shale for surfacing a county road in the vicinity of Keyhole Dam near Moorcroft, Wyo.
Do	One 115-kilovolt circuit breaker, one 115-kilovolt selector switch, and one 115-kilovolt disconnecting switch for Alcova switchyard.
Do	Painting certain exposed metalwork, piping, and conduits in Boysen power plant and switchyard.
Palisades, Idaho	Four oil pressure, cabinet-type actuator governors for regulating the speed of four 39,500-horsepower hydraulic turbines for Palisades power plant.
Provo River, Utah	Placing riprap on unprotected sections of river banks along 10-mile reach or Provo River channel about 13 miles northeast of Provo, Utah.
Tucumcari, N. Mex.	Construction of 4 miles of surface drains and structures near Tucumcari, N. Mex.

United States Department of the Interior, Oscar L. Chapman, Secretary

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THE RECLAMATION AREA

The Reclamation ERA

September

1952

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September 1952

Volume 38, No. 9

The Reclamation ERA

35 Years Ago In The Era

War Time Crop Rotations

There seems to be an inclination among farmers to forget that there's such a thing as crop rotation and to produce the crops that at this time are bringing in the most money. The production of the staple crops most needed now is the right thing to do as long as the farmer does not "kill the goose that lays the golden egg." Soils have their limitations and the farmer must keep in mind the fact that he will have to keep right on producing food after the war is over. He should not throw his crop rotation plans so much out of gear that he will be unable to produce profitable crops under normal conditions in normal times.

(From p. 426, September 1917 issue of the Reclamation Record, predecessor to the Reclamation Era.)

OUR FRONT COVER—CASH CROP—Donald D. Dunn, winner of the Farm-in-a-Day (see p. 214) and his dog inspect the bean field which will be harvested this month on his Columbia Basin project farm in the State of Washington. Photo by Fran B. Pomeroy, Region 1 photographer.

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DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor.

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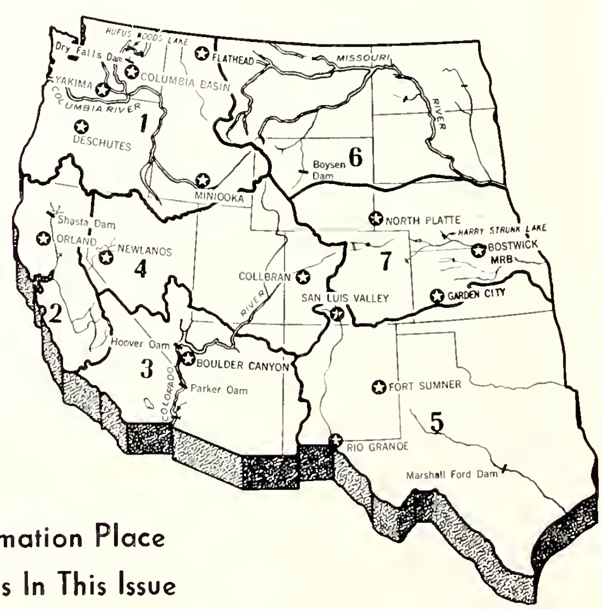
IN THIS ISSUE



Reclamation Place Names In This Issue

NEW LIFE FOR THE SOIL

by

BRUCE F. BEACHER, Soil Scientist
Bureau of Reclamation, Washington, D. C.

1 POUND = 200 POUNDS.—Dr. R. M. Hedrick with a pound of Krilium, which does the same job of soil conditioning as the pile of peat moss used on 100 square feet of garden. ***All photos for this article, courtesy of the Monsanto Chemical Co., New York, N. Y.***

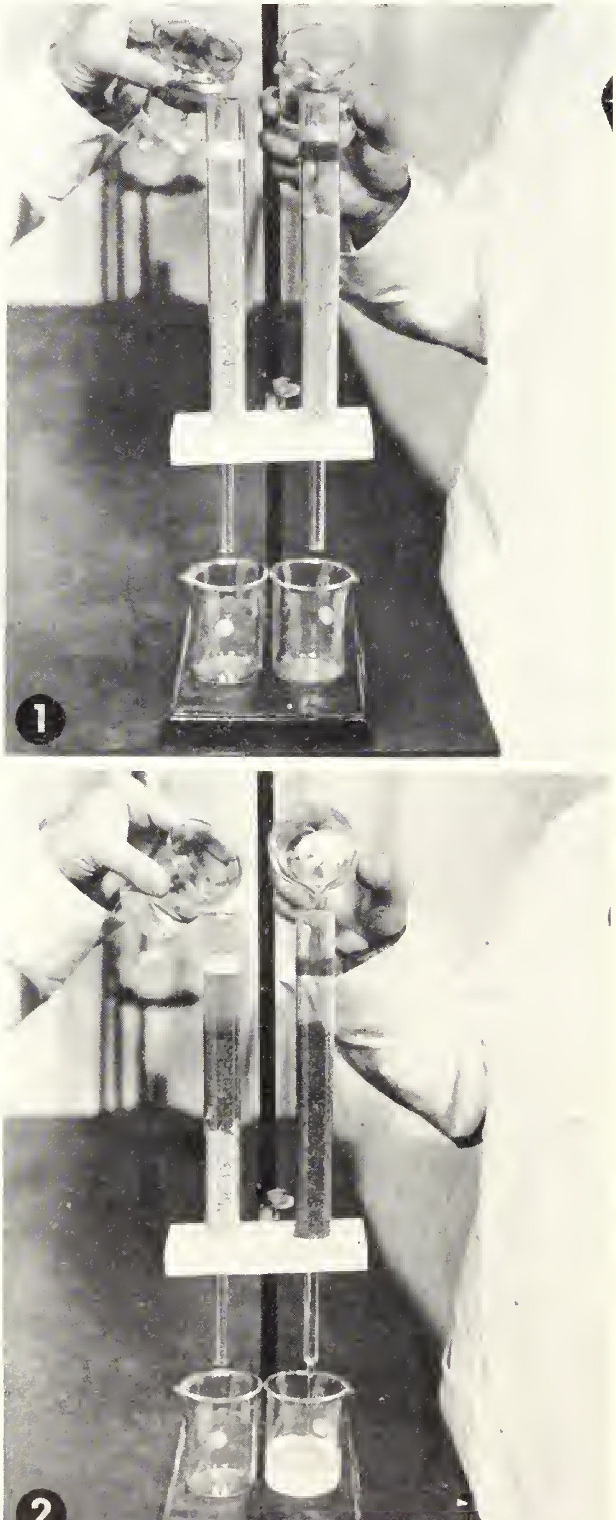
Krilium, Aerotil, Flufflum, Acrylon, and other new soil conditioners may eventually be the answer to the irrigation farmer's prayer for a weapon against his old enemy—gumbo. Experiments up to the present time have indicated that these synthetic resins, which can be dissolved in water, help to germinate seeds, enable a farmer to plow earlier in spring, keep soil from clodding, control erosion, save water by holding more of it in the soil for a longer time, increase crop yields, help solve the drainage problem and can even be used to condition footpaths, playgrounds, tennis courts, baseball diamonds, and the like to give a quick-drying surface and cut down on dust and mud. Another possible use of great importance to irrigators is in the reclamation of alkali lands. At present, the Bureau of Reclamation is cooperating with the Colorado Agricultural Experiment Station in making studies with synthetic soil conditioners on alkali soils of the San Luis Valley project, and plans additional work elsewhere. Much experimentation is being conducted by the State Agricultural Experiment Stations in order to determine how to apply these materials for best results and what effects can be expected on all types of soils and crops.

First, we must caution that the soil conditioners are not fertilizers. Soil scientists and agronomists, who have been concentrating on problems of soil structure as well as those of soil fertility during the past 20 years or more, have observed that the framework of the soil is just as important, and in some cases more so, than the supply and availability of plant nutrients. An irrigator, who has desperately tried to improve a soil that puddles when it is wet and crusts as hard as a turtle's back when it dries, certainly recognizes the truth of this observation.

This problem of soil structure, and packing of soil particles so closely together that the soil repels water, air and roots, is quite widespread and has resulted in submarginal farming and even the abandonment of many thousands of acres of land under ditches.

About 10 years ago, chemists in the research laboratories of one of the Nation's leading chem-

CONDITIONED SOIL LETS ALL THE WATER THROUGH.—Soil in the tube at left has not been treated; at right, treated soil. Using the same amount of water and soil, photo No. 2 shows how the untreated soil obstructs the passage of water.



ical companies started to work on the problem of finding a quick cure for physically sick soils. They knew that many tons of manure, composts and other organic materials are required to produce a relatively few pounds of the natural gums which create good structure in soils. They also knew that, unfortunately, these natural sticky materials or "polyuronides" are temporary in the soil and vulnerable to decay by bacteria.

After trying over 700 samples of chemical synthetics as possible substitutes for natural soil conditioners, they narrowed the search down to the hydrolyzed polyacrylonitriles, which are manufactured from acetylene and hydrocyanic acid, and to a vinyl acetate-maleic acid compound. The large molecules of the substances have hundreds of points at which they can combine with inorganic chemical elements in the clay of the soil.

Applied as powders or as a water solution, the compounds seem to coat the soil particles and create a spongelike structure in the soil, holding the particles together, despite running or percolating water and disturbance. At the same time, they keep the "pores" open, thus improving aeration, drainage and making it easier for the farmer to plow or cultivate. They help to maintain good structure in soils which puddle when irrigated and bake or crack on drying after irrigation. Yet more water can be taken up and held by treated soil than can be absorbed by untreated soil.

At Dayton, Ohio, experiments proved that in cases of very poor soil structure, the yields of vegetables and root crops could be doubled, tripled and in some cases increased 10 to 20 times, through the use of the products. The best results were obtained with the least amount of conditioners where sodium, calcium, and magnesium were present in the soils. These elements are generally prevalent in soils of the Western States. Results were apparent within 24 hours, and lasted 10 times as long as natural organic matter. Tests conducted to date indicate that the conditioners have no toxic effects on soil micro-organisms and, in most cases, do not appear to have any toxic effect upon plants. Certain harmful effects are suspected on potted plants, however.

But don't run to the store or call your salesman for a stock of the new soil conditioners. In the first place, they are not yet available in the quantity which would be required for farm use. In the second place, they are expensive, as were other developments such as 2,4-D, DDT and tetraethyl lead, until mass production methods were devised. In the third place, much experimental work remains to be done in order to determine the quantities to use under different conditions, the methods of application for best results, and the effects on different soils and crops.

Generally, 1 pound of synthetic soil conditioner per 100 square feet has been found effective for meeting soil erosion conditions. About 300 to 500 pounds of the synthetic are required per cropped acre. Soil-building effects take place at low concentrations. If more than about 0.2 percent is used (about 1 ton for 3 acre-inches of soil) the results might be detrimental and quite the opposite of the effect desired. Puddling and baking of the soil may be very pronounced. Considering the strong fixation of the conditioners in the soil, severe consequences may result unless suitable economical methods are developed to remove excess concentrations. Soil should not be allowed to dry out completely. Once this occurs, it may be difficult or impossible to wet the soil again.

On cultivated lands, the powder forms may be applied at the rate of 300 pounds per acre and worked into the top few inches. For deeper effects, 500 to 1,000 pounds per acre may be applied in two steps—one-half top dressed and plowed down, and the other half disked in after plowing. They can be applied along with fertilizer in preparation for planting, and enough nutrients should be provided in the soil to take advantage of the better growing conditions provided for the plants through the treatment.

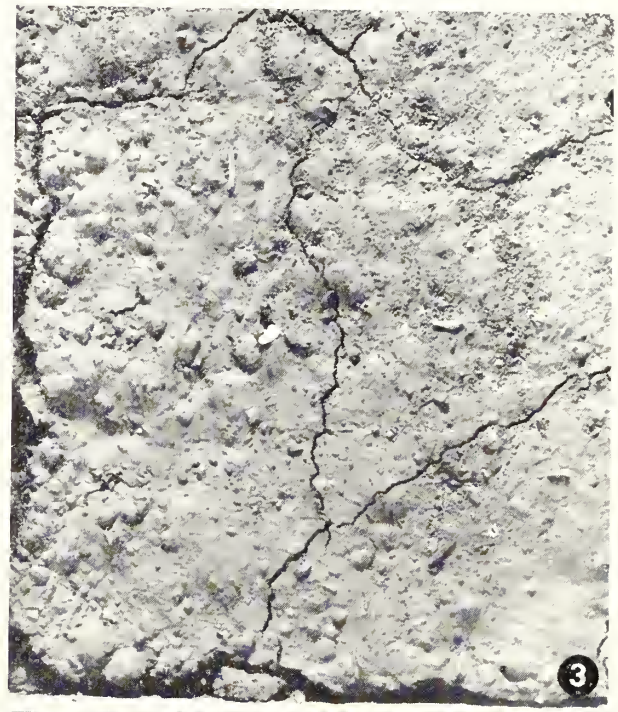
On garden soils and in the greenhouse, the conditioners may be used at the rate of about 1 pound per 100 square feet and thoroughly worked into a depth of 3 inches. To control erosion, a carefully prepared solution may be sprayed on the surface.

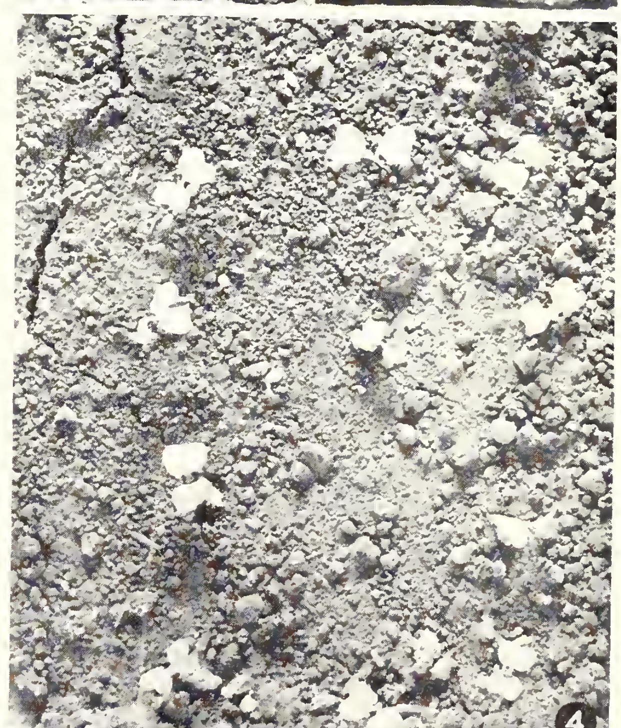
In all cases, the soil should be reasonably dry at the time of application. Some water is necessary after the treatment to permit the synthetic conditioner to act.

The powders must be stored in dry places with containers tightly closed since slow hardening may occur in some climates. In mixing it with other products, don't combine it with ammonium nitrate. It might explode.

Krilium, Aerotil, Fluffium, and other similar products are already on the market primarily for home garden use, but by next year, one company may have enough raw material available to make tens of millions of pounds if the market justifies this output. The commercial products consist of

(Please turn to page 212)





CONDITIONED SOIL LETS RADISHES GROW.—Untreated soil in photo No. 3 shrank and dried to a hard crust from watering. Treated soil in photo No. 4, watered in the same manner, shows greater germination resulting from synthetic soil conditioner.

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IRRIGATION MADE EASY.—At left, J. A. Fambro, ditch-rider, Carl Duke and Mark Ratliff watch water flowing over lower side of Duke's ditch. Above, Dee Inman removes a concrete block from his box-type lateral.

FORT SUMNER'S CONCRETE LATERALS

by GARFORD WILKINSON, Region 5 headquarters, Amarillo, Tex.

"WE'RE THE LAZIEST BUNCH of irrigation farmers in the West and we're spending a lot of time and money to prove it."

So said Mark Ratliff recently as he adjusted his hat and sighted across the Waller brothers' 155-acre farm in the Fort Sumner, N. Mex., irrigation project.

"Take these Waller brothers, Dan and Forrest," Ratliff continued, "they have built concrete laterals so they can water their entire place in less than 24 hours and never soil their Sunday shoes."

Ratliff, president of the irrigation district, was showing radio and newspaper men the work farmers had accomplished since the Bureau of Reclamation completed its rehabilitation of the project in 1951. He took the visitors to several places to view concrete laterals, bench leveled farms and growing crops. Before the rehabilitation program, the project looked like a mule in buggy harness. But that's been changed. Fields and feed lots are spick and span. The homes and outbuildings are repaired and painted. The entire project is being dressed in party clothes and the change from the previous rundown appearance now reflects new pride of ownership.

The former privately financed and engineered Fort Sumner project had experienced innumerable difficulties from its very beginning in the 1860's up to the time landowners contracted with the Bureau to build a new diversion dam on the Pecos River and rebuild the main canals and drainage system. Previously constructed diversion dams were inadequate and the loss of water in the canals and farm laterals was a constant source of disappointment come harvest time.

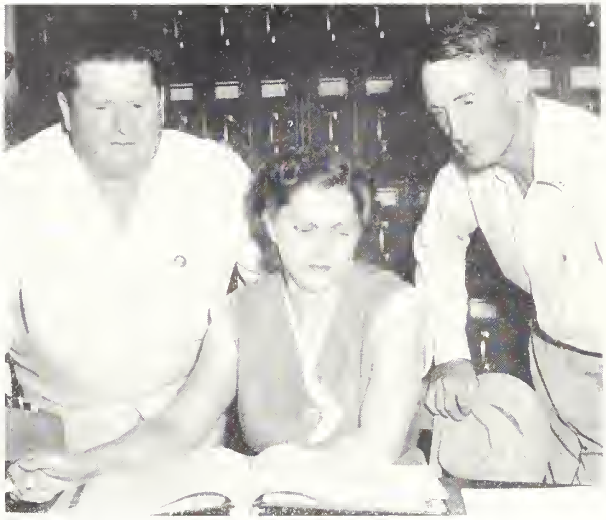
Today, the Bureau-constructed main canal and many of the ditches serving the 6,500-acre project are concrete lined. Under the old set-up water from the Pecos flowed to farms in a dirt canal. Loss was estimated at about 50 percent in the 3-mile stretch from the point of diversion to the first turn-out. A great deal more of the supply was wasted in the poorly constructed, weed infested farm laterals. Now, the farmers receive virtually full use of the water. Only 45 minutes are required for it to move from the dam to the first farm ditch. It seems only a matter of seconds after one of the two ditch riders, J. A. Fambro or Percy Sweat, opens the gates to let the water enter a farm lateral until it is spreading out evenly over thirsty fields.

Project farmers early eyed the Bureau's engineering and construction methods. They decided that their individual farm distribution system should be no less efficient. They summoned Soil Conservation Service engineers to lay out farm laterals. Some obtained financial assistance from the Production and Marketing Administration. Several received help from the Farmers Home Administration. Still others went about their business with different means. Dirt began to fly, concrete laterals laced the countryside, and fertilizer spreaders moved across the leveled fields.

Forrest and Dan Waller designed their own system. This lateral is a square-type, with permanent indentations or scallops on the top of one side through which water flows automatically onto the lands to be irrigated. Check gates control the flow of water onto various fields. The concrete lined lateral drops two-tenths of a foot in each section between check points.

The Dee Inman farm was more of a problem. Inman had to bench level his place in three tiers. He chose a box-type ditch with concrete blocks spaced at regular intervals on the land-to-be-irrigated side of his lateral. These concrete blocks can be removed easily to increase the flow of water through indentations to any desired area. The Inman design, not greatly unlike the Waller design except for the removable blocks in the indented border, also has a perfectly graduated drop between check points.

Carl Duke built a V-type concrete lateral. He, like Inman, used the removable concrete blocks set in the upper edge of one side of the lateral, but he went one step further than Inman in the refinement of painless irrigation. He placed wire handles in each concrete block to lessen the stooping and lifting process. Obviously no siphons are required on any of the project's lined canals.



THEY SAVE TIME AND MONEY by spending time and money for more efficient structures. Here are the Fort Sumner Irrigation District officers: Sheriff Sam Martin, Mrs. Wilma White (secretary) and Mark Ratliff (president). Bill Mullins, other board member, was absent when this picture was taken.

Although the project already is an oasis in the midst of arid rangeland in its second year of operation following Bureau rehabilitation, much work remains to be done before all of the 250 farmers will have virtually automatic irrigation systems like those of Dee Inman, Forrest and Dan Waller, Carl Duke, Mark Ratliff, Sheriff Sam Martin and others. However, numerous farmers are working toward the goal set by the pioneers of easy irrigating.

As the SCS completes its farm survey, construction of the concrete lateral system follows.

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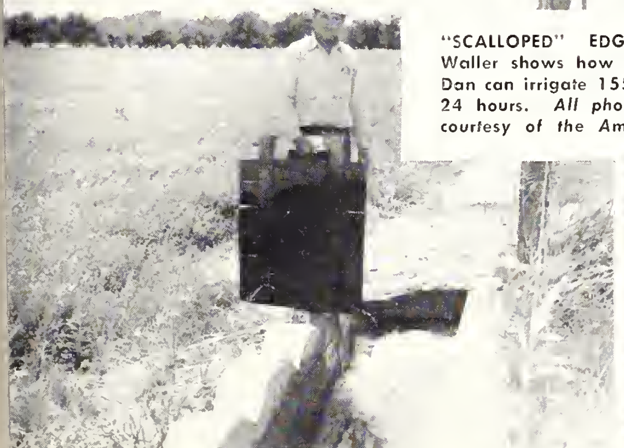


"SCALLOPED" EDGE DITCH.—Forrest Waller shows how he and his brother Dan can irrigate 155 acres in less than 24 hours. *All photos for this article, courtesy of the Amarillo Daily News.*

DESCHUTES' "WEED HOLIDAY"

FOUR HUNDRED FARMERS AND BUSINESSMEN in 70 crews took a day off to destroy weeds on 200 miles of Deschutes' laterals during Reclamation's Golden Anniversary, June 17, 1952. *All photos for this article by Stan Rasmussen, Region 1 photographer.*

by CARLOS RANDOLPH, Irrigation Manager, North Unit, Deschutes Project, Oreg., Region 1

FREEDOM FROM WEEDS is most important to the champion seed growers of the Deschutes project in eastern Oregon.

The farmers simply cannot afford to let weeds choke out their crops, steal water, or mix with their alfalfa and clover seed. That is why, since the beginning of irrigation on this project in 1946, weed control has perhaps attracted more attention than on other developments. More than half of the 50,000 acres of the North Unit of the project was in clover and alfalfa seed crops in 1951.

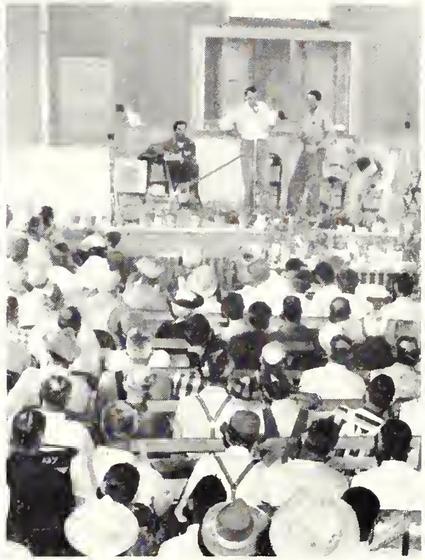
Deschutes is the project where the weedmobile was developed (see Deschutes Weedmobile, p. 3, January 1952, RECLAMATION ERA), where the farmers raise prize-winning, high-quality seed year after year (see Deschutes Project—Deep in Clover, November 1949, and Deschutes Does It Again, p. 92 of the May 1951 issue), and where on June 17, 1952—Reclamation's Golden Anniversary—400 farmers, businessmen, Federal, State, and county employees joined together in what may well be the greatest 1-day war on weeds in the 50-year history of Federal Reclamation.

During this "Weed Holiday," 70 crews, each under the direction of a farmer with a businessman as a "strawboss," covered 200 miles of laterals, locating, identifying, and destroying every weed known to exist on this project.

The entire lateral and canal system had previously been covered with mobile spray units, but the weed holiday was declared to promote weed consciousness and thus assure even better methods of control.

The idea of a "Weed Holiday" in which everyone could participate was conceived about a year ago, and was developed through meetings with the directors of the North Unit Irrigation District, the Jefferson Seed Growers Association, the Jefferson County Extension Service, and farm and business organizations. Eleven Bureau of Reclamation ditch riders, whose rides or beats cover the project, organized the farmers along their rides into several divisions, each division assigned to a certain farmer who became the leader of a crew composed of his nearest neighbors. Most farmers worked on laterals near their own farms or from which they received irrigation water. Businessmen from the project towns of Madras, Culver, and Metolius volunteered to help clean out the weeds.

The members of the 400-man army cut, hacked, and pulled away at every weed they could find, except for primary noxious weeds (white top, Russian knapweed, quackgrass, morning glory, and Canada thistle). The eagle-eyed crews spotted 15 hitherto unknown patches of these weeds, marked



WHAT IS IT?—At left, farmers test their skill at weed identification during a contest. At right, County Agent Paul Barnes, at microphone, and Carlos Randolph demonstrate how to identify the "plants out of place" which threaten seed crops.

them plainly for future destruction and reported them to Bureau personnel. Curly dock and plantain especially got a rough going over. These are the seeds which are difficult if not impossible to remove from Alsike or Ladino clover seed.

The work was completed by noon, when the victorious weed crews gathered at the recreation hall at Irrigation Headquarters for luncheon provided by the North Unit Irrigation District and served by the ladies of the Jefferson County Library Association. After luncheon, weeds were tagged with their most common names and placed on display for everyone to observe. Added to this Rogues Gallery were weeds grown in a hot house by the Pacific Supply Cooperative.

Prizes were awarded by the Jefferson Seed Growers Association to farmers Wiley Clowers and Art Carlson for their tying high score of 88 in the weed identification test; to businessman William Robinson and farmer Leo Bicart for bringing in a weed that could not be identified by Dr. A. N. Steward, head of the Oregon State College Herbarium, and his assistants, Mrs. Wiletta Smith and Dean Clarkson (later the weed was properly tagged as Agoseris species, commonly called summer dandelion or wild cotton); to farmer Jesse Gregg for bringing in the largest weed (a 71-inch curly dock) and to Art Carlson's crew for bringing in the largest variety, 24.

Probably the greatest accomplishment of the day was one of education. The people were surprisingly interested in weed identification and cer-

EXCELLENT GRASS COVER on canal and lateral banks of the North Unit, Deschutes project, in Oregon prevents weed infestations.

tainly more people are weed conscious than ever before. The farmers were in a position to observe the scope of the weed problem and understand that in order to have a successful weed control program everyone must do his part. No less important, public relations between the farmers and businessmen were strengthened. There is little doubt that the "Weed Holiday" will be an annual event.

###

New Life for the Soil

(Continued from page 207)

one to two parts of the chemical to three or four parts of carrier, and cost several dollars per pound. Although the present cost sounds high, 1 pound does as much as 200 pounds of peat moss at 0.04 a pound, or 500 pounds of commercial compost at 0.025 per pound.

Lower costs for the synthetic soil conditioners may become possible with more efficient production methods, development of competing materials, and volume sales.

This is only a beginning, and research and practical experience in the development and use of these soil conditioners may disclose many new and wonderful ways to bring new life to both good and poor soils. ###

Fort Sumner's Concrete Laterals

(Continued from page 209)

Production and Marketing Administration conservation payments are available to cover a part of the costs of the irrigation structures, leveling and fertilizing. The Farmers Home Administration makes water facility loans to cooperating farmers for reorganizing farm irrigation systems.

Water is available to project users through the district's holding senior right to 100 cubic feet per second from the natural flow of the Pecos River. The district's water passes through Alamogordo Reservoir, constructed upriver in 1937 to store a supply for the Carlsbad irrigation project, about 160 miles downstream from Fort Sumner.

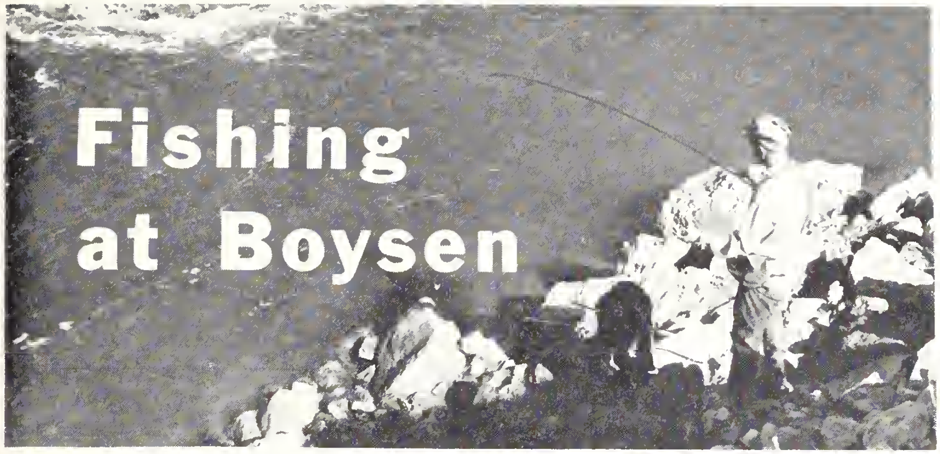
Principal crops are alfalfa, corn, cotton and vegetables, with some orchards. Cotton, which averages about a bale and a half per acre, is a minor crop. Alfalfa, currently selling at $35 per ton, is favored by project farmers. The market includes ranches in the area, feed lots, dairies and sales rings within a 150-mile radius of Fort Sumner.

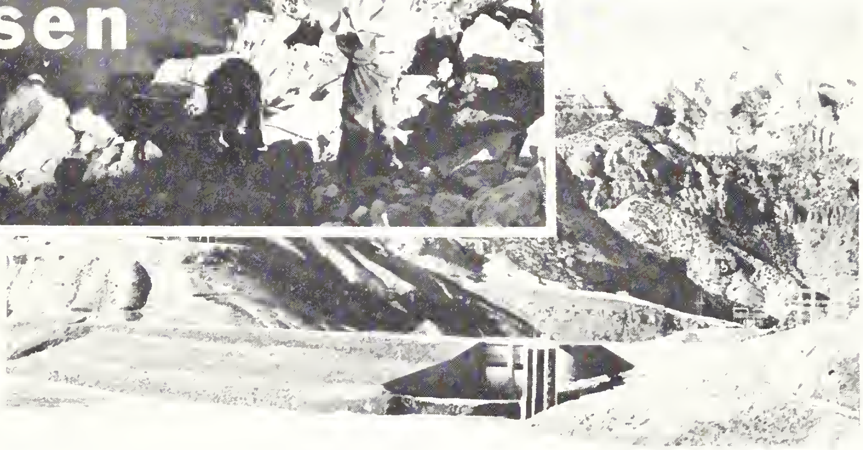
Costs of the concrete laterals constructed to date range from a low of $1.07 per running foot to a high of $2 per foot. The average project-wide cost is about $1.30 per foot.

Sheriff Sam Martin, who divides his time between farming and keeping law and order in New Mexico's De Baca County, says the idea of constructing concrete farm laterals is spreading throughout the project area like measles in a kindergarten. The sheriff also emphasizes the fact that night irrigation can be performed without any form of lighting. Mark Ratliff was kidding when he said Fort Sumner project farmers are the laziest bunch of irrigators in the West. He could have been completely honest in the same space of time had he said that he and his neighbors are wise and industrious. They're making it mighty easy to irrigate. Of far greater importance, however, is their program to conserve and use every drop of water allotted to them from the Pecos. ###

SHASTA SPILLS.—Shasta Dam's spillway went into action in late May this year for the first time in history, creating California's brand new waterfall as the 35-mile-long lake behind the dam filled and overflowed. The 487-foot waterfall is three times higher than Niagara Falls. Carla and Terry Benoit, on the lawn just below the 602-foot structure, demonstrate that they understand the basic principles of the "spill"—on a smaller scale.

Fishing at Boysen





SINCE THE FIRST OF MAY, the scene above has become more and more common, with fishermen completing a day with good catches of trout. At lower right, the dam and reservoir responsible for the added attraction.

FOR THE FIRST TIME IN RECENT YEARS, the Bighorn River in north-central Wyoming is offering excellent opportunities to trout fishermen, made possible by the recent completion of the Bureau of Reclamation's Boysen Dam midway between Thermopolis and Shoshoni.

In a period of a few short months, the reservoir forming behind the dam has become large enough to trap a very large portion of the heavy silt load of the river. The removal of the silt plus the colder temperature of the water resulting from sustained storage in the reservoir have made excellent trout habitat not only within the reservoir but in the Bighorn River for many miles downstream from the dam. These two factors and the recent planting of game-sized fish both in the reservoir and in the river below the dam brought Wyoming anglers flocking to the area on May 1—the opening day for fishing.

Constructed primarily to conserve wasted flood flows of the river for irrigation development and the generation of hydroelectric power, the Boysen Unit is typical of many units of the Missouri River Basin project in that the development plan calls for many beneficial uses to be served. Irrigation benefits from the unit consist of the provision of a stable supply of water for about 20,000 acres in pumping units along the river downstream from the dam and, by conserving water for downstream uses, the irrigation development of an additional 80,000 acres upstream from the reservoir. The 72,000,000 kilowatt-hours of electrical energy to be generated annually at the 15,000-kilowatt power plant will help to relieve a critical power shortage in the Big Horn Basin of Wyoming.

Boysen Dam was started in 1947. Late in 1951, final closure of the 230-foot-high, 1,100-foot-long earthfill dam was made. Soon thereafter the waters began to clear and the Wyoming Game and Fish Commission began planting trout in the reservoir and the river below the dam. Most of the fish planted were 6 or more inches long and of legal size for catching. So far more than 57,500 trout have been planted and this planting will continue until the 820,000 acre-foot reservoir and the river downstream from the dam are top fishing centers in the area.

Wyoming Fish Warden A. F. C. Greene said that an effort will be made to stock the stream with fish of as large a size as are available because of the extreme fishing pressure expected in the easily reached area, part of which is in the Wind River Canyon which annually attracts a great number of visitors with its scenic value alone.

In addition to its appeal to fishermen, Boysen Reservoir will make possible many new types of recreation to residents of the area. The presence of a sizable lake in a region of very few large bodies of water will draw visitors from an extensive area for boating and other water sports and picnicking and sightseeing at the reservoir will be enjoyed by thousands. ###

COLUMBIA BASIN'S SHOWPLACE

by HUGH H. MONCRIEFF

Columbia Basin project
Washington, Region 1

"DON'T WASTE THE WATER!" cautions Mrs. Dunn, as Sally hoses the bushes in the front yard. *Photo by Frank B. Pomeroy, Region 1 photographer.*

"It's a far cry from Hoeing sunflowers in Kansas."

That is what Donald D. Dunn says about operating his Columbia Basin farm 3 miles north of Moses Lake, Wash., where he is working hard to make it "the best farm in the United States."

The farm, valued at more than $50,000 (on which all the materials, labor, and land had been donated by business firms and private individuals) was given to Donald D. Dunn, picked in a national search by the Veterans of Foreign Wars to decide the most worthy veteran in the United States.

Presentation of the farm on May 29, and the building of it, was a feature of the 11-Day Columbia Basin Water Festival celebrating the start of irrigation on the 1,029,000-acre Columbia Basin project.

A great number of changes have taken place since the day after the farm was built, and the Dunn family awoke to start a new life. Even though the crops had all been planted, Dunn couldn't say, "Well, I guess I'll stay in bed this morning." No, he had work to do and plenty of it. He has been busy at it ever since. Some of the neighbors came over to help him during the first few days as water had to be put onto the newly planted land immediately.

Water, the precious substance which turns the barren areas of the Columbia Basin project into bountiful green fields, at times requires expert troubleshooting in the field. New ground broken for irrigation sometimes reacts violently when water is first turned into the ditches. Dunn, who formerly dry-land farmed in Kansas, survived the first few weeks and, with the help of a foreman experienced in irrigation, soon learned the capacity of his ditches and how much water was needed for his crops.

After getting over the first tough hurdles, they did not stop working even though the buildings were all completed and the fields planted. With the aid of hired help, they prepared and planted another 12 acres and built a corral for the seven cattle—6 head having been donated by cattlemen of the Pacific Northwest, and one a gift sent by the Governor of Texas to Barbara June Dunn, Reclamation's Golden Jubilee baby, born on June 5, 1952.

The hired hands on the farm during the month of July were unique—three German exchange agriculture students who had been studying here in the United States. Klaus Flack, 26, finished a year of study at Washington State College; Ruppprecht Zapf, 25, and Wolfgang Gruber, 24, have finished a year at Kansas State College. These three, who must return to Bavaria in September, came out to look at this showplace for new farmers in the Pacific Northwest and were hired by Dunn.

"We fought on different sides during the war but that is all over now and I thought they were swell fellows," says Dunn. "That's just plain Americanism, isn't it?"

Dunn was particularly happy that Wolfgang Gruber had made poultry his specialty in school. The 500 chicks, just delivered to the farm, were

CONGRESS HONORS THE DUNNS

The Senate and the House of Representatives jointly commended Mr. and Mrs. Donald D. Dunn by passing the following Concurrent Resolution 214, introduced to the House by Henry M. Jackson of the State of Washington, reported by the Honorable John R. Murdock of Arizona, chairman of the House Committee on Interior and Insular Affairs, and submitted to the Senate by Warren G. Magnuson of the State of Washington.

> WHEREAS the Congress and the President of the United States recognized the importance of water-resources development by enacting into the law the Reclamation Act of 1902; and
>
> WHEREAS this and subsequent legislation has been the means of placing more than 6 million acres of land under irrigation and installing more than 4 million kilowatts of hydroelectric power on our rivers and streams; and
>
> WHEREAS people everywhere in the West are joining this year in celebrating this Golden Jubilee of Reclamation; and
>
> WHEREAS a principal celebration is being sponsored by the people of the Columbia Basin reclamation project and the State of Washington as a part of the golden jubilee celebration and also in honor of the first integrated operation of the great Columbia Basin reclamation project; and
>
> WHEREAS Mr. Donald D. Dunn, judged the most worthy war veteran to be found in the United States, is to receive a farm fully developed and equipped, which has been provided by the people of the project as a part of the celebration; and
>
> WHEREAS Mr. and Mrs. Dunn and family, displaying an earnest resolution not to let misfortune deter them from winning a stake in the land for which he fought, are typical of the strength of America:
>
> NOW, THEREFORE, BE IT RESOLVED by the House of Representatives (the Senate concurring), That this Congress congratulates Mr. and Mrs. Dunn on the record of heroism and fortitude in the face of misfortune which has won for them this first family farm to receive irrigation water from the great pumps at Grand Coulee Dam on the Columbia River.
>
> Passed the House of Representatives June 3, 1952.

giving the entire family a great deal of trouble. Wolfgang took the chicks on as his personal responsibility and with a change in the diet and an outdoor pen, they were soon on the way to being future money producers.

Donald D. Dunn has not always seen the bright future that is now before him. At the age of 17 he had to quit school in the middle of his senior year at Marion High School, Marion, Kans., because of illness in the family. He entered military service when he was 21 where he drove a tank for the Seven-hundred-seventy-first tank battalion, the first American outfit to cross the Ruhr. He says he guesses he was a pretty good soldier, but he was surely looking forward to getting back on the farm, and to his high school sweetheart, Vernetta Jean Seifert, whom he had married after he was in the Army 6 weeks. He postponed the wedding until that time because he didn't want

A WELCOME FLOOD of gifts and commendations poured on onetime flood victim Donald Dunn during hearings before the House Interior and Insular Affairs Committee in Washington, D. C. 1. Dunn and Secretary of the Interior Oscar L. Chapman. 2. From left to right, Representative Henry M. Jackson, Dunn, Representative Hal Homes, and Representative John R. Murdock. 3. William E. Welsh, secretary-treasurer of the National Reclamation Association, presents gold-plated irrigation shovel and other gifts for the NRA's adopted Golden Jubilee baby, Donald Dunn's daughter.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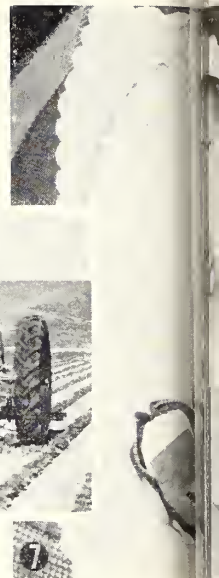

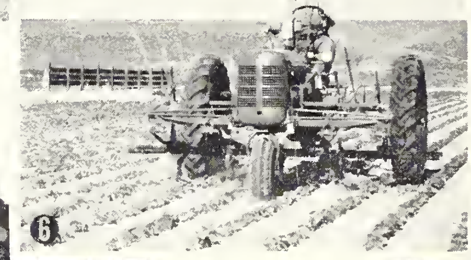

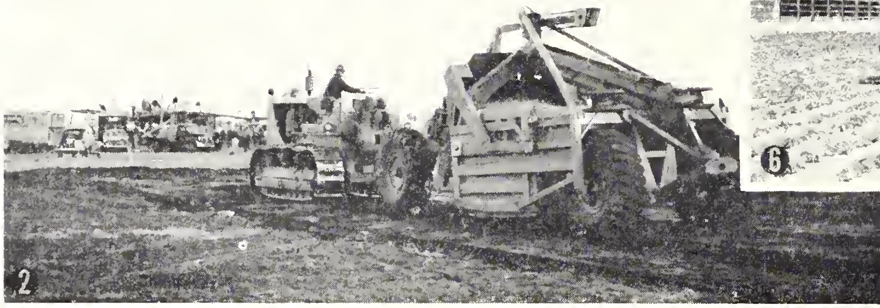

OFF TO A NEW START.—With a farm and built in a day (1, 2, and 3). Commis Michael W. Straus hands irrigation shov Dunn as first water is delivered. Former Secretary of Interior Richard D. Searles, stan tween them (4). Hubert H. Walter, chairm Columbia Basin Water Festival, presents the to the farm in-a-day (5). Dunn at wor The new baby, Barbara June (7). The house (8), where daddy reads the p Deanna sits on the floor, Mrs. Dunn hol baby, and Sally flirts with the photogr *Photos 2 through 8 by Frank B. Pomeroy; by Ellis E. Shorthill, both Region 1 photogra*

8

nyone to think he was trying to avoid the draft y getting married. There may have been times hen he thought he would never get back to his ife and farm in Kansas. He was one of only wo tank drivers out of the original overseas outfit ho was not either killed or wounded.

After 3 years, 3 months and 1 day of service, he as honorably discharged at Fort Smith, Ark., ith the rank of sergeant, having received three attle stars and ribbons for each theater of operaon.

He then rented a farm near Marion, Kans., here he took advantage of the GI bill to get 3 ears of on-the-farm training. He demonstrated is progressiveness as a farmer by planting test lots of wheat and hybrid corn, going into partership with a neighbor to purchase a hay baler, nd handling all of his own hay in addition to bout 10,000 bales sold each year. Wheat, corn, nd alfalfa hay were his main crops, but he kept few head of dairy cattle, and either a herd of eef cattle or feeder lambs during the winter, plus ogs part of the time.

Everything went well. A daughter, Deanna ean, was born, and then on December 10, 1946, he Dunns became the proud parents of twins, a oy and a girl, named Gary Don and Sally Ann. ut the boy died of pneumonia at the age of 3 onths—a great shock to the young couple.

On July 8, 1951, 6 years after his discharge from e Army, Donald Dunn could see all that he had eamed and worked for coming true—he had 400 res of rented land, 20 years of farming "know-how," a wonderful wife, two fine children, was happy and comfortable, looking forward to a good crop, with hardly a worry in the world.

The next night, the bottom dropped out. Dunn's crops, livestock, and much of what he owned went swirling down the raging Cottonwood River. It was the 1951 Kansas flood, the worst catastrophe in Kansas history—and the Dunns were in the middle of it. The family drove to Marion when the water started to threaten the farm, but when Dunn heard his neighbor was among the missing, he went to the rescue in a motorboat, finding the neighbor, his wife and three children, marooned on a small island—once a hill,

(Please turn to page 225)

A FAIR EXCHANGE.—Dunn shows his three hired hands how to couple a sprinkler irrigation pipe. Rupprecht Zapf, Klaus Flach, and Wolfgang Gruber, exchange agricultural students from Germany, help with their know-how, Gruber having saved Dunn's 500 chicks. *Photo by Frank B. Pomeroy, Region 1 photographer.*

WILL THIS LAND GROW CROPS SUCCESSFULLY?—That's what Bureau land classifiers *must* determine before Uncle Sam invests public funds in Reclamation works like the Roza Canal of the Yakima project, below. *Photo at left of sagebrush in the Snake River country near Mountain Home, Idaho, by Ben Glaha, Region 2. Photo below by Stan Rasmussen, Region 1.*

Land Classification and Construction

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Boise, Idaho, Region 1

Part 8 in a series of articles on soils and land classification

TODAY, IN OUR WESTERN STATES we see broad expanses of productive, irrigated crop lands occupying areas which a few years ago were covered by sagebrush and other native vegetation. The transformation of this vast area of desert into rich productive farm lands through the application of life-giving irrigation water is a tremendous task.

Many people might look at a broad panorama of level or gently rolling raw sagebrush land and think it would be ideal for irrigation development. It is not as simple as that. Before you can draw up sound, coordinated plans for project development, you have to know about the climate, whether the land can produce crops under irrigation, whether the people could raise and market enough farm produce to help pay for the necessary construction, and whether efficient, feasible works could be built to store and deliver the water.

Land classification has become more and more important in determining these things before a project is developed. Its primary and most important function is that of segregating this broad expanse of desert land into areas which are suitable for agricultural production under irrigation, and areas which because of their physical limitations will be unable to sustain profitable irrigated agriculture, or will be too costly to develop under existing and anticipated economic conditions.

For example, some lands might be located at such a high elevation that it is not economically feasible to supply water under present costs. They would be eliminated from the project area, through the process of irrigable land selection. Shallow depth of the soil or the presence of excessive amounts of salt which cannot be leached may limit the use of other lands to the extent that they will not provide a satisfactory level of living for a farm family after production, operation, and maintenance expenses and a reasonable share of project construction costs are met. The topography of some of these lands may also render them unfit for irrigation. Thus, not until a land classification has been made is it possible to determine the extent and location of the lands suitable for irrigation in these vast expanses of arid land.

Perhaps at some future date, it may become feasible to serve these high lands with water. Improved methods of land development, such as the use of modern, heavy-duty machinery; more economical and efficient methods of lifting water, such as low-cost power and improved pumps; advancements in plant and soil sciences, such as the development of salt-tolerant varieties of crops and low-cost effective soil conditioners, or some other economic changes—all these or a few of these things might permit profitable development of lands now considered unsuitable.

On operating irrigation projects in the West, many of which have recently provided homes and livelihood for veterans, the information obtained from land classification has supplied basic data for irrigation development. Through careful evaluation of the soil and land characteristics, suitable land areas for irrigation are selected. Full crop production and development depend upon the water supply available from direct diversion or storage. It is, therefore, necessary to determine the water requirement or the amount of water necessary to adequately irrigate the land.

In determining this requirement, we try to figure the amount of water per acre which the farmer needs and can beneficially use, both with respect to yields and profitable returns, from the cropping program forecasts and with respect to the conservation of soil and the prevention of excessive seepage. There are many climatic and agronomic factors which enter into this determination, such as the length of growing season, annual precipitation, and the cropping pattern to be followed on the developed irrigation project.

The nature of the soil is very important in the determining how much water is required. Fine-textured soils have a higher waterholding capacity than the coarser-textured soils, and the deeper soils have a greater storage capacity than the shallower ones. Whatever is learned about the soil during the land classification has a definite bearing on the irrigation methods and practices which the farmer will put into effect. The manner in which the water is used has a great deal to do with the total amount which will be required.

When available moisture capacity of the soil is the critical limiting factor (as in the soils on the Yuma Mesa in Arizona and most of the soils on the East Mesa of the Imperial Valley lands in California), it is a major factor in the land classification standards. On the vast Columbia Basin project in the State of Washington, four different types of land, designated as water-duty classes, were recognized on the basis of the textural profile characteristics determined in the land classification. Each of these classes, because of available moisture capacity and other physical properties, will require specific amounts of water for crop production. For each class, an annual water allotment has been recommended.

This farm delivery water requirement, together with the amount necessary to offset the anticipated

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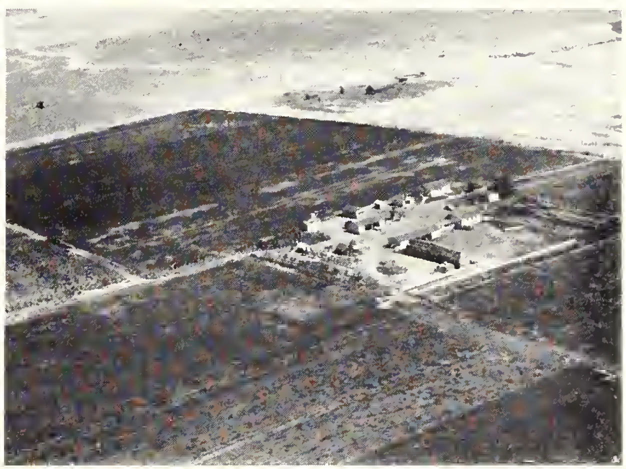
BUILT TO FIT THE FARM.—The farm unit and field lay-out on the Pasco Unit, Columbia Basin project, Wash., was determined with the aid of land classification to take advantage of the natural topography and achieve maximum production.

SPRINKLERS FOR SANDY SOIL.—The Winchester Development Farm of the Columbia Basin project, Wash., was prepared for sprinkler irrigation because of the sandy nature of the land. ***Photos at left and right by H. E. Foss, Region 1.***



DISTINGUISHED SERVICE MEDAL is pinned on Moritz's lapel by Senator Ernest McFarland of Arizona (at right) at Boulder City. *Photo by John Santa, Region 3 photographer.*

Reclamation's Hall of Fame

Nomination No. 14

ERNEST A. MORITZ "Mr Reclamation"

by WILLIAM J. WILLIAMS, Information Officer, Region 3, Boulder City, Nev.

"MR. RECLAMATION—DEAN OF THE REGIONAL DIRECTORS. That's Ernie Moritz."

So stated Reclamation Commissioner Michael W. Straus, during the presentation of the Department of the Interior's highest honor, the Distinguished Service Award, to Ernest A. Moritz, who retires this fall after 31 years as a Reclamation engineer-administrator. The award ceremony, in which Commissioner Straus, then Under Secretary of Interior Richard D. Searles, and Arizona Senator Ernest McFarland participated, was held last April 30 almost within a stone's throw of Hoover Dam over which Moritz has had supervision during the past decade.

Commissioner Straus titled Moritz "Mr. Reclamation" because he typifies men such as Newell, Davis, Savage, Banks, and other Reclamation greats with whom he shares Reclamation's Hall of Fame. These and many other "Mr. Reclamations" have tamed the western rivers to irrigate over 6 million acres of land and generate hydroelectric energy at the present rate of over 23 billion kilowatt-hours annually.

When Ernest A. Moritz started his Reclamation career 47 years ago, engineers relied largely on their good eyesight and good judgment. There were no well-equipped laboratories and elaborate instruments such as are used today. Nevertheless these early engineers built, along with their dams, reputations that have stood strong through the years. The Bureau of Reclamation is recognized the world over as the greatest engineering organization of its type, and certainly Ernie Moritz has helped to make it that.

Ernest A. Moritz was born August 30, 1882, in Sheboygan, Wis. He received a B. S. C. E. degree in 1904 from the University of Wisconsin. Awarded a scholarship for further work at the same university, he completed requirements for his civil engineering degree a year later.

He accepted a summer job in 1905 with the fledgling Reclamation Service, created after passage of the Reclamation Act on June 17, 1902, and was assigned to the Garden City project in Kansas. Normally a semiarid area where irrigation for successful agriculture over a long period is a "must," the early years of the project proved to be an exception. The rains came, and the farmers decided they didn't need an irrigation system, so the irrigation works eventually were sold to a private concern.

The young engineer shook off the Kansas rains and in the fall returned to the University of Wisconsin, where he was instructor in applied mathematics for three semesters. He wrote the first bulletin published by the university on reinforced concrete. Leaving the university, he worked for a short time with the C. M. & S. & P. R. R. at Chicago, Ill., in its bridge and building department.

Reclamation proved "right as rain" on his next assignment, which took him in April 1907 to the Yakima project in Washington as assistant engineer. Soon he became engineer in charge of all engineering work on the project's Sunnyside unit. There he rehabilitated the private irrigation system on 30,000 acres acquired by the Government and enlarged and extended the system to cover 100,000 acres of land in the Yakima Valley. He also investigated dam sites and storage requirements for Yakima Valley irrigation and made reconnaissance surveys and reports on future extensions.

When Moritz visited the Yakima project last year he found the structures he had built in those early years still sound and performing their functions. The Yakima project is one of the most successful of the Reclamation projects to date. Its 27,500-acre Tieton Division was the first major unit of any Reclamation project to repay in full its construction costs to the Federal Government. Moreover, the Yakima project's annual crop production is one of the highest of all Reclamation projects.

Upon arriving in Washington in October 1912 to serve on F. N. Newell's staff he was given charge of the monthly publication of the service, then known as the Reclamation Record, a forerunner of the RECLAMATION ERA.

Editing the magazine was strictly a side duty, as at that time the Record was devoted almost entirely to technical articles, and Moritz recalls that he always had on hand a wealth of material prepared by engineers. When he needed to fill up space, he would reach into a pigeonhole for an article of the right length. The Reclamation magazine since it was first published in 1905 has undergone numerous changes, and is now published primarily for water users on Reclamation projects.

On the Washington staff, Moritz had charge of engineering plans, specification and contract analysis and review. He was the first to recognize the value of experimental investigations and their practical application—an activity now carried out in the Bureau of Reclamation's Denver laboratories, largest of their type in the world.

In August 1915 Moritz transferred to the newly established office of design and construction at Denver. There, under the late F. E. Weymouth, he organized the engineering section and supervised all office engineering, preparation of plans and specifications, contract review, and general administrative work involved in the design and construction of Reclamation projects.

Moritz left Denver in March 1920 to become project manager of the Flathead project in Montana. He resigned in April 1921 to enter private practice with his brother, C. J. Moritz, of Effingham, Ill. During the next 13 years, under the firm name of C. J. Moritz, Inc., he was engaged in municipal engineering and heavy construction work on buildings, highways, streets, bridges, sewers, and dams.

He returned to the Bureau of Reclamation in 1934 as engineer at Parker Dam. A year later he became construction engineer, and by 1938 he had the dam substantially completed. With 235

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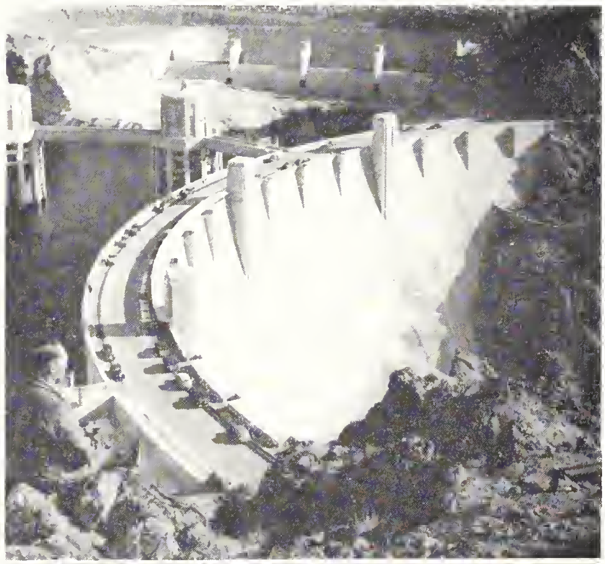
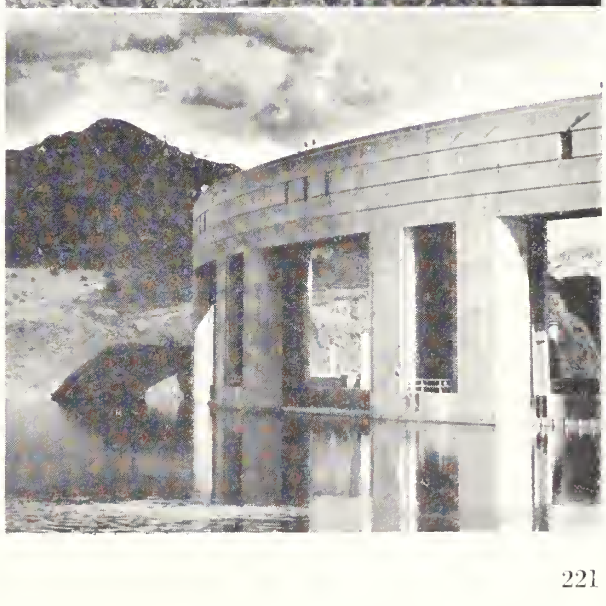




HIGHEST AND DEEPEST.—Hoover Dam, at top, right, and Parker Dam, below, represent the highest and deepest of Reclamation dams, on both of which Moritz worked. *Photo at top by James Major; photo at bottom by George O. Bonawit, both of Region 3.*

WHEN THE WATER COMES TUMBLING DOWN.—The steep cultivated field above the canal at left will be protected by the terracing, contour farming, and drainage inlet into the canal. At right, a canal with no such terracing or other erosion control on the slopes in the background. *Photos submitted by the author.*

CONTROLLING UPLAND RUNOFF

by BEN W. HARRINGTON, Secretary-Treasurer, Bostwick Irrigation District, Superior, Nebr.

CONTROLLING UPLAND RUNOFF is a comparatively new problem to the Bostwick Irrigation District of Nebraska but old to some of the longer operating irrigation districts.

Side hill runoff is a very serious problem in the Republican River Valley where much of the irrigated land is on the terraces and bottoms above the river. These terraces and bottoms are traversed by numerous natural drainage channels, both large and small, which carry storm runoff water from the uplands. The uplands in this area are characterized by a very rolling topography, the bulk of which is under cultivation, and a type of soil which is very susceptible to erosion. Annual rainfall for the area as a whole averages approximately 23 inches—most of which falls during the spring and summer months when thunderstorms are the rule.

The canals serving the irrigated lands must be protected from the upland runoff as well as the distribution system and the project lands below the canal.

To provide this protection involves, in general, the construction of:

1. Intercepting drains directly above the canals and laterals which intercept side hill runoff from adjacent lands and carry this runoff to natural stream channels.

2. Drainage structures (culverts or overchutes) which pass runoff water carried by the smaller streams under or over the canals and laterals.

3. Siphons which carry irrigation waters under the larger natural streams.

4. Surface drains or other necessary flood control works to protect project lands.

If the irrigation district is going to continue to function, these drainage works must of course be maintained. This one item has been an aggravating and expensive problem since the beginning of irrigation. At the best, the drainage ditches cannot all be designed to prevent silting or scouring under all conditions. Further, the general topography combined with abnormal rainfall, which occurs in the central western area and arrives in unpredictable amounts at times, acts as a costly hazard to areas requiring drainage ditches and maintenance of these drains.

There are many things which create a wide variation in the requirements of drainage ditches. Thus a season with normal rainfall might tax the absorbing capacity of the soil to the limit. Then, we might expect a sudden rain in the amount of

2 to 5 inches, most of which would happen within a time period of 30 minutes to 1 hour. You can readily see how, under the above conditions, the steep-rolling uplands would cast large amounts of runoff into the man-made drains and overtax their capacity.

The engineers anticipate these occurrences and endeavor to outline or design a drain or drain system to control actions of this nature. Nevertheless Mother Nature creates other "freaks" or abnormal conditions with which our most learned scientists must contend.

I personally recall very vividly the flood that occurred in the Republican River valley in 1935, caused by perfect timing of tributaries emptying their flood waters into the Republican River, all of which was an accumulation of excessive upland runoff water covering eastern Colorado, northwestern Kansas, and southwestern Nebraska. Then there are cases where existing topography makes it impossible or infeasible even to approach a so-called perfect design. Hence, drain maintenance is a necessary evil.

It is possible for the engineers to minimize the scouring or gullying in the drains themselves through the use of drops or other structures. However, the engineer does not have control of the amount of runoff and, more important, the volume of sediment which enters the drainage system from the lands above. In addition, he must design for the conditions which will be in existence at the time the irrigation system is to be constructed.

If a complete land management program to prevent erosion and excessive runoff from agricultural lands above the canal could be put into effect prior to the design and construction of the irrigation system, the construction costs could be materially reduced, as well as the maintenance requirements for operating the system. It becomes more and more obvious that the program of soil conservation and water retardation on upland areas as recommended by the Department of Agriculture and installed by the soil conservation districts is an important aid to the economy of the irrigation districts. It seems that we cannot emphasize too strongly the need for a full and complete cooperation between the operators of lands above the irrigation canals, that contribute runoff waters, to work with our soil conservation districts, other agencies and the irrigation districts, for a purpose that will be of great value to them in retaining the soil fertility of their lands and at the same time not allowing thousands of tons of highly productive topsoil to be wasted into the Gulf of Mexico.

It is logical to assume that maintenance costs on a drain are in some proportion to the size of the drain. For example, a 20-foot bottom drain will require more maintenance dollars than a 10-foot drain, all other conditions being equal. In many cases the difference between no watershed control and complete control would mean such a difference in design. However, with complete control, the drain would not only handle less runoff water but would transport a much smaller percentage of silt which could settle out and fill up the drain.

In many areas wind is a cause of expensive maintenance, as soil and weeds which blow into the ditches have to be removed each year. Again the solution of this problem is in the hands of the soil conservation districts, the irrigation districts, and the landowners who must tie down the soil and keep it out of the irrigation ditches. Although under the best of conditions this cannot be eliminated entirely, better farming practices are the answer to the wind problem. ###

Interior Shifts Secretariat

Robert M. McKinney of Santa Fe, N. Mex., and Joel D. Wolfsohn of Chicago, Ill., were recently nominated by President Truman as Assistant Secretaries of the Interior.

Vernon D. Northrop is now Undersecretary of the Interior, replacing Richard D. Searles, who resigned to enter private business. Otis Beasley, former Budget and Finance Director, succeeded Mr. Northrop, as Administrative Assistant Secretary.

New Names for One Dam and Two Lakes

Congress recently named or changed the names of the following:

South Coulee Dam on the Columbia Basin project in Washington is now named *Dry Falls Dam*.

Chief Joseph Reservoir to be formed in back of the Chief Joseph Dam in Washington is to be called *Rufus Woods Lake* (see Reclamation's Hall of Fame, Nomination of Rufus Woods on p. 236, December 1949 Reclamation Era).

Medicine Creek Reservoir in Nebraska is to be called *Harry Strunk Lake* (see Reclamation's Hall of Fame, Nomination of Harry Strunk on p. 195, September 1949 Reclamation Era).

WHEN YOUR HEART IS IN YOUR WORK, Martha Baumann proves you can live a healthy, happy, and prosperous life.

SUCCESS IS THE RESULT of courage, energy, and the true pioneering spirit. Miss Baumann and her profitable poultry.

WOMEN OF THE WEST

Martha Baumann—34 Years on the Newlands Project

"I'M GOING TO TAKE LIFE EASY for a while," said Martha Baumann, pioneer homesteader and progressive irrigation farmerette of the Newlands project in Nevada.

Bryan L. Harris of the Lahontan Basin area office of the Bureau of Reclamation was visiting her, and this statement nearly rocked him back on his heels.

Martha Baumann is well known around Newlands, known for its many "firsts"—having been among the first five projects to be authorized for construction by the then Reclamation Service and, the first to receive irrigation water. Martha has quite a few "firsts" of her own. She owned the first tractor in the Fallon, Nev., area. She worked with Fallon's first farm advisor L. E. Cline, and took the first bunch of 75 4–H Club children from around Fallon to summer camp in Reno.

At the age of 18 she and her brothers moved to the Newlands project where Martha was the leading and guiding force which helped them to weather the tough years on the bleak, sagebrush covered land near Fallon.

She herself homesteaded the 80-acre farm she now owns, laying the foundations for her home, and helping to build it from floor to rooftree.

She has ridden the range with her sheep at night, riding back to the modern dairy in time to milk the cows in the morning. Incidentally, she has a grade A milking barn with the best in electric milking equipment and until very recently was milking 23 high producing Holstein cows. She has out-stubborned that stubbornest of animals—the mule— when at the age of 19 she and her brothers got 10 of the onery critturs to "help" them level their land. As the story goes, she just tied the reins around her waist, and got the job done.

For years, in addition to her dairy business, Martha has raised fruits and vegetables, disposed of her eggs and poultry through the local Fallon cooperative, and been an active member of the Farm Bureau's Board of Directors in Churchill County. The night before she was interviewed she had traveled 75 miles to attend a meeting of the Milk Producers Organization.

Martha Baumann—"taking it easy?" The idea seemed a little on the impossible side. But she replied that she was going to try it, for a change, and her first experience along that line would be a visit back to the old friends and relatives in Oregon City, whom she had not seen since 1916.

As a teen-ager she had wrestled with a homestead, and for 34 years has waged a steadily winning fight for a good living. Never having had a college education, she "learned by listening" and made a success of her 80-acre ranch-farm. This success was not achieved without many long hours of work. With irrigating, caring for her livestock, attending to business and community affairs, she has often worked around the clock. She has experienced many hardships and disappointments, such as the night coyotes killed 20 of her prize chickens, and the time 2 of her best Holstein cows died from bloating on alfalfa.

She has not sold her farm, and her 3 brothers who own and operate farms on the Newlands project will take care of it during her absence.

Many youngsters leave the home town to seek their fortune and dream of the day they may return, the fortune won. Martha Baumann's dream came true. Despite the hard work, the hardships, and the heartbreaks, she claims she wouldn't have missed a minute of her 34 years on the Newlands project, "for anything." ###

Columbia Basin's Showplace

(Continued from page 217)

the only spot of ground above water in the area. The oldest boy and girl had their hands over their ears to keep from hearing the baa-ing of the drowning sheep—as Dunn says, some of the sheep were their 4–H projects, "which didn't help matters much."

When the Dunns returned to their own farm several days later, they found everything covered with muddy slime. The brooder house which contained 350 3-month-old chicks had washed away. Only two chickens escaped by resting in the top branches of a tree. When the Dunns opened the door of the laying house they found all the hens drowned with one notable exception—a valiant survivor who had proudly laid an egg on a soggy bale of hay! All other livestock had perished.

In the house, everything below the 3-foot level was a mess. The furniture was ruined, and mattresses so waterlogged that several men struggled to carry them out. After scrubbing the interior until their fingers were raw and disinfecting everything, they moved back in, after 2 weeks, but it was some time before the musty flood smell was gone. About the only things saved were the motor-driven machines, which Donald Dunn had providentially moved to higher ground the day before the flood.

After making a thorough survey of the damage, Dunn decided to salvage all he could, sell everything to pay off his debts and start all over. Like many pioneers before him, he went West, moving to Yakima, Wash., where his aunt Mrs. E. K. Cherrington, lives. He got a job as a salesman for farm equipment, but the longer he worked, the more he realized that he would much rather use the machinery than sell it.

When he heard about the farm-in-a-day, he thought he might give it a try. After all, there were no cows to milk, no farm chores to do after a day of salesmanship, so he, with the help of his wife, just started writing. The rest is now history.

The frequent visitors to Donald Dunn's farm (in a 2-hour period 117 cars were counted) find that it is continually changing. Even the cropping pattern has changed from that shown in the May 1952 issue of the RECLAMATION ERA. The once dry desert land has become a green carpet of beans, clover, oats, alfalfa, and potatoes. Dunn is emphasizing more crops to be utilized by the dairy herd he hopes to start this fall, and is developing an additional 12 acres of low land himself, planting it to oats.

Donald D. Dunn and his four hired hands have a great job cut out for them. The crops, planted almost simultaneously, all need attention at the same time. Irrigation sprinkler pipes must be changed, ditches maintained, and stock taken care of. Dunn intends using the soil to the best advantage by using the best known methods of crop rotation and other farm utilization methods.

Donald D. Dunn and his family, Mrs. Dunn, Deanna, 9, Sally 6, and the baby Barbara June, 3 months, realize that they were extremely lucky to have been chosen to be owners of this show place of the Columbia Basin project. Dunn intends to keep it as an example of what can be done on the land of this area with the aid of a little water.

The eyes of the Nation and in particular the eyes of the farmers and future farmers of the Columbia Basin project are on Donald D. Dunn and his family. ###

Land Classification and Construction

(Continued from page 219)

losses in transporting the water to the farms, such as evaporation, and canal and lateral seepage losses, represents the water requirement for the project. Storage dams which impound the waters during the runoff season for the irrigation season's supply are designed in full cognizance of this factor.

Often the watershed does not provide enough water to irrigate the entire amount of arable land delineated by land classification in the area. It is then necessary to choose carefully the lands which, in consideration of all other economic and engineering factors, will comprise the irrigable area. In reducing the acreage, the less desirable lands, as determined by the land classification, are eliminated.

The land classification map, showing the location and extent of the irrigable lands, guides the engineer in locating the system of canals and laterals, as he endeavors to provide water for as much good land as possible through an adequate system at the lowest possible cost. Rocky areas in which construction costs are generally quite high are isolated on the map and may be avoided. Also, canal sections through open, porous soils where seepage losses are frequently excessive may be avoided or plans made to take them into account. The extent of the network of canals and laterals is determined by the acreage of land which is to be served as well as by the method of delivery. Likewise, the size and type of structures are determined, in part, by the amount of water which will be delivered to the land.

On the 50,000-acre North Unit of the Deschutes project, which has just been completed in central Oregon, the soils are generally of a coarse texture. Because of their relatively high infiltration rate, it is desirable to spread the water over the soil rapidly to avoid overirrigation and excessively deep percolation losses. Here, large delivery structures have been installed and water deliveries will be made on a modified demand system which will allow the farmer to irrigate his farm in a period of a few days.

Certain soils erode more easily than others when exposed to a stream of moving water. By using the land classification data, the engineer is able to design the canals and laterals to keep the velocity of flowing water below an erosive rate in the various textured soils.

(Next month—Land Classification and Farm Development.)

Ernest A. Moritz

(Continued from page 221)

feet of its 320-foot height below river bed, Parker is the deepest dam in the world.

In 1938 Moritz switched from the Colorado River of the Pacific Southwest to the Colorado River of Texas, where he was construction engineer on Marshall Ford Dam near Austin. With the job finished in 1941, he returned to the other Colorado River as director of power, Boulder Canyon project, at Hoover Dam, with headquarters in Boulder City. During this period several additional generators were installed and Hoover Dam boasted the largest power installation in the world.

Hoover Dam, rising 726 feet above bedrock, is the highest dam in the world. Moritz is the only person who has had direct supervision over both the world's highest (Hoover) and deepest (Parker) dams.

The Bureau of Reclamation was regionalized in 1943, and Moritz was named director of Region 3, comprising southern California, southern Nevada, most of Arizona, and small portions of southern Utah and western New Mexico, with headquarters at Boulder City, Nev.

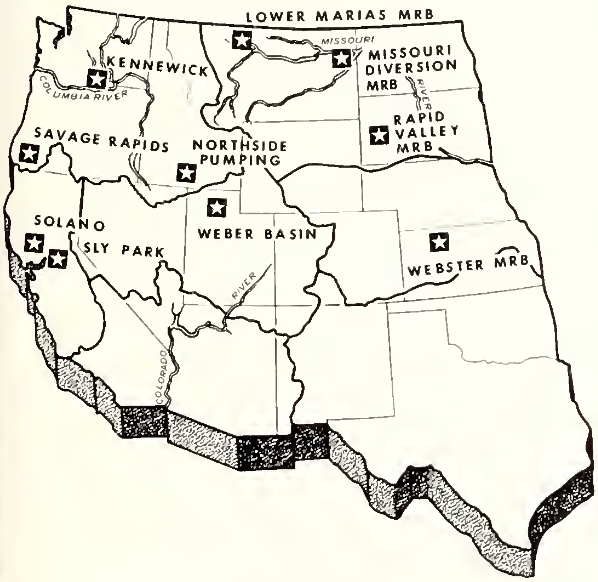
Throughout his career he has wasted few words or actions. Once he has spoken, there is never a doubt as to how he thinks.

Moritz can be as witty as he can be serious. His sense of humor has endeared him to all who know him. The light side of a subject brings a twinkle to his eyes and a broad smile to his lips.

His love of simplicity and informality is seen in his streamlined organization throughout Region 3. He practices the theory that the shortest distance between two points is a straight line. Modesty is one of his most apparent virtues. He would never tell you of his own fame, and he is ill at ease when he is in the spotlight.

Ernest A. Moritz retires from regular Government service this fall, but you can be sure he is not retiring from usefulness. He will be on call by the Bureau of Reclamation as a consultant and might even write a book on Reclamation. ###

Reclamation's Construction Program Includes 10 New Starts



Congress reaffirmed its belief in the water users of the West and the soundness of the Reclamation program by authorizing the construction of 10 new projects, to inaugurate the second half century of Reclamation, when it passed the Interior Appropriation Bill which President Truman signed on July 9.

The 10 new projects, for which $14,950,000 was appropriated as a start, are tabulated below.

Specifications were issued early in July for initial work on 2 of the 10 new projects: Tiber Dam, a principal feature of the Lower Marias Unit of the Missouri River Basin project in Montana; and 5 wells on the North Side Pumping Unit of the Minidoka project in Idaho. Bids on these jobs were opened last month, August 12 and 14, respectively. The Bureau has set up a schedule for issuing specifications to cover initial work on the 8 remaining projects so that some work will be in progress on all projects on or before the first of next year.

In accordance with established Reclamation policy and congressional endorsement, certain requirements must be met before the dirt begins to fly on these new projects. These include the completion of soil surveys and land classification, to make certain that the lands to be irrigated are capable of producing crops under irrigation, and an over-all definite plan for the orderly development of these projects.

The $240,000,000 budget for the Bureau also includes funds for 73 projects now under construction which by next June will supply 267,000 more acres with irrigation water, bringing the total to 6,400,000 acres, and increase hydroelectric power by 346,000 kilowatts, bringing the total installed capacity of Reclamation plants to 4,600,000 kw. The gains are mainly on the Central Valley, Colorado-Big Thompson, Columbia Basin, Hungry Horse and Missouri River Basin projects. Also scheduled is the second barrel of the San Diego aqueduct under contract with the Department of the Navy.

Project	State	Amount appropriated	Programed for early construction
Sly Park Unit, Central Valley project	California	$1,250,000	Camp Creek Tunnel, and Access Road, Camp Creek Diversion Dam, Sly Park Dam.
North Side Pumping Unit, Minidoka project.	Idaho	150,000	5 wells and lateral systems.
Solano project	California	3,000,000	Monticello Dam, Putah Diversion Dam, Putah South Canal.
Savage Rapids Dam	Oregon	700,000	Rehabilitation of Savage Rapids Dam.
Weber Basin project	Utah	1,350,000	Gateway Tunnel, Wanship Dam, and Gateway Canal.
Kennewick Division, Yakima project	Washington	1,500,000	Chandler pumping plant and associated power plant, Chandler Power Canal and Main Canal.
Rapid Valley Unit, Missouri River Basin project, Cheyenne Division.	South Dakota	1,000,000	Pactola Dam and Reservoir.
Lower Marias Unit, Missouri River Basin.	Montana and North Dakota.	2,500,000	Tiber Dam.
Missouri Diversion Unit, Missouri Souris Division, Missouri River Basin project.	Montana, North Dakota.	2,000,000	Dam and power plant.
Webster Unit, Solomon Division, Missouri River Basin project.	Kansas	1,500,000	Webster Dam.

Salt Water Conversion Program Under Way

A public-private salt water purification research program was launched when Congress appropriated $125,000 for coordinating as much data as possible to determine the best and cheapest method of making fresh water out of salt water.

The high cost of all known methods prohibits processing salt water for wide scale use on irrigated farms, in industries, and in coastal cities in water-short areas. In addition to seeking effective and economical methods for these purposes, the program will also look into the possibilities of purifying brackish and alkaline waters in inland areas to supplement the irrigation supplies throughout the 17 Western States.

Secretary of the Interior Oscar L. Chapman, who was given responsibility for carrying out the program, has designated Assistant Reclamation Commissioner Goodrich W. Lineweaver as his representative to head the activity. The Secretary has instructed all Interior agencies dealing with water resources to cooperate with Mr. Lineweaver and make available to him all data on salt water conversion. Mr. Lineweaver has formed an advisory group of top-ranking leaders of educational, scientific and other agencies, public and private, as the initial step in getting the program under way.

NOTES FOR CONTRACTORS

Contracts Awarded During July 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3714	Columbia Basin, Wash.	July 21	10 motor-driven, vertical-shaft, pumping units for Ringold relift, PE-62, PE-64, PE-65, PE-64 relift, and PE-64C pumping plants, area P-8, Potholes East canal laterals.	Fairbanks-Morse & Co., Kansas City, Mo.	$37,030
DS-3726	Kendrick, Wyo.	July 14	1 lot of bulkhead-gate seats and guides, 6 9-foot 1¼-inch by 10-foot 8-inch bulkhead gates, 1 lifting beam, and 4 draft-tube filling valves for Alcova power plant.	Schmitt Steel Co., Portland, Oreg.	15,778
DC-3731	Missouri River Basin, Wyo	July 10	Constructing auger, pad, caisson, and timber-pile footings, and erecting steel towers for Fort Randall-Sioux City 230-kilovolts transmission line, schedules 1A and 2.	Lipsett, Inc., New York, N. Y	1,657,745
DC-3734	Gila, Ariz.	July 25	Construction of earthwork, concrete lateral lining, and structures for unit 2, Mohawk distribution system.	Macco Corp., Paramount, Calif.	494,402
DS-3771	Boulder Canyon, Ariz.-Calif.-Nev.	July 10	Spare thrust-bearing parts for generator units A3 and A4 at Hoover power plant (negotiated contract).	Allis-Chalmers Manufacturing Co., Denver, Colo.	14,150
100C-146	Hungry Horse, Mont.	July 3	Firefighter lookout tower and connecting road.	Valley Construction Co., St. Ignatius, Mont.	34,840
300C-38	Gila, Ariz.	July 8	Water supply and sprinkling system for Welton Government Camp.	Arrow Construction Co., Inc., Yuma, Ariz.	30,094
600S-96	Missouri River Basin, S. Dak	July 15	Transformer, lightning arrestors, and Circuit breaker for Winner substation, schedules 1 and 2.	Westinghouse Electric Corp., Butte, Mont.	22,250
604C-27	Milk River, Mont.	July 7	Hay Coulee Siphon.	F. L. Flynn & Co., Billings, Mont.	26,367
617C-29	Riverton, Wyo.	July 22	Closed drains.	Hicks Construction Co., Riverton, Wyo.	13,838
704C-256	Colorado-Big Thompson, Colo.	July 18	Construction Salida and Gunnison substations.	Donovan Construction Co., St. Paul, Minn.	56,611
701C-264	Missouri River Basin, Kans.	do.	Earthwork and crushed rock blanket and riprap for Cedar Bluff Dam repairs.	Cass Co. Contractors, Ogallala, Nebr.	116,050

Construction and Materials for Which Bids Will Be Requested by November 1952

Project	Description of work or material
W. C. Austin, Okla.	Asphaltic membrane lining for ¼ mile of Ozark Canal near Altus, Okla.
Do.	Plugging 2 36-inch diameter river outlets at Altus Dam by backfilling with concrete.
Boulder Canyon, Calif.	2 motor-control switchboards suitable for controlling 440-volt induction motors for unit 8, Coachella Valley distribution system.
Cachuma, Calif.	Construction of 27- by 45-foot reinforced concrete chlorination and control house, with a 16- by 20-foot wing, and installation of plumbing, sewerage, drainage, electrical systems, and chlorination and ventilation equipment. Located 10 miles northwest of Goleta, Calif.
General Valley, Calif.	Construction of Sly Park damsite headquarters, including warehouse, garage, office, temporary houses, water and sewer lines, and developing water supply, 15 miles east of Placerville, Calif.
Do.	Construction of 43 miles of precast concrete pipe lines for Saucelito irrigation district on the Friant-Kern Canal distribution system near Saucelito. Work includes furnishing and laying 12- to 60-inch diameter concrete pipe; constructing monolithic concrete moss screen and pumping plant structures; installing moss screens, pumping units, valves, slide and flap gates, and electrical controls.
Do.	Construction of 2,900 feet of 500 cubic feet per second capacity concrete-lined Camp Creek tunnel about 12 miles east of Camino, Calif.
Do.	1 5,000-volt switchgear assembly for Nimbus power plant.
Do.	2 cabinet-type actuator governors for regulating speed of 2 9,400-horsepower propeller-type hydraulic turbines for Nimbus power plant.
Colorado-Big Thompson, Colo.	Construction of 13.8-kilovolt power and control line in the foothills south area near Loveland, Colo.

Construction and Materials for Which Bids Will Be Requested by November 1952—(Continued)

Project	Description of work or material
umbia Basin, Wash	Drilling 3 additional pumping wells and 2 observation wells for the Soap Lake protective works.
Do	Drilling 2 experimental wells in the P–9 lateral area near Eltopia, Wash., and near Ringold, Wash., on the Potholes east canal.
Do	Construction of 56 miles of 2 to 232 cubic feet per second capacity unlined laterals, sublaterals, and wasteways for lateral area P–8 on Potholes east canal, including drops, checks, turnouts, and weirs; and nine 3 to 118 cubic feet per second capacity pumping plants, near Eltopia, Wash.
souri River Basin, ebr.	Construction of a 13-mile unlined reach of the second section of Franklin earth canal, near Franklin and Riverton, Nebr.
souri River Basin, ans.	Construction of Webster dam foundation, consisting of excavating and placing earthfill for cut-off trench and part of dam embankment near Webster, Kans.
souri River Basin, Dak.	Construction of 1,340-foot long by 225-foot high Pactola earthfill dam, one 820-foot long by 115-foot high dike, and 1 1,200-foot long by 65-foot high dike. Work includes construction of spillway with concrete weir, outlet works consisting of tunnel, gate chamber for 2-foot 9-inch by 2-foot 9-inch regulating and emergency gates, access shaft, hoist house, and concrete-lined stilling basin, near Pactola, S. Dak.
Do	Constructing foundations, steel towers, and furnishing and stringing conductor and ground wire for a 2,400-foot long crossing span and 2 800-foot anchor spans for Oahe-Midland 115-kilovolt transmission line crossing of the Missouri River.
Do	Constructing foundations for and erecting steel towers, installing de-icing switches and transformers, and furnishing and stringing conductor and ground wire for transmission line approaches to Fort Randall switchyard and dam, near Fort Randall, S. Dak.
Do	Construction of 54 miles of wood-pole, H-frame, single-circuit 115,000-volt transmission line from Midland, S. Dak., to vicinity of Oahe dam site north of Pierre, S. Dak.
Do	4 2-foot 9-inch by 2-foot 9-inch high pressure and regulating gates for Pactola Dam.
Do	Hauling and placing riprap protection for river channel at Shadehill Dam 15 miles south of Lemmon, S. Dak.
ouri River Basin, Dak.	Clearing 480 acres of the Jamestown Reservoir site of brush, trees, and fencing, 15 miles from Jamsetown Dam.
ouri River Basin, nt.	3 6,667-kilovolt-ampere, 105.9 revolutions per minute, 4,160-volt waterwheel driven generators for Little Porcupine power plant.
Do	80- by 6-foot spillway crest gate and accessories for Missouri Diversion Dam.
North Platte, Wyo	Removing and replacing 80 cubic yards of concrete and 6,400 pounds of reinforcing steel in desilting works at Whelan Dam, Fort Laramie Canal, 7 miles northwest of Fort Laramie, Wyo.
Palisades, Idaho	Four 35,000-kilovolt-ampere power transfromers for Palisades power plant.
Paonia, Colo	Construction of a 2-mile, 35 cubic feet per second capacity extension to Fire Mountain Canal, northwest of Hotchkiss, Colo.
Riverton, Wyo	Furnishing and applying 30,400 gallons of asphaltic undersealing to the Wyoming Canal.
Do	Furnishing and applying asphaltic membrane lining to 41,000 square feet of certain reaches of Wyoming Canal and various places on the Wyoming laterals.
Do	Furnishing and applying asphaltic membrane lining to 84,000 square yards of surface area on Pilot Canal wasteways, Pilot Canal laterals, and Wyoming laterals.
San Diego Aqueduct, Calif.	Construction of 29 miles of 85 cubic feet per second capacity San Diego aqueduct's second pipeline from San Luis Rey River to San Vicente Reservoir. Work consists of furnishing and laying 24 miles of 18-inch and 5 miles of 54-inch inside-diameter precast-concrete pressure pipe of cylinder and noncylinder type.
Shoshone, Wyo	Construction of 2 concrete checks, involving 50 cubic yards of concrete and 3,800 pounds of reinforcing steel; and furnishing and placing 29,000 square yards of buried asphaltic membrane or bentonite lining on canal surface.
Do	Furnishing and placing 8,000 square yards of buried asphaltic membrane or bentonite lining on the laterals of the Willwood Canal, Willwood division.
Weber Basin, Utah	Construction of 3.3 miles of 9.5-foot diameter horseshoe, lined, 435 cubic feet per second capacity Gateway tunnel on the Gateway Canal near Ogden, Utah.
Yakima, Wash	Construction of 8 miles of 1,500 cubic feet per second capacity concrete-lined Chandler power canal and timber bridges from Prosser power plant to proposed site of Chandler power plant near Prosser, Wash.
Do	Furnish and install 2 6,667-kilovolt-ampere, 4,160-volt vertical generators for Chandler power plant.
Do	2 8,500-horsepower vertical-shaft, Francis-type, hydraulic turbines for Chandler power plant, and 2 2,600-horsepower vertical-shaft, Francis-type, hydraulic turbines for driving pumps at Chandler pumping plant.
Do	2 vertical-shaft, centrifugal-type pumps of 167 cubic feet per second capacity for Chandler pumping plant.
Do	2 6,100/7,625-kilovolt-ampere, 3-phase, power transformers, 1 115-kilovolt power circuit breaker, and 3 115-kilovolt air switches for Chandler power plant switchyard.

United States Department of the Interior, Oscar L. Chapman, Secretary

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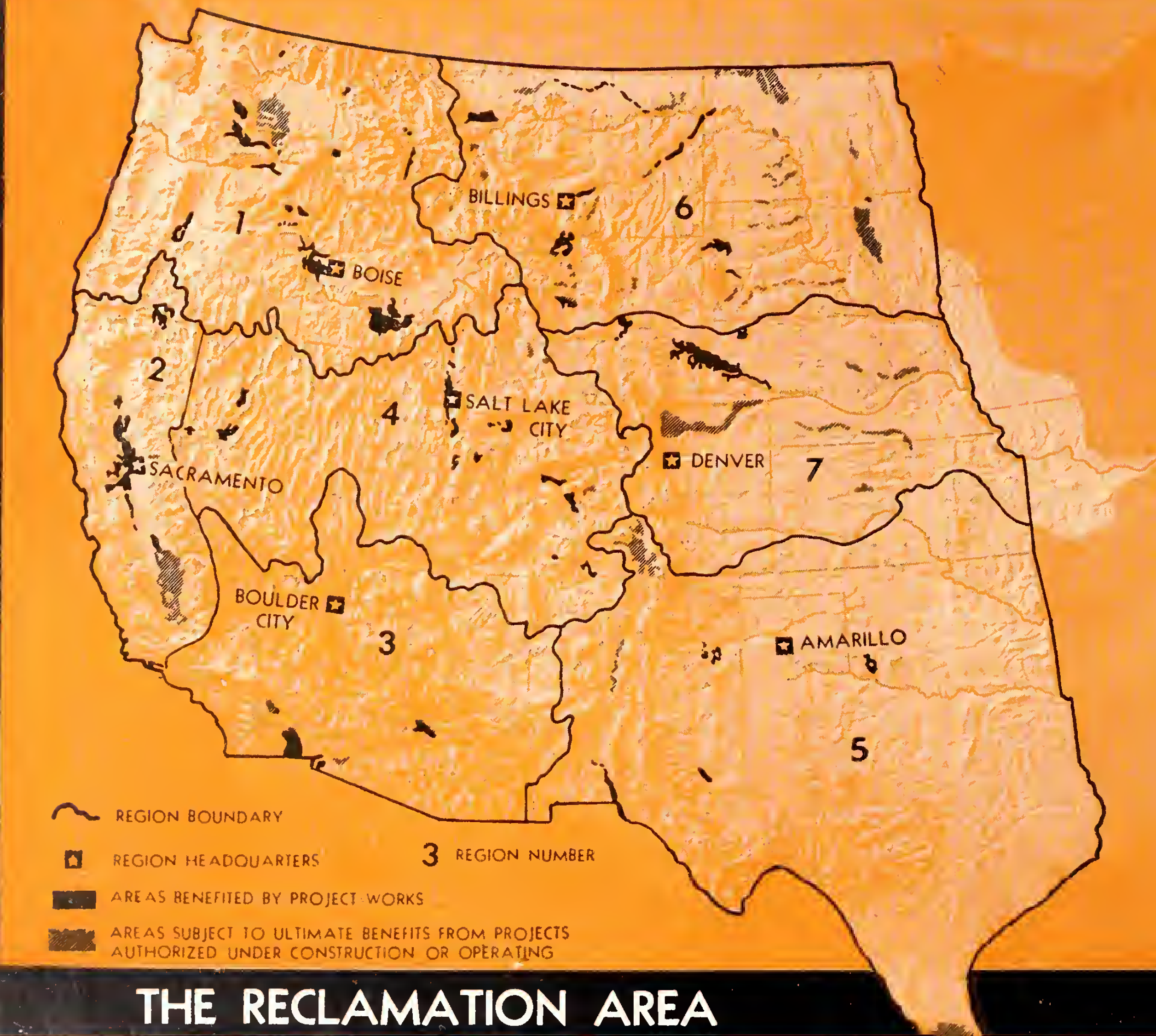

THE RECLAMATION AREA

The Reclamation ERA

October

1952

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Volume 38, No. 10

The Reclamation ERA

35 Years Ago In The Era

Reviving the Art of Bread Making

Housekeepers everywhere are keenly aware that the price of the baker's loaf of bread has soared heavenward and its size has sadly dwindled during the past few months. Heads of families are wondering how they are to pay for the staff of life if it continues its upward trend. Less than 1½ pounds of bread for 10 and 15 cents does seem exorbitant even with flour at $7.50 a hundred.

In one of the large coast cities a campaign is under way to induce the housekeepers to make their own bread, and would you believe it, there seem to be as many of them ignorant of the process as there were grown women who had forgotten the art of knitting socks and wristlets when the war began three years ago.

(From an item by Edith C. Salisbury, on page 453 of the October 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA).

OUR FRONT COVER. Although less than a handful of fluff, this 2-day-old Mongolian pheasant chick is playing one of the leading roles in the wildlife conservation program on the North Unit of the Deschutes project in Oregon. Photo by Stan Rasmussen, Region 1 photographer.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

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R. F. Sadler, Editor

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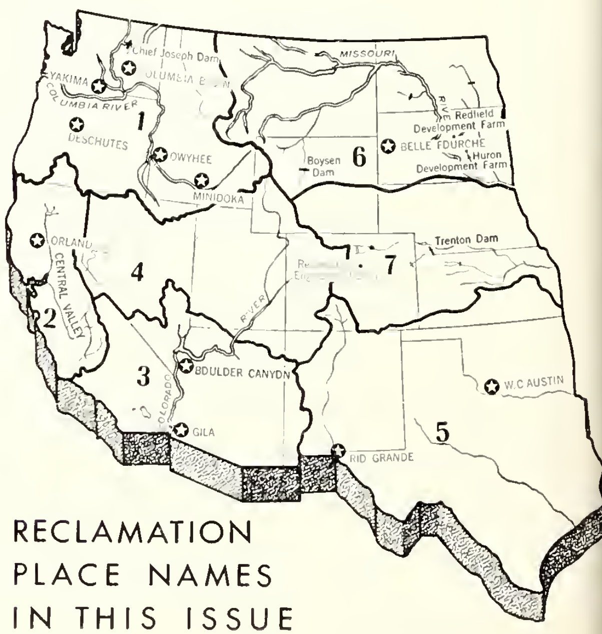
In this issue . . .



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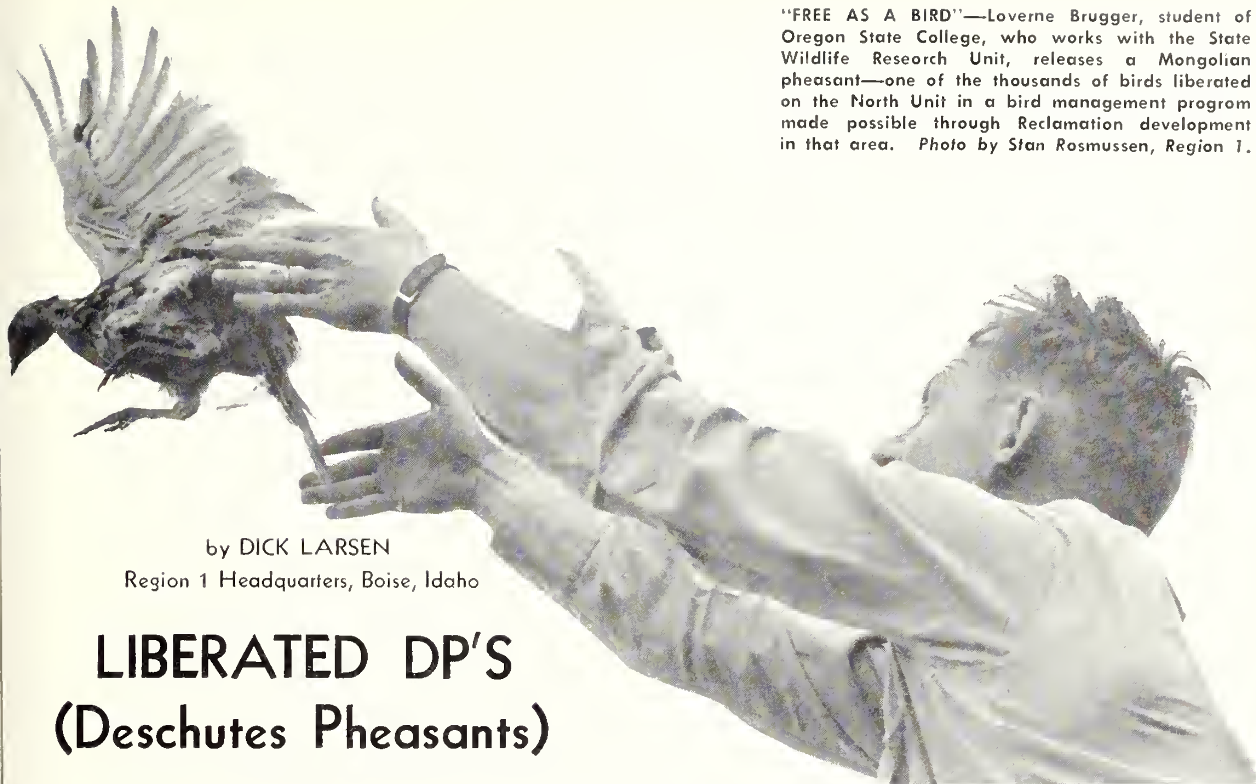


"FREE AS A BIRD"—Loverne Brugger, student of Oregon State College, who works with the State Wildlife Research Unit, releases a Mongolian pheasant—one of the thousands of birds liberated on the North Unit in a bird management program made possible through Reclamation development in that area. *Photo by Stan Rosmussen, Region 1.*

by DICK LARSEN
Region 1 Headquarters, Boise, Idaho

LIBERATED DP'S (Deschutes Pheasants)

Ardent hunters, farmers, fish and game agencies, and the Bureau of Reclamation are creating a valuable by-product of irrigation through a pheasant "planting" program on the North Unit of the Deschutes project in central Oregon.

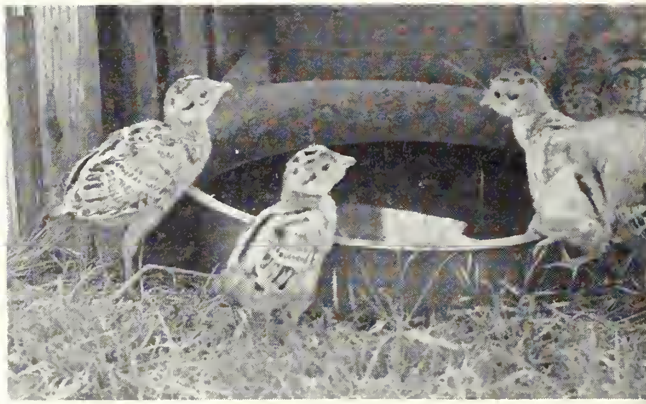
When the Bureau began delivery of water to the 50,000-acre North Unit in 1946, the Oregon Cooperative Wildlife Research Unit of the Oregon State Game Commission, and other agencies, launched a program aimed at insuring the future birdlife of the region.

They saw that irrigation of the North Unit lands was going to provide an excellent habitat for certain upland game birds. But irrigation of North Unit lands—very near the heavily populated Willamette Valley—was also expected to stir up a real problem or two. The agencies foresaw thousands of hunters being drawn from Portland and other population centers to this new pheasant paradise, perhaps wiping out the new bird population with a few seasonal bombardments. Another problem was foreseen for the region in the friction that occasionally arises between the overenthusiastic hunter and the home-loving farmer.

To avoid these problems a program of game management was mapped out right along with the planning for the reclamation project in what is believed to be the first time in the United States that such planning activities have been carried out simultaneously.

In 1946, as the Bureau of Reclamation brought more and more acres under irrigation, the Game Commission's wildlife program and research work moved forward. The area was restricted to hunters, and a pheasant-stocking and inventory program was put into effect. The game management program on the North Unit naturally did not sail onward without its customary quota of crises. At first some opposition cropped up among persons who felt that such a program on their land was entirely impractical. Later, by interviewing the individual land holders it was found that 85 percent were actually interested in the program that was being planned. Another crisis came along when the sportsmen took a dim view of closing the waterfowl season in 1950. When informed during an open meeting that the closure was necessary to determine what was becoming of the introduced game in winter months, the sportsmen promptly began drawing up a resolution offering further protection to the pheasants.

By last year, 4,600 ring-necked pheasants had been planted on the North Unit. Approximately 2,200 were liberated in 1948, followed by a release



BANDED FOR IDENTIFICATION—An Oregon State Wildlife Research Unit worker clips an identification marker on a Mongolian pheasant at left. Above, some of the 2-week-old Mongolian pheasant chicks released in the North Unit wildlife program. *Photos by Stan Rasmussen.*

of 1,400 in 1949 and 1,000 in 1950. Inventories have been taken periodically and the population has been rising steadily. At the beginning of this year the population was about 8 birds per 100 habitat acres. When the population reaches a level of between 20 and 25 per hundred habitat acres the hunters will enjoy their first harvest. Increase in pheasant population must depend largely on natural reproduction. The Oregon Cooperative Wildlife Research Unit states that diversified crops in irrigated acres offer excellent cover and become ideal habitats for pheasants in the first 10 years of development.

In addition to pheasant, Valley Quail and Hungarian Patridges are expected to further enhance the wildlife value of the North Unit. Although the establishing of Valley Quail is a precarious job, the prospects for this bird settling and thriving on the North Unit appear favorable. The Hungarian Partridge, another excellent game bird (although something of a transient) is also expected to find the North Unit to his liking.

Although migratory waterfowl must move on when severe winter weather takes an icy grip on the area, their importance in the field of sport is not being overlooked. Through agreement with the interrelated agencies and the farmers, wasteway water is being used to make attractive resting and feeding impoundments.

Before an open season on any of the birds is declared, a thorough analysis of the conditions under which hunting may be permitted will be prepared and considered carefully in this unique game management program.

The Oregon Game Commission has demonstrated its appreciation for the significance of this operation by regarding it as a model to follow in future similar situations—a model experiment following the lines of real conservation so that the greatest good to the greatest number will be the final result. ###

Good Hunting in the 17 Western States

According to a recent announcement by Secretary of the Interior Oscar L. Chapman, 10 extra shooting days have been added to the 1952 hunting season for migratory waterfowl and coot. Here is a tabulation for the 17 reclamation States. For additional information consult your State fish and game department.

State	From—	To—
Arizona	Oct. 24	Jan. 1.
California	Oct. 24	Jan. 1.
Colorado	Oct. 20	Dec. 18.
Idaho	Oct. 11	Dec. 19.
Kansas	Oct. 12	Dec. 10.
Montana	Oct. 10	Dec. 8.
Nebraska	Oct. 11	Dec. 9.
Nevada	Oct. 17	Dec. 25.
New Mexico	Oct. 14	Nov. 6.
	Dec. 18	Jan. 10.
North Dakota	Oct. 1	Nov. 29.
Oklahoma	Oct. 18	Dec. 16.
Oregon	Oct. 24	Jan. 1.
South Dakota	Oct. 3	Dec. 1.
Texas	Oct. 31	Dec. 29.
Utah	Oct. 17	Dec. 25.
Washington	Oct. 17	Dec. 25.
Wyoming	Oct. 17	Dec. 15.

A GOOD SEED PROGRAM helps to guarantee yield and income. Above, cutting a seed crop on the Yuma Mesa Division of the Gila project in Arizona. *Photo by Samuel B. Watkins, Region 3 photographer.*

IMPROVING ALFALFA SEED IN ARIZONA

All of the experiment stations in the important seed producing and consuming areas in the United States and Canada are cooperating in a nation-wide plan to test and improve hardy alfalfa seed.

When the Board of Directors of the Arizona Crop Improvement Association, a voluntary, private organization, heard that the Yuma Experiment Farm did not have sufficient funds available for participating in this plan by developing isolation plots for alfalfa seed production, they voted a grant of $2,200 to the Arizona Agricultural Experiment Station to help in this work.

As a result of the Association's coperation, during the next 7 years, seed produced in Arizona under this plan will be tested along with comparable northern-grown seed for winter hardiness, drought and wilt resistance.

The production of seed of hardy disease resistant alfalfa varieties in Arizona and California for use in northern, eastern, and central western States has become an important agricultural industry particularly on certain Reclamation projects. Homesteaders on the Yuma Mesa Division of the Gila project, in Arizona, devote considerable acreage to growing alfalfa seed of the Ranger, Buffalo, and Atlantic varieties. It is expected that large acreages on the Wellton-Mohawk Division of the Gila project likewise will be devoted to the production of hardy alfalfa seed which many of the present farmers in the area now are growing. In Arizona the seed of these hardy alfalfas is produced and marketed under the close supervision of the Arizona Crop Improvement Association which, by its recent action, has demonstrated its keen interest in improving Arizona's alfalfa seed and sales.

According to H. E. Jacka, Secretary-Treasurer of the Arizona Crop Improvement Association, it is most important that Arizona cooperate in this program in the interests of future markets for its alfalfa seed. ###

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FARMERS AND BUSINESSMEN listen to land use assistant John W. Eckerdt as he explains how corn is irrigated. The group is one of several touring South Dakota's Huron and Redfield development farms last July.

TOURING SOUTH DAKOTA'S OASES

by JACK BAILEY
Missouri-Oahe District, Huron, S. Dak., Region 6

South Dakota State College played host to 300 men and women last summer during a tour of the Huron and Redfield irrigation development farms in the James Valley of South Dakota.

The college is conducting research projects on the two farms, part of the Oahe Unit, James Division, of the Missouri River Basin project. Under a cooperative agreement with the Bureau of Reclamation, specialists test soil and water relationships and irrigation practices. Their objective is to produce the best seed types and pasture crops for the area.

Tours are conducted regularly to demonstrate to businessmen and farmers what is possible under irrigation in this eastern periphery of Reclamation territory. The Huron farm has been in production 6 years, and the Redfield, 5 years. More than 30,000 persons have visited the farms since their establishment.

This summer, on July 11, 1952, the 300 "tourists" tramped the length and breadth of the farms, and talked to the State College specialists in horticulture, agronomy, animal husbandry, and irrigation who were stationed at strategic spots throughout the farms to explain the various research tests.

The State College group was headed by Dean A. M. Eberle of the College of Agriculture; Dr. I. B. Johnson, Director of the Experiment Station and Dr. W. W. Worzella, Head of the Agronomy Department. Among Bureau of Reclamation personnel on hand for the tour were E. D. Eaton of Washington, D. C., Director of Operation and Maintenance; W. E. Rawlings, Assistant Regional Director of Region 6 and E. F. Landerholm, Region 6 Operation and Maintenance Supervisor, both of Billings, Mont., and J. W. Grimes, of Huron, S. Dak., District Manager of the Missouri-Oahe District. Dr. Johnson and Mr. Grimes gave short introductory talks as the tours began at each farm.

Earlier in the year, a partial drought threatened South Dakota following the Missouri River flood. Warm, drying winds, reminiscent of the "thirties," blew most every day in April and May. Fields of grain stopped growing at knee height. Meadows of native hay had thin stands, and ranges started turning brown. During this period, the oasis-like greenery of the two development farms stood in striking contrast to the crop-stunted landscape of north central South Dakota. The rains came

THERE'S A LOT OF COLE SLAW in the 30 tons of cabbage per acre, grown on the Redfield farm, exhibited by Dr. Sol Cook of the Horticulture Department, South Dakota State College.

n June in time to save the corn, but by that time the small grain and hay crops had been reduced 30 to 60 percent in almost two-thirds of the State. Prompted by the well-known fear of recurring drought, the people on the tour were impressed by:

1. The first cutting of irrigated alfalfa which ran 4.5 tons per acre.

2. Ten acres of mixed legume and tame grass pasture plots which remained belly high after feeding 24 head of cattle for the summer and adding from 300 to 400 pounds to the weight of each.

3. Cabbage which ran 30 tons to the acre on the Redfield irrigated truck plots.

4. Corn more than shoulder high to a 6-foot man in contrast to waist-high corn on adjacent dry land.

5. Potato and tomato fields which promise to duplicate the 1951 performance, when irrigated tomatoes yielded 15 tons per acre and potatoes 536 bushels per acre.

During the course of the tour, many of the "tourists" commented favorably on irrigation, most of them favoring the idea of combining livestock with irrigation. Many farmers in places remote from the James Valley revealed that they are doing small-scale irrigation from wells, and many more displayed an interest in doing so. Water for the Bureau's two development farms is pumped from the nearby James River and run by gravity to the fields. The Redfield farm has about 140 irrigated acres; the Huron farm, 100. The former is devoted to grain and truck, while the Huron farm is used chiefly for research in hay and forage production for livestock.

The farms are units in the general investigations involving the 750,000-acre Oahe Unit approved by Congress in the Flood Control Act of 1944. The irrigation investigations were inaugurated in 1947 along with the establishment of the Missouri-Oahe District office in Huron, S. Dak. ###

Chief Joseph to Aid Irrigation

Power revenues from the Army-constructed Chief Joseph Dam and power plant on the Columbia River in north central Washington may be used to help pay for irrigation development of 65,000 acres of family-sized farms, as provided for in Public Law 577, signed by President Truman on July 17.

The farm units, to be located in Okanogan, Douglas and Chelan counties, would be established as an additional water resource conservation feature of the Chief Joseph project, at present a single-purpose hydroelectric power undertaking 51 miles downstream from the Bureau of Reclamation's Grand Coulee Dam. The Army Engineers started constructing Chief Joseph Dam in 1949. It is scheduled for completion in 1955. Bureau of Reclamation technicians are now speeding up the necessary investigations leading up to a study and report to Congress, upon which depends the authorization for construction of the Chief Joseph irrigation works. •

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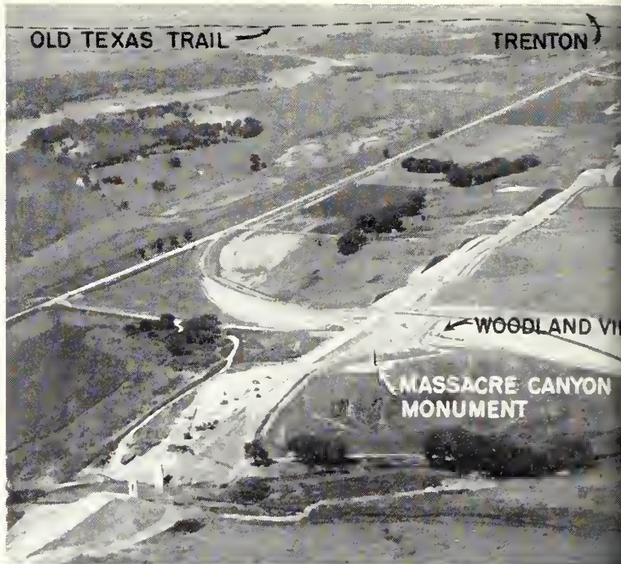
The completion of the giant Trenton Dam on the unruly Republican River in southwestern Nebraska will mark another era well underway in an area that has seen the beginning and ending of many eras by events that were spectacular and sometimes fast moving and disatrous. The "short grass" plains area is the area of the "last frontier" of the old West. It is the area of the buffalo and Indians, sod huts and prairie fires; the area of dust storms and droughts, intense rainstorms, tornados and floods; an area where nature ruggedly romps through extremes.

Trenton Dam, a part of the Frenchman-Cambridge Division of the Missouri River Basin project, is an 8,000,000 cubic yard earthfill structure 144 feet high and 9,000 feet long. It will form the



TRENTON DAM: ANOTHER ERA

by ELLIS L. ARMSTRONG, Construction Engineer
Trenton Dam, Trenton, Nebraska

multiple-purpose Swanson Lake which has a total capacity of 365,000 acre-feet of storage of which 123,000 is for sediment retention and irrigation storage and the remainder is for flood control. Its function is to place a harness on the unstable Republican River to keep it in control and to supply water to fertile lands to increase production of foods and to insure that production every year.

The Republican River in the past has not contributed as it should to the welfare of the valley. When water was needed, too often the river has been bone dry, and when it wasn't needed, many times it has been a muddy, rampaging torrent which literally gallops down the valley carrying precious topsoil, trees, farm buildings, and even livestock and people with it on its destructive course. The river at Trenton Dam has varied in flow from nothing to 200,000 cubic feet per second.

The uncertainties of nature and the abuse of the soil, culminating in the dust bowl days of the thirties and the disastrous flood of 1935, which drowned 135 folks of the Republican River Valley, have resulted in the area losing nearly 30 percent of its people in the last 20 years. The catastrophic 1935 flood undoubtedly marked the end of an era and the beginning of a new. It then became clear that, if the Republican Valley were to retain her people and progress, the river must be controlled and put to use. The dust bowl days emphasized the need for soil conservation. It is a common statement of the valley people concerning the thirties that "Everything not washed away by the floods was blown away by the dust storms."

Today, good soil conservation practices are the rule in the valley and, with the completion of Trenton Dam, the river will be controlled and the waters made available for irrigation. This dam with Medicine Creek, Enders and Bonny, previously completed, and the planned and completed diversion dams and canals, makes the new era a reality. Stability will be had, opportunity for the young people will be available so that they will not need to go elsewhere. The area now promises much for the years ahead.

The "Woodland" people had an era in the area about 1,000 years ago. Excavations in the project construction area under supervision of Dr. M. F. Kivett of the Nebraska Historical Society have unearthed several village sites. One of the old villages was located in the borrow area for the dam and one on a hillside at Massacre Canyon through which the relocated railroad passes. The people lived, flourished, and disappeared. It is believed they lived principally on game and wild plants but it is possible they may have cultivated crops. Their disappearance can probably be attributed to a prolonged drought as their remains are covered with a layer of sterile dust from a few inches to a foot or more in thickness on top of which the present humus soil and grass cover has developed.

The "Upper Republican" people followed and were in the area about 1350 to 1500 A. D. Indications of their culture were found in the Trenton Dam area. It is believed that their culture was of a more permanent type than the Woodland people and that they cultivated corn, beans, and squash.

BEFORE THE FOURTH—THE ERA OF IRRIGATION—came the era of prehistoric man, of the Pawnees and Sioux, and of the cattlemen. At left, J. J. Cram's aerial photo of the area. (1) "Woodlands" Indian of 1,000 years ago, Nebraska Historical Society photo by Dr. M. F. Kivett. (2) Sioux Indians at Massacre Canyon Monument, photographed by Russell I. Alley, Bureau of Reclamation. (3) Monument to "the cattlemen who drove their herds from Texas to Ogallala, Nebr., and the Northern Ranges." (4) M. L. Willson's drawing of Trenton Dam as it will look when completed.

It appears they suffered the same fate as did the Woodland people and were forced out of the area by drought.

Indications were found at the dam abutments and at Massacre Canyon of Pawnee villages dated about 200 years ago. This was probably the beginning of the era that culminated in the massacre of the Pawnee Indian Nation by the Sioux in 1873 at this canyon which has been so aptly named.

The Pawnee Indians claimed this area as their own. After the advent of the white man and the confinement of the Indians to reservation areas, this area was assigned as hunting ground for the Pawnees. However, the Dakota branch of the Sioux nation also felt it was their hunting ground, and although they were supposed to stay north of

R THE UPPER REPUBLICAN VALLEY

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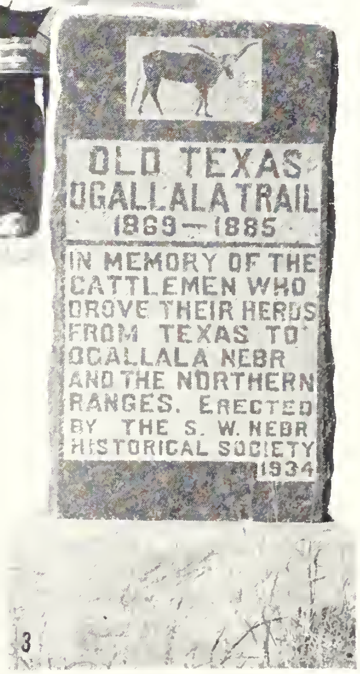

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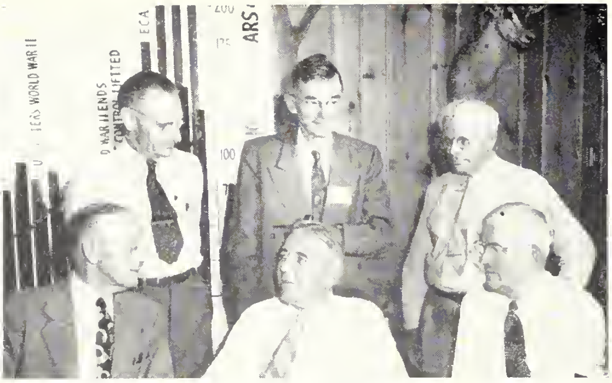

200 YEARS OF WATER RESOURCES ENGINEERING EXPERIENCE is represented in this group of "elder statesmen" which met at Cody, Wyo., during the week of July 17 to help formulate the Bureau's construction and operational program for the year. Seated, l. to r., Harry W. Bashore, former Commissioner of Reclamation (40 years service); present Commissioner Michael W. Straus (18 years); Frank A. Banks, builder of Grand Coulee Dam (44 years); standing, Walker R. Young, former Reclamation Chief Engineer (37 years); R. J. Newell, former Region 1 director (26 years), and H. D. Comstock, former Region 6 director (42 years).

Missouri Basin Power Line in Iowa

Reclamation Commissioner Michael W. Straus recently announced a contract award for constructing footings and erecting towers for a 230-kilovolt transmission line to carry Missouri Basin Power from Fort Randall Dam to Sioux City, Iowa. Lipsett Inc. of New York, N. Y., was the successful bidder, and the American Bridge Co. will supply the steel. The contract for furnishing and stringing conductors is still to be awarded.

The line is to be completed soon after initial production of power at Fort Randall, scheduled for August 1954. Ultimately, it will serve parts of Nebraska, Iowa, Minnesota, and South Dakota.

Fort Randall, Oahe, and Garrison Dams and power plants are all under construction by the Corps of Engineers as part of the Missouri River Basin program. All power from these plants will be marketed by the Bureau of Reclamation. •

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the Platte River, they cast covetous eyes at the rich hunting area of the Republican Valley which from 1860 to 1873 was perhaps the greatest hunting ground in America. "Doc" Carver, the great frontiersman and marksman, hunted the area and claimed that in 1870 within a 25 mile stretch of the valley he saw "at least 500,000 buffalo."

In August 1873, the Pawnees staged their annual buffalo hunt in the Republican Valley. The hunting party consisted of over a thousand horses, 600 young men of the tribe, and enough women and children to tend to the work of skinning and dressing the animals which were killed. On the fifth day of August they reached Massacre Canyon, 4 miles east of Trenton Damsite. They were engaged in killing buffalo when attacked through the buffalo herd by 1,200 Sioux warriors. In the battle that followed the Pawnees were nearly annihilated. They were saved from complete slaughter by the arrival of United States Cavalry troops, who had been dispatched to the area because of reports of impending trouble.

This battle ended the fabulous hunting era as within 2 years the remainder of the Pawnees had migrated to Oklahoma, the Sioux were subdued and maintained in their reservation, and the buffalo disappeared because of the greed of white hunters.

The monument commemorating the last Indian battle in America, marking the ending of an era, is located on a hill where excavation, connected with the starting of another era, unearthed the story of other people of 1,000 years ago.

The old "Texas Trail" from South Texas to the Union Pacific Railroad at Ogallala, 80 miles north of Trenton, passed across the valley just 1 mile east of Trenton Dam. In 1879 a herd of 55,000 head of cattle was driven over the trail and it is estimated that between two and three million cattle passed across the valley on the 1,500-mile Texas Trail jaunt to Ogallala.

However the open range cattle era was cut short by the construction of the C. B. & Q. Railroad up the valley in 1882 and the arrival of settlers, plows and barbed wire and the establishment of homes in sod huts. One of the last big roundups was held in 1881 at the present site of Trenton and one rancher had over 10,000 cattle. A severe winter in 1885–86 killed off most of the remaining large herds of cattle and ended the Texas long-horn cattle era.

The pioneer settlers' era was marked by crop failures, by drought, loss of stock by severe cold and snow in the winters, and by floods. Irrigation was practiced as early as 1886 when a group of settlers built a diversion from the Republican River 3 miles west of Trenton Dam. The project was abandoned after 2 years because, when the water was needed, the river was dry. Wheat was introduced in the area about 1890 and since has been the principal crop. The irrigated areas of the new era will provide needed diversity and stability to the agricultural economy. ###

National Employ the Physically Handicapped Week is designated this year by the President of the United States as October 5–11. Since 1945, this observance has focused attention on the year-round program in behalf of rehabilitating and employing persons who have certain physical imperfections, but who are ready, willing and able to perform well a multitude of tasks.

The American Medical Association's Council on Industrial Health said recently, "The employability of the handicapped depends on the emphasis placed on the individual's ability rather than the disability . . . As a matter of fact, few adults are physically perfect. Minor defects present no problem, and suitable placement solves most of the others."

Last year the Reclamation Era, *at the request of Vice Admiral Ross T McIntyre (MC), USN, Retired, Chairman of the President's Committee on National Employ the Physically Handicapped Week, cooperated by publishing the article, "America Needs All of Us" in the October 1951 issue. Here is this year's story of people in the Reclamation area who prove the wisdom of, as Admiral McIntyre says, "Respecting the God-given dignity of each individual" and providing equality of job opportunity for handicapped workers.*

Ready, Willing and Able

Earl D. Newton isn't a large man. In fact, he's almost frail, weighing less than 170 pounds and standing 5 feet, 9 inches. And although he'll mark his 62d birthday in December, Newt, as he is called, often can be seen in the Bureau of Reclamation laboratories crushing concrete cylinders up to 6 feet high and 3 feet in diameter; or, literally, pulling apart forged steel bars measuring up to 6 inches in diameter. And all of this in spite of the fact that his right foot was removed as a result of infection that followed a sprained ankle suffered when he was 7 years old. He has help, of course, in the form of "Mr. Muscles," a three-story-high machine known as a universal testing machine, but one whose operation calls for a steady hand, the ability to read sensitive gages and make careful computations from collected data.

Newt has never held a "white collar" or desk job. The closest he has come to sitting-down-work was as a chauffeur, which involved the maintenance of cars and trucks in addition to merely driving them.

NEVER MISSES A DAY'S WORK.—Earl D. Newton at the control panel of the five-million-pound capacity universal testing machine in Denver's Reclamation Engineering Center. *Photo by Charles Knell, Region 6 photographer.*

Before joining Reclamation 18 years ago this month (October), Newt had done general garage work in Portland, Oreg., driven trucks and worked in warehouses, been a sheet metal worker in an automobile body factory, and mined gold, quartz, and coal in Colorado—jobs many nonhandicapped persons might consider too rugged.

Newt went to work in Reclamation's Engineering Laboratories in 1934. He was first classified as a laborer, and assigned to tasks like crushing aggregate to be used in testing. His former experience and skill soon called for his redesignation as mechanic in the laboratories.

In 1939, Newt's supervisors requested for him a permanent civil service appointment. On the basis of a cold, impersonal medical report, the commission at first denied the application. However, upon reexamination of Newt's case, requested by the then Bureau Chief Engineer, R. F. Walter, the commission realized that a missing right foot affected his ability no more than a missing fingernail.

For 5 years he had not only been performing capably and satisfactorily, but during that 5 years he had not missed even a fraction of a workday because of illness.

Earl became an assistant engineering aid in the Bureau laboratories in 1937, a laboratory aid in 1943, and in 1945 an engineering aid. It is in this latter capacity that Newt can be seen performing his Samson-like feats with concrete and steel.

Newt also acts as foreman of the labs' "elasticity" crew which conducts tests on a wide variety of concrete, rubber, fabric, and many other construction materials.

Even during school days Earl Newton refused to allow his handicap to interfere with his activities. He played baseball and basketball on high-school teams, and was a member of the first team on the basketball squad.

As is so often true in these cases, it is not accurate to refer to Newt as handicapped. To the casual observer, his disability is not apparent. He walks with a trace of a limp, he performs his job dependably, accurately, and quickly. To see him poised on an upper tier of the giant universal testing machine, securing a test specimen to the machine's cross arm, one would think that he possessed special aptitude for scurrying about in precarious spots.

Earl Newton's case proves again that ability counts.

On the Columbia Basin project in the State of Washington, 108 Bureau of Reclamation employees are disabled veterans, representing approximately seven percent of the district personnel.

In addition, there are men and women who are nonveterans who are handicapped and doing a full-time job of helping to make this project successful.

Some are among the operating personnel employed to keep the irrigation canals flowing with water now that irrigation water has been made available for the first 66,000 acres of the ultimate 1,029,000 acres in this central Washington area.

Herman Bertram, who is stationed at the Moses Lake Watermaster headquarters, is among these. Bertram was hired April 28, 1952, as the start of irrigation neared. He is recovered from a spastic paralysis that affected him in his younger years, and he is able to handle a maintenance labor role.

Settlers on this project, in some cases, carry their scars from World War II. Among these is William S. Lovercheck, a former paratrooper, who continues to make a successful life on the Pasco Unit, despite serious wartime injuries. His picture appeared on page 234 of the October 1951 issue of the Reclamation Era.

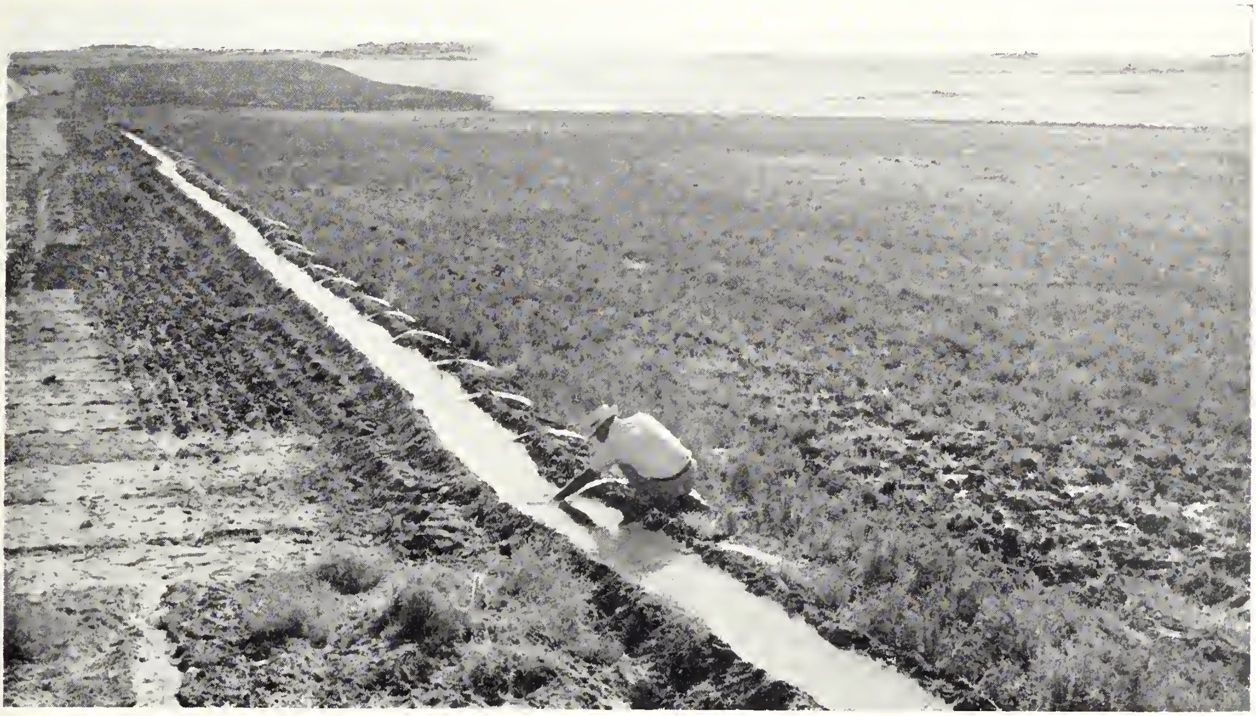
In the Finance Division of the Columbia River District headquarters at Ephrata, Wash., is George Komoto. He lost a leg while serving in the Japanese-American regiment which fought in Italy. Now, a government accountant, he is head of the allotment unit which sees that the various offices don't overspend their appropriations.

In the same division is Russell W. Chambers, accounting clerk, who suffers from arthritis. His handicap does not interfere with his job of processing important papers dealing with selling, renting and leasing government property.

At Ephrata also is Orville Long, government accountant. At the age of 12 he suffered a bone infection which resulted in complete ankylosis of the right hip joint. This handicap did not prevent him from purchasing a 1-acre part-time farm unit near Soap Lake, nor from being listed in the 1951 edition of Who's Who on the Pacific Coast.

In the 17 western States where the Bureau of Reclamation operates, in the laboratory, on construction jobs, in the offices, along the ditches and reservoirs, and on the farms, those with physical handicaps are ready, willing and able to tackle the job of harnessing America's resources and bringing forth the wealth of the land. ###

DO YOU IRRIGATE IN THE FALL?



FOR NEXT YEAR'S CLOVER—September irrigation on Keith H. Johnson's Hunt Unit farm on the Minidoka project in Idaho. ***Photo by Phil Merritt, Region 1 photographer.***

If you live in an area where a dry, open winter is more of a rule than an exception, where there is little or no water held over in reservoirs, and winter moisture is normally short, "putting the crops to bed with their feet wet" is good insurance.

In such circumstances, irrigate alfalfa, clover and pasture grasses during the fall to supply water during the winter and build up reserves for the spring. But woody plants such as shrubs, berries and trees need a dry period in which to harden up before cold weather begins. Put them to bed for the winter after the leaves have fallen but before the first frost.

Fallow or open fields can carry water over for next year's crops, but as a rule they should not be wet any deeper than 6 to 8 feet. Any more penetration wastes water and leaches out plant foods. Be careful irrigating fallowed fields as waste water can cut gullies and fill roadside ditches with valuable soil.

Once the soil has frozen, there is not much use in trying to irrigate—but your perennial crops and next year's crops will do much better next year if the soil is kept moist, whether by fall irrigation or the rains and snows. (Adapted from the Business Farmer, Scottsbluff, Nebr., October 1951 issue, with the kind permission of the Editor, Jim Nunon).

Funds for Boysen Lands Transferred to Indians

Congress recently passed Senate Bill 3333 enabling the Bureau of Reclamation to transfer $458,-000 to the credit of the Shoshone and Arapaho Indian tribes to compensate for some of their lands taken over for the construction of Boysen Dam and Reservoir on the Big Horn River in Wyoming.

The settlement amount was agreed upon by the General Council of the Shoshone and Arapaho Indian tribes in July 1950. The agreement was confirmed by a memorandum of understanding between the Commissioners of Indian Affairs and Reclamation. It provides for title to the 25,880 acres of land to be transferred to the United States but permits the Indians to retain access to a part of the Boysen Reservoir shoreline and grazing rights to some of the reservoir area when not inundated. •

The Downstream Dynamics of Hungry Horse

HIGH IN THE MOUNTAINS OF MONTANA, on the upper reaches of the Columbia River, a new power plant named Hungry Horse goes into production this month.

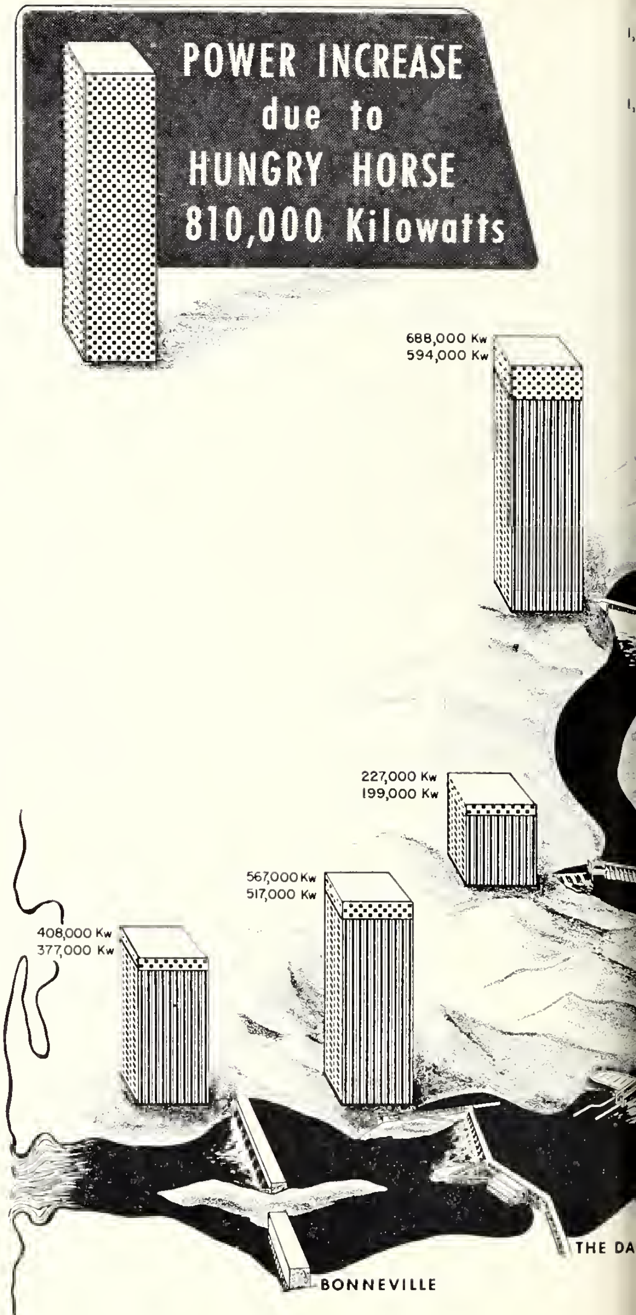
Down along the river, private and public power plants are beginning to flex their muscles to take care of the additional firm power—613,000 kilowatts—which they will be able to produce because Hungry Horse was built.

And this is "firm" power only, the number of kilowatts which can be produced 365 days a year, even during the driest series of years anticipated. During years of high runoff and storage in Hungry Horse's 3½ million acre-foot reservoir, maximum production will be even higher. For example, the accompanying illustration attributes 197,000 kilowatts of firm power to Hungry Horse, whereas its actual installed capacity is 285,000 kw.

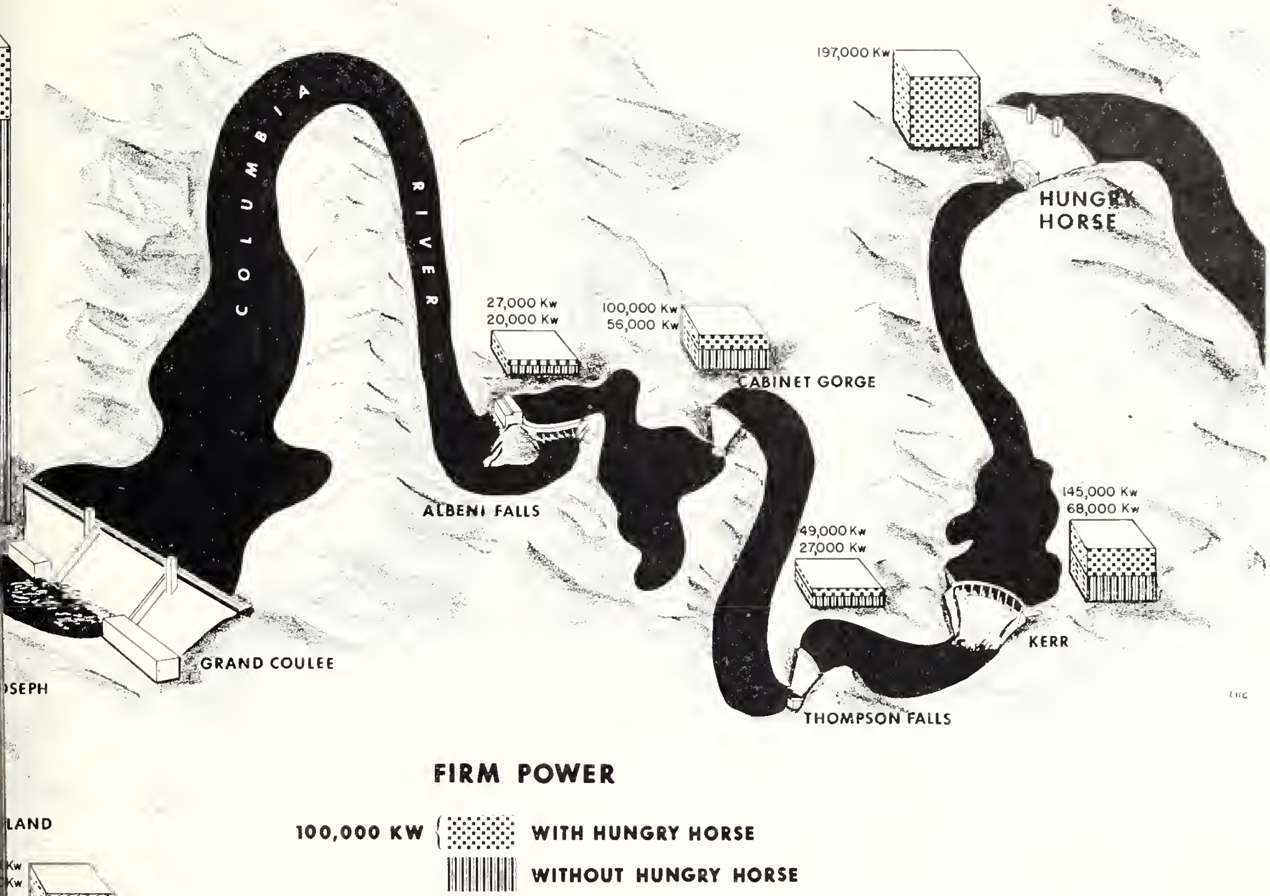
As the power of the Columbia River tumbles from one plant to another, under a controlled system of releases, the operators of each plant, knowing that there will be a dependable amount of water to convert into electricity, can run their plants at least up to the "firm" power rating—winter and summer, drought or flood. As runoff increases, the output of energy can be stepped up.

Not counting its own installed capacity, the added power made available by Hungry Horse is over 3 times its firm production when all four of its 71,250-kilowatt generators are installed. Grand Coulee alone will be able to produce 208,000 additional kilowatts as a result of Hungry Horse's strategic location in the upper reaches of the Columbia—11,000 more kilowatts than the firm generation at Hungry Horse itself.

This additional hydroelectric power will benefit water users in the Pacific Northwest through the availability of low-cost power for farm and home use and for pumping irrigation water. If, and when, the irrigation possibilities in the Flathead Valley are developed, excess revenues from the sale of Hungry Horse power can be used to help the farmers repay the Federal Government for bringing water to the proposed 60,000 acres near the city of Kalispell.



PLANT	STATUS
BONNEVILLE	Constructed and operated by the Corps of Engineers.
THE DALLES	Construction started last year by Corps of Engineers.
McNARY	Construction to be completed by Corps of Engineers in about 2 years.
ROCK ISLAND	Owned and operated by Puget Sound Power and Light Company. Now being enlarged to take advantage of Hungry Horse's upstream benefits.



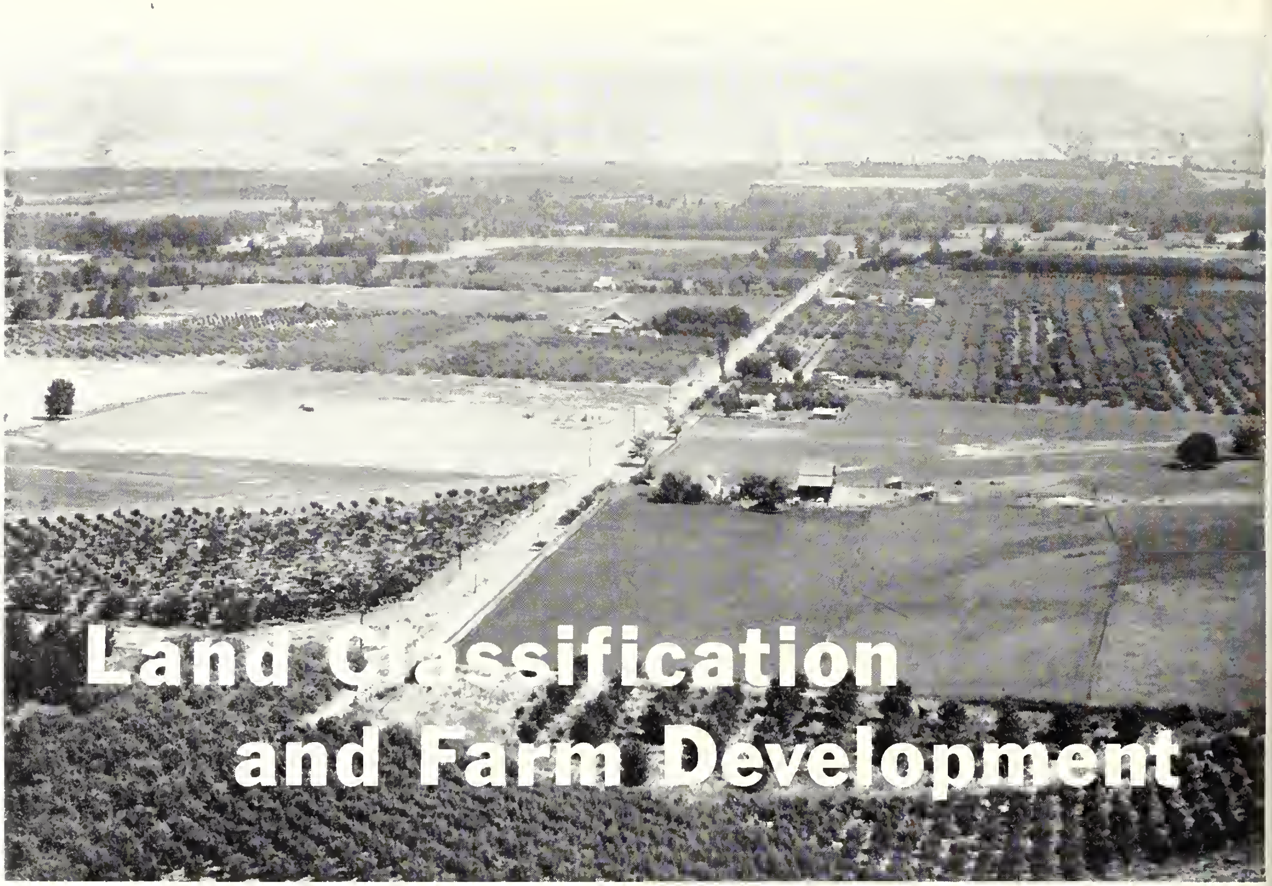
HOW HUNGRY HORSE SETS POWER-FULL PACE

Year-round dependable power supply made possible through coordinated system operation

PLANT	STATUS
Chief Joseph	Under construction by Corps of Engineers, about $\frac{1}{3}$ completed.
Grand Coulee	Constructed and operated by Bureau of Reclamation. Power marketed by Bonneville Power Administration.
Albeni Falls	Under construction by Corps of Engineers; to be completed within two years.
Cabinet Gorge	Under construction by Washington Water Power Company. To be completed in about a year.
Thompson Falls	Completed. Owned and operated by Montana Power Co.
Kerr	Completed. Owned and operated by Montana Power Co.
Hungry Horse	First power on the line this month. Built and operated by Bureau of Reclamation. Power marketed by Bonneville Power Administration.

In addition, proposed dams and power plants that would derive power benefits from Hungry Horse are: John Day, Ringold or Richland, Priest Rapids, Rocky Reach, Wells, Boundary, Noxon Rapids, Trout Creek, and Paradise.

Land Classification and Farm Development



SUCCESSFUL IRRIGATION FARMS depend upon proper planning, before, during and after construction of the project works. Above, the fertile farms in the Natches Valley, Yakima project, State of Washington. *Photo by Stan Rasmussen, Region 1 photographer.*

by E. N. POULSON, Soil Scientist, and
L. R. SWARNER, Irrigation Engineer,
Boise, Idaho

Part 9 in a series of articles on soils and land classification

The success of any reclamation project, in the final analysis, depends upon the settlers. They prosper if they are able to meet operation and maintenance charges, repay their share of construction costs, make enough profit to represent a reasonable return on their investment, and maintain a good standard of living.

To provide these conditions, it is essential to plan the proper size and type of farm units. Land classification is important in this determination. On the million-acre Columbia Basin project, in the State of Washington, detailed studies have been made to determine the acreage of various classes of land or combinations of classes necessary to support an average-sized family at a suitable level of living. The crops which can be safely grown, the probable yields under average management, and the long time average financial returns which may be expected per acre differ markedly between various classes of land. The land classification for the project area provides an ideal base for the establishment of the farm type and size as well as the location of the farm unit boundaries.

On the Roza Division of the Yakima project in the State of Washington, where public land has been subdivided into 28 units for homesteading by World War II veterans, and on the Hunt Unit of the Minidoka project in Idaho, where 89 units have been provided for the homesteaders, similar studies have been conducted to determine the acreage of the various classes of land necessary to provide an adequate farm unit. The land classification and topographic maps in each case have proved invaluable in establishing the farm unit boundaries. These boundaries follow the topography and natural land features whenever such a layout will provide a more satisfactory operating unit than when following legal subdivisions.

In conjunction with the layout of the farm unit, it is necessary to make a survey to determine the exact acreage of irrigable land that may be served by the delivery to that particular farm unit. This is commonly called an irrigable acreage survey. This survey is a joint engineering and agricultural operation. Here again, land classification maps prove invaluable in delineating the various classes of lands suitable for irrigation from those of poorer quality which are not suitable for irrigation. In making this determination on the Hunt Unit of the Minidoka project, a very satisfactory arrangement was followed whereby a land classification man accompanied the survey party and made the final adjustments in the land classification and farm unit boundaries.

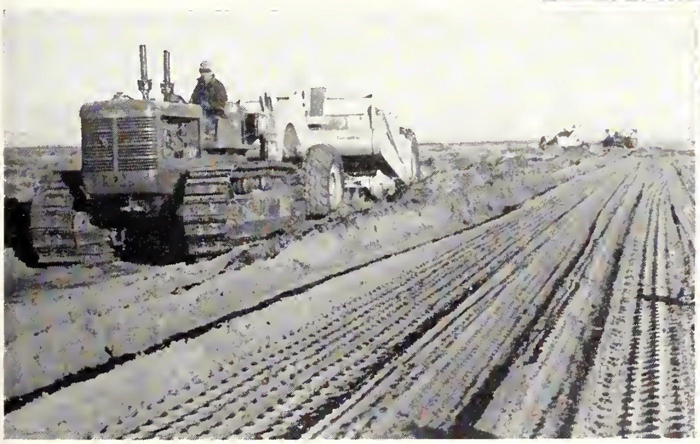
A suitable land classification provides the basic information for a land development program designed to hasten the full production of the land. In land-leveling operations on the Deschutes project in Oregon, where the depth of the soil is limited in some areas, it is essential to have a complete knowledge of the soils in order that the fertility, moisture-holding properties, and the effective depth of the soil will not be seriously impaired. Soil depth indicated in the land classification of this area prevents excessive grading.

For effective distribution and efficient use of water, it is important to have proper length of furrow and proper spacing of the furrows or corrugations. For successful drainage, proper type, depth and spacing of drains are vital. These decisions may be made by evaluating the soils and substrata as to permeability and waterholding and transmitting properties. This information serves a useful purpose for a new project in its initial development period as well as for an older operating project.

For instance, during a recent classification of the Owyhee project in Oregon and Idaho, as on all other projects, the physical properties of the profile as to permeability and waterholding capacity were included in the land classification. As a result of this classification, recommendations for land use and cultural practices were made to the farmers through the local extension service. "Problem soils," packed so tightly that water cannot penetrate them, have been improved by the recommended practice of subsoiling or breaking up the compact layers.

The land classification information which proves beneficial in the development of land serves equally well as a basis for a sound land use or farm management program. Generally speaking, shallow soils are better adapted to hay and pasture than to row crops. It is also almost essential that the fertility of shallow soils be constantly replenished through a livestock program whereby a large portion of the products could be returned to the land. Thus, the land classification informa-

HOW MUCH WILL IT COST TO DEVELOP?—The amount of investment for such items as leveling land with carryalls on the Columbia Basin project (below) has to be figured in selecting land to be irrigated. Irrigable lands of the Pasco Unit, at right. *Photo below by F. B. Pomeroy, Region 1 photographer, at right by H. C. Robinson, former Region 1 photographer.*



tion guides the land use and farm management program.

Since Reclamation law requires the repayment of project costs pertinent to irrigation, the ability of the lands to produce enough income to permit the waters users to repay the costs is of vital concern. When repayment contracts are drawn up for a project, one of the important things to be considered in arriving at the annual assessments is this "payment capacity" of the lands to be served by the project. In order to arrive at this "repayment potential," it is necessary not only to know the acreage of the various classes of land but the potential net income of these classes as well.

The assignment of variable repayment charges to different classes of land is necessary in all fairness to water users. This practice is operating successfully on Federal Reclamation projects in the United States and in many different irrigated communities throughout the world. ###

L. R. Fiock Retires from Rio Grande

L. R. FIOCK, left, congratulates his successor, William F. Resch, who takes over as manager of the Rio Grande project, El Paso, Tex. *Photo courtesy of the El Paso Times.*

After 41 years of devoted service with the Bureau of Reclamation, and its predecessor, the Reclamation Service, L. R. Fiock on June 27, 1952, retired as manager of the Rio Grande project in New Mexico and Texas, where he had worked for the past 30 years.

Scores of friends and employees assembled in the project office at El Paso, Tex., on that date to honor Mr. Fiock, who received a shower of gifts, scrolls, a medal and the Department of Interior Distinguished Service Award, highest honor bestowed by the Department.

The citation, signed by Secretary of Interior Oscar Chapman, and presented by Regional Director H. E. Robbins, lauded Mr. Fiock for his "eminent career" and praised his "economical, balanced and progressive" operation of the interstate project.

Director Robbins also gave Mr. Fiock a lifetime pass to all national parks and a scroll from the regional office staff stating that his "record will ever serve as an inspiration."

Mr. Fiock was born on August 21, 1886, at Yreka, Calif. He received his degree in civil engineering from the University of California in 1911.

Mr. Fiock joined the Bureau of Reclamation in May of 1911 as a surveyor on the Strawberry Valley project in Utah. He transferred to the Rio Grande project in January 1913, when the works were about 30 percent complete. He helped lay out the irrigation system and years later personally supervised the survey of routes for much of the Elephant Butte-El Paso and Deming power transmission lines.

William F. Resch, who has served with the Bureau of Reclamation in El Paso for 27 years, was named project manager to succeed Mr. Fiock, his former superior. •

Jack Savage Receives Another Honor

John L. Savage, world renowned "billion dollar" engineer, has been elected to the Hall of Fame of Popular Mechanics Magazine "as one of 50 Americans deserving honor of their fellow men for their achievements in the fields of mechanics, science, discovery, and for their contributions to the welfare of mankind during the past half century, 1902–52."

This award places Mr. Savage, designer of such structures as Hoover, Grand Coulee, and Shasta Dams, in the same class with such celebrated Americans as Henry Ford, Glenn H. Curtiss, Admiral Richard E. Byrd, Albert Einstein, and the Wright Brothers who also received this honor.

Savage, former Chief Designing Engineer for the Bureau of Reclamation, received this latest honor during the Popular Mechanics Golden Anniversary, the same year the Bureau of Reclamation is celebrating its Golden Jubilee. The scroll of honor was presented to Mr. Savage by Mayor Quigg Newton of Denver, Colo., at ceremonies held in the Reclamation Engineering Center at Denver, which were attended by more than 200 Bureau engineers, headed by Chief Engineer L. N. McClellan. •

ALTUS FARMERS SPEAK UP

PART 1—WATTS AND WALKER

by U. H. WARNER
Editor, The Geary Star, Geary, Okla.

Mr. U. H. Warner, publisher and editor of The Geary Star, a weekly newspaper published at Geary, Okla., is also President of the Geary Chamber of Commerce, an area-wide organization whose membership includes many of the progressive farmers from the surrounding country as well as business and professional men of the town of Geary.

Due to his interest in the proposed Canton irrigation project in the North Canadian River Basin in west-central Oklahoma, Mr. Warner has undertaken to tell the landowners in the project area, and the people of the nearby communities, what irrigation development will mean to them. As the W. C. Austin project in southwestern Oklahoma, about 95 miles southwest of the Canton project, is the nearest large scale irrigation development, Mr. Warner has sought these examples of nearby successful irrigation farmers so that the people in the area can acquire an understanding of the benefits of irrigation, both to the irrigation farmer and the surrounding community.

EARLIER THIS YEAR, we spent 2 days with farmers of the Altus irrigation district in an effort to find out what can be done in Oklahoma with irrigation.

We found one man who harvested more than $225,000 worth of produce from one farm of 150 acres in 1950. He did the same thing again last year. Of course, the average farmer untrained in irrigation would be unable to make such a record without many years of irrigation experience.

The story of Herman Watts, a native of the area where he is now irrigating cotton, is a story which could be reproduced in Blaine county if irrigation water ever flows down the North Canadian river valley.

Watts was born and raised on the land which adjoins his present farm. He had no previous irrigation experience when water came to his land in a ditch in 1948.

Watts posed for his picture from the seat of his tractor which was pulling a harrow when we stopped at his place 2 miles north of the town of Martha.

"Would you consider leaving this area and going back to dry-land farming after growing four crops with irrigation water?" we asked.

Watts smiled knowingly, shook his head negatively, and started quoting figures.

"I have averaged 600 pounds of lint to the acre on my cotton in a 4-year period," he said, "and when I get a little more know-how on insect control, I will beat that all hollow. I used to be lucky to raise one-third of a bale before I had irrigation water."

"I planted my best field of 30 acres to cotton in 1951 and harvested 1½ bales to the acre. It would

EX-DRY-LAND FARMERS—At left, Herman Watts who had no previous irrigation experience prior to 1948, now making a success of his Altus farm. At right, Jack Walker, brought up on a dry land farm, has convincing evidence that irrigation pays in Oklahoma. ***Photos by Fred Finch, Region 5 photographer.***

have done over 2 bales to the acre if I had started fighting the worms a little earlier in the season. I had 90 acres of cotton all told and got a total of 104 bales.

"My 1952 program calls for 90 acres of cotton, 13 acres of castor beans, 30 acres of alfalfa, 8 acres of sweet clover, and a little sudan for pasture.

"Alfalfa has been a money-maker with irrigation water. My best yield to date has been 5 tons per acre for hay plus a seed crop which made 4½ bushels per acre."

Watts pointed across the field to a neighbor's farm. "There is Iris Kelly, a man who made $100 per acre net profit on castor beans on 100 acres," he said, "and I think that beans are going to be a big money maker for us here some day." He added that he intends to experiment some with beans this season.

Watts pointed south across the table land where one can see houses several miles away. He indicated a farm house where the original owner had sold his place at $125 per acre about the time irrigation ditches came through the valley. The man who purchased it has now sold the rolling 80 acres out of the original 160 for more than he paid for the entire place.

When asked what he values his land at today, Watts said he would not sell it for $300 per acre. He owns 80 acres and pays rent on 72 acres across the road from his land. The owner, who lives at Chickasha, collected $4,350 from Watts for his share of the crops on 72 acres in 1951. The landlord's share was one-third on the feed raised and one-fourth on the cotton.

Water at the Right Time

Jack Walker was sitting in his car, avoiding a cold north wind, while he watched the water flow down cotton rows one-half mile long when we stopped to talk to him on March 22. He stepped out of his car to pose for a picture beside the irrigation water which was soaking in to a depth of 10 inches on the 45-acre field which he planned to plant to cotton about April 15. We climbed back into the car and settled down for a series of questions and answers on irrigation of wheat. Walker said, "My dad raised me on a dry-land farm and when I grew up I started to farm. This thing of waiting on rains that fail to come at the right time finally disgusted me and I went into business in Altus and stayed there for 9 years.

"When I saw that irrigation was coming I realized that water which you can get in a ditch on the right day that you want it is real insurance for a farmer. I knew some good land to pick and bought it and was ready when irrigation came.

"Our average annual rainfall at Altus is 26 inches per year but we get only a little bit of it in the summertime when the crops are growing.

"The biggest trouble with our inexperienced irrigation farmers here at Altus is their failure to water at the right time. A man who should have watered last week looks up at the sky this week and sees clouds so he thinks, 'maybe it will rain. I will just wait until next week before I irrigate.' It doesn't rain, so next week he waters. But he waters two weeks too late."

Walker raised 157 bales of cotton on a 144-acre field in 1951, a season when worm damage cut yields considerably.

He wet his 1952 cotton field down 10 inches on March 22 and planted the cotton around April 15. He expected to run irrigation water down the cotton rows about the middle of July. If the weather stayed dry and hot the rest of the summer, he planned to irrigate about every 10 days through August and early September.

Mr. and Mrs. Walker live in a modern home at 728 East Commerce in Altus.

(Next Month—Lagree and Hafner)

Water Users Take Over W. C. Austin Project

Water users of the Lugert-Altus Irrigation District took over the operation and maintenance of the W. C. Austin project on October 1st, marking the 100th contract under which operation of an irrigation system constructed under the Federal Reclamation program has been turned over to private water users by the Government.

In announcing the transaction, Commissioner of Reclamation Michael W. Straus said, "Relinquishment of responsibility over Federal projects to the water users as rapidly as they become able to assume the financial and administrative obligations involved, has been a fundamental policy of the Federal Reclamation program since its inception 50 years ago.

"As a result, the private water users now operate and maintain more than twice the number of systems run by the Bureau itself, and these latter will be still further reduced as soon as districts are able to take over the responsibility." ●

Women of the West—

MYRA MARSHALL
Colonel Marshall's Helpmate

ALWAYS IN THE BACKGROUND, but always helpful and sympathetic, Myra Marshall performed the gallant role demanded of the wives of many great men. *Photos, courtesy the Marshall family.*

by
A. L. EVANS, Editor and Co-Publisher
of the Lindsay Publishing Co., Lindsay, Calif.

Mrs. Robert B. Marshall is quite modest and takes little credit for herself, but she has given service to her country far greater than she realizes.

She is the widow of Colonel Robert B. Marshall, who in 1891 had a vision, or dream, of the reclamation of the valley of California, embodied in his Marshall plan, and given to the people of California, without cost, in 1919.

The Marshall Plan which evolved into the present Central Valley project is almost identical to the project as ultimately consummated.

In Marshall's own words he sums up the beginning of the project: "The first night from Nevada City after driving about 40 miles was spent in the town of Folsom. I saw a lot of water in the American River as I crossed it. Was anybody using it for irrigation?

"The next morning early, the road leading to Galt (the next stop for the night) was along the bluff south of Folsom. The morning was bright sunshiny, blending the brown grasses and the few scattered oak trees under a blue canopied sky—a dream landscape—and west, south and north I saw the valley of California, in a natural buff canvas of endless beauty as far as the eyes could see. There were strips of green shades, and here and there green splotches, mixtures of yellowish grass stubble fields, scattering oaks and strings of green along streams and stream beds under the blue sky canopy—all aglow with the untempered light of the November sun—and what a country!

"Then and there I paused—overpowered by the picture—an endless plain, and not a house in sight. In my mind came the thoughts: Irrigation, Major Powell's talks, alfalfa along Fountain creek, farms, colonial houses, fruit trees and vines, happy, laughing children, health, happiness, wealth, contentment.

"A new world lay before me. I pledged my effort that something must be done to reclaim those brown endless fields."

Then Marshall began to fight, to promote his dream, and finally in 1919 an appropriation was made by the legislature to carry on the work. Thus was set in motion the great Central Valley irrigation project.

Constant lecturing on, and promotion of, the project resulted in a severe throat ailment. An operation in Philadelphia removing the vocal organs, slowing him to talk only in a whisper, placed the burden upon his faithful wife, Myra.

Mrs. Marshall is the daughter of the late John Bradford Crow, an early settler of the San Joaquin Valley. Her father, for whom Crow's Landing is named, bought a large Spanish grant, a part of the Orestimba grant, southwest of Modesto.

Mrs. Marshall remembers well when most Californians thought her husband's plans were "plain crazy." And they didn't restrict their remarks to plans.

"Bob, you're crazy," they said when he announced that one of the world's biggest dams could be built where Shasta Dam now solidly reposes.

Mrs. Marshall met the man who was to become her husband while he was camped at Aspen Valley

AT THE MARSHALL MONUMENT—(from left to right) Mrs. B. Marshall, Miss Virginia Marshall, Mr. Evans, and Mrs. Evelyn Maddox. *Photo, courtesy of the Fresno Bee, submitted by the author.*

in charge of mapping California for the United States. She says of him that "he was a simple man and a practical man."

"Following the operation for incipient cancer of the larynx he never used his voice again," Mrs. Marshall said.

While Mrs. Marshall would interpret for him she never did so publicly. "I'm not a speaker," she said. "I get on my feet and just tremble."

Marshall spent his last years in San Francisco hoping that he would see the Central Valley project through. "He never gave up for a minute," his wife said.

He died in 1949, just 10 years after he attended the groundbreaking ceremonies for Friant Dam. There he said, "This brings to actuality my dreams of 48 years ago when I began my plan for the comprehensive, coordinated control and use of the water resources of California."

After Marshall died, Governor Earl Warren wrote Mrs. Marshall: "All California is indebted to him for his wisdom in laying the foundation of the Central Valley project and his courage in advocating it at the cost of his own health and at a time when public opinion was hostile."

When asked about the trials which she went through she replied, "You know, I never minded those hard years. What wife wouldn't fight along beside her husband?"

Mrs. Marshall is a woman of culture and refinement. Widely traveled, she is conversant with many parts of the world. Her intellectual grasp of situations is very keen and in her 83 years she exemplifies wisdom and clarity. Mr. Marshall surely had a helpmate who was devoted and competent. Her great service to a great man who had a great idea should be remembered by the millions who will benefit from the huge governmental works of reclamation.

The gratitude of the people of Lindsay for the Reclamation water was expressed in a monument to Marshall which was dedicated and placed in the city park in April 1950. The monument was a large core of foundation rock from the Friant damsite and a bronze plaque said: "Erected in honor of Colonel Robert Bradford Marshall whose vision and untiring service made possible the Central Valley project." Had it not been for this project thousands of rich orchards would have perished.

The daughter, Virginia, in expressing her mother's service to her father said "she gave him the courage that he needed."

Virginia lives with her mother at 2523 Gough Street, San Francisco, Calif. The other daughter, Mrs. Evelyn Maddox, makes her home in Sacramento, Calif. # # #

N. R. A. to Meet in California

The annual convention of the National Reclamation Association is scheduled to be held at Long Beach, Calif., November 12 through 14. This will be their twenty-first annual meeting. •

Reclamation Man Heads Western Soil Scientists

Maurice N. Langley, head of the land use and settlement branch of the Lower Colorado River District, Yuma, Ariz., was elected president of the Western Society of Soil Science, an organization of the leading professional and industrial soils men in the western United States, who recently met at Oregon State College, Corvallis, Oreg.

This represents the fourth year that Langley has held office in this organization. •

Boysen Dam Dedicated

Boysen Dam on the Big Horn River in Wyoming, the eleventh major structure to be completed in the Missouri River Basin project, was dedicated on August 2 at a celebration attended by Reclamation Commissioner Michael W. Straus and other reclamation officials.

During the ceremony, Mr. Straus paid tribute to Major John Wesley Powell, the great geologist, whose vision almost a century ago brought about the present-day development of the Missouri River Basin project. The Boysen unit will provide 15,000 kilowatts of power for the people of the area, has possibilities for irrigating nearby farm lands, and has already proved its value as a recreational center. See article entitled "Fishing at Boysen" on page 213 of last month's issue. •

No Swimming—Yes?

To answer the many queries about our August front cover, the photo was taken by Charlie Knell, Region 6 photographer, one hot June day back in 1950. Sam Larsen, author of the story, "No Swimming—Stay Alive by Staying Out," tells us that the photo was taken in what used to be his back yard. He says that the water is not deep enough to be dangerous there as the canal is not a large one. When he was Superintendent of the Belle Fourche project, the principal hazards to the kids were in connection with eating strawberries and green apples out of his garden. F. C. Winkler, the present project manager, has fixed up the hole by putting in a gravel bottom and the neighbors have a volunteer arrangement to keep an eye on the youngsters while they are in the water. •

Land Office Business at Columbia Basin

The old phrase "doing a land-office business" has become something more than just an old phrase on the Columbia Basin project, where each farm unit that becomes available for sale is met with a deluge of applications from veterans and others anxious to own their own farms.

The first land drawing involved 84 units and 158 applications were received. In succeeding drawings, more and more applications for each unit poured in. So far, 14,564 applications have been made for the 261 units which have been offered in the last 8 public announcements, for an average of 55.8 applicants per unit. One recent announcement which offered 9 units drew a flood of some 2,817 applications from enthusiastic would-be Columbia Basin farmers. •

Vetter Heads Large Dam Commission

Carl P. Vetter, Boulder City, Nev., Bureau of Reclamation engineer has been elected Chairman of the United States Committee of the International Commissions on Large Dams, an international organization for advancing engineering techniques for building and operating high dams.

Vetter, who was elected at a meeting of the United States Executive Committee in Washington, D. C., took office upon expiration of the term of Gail A. Hathaway of the United States Army Corps of Engineers in September. Vetter has been a member of the committee since its reorganization after World War II.

As Chief of River Control of the Colorado River, Vetter's normal job is to regulate the flow of the lower river through operation of Hoover (Boulder), Davis, Parker, and Imperial dams.

The Executive Committee of the international Commission, representing 24 foreign countries, met this fall in Chicago coincident with the principal meeting of the centennial of the American Society of Civil Engineers. •

Comptroller Denit Resigns

W. Darlington Denit, who has served as Assistant Comptroller and Comptroller in the Bureau since 1948, resigned his post on July 17 to enter private business. His assistant, William Peratino, was named acting Comptroller.

CROPS

Castor Beans Meet Aircraft Needs

Irrigation in California's Imperial Valley again demonstrated the tremendous strategic importance of Reclamation. Seventeen thousand acres in the Imperial Valley were planted to castor beans from which an essential lubricant for jet aircraft engines is obtained. The long growing season and fertile soils of the Valley make it an ideal locale for "custom tailoring" to the Nation's highly specialized agricultural needs.

Reclamation Crops Top 3/4 Billion Dollar Mark

Crops valued at $821 million were grown on Reclamation projects in the 17 Western States during 1951 to set an all-time record for crop income. The top per acre value was $2,500. The over-all total income exceeded that of the previous year by a quarter of a billion dollars and thoroughly reflected the impact of new acres and greater production on federally irrigated lands. It also indicates that still larger returns may be expected from large projects now nearing completion when they go into full production.

Top-value crops for 1951 included tomatoes from the Coachella Division of the All-American Canal project in Southern California, $2,500 per acre; strawberries from Salt River project in Arizona, $2,200 per acre; flowers from Rio Grande project, New Mexico and Texas, $2,118 per acre, and nursery products from Lewiston Orchards project in Idaho $2,000 per acre. The Coachella Division rated first in the largest number of premium crops (those returning $500 or more per acre) with 15 varieties. Salt River and Central Valley tied for second place, each with 12 varieties grown. The combined values of these crops was almost $32,600,000. All told, on 34 projects (about half of the Bureau's total of 69) farmers produced crops valued at more than $500 an acre.

Commissioner Straus pointed out that as the older projects attain full production and the newer ones make their increasing contribution to the world food supply, the Nation can count upon Reclamation soon to furnish an annual billion-dollar addition to its economic structure. A significant part of the increases in crop production resulted from the extreme flexibility of irrigation farming and its ability to adapt production to national needs. More than $100,000,000 of this total increase in crop value came from acres receiving irrigation water from Bureau of Reclamation facilities for the first time.

The cumulative value of crops produced on Reclamation projects is now about $8 billion. This is four times the approximate $2 billion spent on all Reclamation works to date. ●

LETTERS

A Civil Engineer and a Captain

Among our letters this month, we were proud to receive the following indications of the widespread interest in our official publication.

48th Supply Squadron
48th Fighter Bomber Wing
APO 119
c/o Postmaster, New York, N. Y.

DEAR SIRS: Enclosed is a check for $1.50 for 1 year's subscription to your very fine magazine, the Reclamation Era. Please note my change of address.

Very truly yours,

CAPTAIN JOE STAHL.

133 Noble Street
Brooklyn 22, New York

DEAR SIRS: I am a civil engineer and have just returned from a rather extensive tour of many of your projects in the far west and was tremendously impressed by the wonderful work going on out there and particularly at the Denver Federal Center Laboratory.

I would like to keep further informed on this work by subscribing to your periodical "Reclamation Era." Enclosed please find a check for $1.50.

Respectfully yours,

STEPHEN MIKOCHIK.

Banker's Friend

From the First National Bank of Glasgow, Mont., comes this gratifying note regarding the Bureau of Reclamation's official publication:

DEAR SIR: I just received my first copies of the Reclamation Era. I'm very pleased with them and especially so since both the June and July Issues contain articles on our own Milk River Project.

The articles and information will help me to better acquaint myself with Reclamation and irrigation projects and procedures.

Also these copies are placed in our lobby in a special farm bulletin rack for people to study.

Very truly yours,

STEPHEN J. URS,
Agricultural Representative.

Good Reading for Chamber of Commerce

DEAR MRS. SADLER: We discovered with much interest and pleasure the fine article, "Yuma—an investment that makes cents" in the June issue of the Reclamation Era.

Could we get permission to reprint this article, with full credit of course, in the monthly publication of the Yuma County Chamber of Commerce? I have enclosed a copy for your information.

I happen to be in charge of editing the publication for the Chamber this year, and I think this one would make fine reading for our members.

Sincerely,

JONES OSBORN,
Publisher, The Yuma Daily Sun.

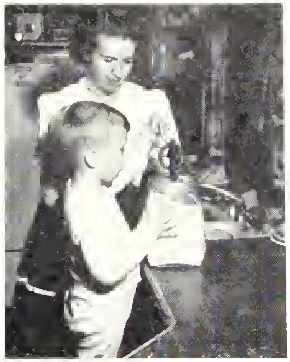
Permission gladly given—Ed.

Boys and Butter

BOX 134, WILLOWS, CALIF.,
May 22, 1952.

DEAR MADAM: The front page picture of the February issue of the ERA recalled to my mind one I took of Mrs. Crouch and my youngest grandson 19 years ago when I was caretaker at the Stony Gorge Reservoir (Orland project, California) from 1928 to 1937. Mrs. Crouch passed away May 9, 1951, and my grandson, Gene Clow, reaches his majority tomorrow and has passed his physical examination for the Navy.

A photo of 19 years ago by Jonas H. Crouch, Orland project



Our cover for February '52.

If you care to use this picture, do so. I would appreciate its return as it is the last one I have and I can't find the film.

Sincerely yours,

JONAS H. CROUCH

Here are both photos—the February 1952 cover and Mr. Crouch's picture taken in 1933, proving that times do not change very much, after all, and there is something fascinating about a butter churn—particularly to very young boys.—Ed.

A Comment from Colorado

Thanks to Mr. Marc G. Williamson for this complimentary note to Commissioner Michael W. Straus:

Tell Mike Straus for me that he and his helpers are doing a H . . . of a good job on the ERA.

RELEASES

The Status of Planning Reports

Before the dirt begins to fly on a construction job for a reclamation project, money has to be appropriated by the Congress. Before that, the project must be authorized and repayment contracts negotiated so that the Government's investment is protected. Even before a project reaches this stage, the plan for the project must be carefully considered by the States and other agencies who will be affected by the dam, reservoir, power plant, or other structures designed to conserve western water resources, and develop them for the maximum benefit of the greatest number of people.

At the present time, four reports approved by the Secretary of the Interior are circulating among the interested States and Federal agencies for review and comment. These reports are on the Trinity River Division and Sacramento Canals Unit of the Sacramento River Division, both of which are part of the Central Valley project (Ultimate Development), in California; the Canton project of Oklahoma, and the Santa Maria project of California. When the comments of the reviewing agencies are received, they are incorporated in a final report which is approved and adopted by the Secretary of the Interior prior to its transmittal to the President of the United States, via the Bureau of the Budget.

Occasionally after compiling the necessary surveys, investigations, charts, maps, and tables which are required before a project can be authorized, designed and constructed, the engineers and other technicians of the Bureau and cooperating agencies find that the project is not feasible from an engineering, economical, agricultural or other standpoint. In such cases, even though the law does not require it, the planning reports are sent to the interested States and Federal agencies for their information, with the notation that the Secretary of the Interior does not recommend authorization and construction by the Federal Government at the particular time. At present there are three reports on projects thus considered infeasible, which have been recently transmitted to the Secretary for his final approval after being reviewed by the interested States and Federal agencies. These are on the Payette Heights Unit of the Payette Division of the Boise project in Idaho; the Fort Gibson project in Oklahoma; and the Braziel Dam and Reservoir in Nebraska—proposed as supplemental works for the Fort Laramie Division of the North Platte project in Wyoming and Nebraska. After the Secretary has given his final approval to these reports and the recommendations contained therein, these unfavorable reports are also transmitted to the President with the reviewers' comments for information and future reference.

The report on the Colorado River Storage project and Participating projects to be located in the Upper Colorado Basin States has been reviewed by the States and Federal agencies, and is now awaiting final action by the Secretary of the Interior and transmittal to the President. Also awaiting final action by the Secretary is the report on the Swan Lake project to be located near Ketchikan, Alaska, which has been reviewed by the interested States and Federal agencies.

Favorable reports are transmitted in accordance with the provisions of the Flood Control Act of 1944 (58 Stat. 887), act of August 14, 1946 (60 Stat. 1080), and voluntary agreement between the Federal agencies concerned with water resources. As stated above, unfavorable reports are transmitted on a purely voluntary basis. ●

Central Valley Booklets

The Bureau of Reclamation recently released three illustrated folders containing information regarding the Central Valley project, entitled as follows, "Central Valley Project," "Shasta Dam," and "Friant Dam." A limited supply is available free of charge from the Bureau of Reclamation, Supply Field Division, Attention: 841, Building 53, Denver Federal Center, Denver 2, Colo.

Land Reform—A World Challenge

The State Department recently released an 80-page booklet entitled, "Land Reform—A World Challenge" containing statements regarding the problems of land tenure in the world. This publication is for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 20 cents a copy.

NOTES FOR CONTRACTORS

Contracts Awarded During August 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3695	Missouri River Basin, N. Dak.	Aug. 26	12 lots of very high-frequency radio equipment and 20 mobile radio transmitter-receiver combinations for Missouri-Souris District, schedule 1.	Radio Corp. of America, Camden, N. J.	$37,910
DC-3721	Central Valley, Calif.	Aug. 11	Construction of earthwork and structures for lateral 6.2 and sublaterals, for east section of Unit 1 on Madera distribution system.	H. Earl Parker, Inc., Marysville, Calif.	2,096,200
DS-3728	Missouri River Basin, N. Dak.	Aug. 25	One 15,000-kilovolt-ampere transformer with 3 lightning arresters for Washburn substation.	American Elin Corp., New York, N. Y.	103,425
DS-3730	Missouri River Basin, Wyo.	Aug. 12	1 controlling and 2 controlled station supervisory control and telemetering switchboard sections and associated equipment for Thermopolis and Lovell substations and Boysen power plant, schedule 1.	Control Corporation, Minneapolis, Minn.	23,540
DS-3735	Davis Dam, Ariz.-Nev.	Aug. 29	One 69,000-volt circuit breaker for Cochise substation, schedule 1.	Brown Boveri Corp., New York, N. Y.	13,539
DS-3736	Central Valley, Calif.	Aug. 13	One 50-ton gantry crane for Nimbus power plant	Judson Pacific-Murphy, Emeryville, Calif.	98,300
DS-3738	do	Aug. 12	Six 10.5- by 12.25-foot fixed-wheel gate frames for intakes at Nimbus power plant.	Valley Iron Works, Yakima, Wash.	26,500
DS-3740	Missouri River Basin, Mont.	Aug. 29	3 horizontal-shaft, centrifugal-type pumping units for Crow Creek pumping plant.	Economy Pumps, Inc., Philadelphia, Pa.	48,810
DS-3741	Missouri River Basin, S. Dak.	Aug. 25	One 15,000-kilovolt-ampere transformer with 6 lightning arresters for Weaver substation.	American Elin Corp., New York, N. Y.	85,535
DS-3749	Central Valley, Calif.	Aug. 15	Six 10.5- by 12.25-foot fixed-wheel gates for intakes at Nimbus power plant.	Pacific Coast Engineering Co., Alameda, Calif.	39,180
DC-3751	Colorado-Big Thompson, Colo.	Aug. 13	Construction of Parsball flume and inlet for Aspen Creek siphon, power canal No. 1.	Crocker and Ellett, Inc., Denver, Colo.	99,115
DC-3753	Missouri River Basin, Mont.	Aug. 29	Construction of Toston tunnel and access road	A. J. Cheff Construction Co., Seattle, Wash.	326,964
DC-3755	Central Valley, Calif.	Aug. 25	Construction of earthwork and structures, turn-out extensions, and 13 venturi meter installations for Friant-Kern canal.	Gardner and McCall, Long Beach, Calif.	77,405
DC-3766	Columbia Basin Wash.	Aug. 22	Cleaning and painting floating caisson, caisson drydock, and accessory equipment at Grand Coulee Dam.	Runnels Paint Co., Seattle, Wash.	24,600
117C-148	do	Aug. 25	Ringold Pumping Plant to Babcock Pumping Plant 13.2-kilovolt transmission line.	G. A. Estep Electric Co., Yakima, Wash.	37,524
100C-148	Minidoka, Ida.	Aug. 27	Drilling 5 water supply wells	Commons Drilling Co., Rupert, Idaho	21,045
100C-149	Hungry Horse, Mont.	Aug. 21	Relocation of east side Forest Service telephone line, section 3a.	Robert D. Claxton, Somers, Mont.	27,038
200C-206	Central Valley, Calif.	Aug. 12	Shoulder drains, drain crossing, and road culvert, Delta-Mendota Canal.	Dana R. Tyson Co., Sacramento, Calif.	15,630
200C-207	do	Aug. 21	Constructing 5 radio reporting rain and snow gage stations.	M. C. Balwin and A. E. Mangs, Watsonville, Calif.	12,900
200C-208	do	Aug. 19	Constructing temporary headquarters at Nimbus Dam.	Waterbury and Chapek, Sacramento, Calif.	37,573
300S-37	Davis Dam, Ariz.-Nev.	Aug. 21	161-kilovolt power circuit breaker for Knob substation; schedule 1.	Brown Boveri Corp., New York, N. Y.	34,211
300C-39	Gila, Ariz.	Aug. 5	Gravel road surfacing for Mohawk and Wellton canals and construction of Ligurta Creek dike.	James E. Roberts, San Bernardino, Calif.	90,000
605C-18	Missouri River Basin, Mont.	Aug. 25	Drilling holes for groundwater investigations at Yellowtail dam site.	Vivian Brothers, Kellogg, Idaho	10,862
601C-24	Missouri River Basin, Wyo.	Aug. 22	Transmission line connecting road at Boysen Dam	Ready Construction Co., Thermopolis, Wyo.	13,160
703C-265	Missouri River Basin, Nebr.	Aug. 12	Construction of Ogallala substation	Commonwealth Electric Co., Lincoln, Nebr.	26,791

Construction and Materials for Which Bids Will Be Requested by December 1952

Project	Description of work or material
Cachuma, Calif.	Construction of chain-link fence around Glen Anne Reservoir area, 9 miles north of Santa Barbara, Calif.
Central Valley, Calif.	Construction of remaining portion of Contra Costa canal distribution system, consisting of 15.8 miles of of 12- to 60-inch diameter reinforced concrete pressure pipeline between Antioch and Martinez, Calif., for Contra Costa County water district. Work includes furnishing and laying pipe, constructing moss screen and turn-out structures, installing stationary moss screens, gate valves, meters, slide gates, pipe vents, and air valves.
Do	Construction of 16 miles of precast 12- to 48-inch diameter concrete pipelines for unit 2 of Saucelito irrigation district on the Friant-Kern canal distribution system. Work includes construction of monolithic moss screens and pumping plant structures and installation of moss screens and pumping units. Located east of Pixley, Calif.
Do	Construction of Camp Creek diversion dam, a concrete overflow weir 44 feet long and 10 feet high built on a rock foundation. Work also includes construction of a 70-foot-long headworks, including a 7- by 7-foot radial gate, which diverts water into Camp Creek tunnel and finally into Sly Park Reservoir. Work located on Camp Creek, 2 miles east of Sly Park, Calif.
Central Valley, Calif., (Continued)	Construction of 32 miles of unlined or earth-lined laterals varying in width from 6 to 18 feet, for the north section of Madera distribution system's unit 1, near Madera, Calif.
Do	Two 5,000-volt, metal-clad switch-gear assemblies with two 250,000-kilovolt-ampere air circuit breakers in each assembly for Nimbus power plant.
Do	360,000 pounds fabricated galvanized structural steel for bolted switchyard structures at Folsom and Nimbus power plants.
Do	4 motor control cubicles for controlling 2,300-volt synchronous motors for the Contra Costa pumping plants.
Colorado-Big Thompson, Colo.	Installing gravity drain for stilling basin on Horsetooth feeder canal, 5 miles west of Fort Collins, Colo
Columbia Basin, Wash.	Construction of 6.5 miles of 36 cubic feet per second capacity channel for interception and conveyance of excess ground water in the vicinity of Soap Lake, Wash. Work includes lining the channel with 3-inch concrete and construction of a 20-foot drop structure and four road crossings.
Do	Repair of breaks in the lined sections of the East Low canal in the vicinity of Rocky Coulee siphon, either by intrusion grouting or by removing existing concrete lining, backfilling with select materials and placing new concrete lining.

Construction and Materials for which Bids Will Be Requested by December 1952 (Continued)

Project	Description of work or material
Columbia Basin, Wash., (Con.)	Construction of a 34-mile reach of unlined East Low canal, varying in capacity from 1,490 to 550 cubic feet per second and a base width of from 22 to 20 feet, to extend south from Warden, Wash.
Do	Construction of 56 miles of unlined laterals, sublaterals, and wasteway, varying in capacity from 2 to 232 cubic feet per second and in bottom width from 2 to 16 feet, for lateral area P-8 on Potholes East canal, near Eltopia, Wash. Work also includes construction of drops, checks, turnouts, weirs, and nine outdoor type pumping plants of 3 to 118 cubic feet per second capacities.
Do	Three 45 cubic feet per second pumping units for Warden plant, three 13.7 cubic feet per second and two 8 cubic feet per second pumping units for Warden relift plant, three 24 cubic feet per second pumping units for EL-63.1 plant, one 9 cubic feet per second pumping unit for EL-63.1E plant, two 7 cubic feet per second units for EL-61.7 plant, and two 8 cubic feet per second units for EL-61 plant, all on East Low canal.
Davis Dam, Ariz.-Nev.	Erecting steel structure and mounting 161-kv buses and switches for Buckeye substation near Buckeye, Ariz. The steel and electrical equipment is Government-furnished.
Do	Installation of unit substation and other electrical equipment, erection of steel structures, and construction of concrete foundations for the 8,000/10,000-kilovolt-amperes Maricopa substation near Maricopa, Ariz.
Do	One 28,667/35,833-kilovolt-amperes and one 25,000-kilovolt-amperes transformer for Prescott substation.
Missouri River Basin, Nebr.	Construction of 20 miles of Bartley canal near Bartley, Nebr. Main structures are siphons, overchutes, culverts, turnouts, and timber bridges.
Do	Construction of Bartley diversion dam, a concrete overflow weir 1,100 feet long and 3 feet high above river bed. It will have steel sheet piling cut-offs, sluiceway, and canal headworks. Dam is to divert water into Bartley canal for irrigation of land on the south side of the Republican River. Dam site near Indianola, Nebr.
Do	Construction of 2.4 miles of 685 cubic feet per second capacity Courtland canal, 3 miles southeast of Superior, Nebr. Work includes 9 embankment sections which are to serve also as detention dams, 5 timber bridges, 2 drainage inlets, 2 lateral turn-outs, 9 detention basin evacuation conduits, and 0.4 mile of unreinforced concrete canal lining.
Missouri River Basin, Kans.	Construction of Webster earthfill dam foundation, involving 400,000 cubic yards of excavation for cut-off trench, and placing 1,000,000 cubic yards for a portion of dam embankment. Dam site is on the south fork of the Solomon river, near Webster, Kans.
Do	Painting certain exposed metalwork, piping, and conduits in Boysen power plant and switchyard, about 20 miles south of Thermopolis, Wyo.
Missouri River Basin, Mont.	Constructing two 3-bedroom permanent type residences with water-supply well and septic tank or other sewage disposal means at Missouri diversion dam site near Frazer, Mont.
Missouri River Basin, S. Dak.	Construction of 15,000-kilovolt-amperes Weaver substation for the Air Force base near Rapid City, S. Dak.
Missouri River Basin, Wyo.	Construction of 2,000-kilovolt-amperes North Cody substation near Cody, Wyo.
Missouri River Basin, Kans.	Completion of 105-foot high by 12,600-foot long Kirwin earthfill dam, located on the north fork of the Solomon River near Kirwin, Kans. Work consists of excavation for structures, completion of excavation for foundation of dam, completion of dam embankment and construction of concrete structures. Concrete construction will include a 400-foot wide spillway with chute and stilling basin, a canal outlet works with conduit, intake structure, gate chamber, stilling-well, and a concrete-pipe river outlet with stilling basin. Installation of high-pressure gates will be required in the spillway sluices and in the outlet works.
Missouri River Basin, S. Dak.	Construction of Missouri River crossing for Oahe-Midland 115-kilovolt transmission line. Work includes constructing foundations and erecting steel towers, furnishing and stringing conductor and ground wire for a 2,400-foot long crossing span and two 800-foot anchor spans.
Missouri River Basin, S. Dak.	Constructing foundations for and erecting steel towers; installing de-icing switches and transformers; furnishing and stringing conductor and ground wire for transmission line approaches to Fort Randall switchyard and dam near Fort Randall, S. Dak.
Missouri River Basin, Mont.	Three 6,667 kilovolt-ampere generators for Little Porcupine power plant.
Palisades, Idaho	Four oil pressure, cabinet-type actuator governors for regulating speed of four 39,500-horsepower hydraulic turbines for Palisades power plant.
Do	Four 35,000-kva transformers for Palisades power plant.
Shoshone, Wyo	Construction of less than 0.5 mile of 10 cfs capacity laterals with 5 turnouts and 4 small drop structures.
Do	Leveling building sites of Heart Mountain camp area and obliterating 12 miles of roads.

United States Department of Interior, Oscar L. Chapman, Secretary

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THE RECLAMATION AREA

The Reclamation ERA

November

1952

Official Publication of the Bureau of Reclamation

November 1952

Volume 38, No. 11

The Reclamation ERA

35 Years Ago In The Era

The Harvest of 1917 Has Been Garnered

The granaries are filled with cereals. Huge stacks of forage are clustered about the feed lots. Livestock of all kinds is in good condition. And the storage cellars are filled with vegetables. Approaching winter finds the project farmer satisfied with the result of his labors and the assurance of good demand and prices for all crops.

The Reclamation Service closes the season with reports of good progress in all lines of construction, of satisfactory delivery of water to a greatly increased acreage, and a continuance of cordial relations between the farmers and the operation forces.

Notwithstanding the stress and worry incident to the crisis through which we are passing, the service and the people have much to be thankful for this year.

ARTHUR P. DAVIS

(From the front cover of the November 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA).

OUR FRONT COVER—TIBER DAM, FIRST CONTRACT AWARDED ON THE "NEW STARTS" (see p. 227, September 1952 issue). Here, Robert J. Kennedy is sighting through a transit at Tiber damsite south of Chester, Mont. On October 1, President of the United States Harry S. Truman visited the scene of construction and pushed a plunger, setting off the first explosion. Tiber Dam, key water-control feature in the Lower Marias Unit of the Missouri River Basin project will be an earth-fill structure, 4,300 feet long and 205 feet high, with a dike 17,000 feet long and 60 feet high. The reservoir, extending 25 miles upstream, will provide storage capacity for 1,337,000 acre-feet of water.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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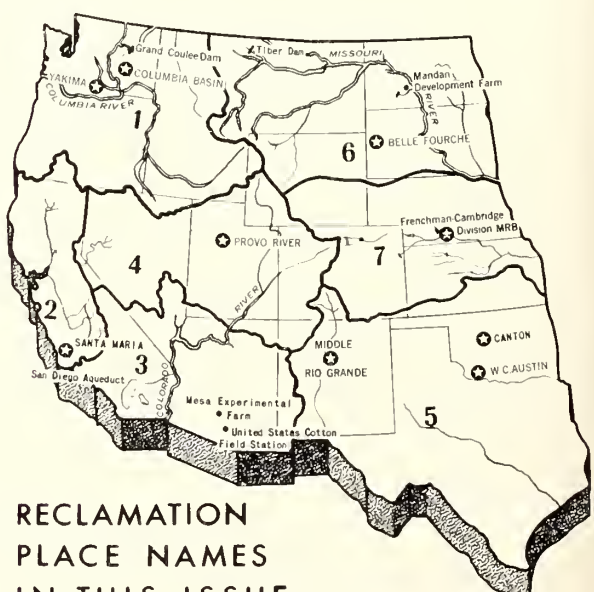
In this issue . . .



RECLAMATION PLACE NAMES IN THIS ISSUE

IN 1948—3½ BALES PER ACRE were grown on the Number 1 first foundation field of high yielding, high quality . . .

ARIZONA 44 COTTON

by PROFESSOR E. H. PRESSLEY, Plant Breeder

College of Agriculture and Agricultural Experiment Station,

University of Arizona, Tucson

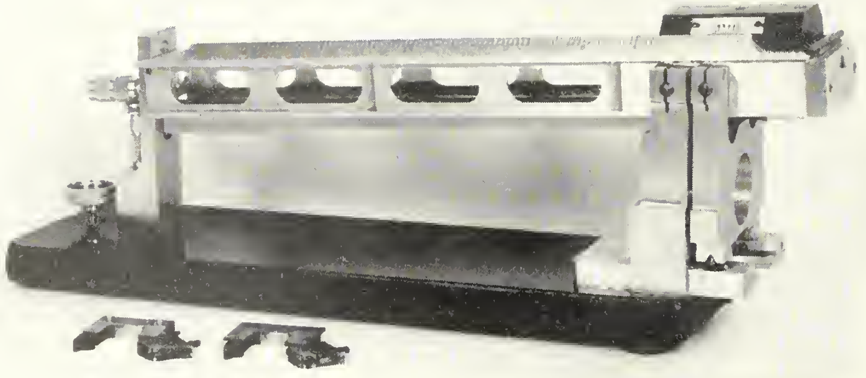
When Professor Pressley began his cotton breeding work at the Arizona Experiment Station, certain spinners were casting aspersions against "irrigated cotton," believing it to be inferior in strength and spinning qualities to rain-grown cotton, even though yields under irrigation were higher. Professor Pressley's job was to determine whether breeding could improve the quality of the fiber as well as the quantity.

As there was no mechanism available for quick-testing individual plant selections, Mr. Pressley designed and constructed the Pressley strength tester to enable the breeder to propagate only plants with strong lint or fiber. Consequently spinners are now assured that new selections sent to them for testing are known to be strong. Mr. Pressley's success in developing the superior varieties of cotton now grown by Arizona farmers has proved that "irrigated cotton" is among the best.—Professor W. E. Bryan, Head, Department of Plant Breeding, College of Agriculture and Agricultural Experiment Station, University of Arizona.

ARIZONA 44 APPEARS TO BE THE BEST BET for "irrigated cotton" growers in Arizona so far as production and spinning quality are concerned.

In 1941, as part of a general cotton breeding program, we crossed many southern varieties with each other as well as with varieties being commonly grown in the irrigated areas. Among these crosses was one between New Mexico 1517 and Santan, a local strain of California type Acala. The New Mexico 1517 variety represents the first "break" in the prejudice against irrigated cotton, as it has the longest fiber (approximately $1\frac{1}{8}''$) of the "upland" types of cotton, has exceptional strength, and good spinning quality. It was developed at high altitudes of about 3,800 feet and is adaptable to high, cool mountain valleys. In the hot, low valleys of Arizona this medium staple cotton did not have as high a yield.

Santan, on the other hand, was developed from the California Acala and was well adapted to hot



THE PRESSLEY STRENGTH TESTER. *This device, which somewhat resembles a weighing machine, is used to determine the strength of cotton fibers. The two halves of the "breaking clamps" are shown in the foreground. Photo submitted by the author, and inventor of the testing machine, E. H. Pressley.*

valleys, having an excellent yield, but with a less desirable fiber quality.

The result of crossing the "high altitude" New Mexico 1517 with the "low altitude" Santan was Arizona 44, which combines the former's spinning quality with the latter's high yield.

Nothing of value was obtained from crosses involving southern varieties, and so far in our cotton breeding program we have discarded most of the other strains, although breeding work is being continued in the hope of achieving further improvement.

By 1946 several of the strains coming out of the cross between 1517 and Santan were sufficiently uniform to make the first test, at which time Arizona 44 appeared to be one of the best from the standpoint of yield. Cotton breeding often involves crossing of varieties to increase segregation which provides a wider range for selection. Then the job is to make selections from the segregating generation to get the desired combinations of characteristics carried by the parents. After the cross has settled down to a uniform type, a seed program may be started in which foundation seed is planted, from which registered seed is produced, and which in turn provides the certified seed for the grower. It takes about five or six generations to get a new variety stabilized.

In 1947 we began a thorough program of testing, in cooperation with the United States Cotton Field Station at Sacaton, Ariz. Three locations were selected: in Maricopa County we had the Mesa Experimental Farm, and in Pinal County we had plots at Sacaton and near Casa Grande.

At the end of the 1947 season we discarded four strains and during the next 4 years included eight new strains and varieties. Between 1947 and 1951 we made spinning and other tests on a total of 123 plots for each variety grown at the several locations.

For comparison with Arizona 44, we used the formerly popular P18–C cotton, a medium staple cotton with a fiber length of about $1\frac{1}{16}$ inches, which, although it lacks fiber strength, is particularly adapted to irrigation. Arizona 44, however, out-yielded P18–C in 11 out of 14 separate tests despite the fact that during the 5-year testing period weather conditions varied considerably. For all tests run over the entire period, Arizona 44 came out ahead by 4.2 percent or an average of 43 pounds of lint per acre, representing an average yield of over 2 bales an acre.

The greatest gain achieved with the new variety is in the strength of the yarns which is considered the most important reliable single index of spinning quality. For the 14 spinning tests conducted, the average breaking strength of "22s" yarns made from Arizona 44 has been 122.3 pounds. (22s is one of the standard laboratory yarn numbers, used for testing the spinning qualities of cotton. Other standard yarn numbers are 14s, 36s, 44s, 50s, 60s, 80s, and 100s, assigned according to the number of cotton skeins per pound.—Ed.) This means that it would take a 122.3 pound weight to break a skein of yarn made of Arizona 44 cotton. In the same series of tests 22s yarn made from P18–C had an average breaking strength of 108.4 pounds. According to yarn strength classifications as set up by the Production and Marketing Administration who made the tests, anything above 119 pounds for 22s yarn is excellent.

Other gains have been made in spinning quality, other than strength. For example, Arizona 44 cotton has 12 percent fewer "neps," or small knots, per 100 square inches of card web, than P18–C. In appearance, Arizona 44 is one-half a grade better than the P18–C, making it more desirable for use in higher quality fabrics. There is very little difference in staple length or in the percentage of waste between the two. There is some variation in the fineness of Arizona 44 cotton, which may eventually result in further improving its spinning quality. At present the fibers are apparently a little too fine for the production of the best quality yarns, although some spinners have reported good results by blending it with coarser cottons.

In the past 2 years we made spinning tests on two Arizona 44 families, one having the coarsest and the other the finest fibers. Both in 1950 and in 1951 the coarser fiber produced yarns with an appearance index of 110—considered good by testing standards, while the finer fiber was graded at 100, or average.

If we get the same results after further intensive tests this year, we will remove the finer fibered families from the parent seed to improve considerably the spinning quality of Arizona 44 fiber in the course of a few years.

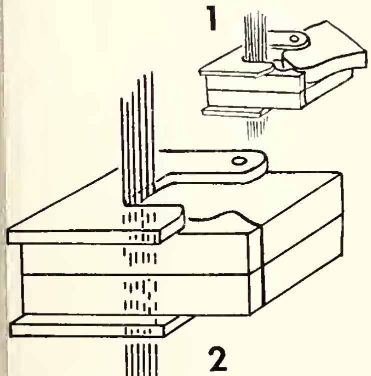
Arizona 44 has been accorded a much better reception by spinners than has P18–C, against which there has been so much prejudice that some buyers have stated they will purchase no Arizona cotton so long as P18–C is being grown, and others now indicate that they would use much more Arizona 44 but for the possibility of getting some P18–C at the same time. It appears now that P18–C may be completely out of the picture in a few more years.

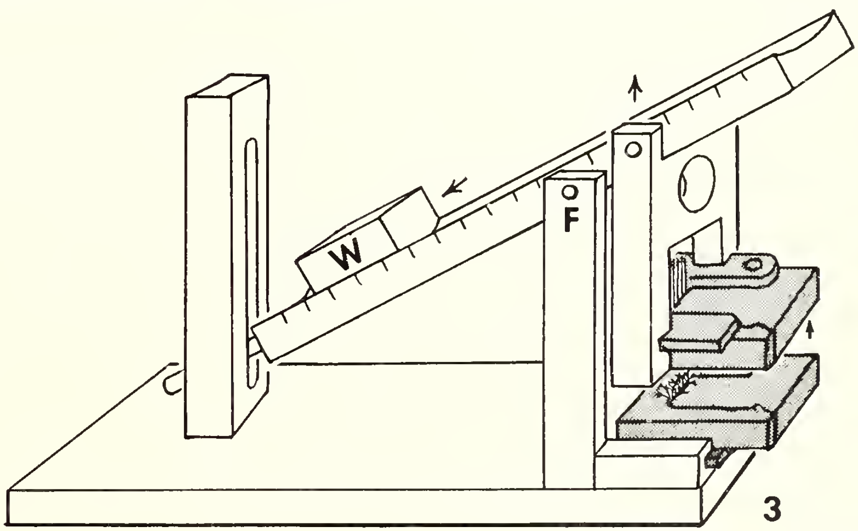
Since a few growers have brought up the question of the seed of Arizona 44 "running out," some explanation should be given regarding the plans for maintaining the purity of the variety. An organization whose membership consists of growers of pure cotton seed, known as the Arizona Cotton Planting Seed Distributors, has been set up to take care of the production of planting seed of approved varieties, and to furnish them to the growers at the least possible cost.

According to an agreement between this organization and other interested parties, the Plant Breeding Department of the University of Arizona will each year supply the seed distributors with from 15 to 20 pounds of selfed Arizona 44

(Please turn to page 258)

HOW STRONG IS THE FIBER? The Pressley Strength Tester helps to answer this important question. First a sliver (pronounced *sligh*-ver) or small roll of cotton is combed into tufts, about 2 inches long. From one of the tufts a ¼-inch wide "ribbon" of flat, parallel strands of cotton is combed and placed in a set of breaking clamps, as shown in figures 1 and 2. When trimmed and inserted in the clamps, the ribbon becomes a "bundle." The clamps are inserted in the Pressley tester as indicated in the exaggerated and simplifield figure 3. As the weight moves down the beam, the bundle of cotton reaches its breaking point, the clamps click apart, and the sliding weight stops, indicating to the nearest one-tenth of a pound, how much "pull" it takes to break this particular sample. The two broken pieces of the bundle are carefully picked up with tweezers and placed in a weighing device to determine the bundle's weight to the nearest hundredth of a milligram. From these figures, cotton testers figure how many pounds per square inch it takes to break a bundle 1-inch square. Six "breaks" and "weighing's in" are made on each sample, and two people make three each to assure accuracy and take care of variations in handling the sample. *Drawing by Graphics Section, Washington, D. C., based on information from the Cotton Branch, Production and Marketing Administration, United States Department of Agriculture.*





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FOUR-WAY PROTECTION along the West Canal, Columbia Basin project, within the city limits of Ephrata, Wash. Fenced banks, locked access gates, warning signs, and the means for escape are provided for the unwary if all these precautions fail.

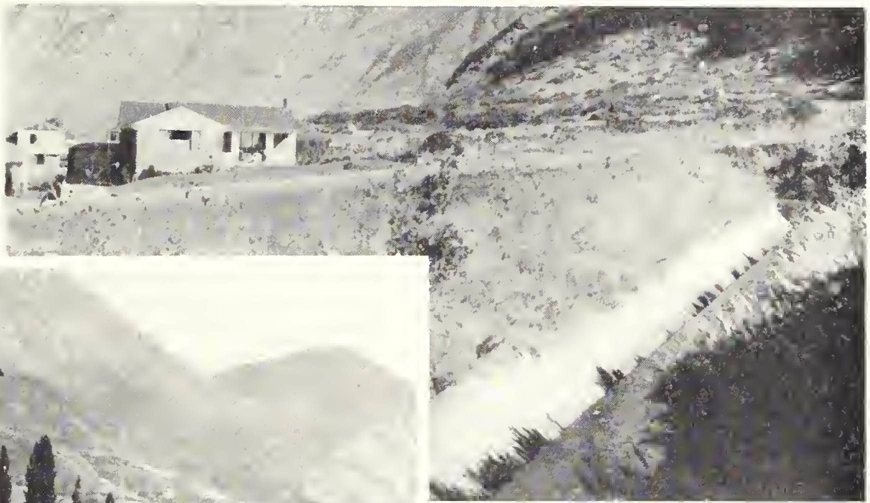
CANAL SAFETY IS OUR BUSINESS

by R. J. WILLSON, Assistant Operation and Maintenance Liaison Representative, Design and Construction Division, Denver, Colo.

"92 KNOWN DEAD" would easily make the headlines if the tragedy were the result of flood, fire, train wreck, explosion, or other major catastrophe. But recorded one by one, only those directly concerned take much notice. The grim, hard facts are that on only three of the Bureau of Reclamation's projects in the western United States, 92 men, women, and children have lost their lives. Most of them might still be living had they realized the ever-present danger of flowing water in irrigation canals. It is true that the accident rate on all the projects is not as high as on the three projects where the 92 tragedies occurred, but the danger exists and that is the important fact we must bear in mind.

Canal safety is our business whether we are the designers, builders, operators, irrigators, or dwellers on an irrigation project. We must see that the same water which is so necessary to our existence does not become a menace threatening the lives of the very ones who depend upon it. We who design, build, operate, maintain, and live near irrigation systems and their indispensable canals, siphons, chutes, and other structures, are aware of the inherent hazards in an irrigation canal. Even so, we may become careless—and tragedy is often the result of our carelessness.

The general public, on the other hand, does not usually realize that the apparently peaceful and invitingly cool water can sweep a man several hundred feet before he can catch his breath. And if he doesn't drown from the panic brought on when he finds that the water is too deep for him, he may be swept suddenly into a siphon, over a check, or through other irrigation structures.

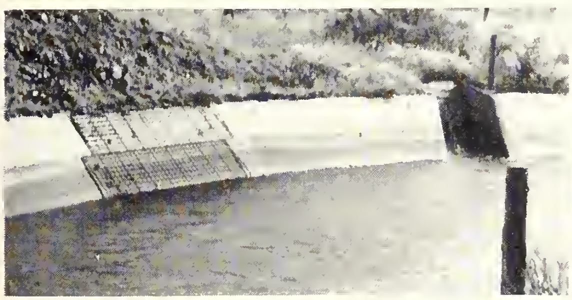


CLOSING IN ON THE CANALS. Above, a canal built in a once uninhabited area. Ever-expanding population and spreading farm and home developments call for protective measures. At left, a highway along the Provo Reservoir Canal, Deer Creek Division, Provo River project, Utah. Chain-link fencing with barbed-wire guard at top keeps vehicles from running into the canal, prevents access by the public, and protects domestic animals. *Both photos by R. W. Reitz, Region 4.*

Since canal safety is our business, it is the joint responsibility of all of us to mind our business in several ways. One way to protect the unwary is to fence off hazardous reaches. Perhaps a more effective way to caution the unknown is to publicize through newspaper articles, radio broadcasts, signs and posters, and movies the hazard of using a canal as a recreational facility.

On many reclamation projects, both old and new, plans are under way or being considered for the use of irrigation facilities for recreational purposes such as swimming and fishing and boating, and parks to entice people to safe areas and reduce the tendency of youngsters and adults to slip away to the canal for a "dip." Such facilities will afford new opportunities for hunters and fishermen to apply their skills and tend to eliminate accidents like the one which occurred recently when a fisherman, trying his luck in the deeper ponds of a sluiceway, was drowned in a sudden surge of released water.

The problem of making canals safe requires an individual study for each project. What must be done varies with the density of population, size



STEEL BARS DO NOT A PRISON MAKE—they are a means of escape from canals. Above, reinforcement bar mats and an escape ramp on the side slopes of the North Branch Canal, Kittitas Division, Yakima project, Washington. At right, handrails and escape ladders at the Jordan Narrows Siphon of the Provo River project, Utah. *Photo above by S. T. Larsen, Denver, Colo.; at right by R. W. Reitz, Region 4.*

of the canals, types and numbers of structures, and the terrain. Warning signs barring the public from these canals are not sufficient. Policing a large canal system to enforce the regulation is both practically and economically impossible. Cooperative effort by project management, water users, and civic and safety organizations to publicize unsafe practices relative to irrigation canals appears to be a better approach to the solution of canal safety.

Canal safety is being extended to embrace both domestic and wild animal protection. In some areas, remote from population centers, the yearly toll of domestic and wild animals is extremely high. An animal coming to drink from the canal often loses its footing and, being unable to gain firm footing to climb back to dry land, it is swept down the canal and drowned. Escape devices, both for animals and humans, are difficult to construct without interference to canal operation or debris removal. However, we are developing practical escape devices for both humans and animals.

Although a completely safe canal can probably never be built—there are always those who will deliberately disregard all warnings—safety measures which will materially reduce the number of accidental deaths can be built. With full cooperation from all, we can reduce the too numerous drownings which result from swimming, bathing, or fishing in reaches of canals or other waterways where such practices are hazardous. We can also design our structures to provide a maximum of protection for workmen and operators. Although we will not always know where a safety installation has saved a life, we do know now that there have been no accidents on many canals where safety measures have been installed. ###

Arizona 44 Cotton

(Continued from page 255)

seed, known as breeder's seed. The Department will at the same time supply the distributors with approximately 1,000 pounds of parent seed grown from the breeder's seed of the previous year. The distributors will select one or more growers who will plant this seed and who will grow, under the supervision of the cotton breeder, parent and foundation fields. Registered seed thus produced will then be used for the production of certified seed used for general planting. All seed from the general crop should go to the oil mill for crushing. According to this plan the main crop should never be more than 5 years away from selfed seed.

This plan should forestall a reoccurrence of the unfortunate situation which arose in 1951 when the demand for Arizona 44 seed was so great that some fields were planted with seed not eligible for certification because of a lack of proper isolation. As a result there were hybrids between Arizona 44 and American Egyptian, which detracted a great deal from the appearance of our fields, and which may have injured the spinning quality of 44 to some extent.

In conclusion, we believe Arizona 44 has taken irrigated cotton out of the "penalty" class, into the "premium" class, proving that high quality as well as high quantity crops can be grown under irrigation. ###

Plans Released on Santa Maria Basin

Bureau of Reclamation plans for constructing the 184-foot-high Vaquero Dam and 214,000 acre-foot storage reservoir on the Cayuma River, 7 miles from the city of Santa Maria, Calif., and Corps of Engineers' plans for installing levees and channel improvements in the Santa Maria Valley have been incorporated in a planning report and sent to Federal agencies and California State officials for review and comment prior to submittal to the President and the Congress.

The $24,575,000 project, of which $14,300,000 would be for Vaquero dam and reservoir and $10,275,000 for the levee and channel improvement work, would replenish a dwindling underground water supply and provide flood protection for life and property in the Santa Maria Basin, 130 miles northwest of Los Angeles and 60 miles northwest of Santa Barbara in southern California. Water users would repay the Federal Government $10,770,000 of the dam and reservoir cost. The remainder of the project expenditure would be allocated to flood control benefits, for which no reimbursement is provided under Federal Law.

Authorizing legislation and appropriations must be provided by the Congress before the program can be put into effect.

HOW DO YOU DO IT?

Did you ever have a weed control, ditch cleaning, and other operation or maintenance problem and not a single piece of equipment to do the job just right? And did you wish that you knew someone who had had a similar problem who had developed a machine or gadget that did the trick? Did you finally have to build the equipment in your project shop, and it took several seasons of operation before all the "bugs" were worked out? Then you are just the person we are looking for.

The Bureau of Reclamation is going to publish some booklets with descriptions, photographs, and drawings of equipment, attachments and tools which have been developed in irrigation district shops, by mechanically minded employees, to solve some of the many problems that plague irrigation projects. Weed control, ditch cleaning and other operation and maintenance equipment will be included. We know there are many ingenious devices which also would help the irrigation farmers.

How did you solve your problems? We want your suggestions for these booklets. The first one will be on weed-control equipment. As we want to make it available as soon as possible, we would appreciate receiving your suggestions by December 15. Anyone connected with any irrigation project, either private or Federal, is invited to send in a description of an irrigation device, telling how it is built and how it works. A photograph or drawing, or both, should also be included so that another shop would be able to build one like it. It doesn't have to be a major piece of equipment. Often, special tools, gadgets, or attachments are the biggest time, labor, and expense-saving devices. Anyone sending in an idea will be placed on a special mailing list to receive a copy of the first edition of the weed-control booklet.

It is planned to punch the sheets so they can be placed in a standard 3-ring looseleaf binder. Then as we obtain new developments and ideas they will be printed for filing in your binder with the others. Be sure and get your weed control equipment suggestions in by December 15, if possible. You can send your ideas on other equipment now also if you wish. Send them to the Commissioner, Bureau of Reclamation, Washington 25, D. C., attention code 420.

Second Barrel of San Diego Aqueduct under Construction

Three contracts were awarded in September for the 31-mile, Hamet to Rainbow, Calif., stretch of the 71-mile second barrel of the San Diego aqueduct being built under an agreement between the Departments of the Interior and Navy which provides that the Bureau of Reclamation shall undertake the design and construction and administration of the work with funds advanced by the Navy.

Charles S. Hale, Bureau of Reclamation engineer who was in charge of building the 123-mile Coachella branch of the All-American Canal system, and an underground concrete pipe irrigation system in the Coachella Valley, is acting project engineer on the San Diego aqueduct project.

For announcement of successful bidders on the first three contracts, and description of the work which must be completed in 2 years, see notes for contractors on page 276 this issue.

The second barrel, paralleling the first, will start at the equalizing reservoir near the western outlet of the San Jacinto Tunnel of the Metropolitan Water District of Southern California's Colorado River aqueduct, and extend southward 71 miles to empty into the San Vicente reservoir. Present plans call for completing the job in $3\frac{1}{2}$ years.

MULTIPURPOSE PLANT—"MULTIFLORA ROSE" furnishes wildlife shelter, helps control erosion, makes a good windbreak, and keeps livestock in bounds. Conservative estimates indicate birds will nest every 40 feet. *Photo courtesy of the Soil Conservation Service.*

A "LIVING FENCE"

by DEREK D. EARP, Acquisition Biologist, State of Washington, Department of Game, Seattle, Wash.[1]

WITHIN THE NEXT 10 YEARS, the Columbia Basin in the State of Washington will come into its own, not only as an agricultural center but as a happy hunting ground for upland game birds.

Only the sage grouse and the sharp-tailed grouse inhabited the region before white men made their appearance in the basin. Unfortunately, these two fine birds cannot withstand competition with man, his farming methods, and grazing by domestic livestock, and only a few scattered flocks persist in the more remote areas. From a game management viewpoint they will never again be an important hunter's bird.

With the advent of irrigation, however, the Chinese or ring-necked pheasant have been established in the project area. Unlike the sage grouse and the sharp-tailed grouse, the Chinese pheasant not only persists but thrives in the company of man and diversified farming.

To produce an abundance of food and cover for upland game birds, the State of Washington, Department of Game, in cooperation with the Bureau of Reclamation, is creating bird habitat areas ranging in size from 10 to 360 acres, planting a variety of shrubs and food plants in which the Chinese pheasant, Hungarian partridge, and California quail can live and thrive.

At the same time, and to supplement the habitat areas, the Department of Game offered free multiflora rose plantings to the basin settlers and established farmers last year.

Multiflora rose is a hardy shrub of Asiatic origin, and is used extensively in windbreak and erosion control plantings. In many ways it will benefit the landowner who plants it on his property. Its foremost use is that of a "living fence" which is inexpensive to install and economical to maintain. Within 3 to 6 years after planting it forms a hedge 8 to 10 feet high and about as wide. Its dense growth and sharp thorns will turn all domestic stock except poultry. Other benefits the landowner may receive from this plant are as follows:

1. It can be planted on contours where conventional fences are difficult to construct.

2. It provides homes for many beneficial birds

[1] We regret to announce that Mr. Earp died of cancer in a Seattle, Wash., hospital on April 15, 1952. His home was in Okanogan County, and he worked for the Washington Department of Game almost up to the last, although he had been suffering for some time, having spent much time in hospitals. The RECLAMATION ERA sends its deep sympathy to his mother and two brothers.

and insects, and will shade out weeds and other unwanted shrubs.

3. When planted along property lines it eliminates intrusion by unwanted persons.

4. It does not sap surrounding fields like ordinary brush. Crops can be planted up to the very edge of the hedge without loss of production.

5. It will aid in the control of wind erosion and drifting snow.

6. Acting as a windbreak, it will reduce the loss of irrigation water by evaporation.

Multiflora rose is not difficult to plant. It is preferable if the land to be planted is prepared in the fall, by plowing and discing thoroughly. Planting should be done in the spring.

Planting can be done in several ways. When only a few plants are to be put in, a shovel or mattock can be used to good advantage. Plowing is faster. With a two-bottom plow, operated at a low speed, an additional man can walk behind the forward slice and place the plants against the outside of the furrow just ahead of the rear share which in turn covers the roots of the plant. With a single-bottom plow, after one furrow has been made, the plants can be laid in the ground and a second run with the plow will cover them. The plants can be firmly set either by stamping them down with the feet or by running a wheel of the tractor down the plant row. During the planting operation the roots should always be kept moist. In single row plantings the plants are spaced 18 inches apart and in multiple row planting they are spaced 36 inches apart and staggered.

In the Columbia Basin, irrigation is necessary if multiflora rose is to survive and mature. Too much irrigation, however, can be as detrimental to the plant as no irrigation at all.

In order to obtain maximum growth the young plants should be cultivated for at least 2 years. Any good spring tooth or fixed blade type cultivator may be used. An application of a complete fertilizer will also aid the plants in becoming established.

To receive free multiflora rose planting stock from the Department of Game the landowner must meet certain requirements.

1. He must have been farming at least 20 acres.

2. The land must be under an adequate irrigation system.

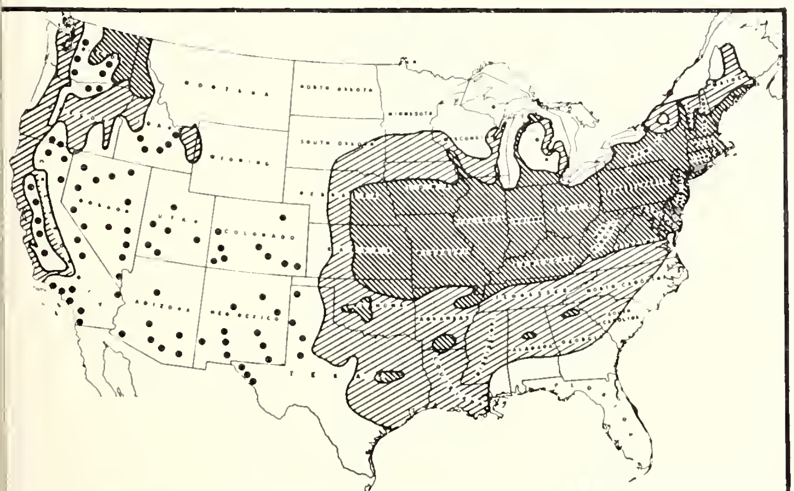
3. The plants must be cultivated, irrigated, and cared for until they become well established.

4. Livestock should not be permitted to browse upon the young plants.

Irrigation farmers in the State of Washington who are interested in making rose planting on their property can make application for free planting stock by writing directly to the Department of Game, 509 Fairview Avenue, North Seattle, Wash., or by contacting their local game protector. In order to receive planting stock for next spring, applications must reach the office by December 1, 1952.

Planting stock is also available free for wildlife habitat sites in South Dakota from the State Game, Fish, and Parks Department. In some of the other States in the reclamation area, free planting stock may be obtained in some instances from the Soil Conservation Service. In Nevada, multiflora rose plants are available under provi-

(Please turn to page 268)



WHERE MULTIFLORA ROSE GROWS

• Localities where it can probably be used with success on irrigated lands.

Area in which multiflora is known to be adapted for use. In the northern fringe of this zone, tops will be killed back in occasional severe winters but will not seriously hurt plantings.

Area in which multiflora is probably adapted for use but where it has not yet been adequately tested. *Map and data, courtesy, Soil Conservation Service.*

PETER P. VALLERY—

"Messiah" of Belle Fourche

The late Peter P. Vallery, who homesteaded in the Belle Fourche River valley about 10 miles below the City of Belle Fourche, S. Dak., in 1880, is credited with being the chief "messiah" for the establishment of the Belle Fourche irrigation project.

It is said of Mr. Vallery by old-timers that he was so enthusiastic about irrigation that he was irrigating plots of sugar beets on his ranch before most people even dreamed of an irrigation development in South Dakota. He did this with water he got from artesian wells—among the first in Butte County. He also pumped water for irrigation from the Belle Fourche River.

Along about the turn of the century Mr. Vallery had enlisted several other men in his crusade for irrigation, among them Alonson Giles, a Belle Fourche hardware dealer and owner of a 20,000-acre ranch where the project is now located.

Using a carpenter's level and a home-made tripod, Vallery and Giles located the diversion canal and hatched the original idea for a storage reservoir to irrigate about 8,000 acres under what is now the South Canal. At this juncture, they, and others, interested the late Congressman E. W. Martin of South Dakota's third district, in their irrigation plan.

Representative Martin presented the necessary facts in Washington, D. C., and soon the Reclamation Service was on the job with more refined surveying tools and water control know-how. In April 1904 the reclamation engineers recommended that 60,000 acres of land be investigated for irrigation in the valley of the Belle Fourche River. The Secretary of Interior approved the project in May 1904 and set aside $2,100,000 of reclamation funds for its construction. Construction was begun in 1905 and water was brought to the first land in 1908. Thus came to a realization Peter P. Vallery's long-cherished dream.

Mr. Vallery, "daddy" of Belle Fourche irrigation, was born in 1866 and went to South Dakota's Black Hills from Plattsmouth, Nebr., in 1876 during the excitement caused by the discovery of gold in the hills. Like many other persons thus caught up in the gold rush to the Black Hills, Vallery decided that ranching and farming, from a long-range standpoint, offered more returns than gold mining. Vallery died in 1937, but he has a son, Philip Vallery, who is carrying on as a friend of Reclamation. He lives on the old Vallery irrigated farm.

Mr. Giles, whose land holdings have changed hands several times and are now, or part of them, owned by William Olson, was born in 1853. He sold his Belle Fourche hardware store in 1901 to Sam G. Mortimer and in 1917 left South Dakota for California where he died in August 1921.

\# # #

ACRES OF ONIONS on Bill Hattori's field near Moses Lake, Wash. Some of the onion harvest was contracted for shipment to Chicago, like many of the other Columbia Basin project crops. *Photo by Harold Foss, Region 1 photographer.*

COLUMBIA BASIN'S FIRST HARVEST

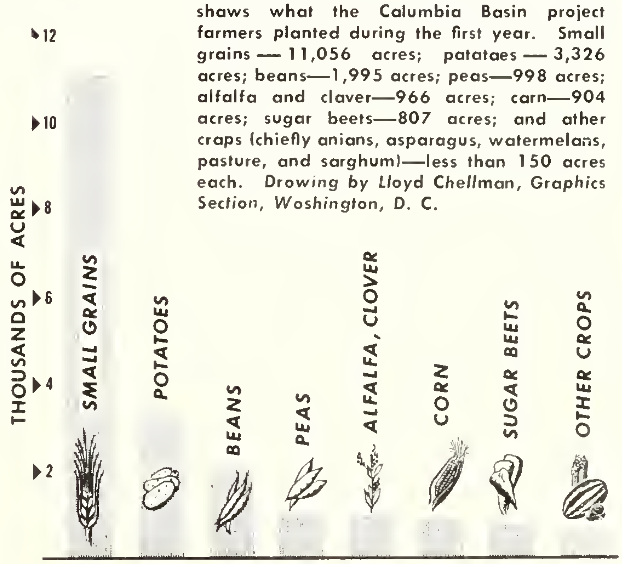
Columbia Basin project's first harvest has been reaped. Farmers who irrigated the first fields in the State of Washington with water pumped from the Columbia River at Grand Coulee Dam are busy consolidating their gains or assessing their losses.

While all the columns are not totaled, the Columbia Basin farmers can be proud of their achievement, which dollarwise includes \$1,000-an-acre potatoes at Moses Lake and \$600-an-acre onions at Quincy. As for production on irrigated Columbia Basin project lands, farmers in the Moses Lake area raised an average of 15 tons of potatoes an acre, some growers reaching a top production of 22 tons per acre. D. C. McLean, a local warehouse superintendent, and one of the seven nearby potato dealers, estimated that the early spuds were running about 70 percent "number ones." At Winchester, Harold Faw raised close to a ton and a half of seed peas per acre, and Percy Kelley raised the peak crop of 3 tons of peas per acre.

Carload shipments of potatoes, onions, and watermelons from Moses Lake in June, July, and August of 1952 are estimated to be almost double the 1951 figure for the same period—287 carloads in 1951 and 533 in 1952. No shipments at all were made from the Quincy area last year, and the figures for 1952 are conservatively estimated at 150 freight carlots.

Wise farm management typified many of the Columbia Basin project settlers. One or two settlers plowed their pea crops under. Earl Gregory of Quincy estimated each acre of his soil would gain at least 200 pounds of available nitrogen worth from \$36 to \$60, with the green manure benefiting his sweet corn planting later.

Paul A. Kelly at Winchester planted Kenland red clover for certified seed, along with his peas. After the peas were harvested, the clover crop



THE FIRST LOOK AT THE FIRST CROPS shows what the Columbia Basin project farmers planted during the first year. Small grains — 11,056 acres; potatoes — 3,326 acres; beans—1,995 acres; peas—998 acres; alfalfa and clover—966 acres; corn—904 acres; sugar beets—807 acres; and other crops (chiefly onions, asparagus, watermelons, pasture, and sorghum)—less than 150 acres each. *Drawing by Lloyd Chellman, Graphics Section, Washington, D. C.*

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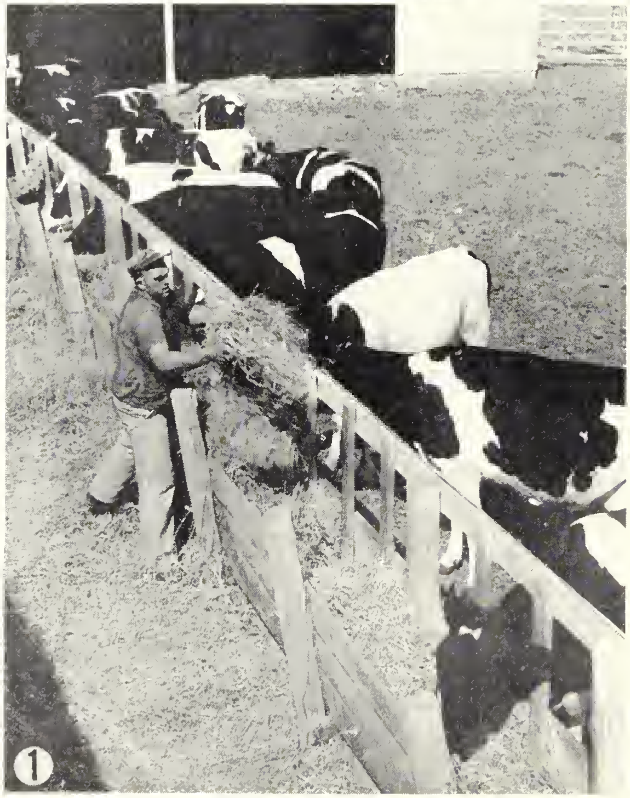

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came out, giving him a second harvest this year. He lined his field with beehives to pollinate the growth.

Many of the farmers are starting to build up their livestock or beef cattle and pastures to combine irrigation farming with dairy operations.

Where did the fruits of the fields go? Some crops were trucked to Yakima, Wenatchee, or other nearby towns, where warehouses and processing plants were ready to receive basin products. A Wenatchee dealer contracted for about 700 acres of green peas, which were deep frozen and will appear in grocery stores all over the country. Others were shipped to Chicago, Ill., for use in one of the nation's leading food processing concerns where they will later appear as split-pea soup. And of course, the famed "Idaho" potatoes were sacked, stored and prepared for shipment all over the country. I. Tanaka near Moses Lake markets some of his watermelons at a highway fruit stand and exports others to Canada.

The Columbia Basin farmers on this first 59,558 acres had their work cut out for them. Traditionally, the first year on new land does not produce a bumper harvest, and at the present time it is not known what the final figures on yields will show. Irrigation water was available to 925 farms; more than 400 actually used water for land preparation, preirrigation and other purposes, and crops were grown on about 385. This resulted in the cropping of an estimated 20,870 acres—about as expected for the first year.

The new settlers faced a tremendous responsibility and considerable investment as they moved onto sagebrush land, cleared it, put up homes, purchased adequate but expensive sprinkler systems or leveled the land, then planted the soil, handled the water, and completed the cycle by the frequently costly, but usually profitable, job of harvesting the crops.

Some of the richest (and most "blowy") lands, particularly in the Winchester-Quincy area, had to be reseeded several times due to wind sweeping across the raw fields. One farmer is reported to have seeded part of his farm four times.

Bob Maurer, southwest of Ephrata, had to irrigate 24 hours, around the clock, and move his

"THIS FRUITFUL EARTH"

ALF OF THE MILLION ACRES of the Co-
a Basin project, when fully developed,
e used to raise dairy or beef cattle, ac-
g to the experts. Here is a good start
e Winchester Development Farm.

d 3. TEN-MONTH TRANSFORMATION.
r A. Peters' farm near Moses Lake.
2 as it looked September 21, 1951.
3 on July 25, 1952, with wheat field,
oad and power lines, and permanent
replacing tarpaper shack where Peters,
y veteran, and his wife lived when they
oved in.

REE TONS OF PEAS AN ACRE were
on P. A. Kelly's ranch. Average har-
or approximately 700 acres on the proj-
as a ton and one-half per acre.

SEMBLY LINE PRODUCTION as peas
Kelly's field and others around his were
to vining machines near Winchester,
elling, loading into lugs, and freighting
ed trucks for quick freezing.

DID THAT ALL IN A MONTH." Paul N.
ds from Idanha, Oreg., looks with justi-
pride at his 120-acre irrigation layout
he prepared between March and April
ar. The field in the right center is used
ainage. Reynolds sprinkler irrigated
but believes he should irrigate more
during the growing season. He has a
nvestment in underground and surface
and a pumping plant. Next year he
to raise alfalfa and red clover, and get
start on a dairying operation by pas-
a couple of heifers.

*1, 2, and 3 by Harold Foss; photos 4,
6 by Frank B. Pomeroy, both Region 1
raphers.*

6

sprinklers every 4 hours to bring out his beans. "My sprinkler system was a little under-designed," he explained.

Deep leveling, in some cases, cut down the productivity of the soil, and will continue to do so until the necessary organic content is built up.

Some farmers did not get their crops in early enough the first year, or were unable to apply water for the first time as soon as it was desirable. The percent of problems encountered runs very high, but the percent of failures runs pretty low—only 2 percent of the plantings. This is considered pretty good for the first year, considering all the problems encountered by new people on new land.

Next spring, as many of these farmers enter their second year, water will be available for the first time to approximately 807 new farms, comprising 59,650 acres, and under a 7-year program, approximately a half million acres will be irrigated by the end of 1958.

The beehive of activity in the first year for irrigation was not limited to the farms. People moved into the entire project area, increasing the population 15 percent—from 35,000 to 39,000. Eventually it will be 150,000 or more.

Five new warehouses were erected on the project this year (two at Moses Lake, and one each at Wheeler, Winchester, and Quincy) mainly to process beans and potatoes.

This year most of the sugar beets were sent by rail to Toppenish, but the Utah-Idaho Sugar Beet Co. broke ground in June for a new $9,000,000 refinery at Wheeler which is scheduled to be operating next fall. Amalgamated Sugar Co. announced plans to develop a site for a sugar beet plant 5 miles south of Quincy.

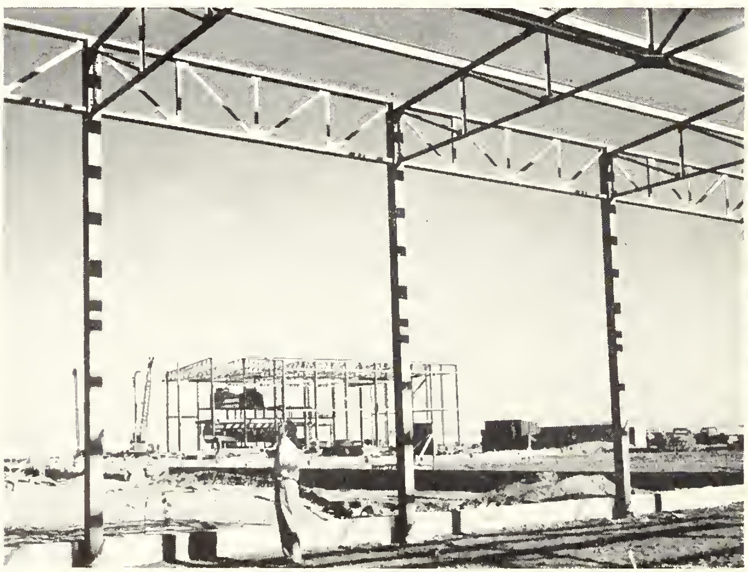
A 191-mile $2,000,000 network of new roads was built in three counties on the project in 1952. This program will continue each year of the 7-year program, moving into new land that is irrigated for the first time. The goal is to provide a road to serve every new farm, preferably in the first year the water is received.

Three new banks were organized in the project this past year. Property in Grant, Adams, and Franklin Counties reached a value of $4,700,000 representing a 9-percent increase in assessed valuation from 1951 to 1952.

In the Moses Lake school district where only 8 school teachers were needed in 1942, this year 92 teachers were educating the younger generation.

A tractor manufacturing firm announced plans to move its headquarters to Ephrata. The company will employ 150 persons.

(Please turn to page 275)



FUTURE CROPS of sugar beets grown on the Columbia Basin project will be processed in these structures being built by the Utah and Idaho Sugar Company at Wheeler which has invested $9,000,000 in the plant. The steel superstructure in the foreground will be the sack-storing wing, eventually to be joined with the steel frame in the background. ***Both photos by F. B. Pomeroy, Region 1.***

"I COULDN'T STAY AWAY," says Charles A. Faw, who came from semiretirement to farm on the Columbia Basin near Winchester. Not easily discouraged, he reseeded his 10-acre patch of onions, contracted for at $32.50 per ton and reportedly worth $600 an acre. He hears they do better the second year in the same field. Here he proudly shows off his 25 acres of red Mexican beans.

IRRIGATION PAYS, according to Altus farmers Frank Hafner (at right) and Brooks Lagree (below). *Photo at right, courtesy of the Geary Star; below by Fred S. Finch, Region 5 photographer.*

ALTUS FARMERS SPEAK UP

by U. H. WARNER

Editor, The Geary Star, Geary, Oklahoma

PART 2— LAGREE and HAFNER

In this series of interviews with successful irrigation farmers of the W. C. Austin project in southwestern Oklahoma, Mr. Warner, publisher and editor of the Geary Star, a weekly newspaper published at Geary, Okla., and president of the Geary Chamber of Commerce, tells how irrigation benefits both the irrigation farmer and the surrounding community.

Mr. Warner started publishing this series in the Geary Star under the title, "Irrigation in Oklahoma," due to his interest in the proposed Canton irrigation project in the North Canadian River Basin in west-central Oklahoma, now under study by the Bureau of Reclamation. The Canton irrigation district, embracing lands of the proposed project area (providing for the irrigation of about 16,000 acres of fertile alluvial lands) was organized in 1945 under the Oklahoma Statutes by a vote of a substantial majority of the qualified land owners.

Castor beans, alfalfa, and cotton, all have been paying crops for Brooks Lagree, Altus, who never had done any irrigating before water came down the ditches from Altus Lake 4 years ago.

Lagree sat in his easy chair in his fine brick home at 917 Commerce Street and told us of his irrigation experience while his servant put the finishing touches to dinner preparations, and his daughter, 7 years old, finished her daily piano practice.

"The big thing about irrigation" said Lagree, "is the satisfaction of knowing after you plant a crop that you can have water on it when it needs water. I farmed dry land for 20 years before we got irrigation.

"I ran water on my alfalfa field last month and if this freeze (it was 24 degrees at Altus the day we visited him) doesn't kill it, I will cut my first crop of hay by April 1."

Lagree raised 11 acres of castor beans last year as a test. They made a gross return of $161 per acre and after he figured out all expense for seed, planting, water, and combining he had a net profit of $128 per acre. He is going to plant 30 acres in 1952 and has a new variety which he thinks will not shatter as much as the strain he used in 1951.

Harvesting is no problem, Lagree said, as he bought a new combine last fall which did a perfect job of taking the beans out of the field. Not one pound was pulled by hand. He said there was some labor problem on castor beans until last year. Laborers have found now that they can make more money pulling beans than they can at snapping cotton.

The castor beans take a lot of water and Lagree has his eye on another crop, soy beans. He watered the castors five times and had 30 acres of soys which he watered only one time. They survived two hail storms which cut the stand by one-half and still came through with 28 bushels per acre.

After the cotton wilts under summer heat, soy beans are still green, said Lagree. They make a great green manure crop. Even if one only got his seed back at harvest time they would be a valuable crop.

Lagree said Boyd McMahan is another Altus farmer who believes in castor beans. McMahan harvested 160 acres in 1951 with a greater cash return than he got from his cotton. Among other advantages, the beans are free from insect pests.

Likes To Break Crop Records

"Give me a few more years and I am going to show you that I can raise three bales of cotton per acre right here in Oklahoma," declares Frank Hafner, Altus farmer.

Hafner's is no idle boast for his record of Irish potato production will be hard to believe even after we set down the facts which the Reclamation Bureau gave to us and which Hafner verified when we visited him on March 21.

Hafner was lying flat on the ground on his back tightening some bolts on the front end of a Chattin ditcher when we stopped our car at his farm seven miles southwest of Altus. He did not have time to talk so we snapped his picture when he stood up to fasten the ditcher to a tractor with a log chain. We made a date with him to visit for a while at 7 p. m., after the borders had been plowed.

When Hafner plows and cultivates his land to get ready for a crop, he turns the machinery on the old borders. He says he can make a new one, half a mile long in an hour or two with the Chattin so he does not bother to save the old ones from year to year.

Hafner grew up in Idaho and learned how to irrigate 30 years ago.

We were ushered into the kitchen of the spacious new and modern home on the Hafner farm that evening. Mrs. Hafner sat at the kitchen table and wrote a letter but she kept one ear on the conversation as her husband related his story of irrigation. She was able several times to fill in dates and figures as the potato story unfolded.

The Hafners irrigated for 5 years out of wells at Hereford, Tex., before they decided to move to Oklahoma to try the new irrigation area at Altus.

They chose a quarter section and took an option to buy with a contract to pay $9,000 cash rent for 2 years.

They planted 150 acres of potatoes in 1950 and raised 500 sacks of No. 1 potatoes to the acre. Those sold at $3 per hundred pounds, or $1,500 return per acre. Their 1951 crop again averaged 500 sacks to the acre. They bought the land. He has turned down a recent offer of $750 per acre for his farm.

Hafner did all the work of producing the first crop himself. He now hires three men full time as he raised 150 acres of cotton last year along with the potatoes. The cotton made a bale per acre but there was much expense because of heavy infestation of boll worm.

"This is better land and better climate than I saw in Idaho or in Texas," said Hafner, "and I am sure that after I get going good on cotton I can raise three bales per acre just like they do in Arizona under irrigation.

"I planted cotton on my potato ground last summer after the potatoes were harvested. I got it in the ground on July 19 and still made an average yield of three-fourths of a bale per acre."

We took another look at Hafner's potato record and at the gleam in his eye and promised to go back down to Altus to write up the story when this energetic irrigation farmer gets his three bales per acre.

(Next Month—Interviews with southall and kelley)

"A Living Fence"

(Continued from page 261)

sions of the Clarke-McNary Act from the Extension Forester of Nevada at $3 a hundred for bare-root stock, 4 to 8 inches high. In the southwest or south central States osage-orange (maclura pomifera) is preferred, due to the fact that multiflora rose is not alkali tolerant.

In Nebraska, on the Frenchman-Cambridge Division of the Missouri River Basin project, the Bureau of Reclamation and the Fish and Wildlife Service are considering establishing a test planting of multiflora rose to determine its value in that area for erosion control and wildlife habitat.

Like any other "plant out of place," if multiflora rose spreads beyond its intended boundaries, it becomes a "weed" and a menace. It also has thorns. For more detailed information, we refer the reader to the following articles in the Journal of Wildlife Management, "Spreading Tendencies of Multiflora Rose in the Southeast," in the July 1950 issue, volume 14, number 3, and "Multiflora Rose as a Cover for Quail" in the April 1951 issue, volume 15, number 2. ###

WATER REPORT

WHEN THE SNOW MELTS, how much water will run to the streams and fill the reservoirs? Snow surveyors find out by carefully weighing the hollow aluminum tube with its core of snow on specially calibrated scales. *Photo by Robert Bronstead, courtesy of the Soil Conservation Service, United States Department of Agriculture.*

by R. A. WORK, Senior Irrigation Engineer, and
CLYDE R. HOUSTON, Irrigation Engineer, both of the Soil Conservation Service, United States Department of Agriculture

We've been hearing some recent talk about dying rivers. History describes rivers that have died. The civilizations supported by these waters likewise withered. It is not always clear to what extent such changes over very long time periods (hundreds of years) were due to slowly changing climate or were chargeable to mankind's abuse of watersheds. Either or both might have been the case. Granted that rivers can die and have died in the past, is it inevitable that the rivers we know today should go the same way? The writers feel sure this will not occur since competent conservationists, engineers and foresters are continually seeking means to prolong the life and conserve or expand the water productivity of our Nation's watersheds. One proven means of prolonging streamflow in the West is by storing surplus waters in reservoirs as an insurance against future shortages.

1952 proved to be one of those seasons which underscores the preeminent value of reservoired water supplies. As pointed out in the Water Report for April 1952, the West-wide mountain snow crop then measured, showed promise of the greatest streamflow of many years in most Western States.[1]

This promise was generally realized, but later in the summer, because of extremely dry weather, extended for months, reservoired supplies provided the back-log that broke the back of the western summer drought. In many areas the natural run-off was so great that reservoired water

[1] The Division of Irrigation and Water Conservation is the Federal coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, other Federal bureaus, various departments of the several States, irrigation districts, and private agencies. The California State Division of Water Resources, which conducts the snow surveys in that State, contributed the California figures appearing in this article.

supplies proved far in excess of water needs during the summer period of greatest need. Thus in many reservoirs, a greater than usual "hold-over" supply of water remains. In California, for instance, the reservoir "hold-over" is the greatest recorded for October first.

No one can now foretell the amount of snow-water that will be stored during the coming winter, but the substantial water supply now held in reservoirs of Western States at least presages well for the 1953 irrigation season.

The following State by State inventory gives a more detailed accounting by States of reservoir hold-over and other facts pertinent to water supply outlook for 1953, so far as it can now be measured.

ARIZONA—With the exception of irrigated areas along the Upper Gila River, Arizona is entering the coming winter months with a good water supply outlook.

The lands irrigated from flow of the Salt and Verde Rivers had plenty of water all season. The reservoirs on the Salt and Verde Rivers now store close to 1.5 million acre-feet of water, or to about 65 percent capacity. Carl Pleasant Dam on the Agua Fria now stores water to 52 percent of capacity. The Maricopa Water Conservation District, supplied from this reservoir, had sufficient water all season.

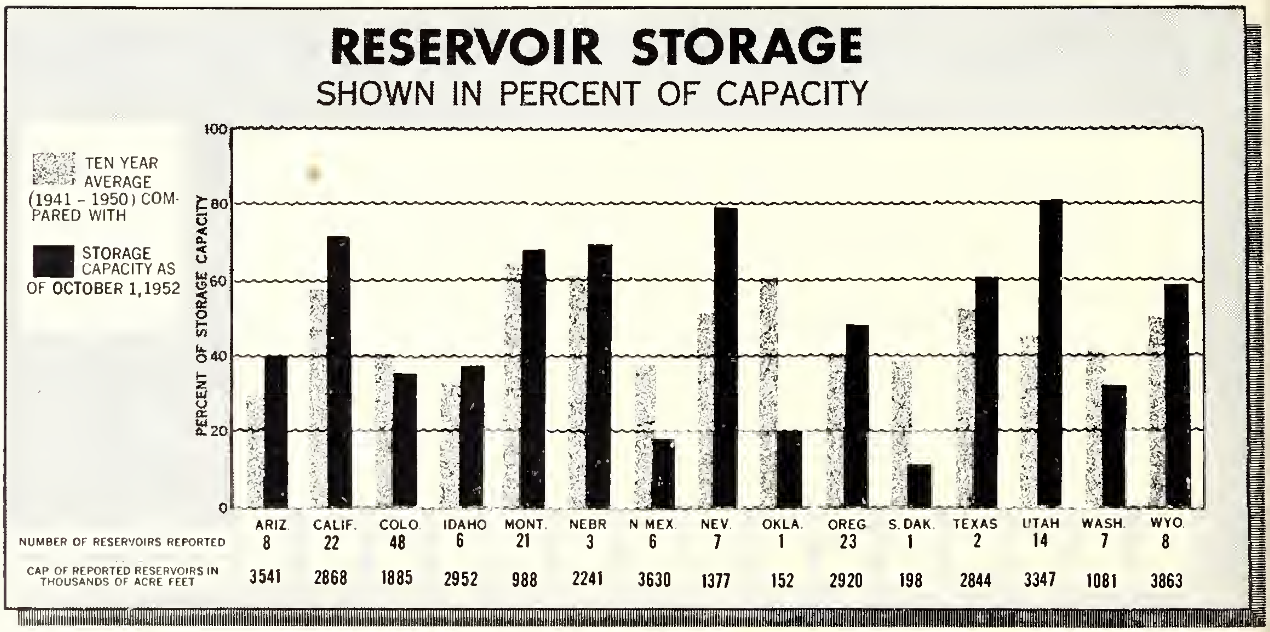
San Carlos Reservoir on the Gila River now contains practically no usable storage. The Irrigation District was able to supply only about 70 percent of the water demanded during 1952.

CALIFORNIA—As the beginning of the snow season approaches, California has in storage, in major Sierra Nevada reservoirs, the greatest supply of water on record for October 1. The 25 reservoirs serving the Sacramento and San Joaquin held 5,691,800 acre-feet on October 1, 1952, or 72 percent of capacity, as compared with 4,380,260 acre-feet and 55 percent of capacity on October 1, 1951. The 1952 storage is 123 percent of the past 10-year normal.

COLORADO—Water stored in 48 Colorado reservoirs is 5 percent below average.

The water supply on the South Platte Drainage was above normal for this season. However, due to a dry summer, demand for irrigation water was much above average. Water was therefore sold by the Northern Colorado Conservancy District (Colorado-Big Thompson

Watershed	Number of reservoirs	Capacity (acre-feet)	Water stored Oct. 1	
			1951 (acre-feet)	1952 (acre-feet)
Sacramento	1	4, 500, 000	2, 557, 300	3, 431, 400
Feather	4	826, 800	624, 580	659, 480
Yuba	3	244, 800	136, 260	159, 150
Bear	1	7, 200	2, 190	1, 680
American	2	30, 200	16, 260	25, 130
Mokelumne	2	349, 000	271, 120	300, 530
Stanislaus	3	145, 500	25, 430	41, 660
Tuolumne	3	676, 800	373, 860	518, 360
Merced	1	281, 000	17, 270	116, 440
San Joaquin	5	854, 400	355, 990	437, 970
Total	25	7, 915, 700	4, 380, 260	5, 691, 800



Most State averages are for full 10-year period, but in a few cases reservoirs having shorter records are included. CALIFORNIA—does not include Millerton or Shasta Reservoirs. October 1 storage in these two reservoirs combined was 3,620,100 acre-feet, or 72 percent of capacity. COLORADO—does not include John Martin reservoir. On October 1 this reservoir was empty. MONTANA—does not include Fort Peck Reservoir. October 1 storage was 13,860,000 acre-feet or 73 percent of capacity. Does not include Flathead Lake in which October 1 storage was 1,620,000 acre-feet or 91 percent of capacity. NEVADA—does not include Lake Mead. October 1 storage was 22,543,000 acre-feet or 83 percent of capacity. WASHINGTON—does not include Franklin D. Roosevelt Lake. October 1 storage was 5,184,000 acre-feet or 99 percent of capacity. WYOMING—does not include Boysen reservoir with capacity of 820,000 acre-feet and September 30 storage of 647,800 acre-feet.

project) in late season, thus avoiding a slight shortage. This was not expected as of April 1952.

Reservoirs on the Colorado-Big Thompson project on both sides of the Continental Divide could have filled this year if power operations had allowed. Granby Reservoir is almost full, 2 to 3 years ahead of expectations.

On the other hand, storage in the small farm irrigation reservoirs over the South Platte Valley is now below normal and less than last year. Should snow accumulation this season be less than normal, the 1953 water supply will be deficient, probably placing demands for water on the Colorado-Big Thompson project. Soil moisture conditions on mountain watersheds are fair to poor.

Summer flow of the Arkansas River was above normal, but the irrigation water supply in some areas was deficient. This was due to limited carry-over reservoir storage from last year and unusually heavy irrigation demand. Except for a few reservoirs in the mountains served by transmountain diversions, most reservoirs are now practically empty, including John Martin. If snow accumulation next season is normal or less, water shortage may be expected along the Arkansas in 1953.

Although the summer flow of the Rio Grande and its tributaries in Colorado was not as high as expected, it was much above normal. The water supply in the San Luis Valley was much improved over that of the past 2 years. Ground-water levels have been raised. Carry-over storage is approximately normal. A very satisfactory crop year has been reported for the San Luis Valley.

Idaho—Reservoirs in Idaho store water in volume 3 percent above the 10-year average. In view of the unusually heavy demand this summer for irrigation water, due to the driest summer in many years, such a favorable hold-over would not exist had it not been for unusually heavy spring run-off.

In practically all cases, the heavy river flows which were forecast last spring by the snow surveys later materialized. Considerable damage to property and farm land occurred. The town of Carey, Idaho, was saved from destruction only by prompt and effective emergency measures. The channel of Little Wood River is now so choked by debris that even average river flow next spring could be damaging unless the channel is cleared.

Montana—Reservoir storage on the first of October is slightly below average and is not as good as 1951. Storage in power reservoirs is greater than average in anticipation of a short natural run-off during the late fall and early winter. These plants are mostly run-of-the-river operation and use storage only when shortages occur.

Nevada—The reservoir storage picture in Nevada is especially bright this year. At the beginning of this winter's snow season, the available storage is about 80 percent of capacity and 150 percent of the past 10-year average.

New Mexico—Storage in Elephant Butte and Caballo Reservoirs combined is now about 370,000 acre-feet. The water supply outlook for next year is improved over a year ago, but normal or above normal flows must be obtained next year to maintain or improve this position.

October 1 storage in six reservoirs in New Mexico is 17 percent of capacity, whereas the 10-year average is 37 percent of capacity. Should a short snow year occur, there will be an extreme shortage of irrigation water in 1953.

Reservoir	Capacity acre-feet	Active storage October 1	
		1952 (acre-feet)	1941–50 average (acre-feet)
Wildhorse	32, 690	19, 514	12, 005
Rye Patch	179, 000	146, 000	103, 174
Bridgeport	42, 455	29, 704	14, 878
Topaz	59, 440	34, 779	18, 661
Lahonton	290, 900	195, 325	137, 443
Tahoe	732, 000	634, 800	407, 621
Boca	40, 900	6, 300	23, 731

The water supply on the Carlsbad project on the Pecos watershed was much below normal this year.

Oregon—October 1 storage in 22 of Oregon's reservoirs was 49 percent of capacity, while the past 10-year average was only 40 percent of capacity. In case of Upper Klamath Lake, present storage is the greatest recorded for October 1.

South Dakota—Storage in Belle Fourche Reservoir is only about one-fourth of normal for this date and is less than 20,000 acre-feet.

Texas—Storage in Buchanan and Marshall Ford Reservoirs is 61 percent of capacity, while the past 10-year average is only 54 percent.

Utah—Reservoir hold-over storage is the best that it has been for many years, being 81 percent of capacity as of October 1, compared to the 10-year average of 44 percent.

Reservoir	Capacity (acre-feet)	Active storage October 1	
		1952 (acre-feet)	1941–50 average (acre-feet)
Bear Lake	1, 420, 000	1, 116, 800	766, 890
Deer Creek	147, 300	124, 300	73, 700
East Canyon	28, 730	12, 000	14, 750
Echo	73, 900	39, 660	20, 050
Hyrum	15, 310	8, 400	5, 090
Moon Lake	35, 760	18, 800	8, 480
Pineview	44, 175	13, 300	13, 865
Strawberry	270, 000	250, 300	68, 725
Utah Lake	850, 200	[1] 902, 000	343, 000
Otter Creek	52, 500	30, 000	23, 870
Piute	84, 750	25, 450	10, 700
Rocky Ford	23, 300	9, 930	9, 660
Sevier Bridge	236, 000	133, 800	101, 370
Scofield	65, 000	47, 800	8, 950
Total	3, 346, 925	2, 732, 540	1, 469, 100

[1] The level of Utah Lake is above what is known as compromise level, which has always been taken as capacity.

Washington—Reservoir storage as of October 1 is nearly 10 percent below average. This is explainable by the unusually heavy summer withdrawal of stored water.

The early temperate spring this year resulted in large volumes of water coming down the stream channels evenly and with little damage. The main stem of the Columbia began its annual rise earlier than usual and continued at a relatively high level through April, May and June. About 9,000,000 acre-feet of water was stored in Columbia Basin reservoirs during this 3-month period. This represents the greatest storage ever obtained in this Basin in that particular time period. The peak flow of the river was held below a damaging point through the skillfully managed water storage program.

Wyoming—The last 3 months of the summer season were characterized by deficient rainfall and heavy demands for irrigation water. In local areas not served by large storage systems, the carry-over storage is below average.

Accuracy of 1952 Run-off Forecasts

1952 forecasts of run-off generally spoke of flows ranging from well above normal to the greatest of record in some cases. Relatively few of the run-off records for the 260 gaging stations

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet) Active capacity [1]	Sept. 30, 1951	Sept. 30, 1952
Region 1	Baker	Thief Valley	17, 400	2, 500	1, 800
	Bitterroot	Lake Como	34, 700	7, 600	600
	Boise	Anderson Ranch	464, 200	344, 600	307, 100
		Arrowrock	286, 600	36, 100	29, 800
		Cascade	650, 000	15, 900	37, 200
		Deadwood	161, 900	0	65, 600
		Lake Lowell	169, 000	53, 200	50, 700
	Burnt River	Unity	24, 600	2, 600	2, 700
	Columbia Basin	Equalizing	1, 001, 000	0	338, 000
		F. D. Roosevelt	5, 220, 000	5, 220, 000	5, 184, 000
		Potholes	350, 000	0	40, 800
	Deschutes	Crane Prairie	50, 000	57, 000	50, 000
		Wickiup	182, 000	19, 000	2, 000
	Minidoka	American Falls	1, 700, 000	1, 021, 300	584, 700
		Jackson Lake	847, 000	622, 700	281, 700
		Lake Walcott	95, 200	94, 000	92, 200
		Grassy Lake	15, 200	12, 100	9, 400
		Island Park	127, 300	86, 400	62, 500
	Okanogan	Conconully	13, 000	7, 500	5, 300
		Salmon Lake	10, 500	10, 200	10, 100
	Owyhee	Owyhee	715, 000	390, 700	74, 200
	Umatilla	Cold Springs	50, 000	400	0
		McKay	73, 800	13, 800	9, 500
	Vale	Agency Valley	60, 000	3, 000	6, 500
		Warm Springs	191, 000	5, 000	98, 200
	Yakima	Bumping Lake	33, 800	3, 000	4, 800
		Cle Elum	435, 700	159, 500	112, 200
		Kachess	239, 000	123, 800	93, 900
		Keechelus	153, 000	55, 000	62, 200
		Tieton	197, 000	80, 600	60, 200
Region 2	Central Valley	Millerton Lake	500, 000	125, 100	168, 200
		Shasta	4, 366, 800	2, 431, 400	3, 505, 500
	Klamath	Clear Lake	513, 300	66, 700	199, 700
		Gerber	94, 300	18, 200	41, 300
		Upper Klamath Lake	524, 800	214, 400	287, 700
	Orland	East Park	50, 600	10, 200	23, 400
		Stony Gorge	50, 000	3, 800	8, 900
Region 3	Boulder Canyon	Lake Mead	27, 207, 000	19, 118, 000	22, 543, 000
	Davis Dam	Lake Mohave	1, 809, 800	1, 373, 100	1, 589, 400
	Parker	Havasu	688, 000	600, 900	603, 100
	Salt River	Bartlett	179, 500	25, 000	53, 000
		Horse Mesa	245, 100	62, 000	229, 000
		Horseshoe	144, 000	7, 000	1, 000
		Mormon Flat	57, 900	18, 000	50, 000
		Roosevelt	1, 381, 600	87, 000	1, 012, 600
		Stewart Mountain	69, 800	38, 000	400
Region 4	Fruit Growers	Fruit Growers	4, 500	300	1, 600
	Humbolt	Rye Patch	179, 000	85, 300	146, 000
	Hyrum	Hyrum	15, 300	5, 600	8, 400
	Mancos	Jackson Gulch	9, 800	1, 000	5, 500
	Moon Lake	Moon Lake	35, 800	11, 900	18, 800
		Midview	5, 800	3, 700	4, 800
	Newlands	Lahontan	290, 900	110, 000	195, 300
		Lake Tahoe	732, 000	531, 600	634, 800
	Newton	Newton	5, 300	1, 500	2, 100
	Ogden River	Pine View	44, 200	13, 400	13, 300
	Pine River	Vallecito	126, 300	22, 400	61, 900
	Provo River	Deer Creek	149, 700	117, 700	124, 300
	Scofield	Scofield	65, 800	26, 700	47, 800
	Strawberry Valley	Strawberry	270, 000	132, 700	250, 300
	Truckee River Storage	Boca	40, 900	27, 800	6, 300
	Uncompahgre	Taylor Park	106, 200	45, 500	77, 700
	Weber River	Echo	73, 900	38, 400	39, 600
Region 5	W. C. Austin	Altus	145, 000	100, 600	22, 400
	Balmorhea	Lower Parks	6, 000	100	300
	Carlsbad	Alamogordo	131, 900	13, 200	18, 500
		Avalon	6, 600	6, 000	1, 000
		McMillan	38, 700	1, 100	0
	Colorado River	Marshall Ford	810, 500	37, 100	737, 600
	Rio Grande	Caballo	345, 900	9, 600	10, 300
		Elephant Butte	2, 197, 600	19, 400	361, 000

Location	Project	Reservoir	Storage (in acre-feet)		
			Active capacity [1]	Sept. 30, 1951	Sept. 30, 1952
Region 5	San Luis	Platoro	54, 000	0	0
	Tucumcari	Conchas	269, 100	135, 300	85, 500
Region 6	Belle Fourche	Belle Fourche	185, 200	44, 000	19, 200
	Milk River	Fresno	127, 200	94, 900	70, 100
		Nelson	68, 800	42, 500	40, 300
		Sherburne Lakes	66, 100	15, 600	5, 400
	Missouri River Basin	Angostura	92, 000	41, 000	69, 200
		Boysen	820, 000	0	647, 800
		Dickinson	13, 500	0	4, 600
		Heart Butte	68, 700	62, 700	69, 400
		Keyhole	270, 000	0	10, 500
		Shadehill	300, 000	0	79, 200
	Rapid Valley	Deerfield	15, 100	13, 800	12, 600
	Riverton	Bull Lake	155, 000	146, 600	88, 200
		Pilot Butte	31, 500	4, 200	6, 200
	Shoshone	Buffalo Bill	394, 600	389, 700	276, 000
	Sun River	Gibson	105, 000	70, 100	31, 300
		Pishkun	30, 100	24, 500	17, 200
		Willow Creek	32, 400	23, 600	18, 600
Region 7	Colorado-Big Thompson	Granby	467, 600	218, 600	432, 400
		Green Mountain	146, 900	132, 300	135, 500
		Horsetooth	151, 700	40, 800	49, 900
		Shadow Mountain	1, 800	1, 500	700
	Kendrick	Alcova	190, 300	162, 300	164, 700
		Seminoe	993, 200	908, 300	865, 700
	Mirage Flats	Box Butte	30, 600	17, 900	10, 000
	Missouri River Basin	Bonny	165, 000	21, 500	21, 500
		Cedar Bluff	131, 700	129, 200	73, 100
		Enders	36, 000	26, 500	19, 400
		Harry Strunk Lake	35, 000	33, 000	32, 200
	North Platte	Guernsey	44, 200	0	10, 000
		Lake Alice	11, 000	3, 000	300
		Lake Minatare	60, 800	21, 000	3, 100
		Pathfinder	1, 040, 500	371, 300	450, 900

[1] Available for irrigation.

at which forecasts were issued are now available. These few show rather good verification of the forecasts. Since historical records for high run-off were established for many watersheds, such close verification provides pleasing evidence of the ability of mountain snow surveys to interpret unusual conditions.

Arizona—The outcome of the Arizona forecasts in 1952 is shown below:

Stream	Obtained [1] (acre-feet)	Forecast for 1952			
		April 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Error, percent
Verde River, below Tangle Creek	[2] 167, 260	150, 000	10	160, 000	4
Salt River, North Roosevelt	[3] 488, 000	500, 000	2	460, 000	6
Gila River at Virden, plus San Francisco at Clifton	[2] 89, 790	100, 000	11		
Colorado River near Grand Canyon	[4] 15, 200, 000	17, 200, 000	13	16, 000, 000	5

[1] Preliminary only, subject to revision; data of streamflow are provided by U. S. Geological Survey.
[2] April-May, inclusive.
[3] April-June, inclusive.
[4] April-September, inclusive.

California—On April 1, it was forecast that the snowmelt run-off in 1952 would be the greatest since the California Cooperative Snow Survey program was initiated in 1930. Precipitation during April was less than half of normal on the watershed above Shasta Dam and on those of the Feather and Yuba Rivers. On the watersheds of the American, Mokelumne, Stanislaus, and Tuolumne, April precipitation ranged from about 60 to 100 percent of normal. On the watersheds of the Merced, Upper San Joaquin, Kings, and Kaweah Rivers, April precipitation was slightly above normal. The Kern River watershed at the southern end of the Sierra Nevada received only 75 percent of normal April precipitation. Nevertheless, the revised forecast on May 1 again anticipated a record amount of run-off.

Preliminary data now indicate that 24,428,000 acre-feet of run-off occurred on the 12 major rivers of the Sierra Nevada during the months of April through July 1952. This total run-off exceeded the previous maximum, following 1930, by 500,000 acre feet.

The over-all forecasts on April 1 and May 1 proved to be high by 8.3 and 3.7 percent, respectively.

Colorado—As indicated by the near record snow accumulation last winter, the flow of Colorado streams originating in the mountains was much above normal in 1952. This flow was generally not as high as expected because of extremely dry watersheds under the snow in some areas of the State. The total flow of Colorado River tributaries in Colorado was the highest in about 30 years. In spite of these high total flows, the snowmelt was extremely orderly, and no extensive flood damage occurred.

IDAHO—In general, the forecasts from snow surveys were for run-off much above normal. The forecasts, of course, were based upon the assumption that rainfall during the run-off season would be approximately normal. Such did not prove the case, but to the contrary, 1952 ranked up among the drier summers of record. This reduced the run-off from that which would have occurred under normal climate.

MONTANA—Precipitation over the entire State of Montana has been considerably below normal since the end of May. The lack of precipitation during August and September created a serious situation in unirrigated sections of the State. Fortunately, the summer streamflow held up exceptionally well. This, plus ample reservoir storage at the start of the irrigation season, brought irrigated areas through in good shape.

NEVADA—The 1952 forecast for irrigation season streamflow was for above normal flow for all streams in the State. For Nevada as a whole, the 1951-52 snow season was probably the heaviest ever encountered here by the white man. Every snow course in the State at one time contained more snow than ever before measured. Some snow courses have 42 years of record. At Donner Summit, the total seasonal snowfall was greater than ever before recorded in the 73 years record. Sierra reservoirs were drawn down prior to the snowmelt season to create a cushion for the expected high summer flows.

Preliminary run-off records verify the "above normal" forecasts and, as forecast, indicate a greater run-off than normal.

NEW MEXICO—The water supply along the Rio Grande in New Mexico was generally inadequate again this season. The only exception was along the small tributaries in northern New Mexico. The flow of the Rio Grande through New Mexico was above normal but not as high as expected. Inflow to Elephant Butte was about average. Since the total storage last spring was low, early season water supply was very inadequate.

A rather large error of forecast was probably due to lack of information as to unusually dry watershed under the snow.

OREGON—Oregon's irrigated lands have enjoyed a banner water year.

Smaller streams have fallen off excessively in the last $2\frac{1}{2}$ months due to prolonged drought. Substantial fall rains could make up the deficiency of watershed soil moisture. Otherwise, next summer's run-off from the coming winter's snow crop could be somewhat reduced.

SOUTH DAKOTA—The 1952 water supply on irrigated areas near the Black Hills in South Dakota was below normal. Soil moisture conditions are reported as poor and mountain watersheds as extremely dry.

UTAH—The April 1 run-off forecasts which indicated that record or near-record peak flows would be experienced on nearly all streams with considerable damage in vulnerable areas proved exceptionally accurate when the snowmelt run-off came.

Major flood damage occurred on the Weber-Odgen, Provo, Utah Lake and Jordan River drainages. Salt Lake experienced the most damaging snowmelt flood in its history when about 400 people were forced to evacuate their homes. Flood damage to farm and irrigation facilities alone was estimated for the State at $2,000,000. Damage to municipalities, highways, bridges, railroads, forest lands and roads would amount to several millions more.

Most damage resulted from melting of the exceptionally deep low and intermediate elevation snowpack during an extended warm period the last of April and first week of May. Run-off from the higher elevation snowpack was less damaging due to below normal temperatures during the rest of May and first week of June. Below normal precipitation during April and May was also a factor in reducing peak flow.

In general, yield from the low elevation snowpack was greater than anticipated, but the below normal precipitation during April and May somewhat compensated for it, with the result that most forecasts were very good. The largest error, 18 percent, was on Big Cottonwood Creek near Salt Lake City. A new forecast curve which has been subsequently developed, giving more weight to low elevation snows, would have forecast the run-off within 3 percent. Error of forecast on the Bear River at Harer is also due to the excessive yield from low elevation snows.

Run-off from springs is considerably higher than normal for this time of year and will have a carry-over effect on next season. However, unless October produces above normal rains, this carry-over effect will probably be minimized by the dry watersheds resulting from below normal precipitation during the summer and fall months.

WASHINGTON—Runoff data are curently available for only three of the streams forecast in April. In all cases, the measured run-off was materially less than forecast. The discrepancy is chargeable to the extended summer drought which prevailed. Less run-off from snowmelt was obtained than would have occurred with normal late spring and summer rainfall.

WYOMING—The irrigation water supply for the southern half of Wyoming was adequate for the 1952 season. The summer discharge of the Green, North Platte and Laramie Rivers was well above normal. On the North Platte, the reservoir system almost filled. There would have been uncontrolled spilling if water had not been released in advance of peak flow to avoid this condition.

The good to excellent water supplies forecast in western Wyoming materialized. ###

Soil Scientist Caswell Goes to Libya

Bureau of Reclamation soil scientist Alfred E. Caswell, left the United States in September on a Point Four project to help the people of Libya in their efforts to increase food production.

Mr. Caswell has been working during the past three years in the Bureau's offices at Casper and Cody, Wyo., on land mapping and land classification surveys.

Canadian Water Users Read ERA

According to a report from Ed Neal, supervisor of irrigation operation and maintenance on the Columbia Basin project, Ephrata, Wash., representatives of the Alberta Irrigation Projects Association at a meeting in Lethbridge, Province of Alberta, Canada, made numerous references to valuable information which they had obtained through reading the RECLAMATION ERA. Said Mr. Neal, "From references that they made, it was evident that the ERA is widely read by our Canadian friends."

Mr. Neal attended a meeting of directors, managers, engineers, and operating supervisors from irrigation districts in the Province of Alberta, representing about 250,000 acres. The Alberta Irrigation Projects Association paid for Mr. Neal's travel and subsistence and have asked that a speaker from the Bureau of Reclamation attend their meeting again next year. •

Columbia Basin's First Harvest

(Continued from page 266)

Grant County public utility district which is trying to bring electricity to the farms in the first year of settlement, reported an increase of 11 percent in the number of customers in the past year.

Eventually, 14,000 irrigated farms will be created within an area almost twice the size of the State of Delaware and for each single nonirrigated farm today, there will be 25 farms which are irrigated.

Much of the produce will be used to feed the growing population of the State of Washington. Owen L. Brough and E. L. Baum, from the Department of Agricultural Economics of Washington State College estimated that if only half the project land were devoted to dairying, the project would hardly be able to keep up with the dairy needs of the State, with the population continuing to increase at the present rate.

If the population of the entire Nation continues to increase at the rate of 2,500,000 persons a year, economists estimate that by 1975, we will need 10 million more cattle, 20 million more hogs, 3⅓ million more sheep and lambs, 87 million more laying hens, and 6 million more milk cows.

Settlers on the Columbia Basin project, when they have completely developed its 1,029,000 acres, will help raise $120 million worth of these farm products each year (according to 1949 prices) thus helping to fill that "fifth plate" at the Nation's dinner table with food raised on irrigated farms. ###

Bureau Engineers Receive Awards

Eight Reclamation engineers who risked death by drowning, exposure, or electrocution, deep inside Grand Coulee Dam, were given awards for heroism by Secretary of the Interior Oscar L. Chapman at a recent ceremony in Washington, D. C.

At Grand Coulee Dam, Wash., on March 14, an insecure cover to an inspection shaft tore loose after a giant outlet valve was inadvertently opened. The terrific force of the Columbia River was turned into the interior of the dam through the inspection shaft and began flowing into the two giant power plants located at the end of the dam. The men waded waist-deep through 34-degree benumbing ice water, fighting surging current in an effort to reach electrical controls and cut off the water before substantial damage was done.

If the flow of water had not been stopped promptly, power production in the Pacific Northwest would have been seriously crippled and the effect of the loss of energy would have been felt throughout the country.

The eight to receive the Gold Medal Distinguished Service Award—the Department's highest honor—were, Norman G. Holmdahl, Donald D. McGregor, Milton L. Berg, John S. Bates, Harold E. Permenter, Irven E. Slaughter, Perry W. Crandall and James P. Green.

During the same ceremony, the Bureau's Chief, Engineer L. N. McClellan, who has designed most of the world's largest hydro power plants received the top Departmental Gold Medal Distinguished Service Award for "out-standing contributions to human progress both in this country and abroad." ●

Final Rio Grande Channel Contract Awarded

The second and final contract for channelization of the Rio Grande to provide an increased water supply for the drought stricken Middle Rio Grande Valley (see "Relief for Middle Rio Grande Valley," p. 289, Dec. 1951 issue of Reclamation Era), was awarded in September to the Clark Construction Co. of Kansas City, Mo.

The contract provides for channelization of a 10-mile stretch of the river extending north from San Marcial, New Mexico, and the construction of dikes, levees, drains, and culverts to control water flow in the stream. Work is scheduled for completion in January 1954.

Channelization of the 21-mile stretch of the River from San Marcial to the narrows of Elephant Butte Reservoir near Socorro, New Mexico, under the contract awarded last year is rapidly nearing completion. ●

Assistant Secretary Rose Resigns

Secretary of the Interior Oscar L. Chapman announced the resignation of Robert R. Rose as Assistant Secretary on September 2, 1952. Mr. Rose, who was in charge of the technical bureaus in the minerals resources area for about a year, returned to Wyoming as a candidate for election to the United States House of Representatives. ●

NOTES FOR CONTRACTORS

Contracts Awarded During September 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
3128	Missouri River Basin, Mont.	Sept. 12	Construction of Tiber dam and dike and 115- and 12.47-kilovolt transmission lines.	Guy H. James Construction Co. and Wunderlich Contracting Co., Oklahoma City, Okla.	$12,838,
DC-3620	Middle Rio Grande, N. Mex.	Sept. 11	Channelization of the Rio Grande, fish and wildlife refuge to San Marcial.	List & Clark Construction Co., Kansas City, Mo.	713,
DS-3746	Central Valley, Calif.	Sept. 18	One main control board and one graphic and auxiliary control board for Folsom power plant.	Wolfe & Mann Mfg. Co., Baltimore, Md.	71,
DS-3747	Missouri River Basin, S. Dak.	Sept. 4	Two 115,000-volt and four 69,000-volt horn-gap switches and one 115,000-volt and six 69,000-volt disconnecting switches for Watertown substation.	Pacific Electric Mfg. Corp., San Francisco, Calif.	11,
DC-3754	San Diego, Calif.	Sept. 8	Construction of earthwork, pipeline, and structures for San Jacinto-San Vicente aqueduct, schedule 1.	R. V. Lloyd & Co., Coachella, Calif.	2,574,
DC-3754	do	do	Construction of earthwork, pipeline, and structures for San Jacinto-San Vicente aqueduct, schedule 2.	Engineering Constructors, Inc., Los Angles, Calif.	2,065,
DC-3754	do	do	Construction of earthwork, pipeline, and structures for for San Jacinto-San Vicente aqueduct, schedule 3.	Johnson Western Constructors, San Pedro, Calif.	3,192,
DS-3757	Central Valley, Calif.	Sept. 18	Two 4,160-volt unit substations for Folsom power plant and switchyard.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	93,
DS-3758	do	Sept. 19	Eighteen 75,000-pound radial-gate hoists for spillway at Nimbus Dam.	Willamette Iron & Steel Co., Portland, Oreg.	158,
DS-3759	Colorado-Big Thompson, Colo.	Sept. 25	Controlling station remote control and telemetering switchboard cubicle and equipment and controlled-station supervisory control and telemetering equipment for Flatiron power plant and Flatiron afterbay dam.	Automatic Control Co., St. Paul, Minn.	11,
DC-3763	Missouri River Basin, Wyo.	Sept. 8	Construction of additions to Thermopolis substation	Commonwealth Electric Co., Lincoln, Nebr.	18,
DS 3765	Central Valley, Calif.	Sept. 29	Three 230,000-volt circuit breakers for Folsom switchyard	Brown Boveri Corp., New York, N. Y.	163,
DC-3769	Missouri River Basin, Mont.	Sept. 23	Excavation for Missouri diversion dam foundation	O'Neil Construction Co., Havre, Mont.	42,
DC-3775	Missouri River Basin, Kans.	Sept. 30	Two 4- by 5-foot high-pressure gates with two 110,000-pound hydraulic hoists, three conduit lining transitions, one hydraulic and one semiautomatic gate hanger, one single mercury switch, two 1¼-inch and one 1¾-inch standard shoulder eyebolt for canal outlet works at Kirwin dam.	Hardie-Tynes Mfg. Co., Birmingham, Ala.	36,
DC-3779	Riverton, Wyo.	Sept. 26	Construction of earthwork and structures, Cottonwood drain, Wyoming canal lateral system.	Sharrock and Pursel, Casper, Wyo.	53,
DS-3794	Missouri River Basin, S. Dak.	do	Two 85-foot and two 225-foot fabricated structural-steel towers for Missouri River crossing of Oahe-Midland 115-kilovolt transmission line.	Westco Steel Co., Oakland, Calif.	52,
100C-152	Minidoka, North Side Pumping.	Sept. 15	Laterals from wells 4B824, 10A824, 10B824, 14A824, and 15A824.	McWaters & Bartlett, Boise, Idaho.	42,
100C-154	Boise, Idaho	Sept. 18	Carpenter shop and garage addition at Anderson Ranch Dam.	Prokesh and Howry Boise, Idaho	13,
117C 161	Columbia Basin, Wash.	Sept. 19	Additional laterals and canal structures, West and East Low Canal areas, W-3, W-4, E-2, and E-3.	McWaters & Bartlett, Boise, Idaho.	19,
200C-216	Cachuma, Calif.	Sept. 26	Repairing erosion damage and constructing asphalt-lined ditch for erosion control, South Coast, conduit.	Charles T. Richardson, Santa Barbara, Calif.	16,
601C 25	Shoshone, Wyo.	Sept. 3	Closed drains	Harry F. Berggren & Sons, Inc., Scottshluff, Nebr.	56,
604C-28	Milk River, Mont.	Sept. 15	Siphons, check and wasteways, stations 865/50, 1147/27, 1195/43, and 1493/72, Vandalia South Canal.	Madsen Brothers & Graves Fairfield, Mont.	89,
701C 269	Missouri River Basin, Kans.-Colo.-Nebr.	Sept. 26	Installation of radio communication equipment	Neale Construction Co., Topeka, Kans.	14,
703C-259	Kendrick, Wyo.	Sept. 3	Earthwork and asphlatic membrane lining, Lateral 256, Stations 783/40 to 857/17.7.	Lichty Construction Co., Riverton, Wyo.	27,
703C-271	Kendrick, Wyo.	Sept. 24	Laramie substation additions	George W. Shelp, Rawlins, Wyo.	23,
703C 278	North Platte, Wyo.	Sept. 19	Rehabilitation at Fort Laramie Canal desilting basin	Henry F. Bergeren & Sons, Inc., Scottshluff, Nebr.	15,

Construction and Materials for Which Bids Will Be Requested by January 1953

Project	Description of work or material
Boulder Canyon, Calif.	Construction of laterals 116.1 and 118, including 3 outdoor-type 15.6 to 54 cubic feet per second capacity pumping plants, 1 equalizing reservoir, and 8.8 miles of 12- to 48-inch diameter concrete pipelines for part 1 of unit 8, Coachella distribution system, adjacent to Coachella canal southwest on Indio, Calif.
Central Valley, Calif.	Construction of Camp Creek diversion dam, a concrete overflow weir about 44 feet long and 10 feet high built on a rock foundation. Water it diverts flows through a 70-foot long headworks into Camp Creek Tunnel to Sly Park Reservoir. Headworks will be a part of this contract and requires a 7- by 7-foot radial gate. Work located on Camp Creek 2 miles east of Sly Park, Calif.
Central Valley, Calif.—Con.	Construction of 16 miles of precast 12- to 48-inch diame concrete pipelines, including monolithic moss screens a pumping plant structures, and installation of moss scree and pumping units for unit 2 of Saucelito irrigati district on the Friant-Kern Canal distribution syste east of Pixley, Calif.
Do	Construction of laterals for the north section of Made distribution system's unit 1 near Madera, Calif., co prises 32 miles of laterals varying in bottom width fro 6 to 18 feet. Laterals will be unlined or earth-line Work includes construction of turn-outs, farm bridg highway crossings, division boxes, checks, and chec drops.

U. S. GOVERNMENT PRINTING OFFICE: 1952

Construction and Materials for Which Bids Will Be Requested by January 1953—Continued

Project	Description of work or material
entral Valley, Calif.—Con.	Construction of the remaining portion of Contra Costa Canal distribution system is to comprise 15.8 miles of 12- to 60-inch diameter reinforced concrete pressure pipeline between Antioch and Martinez, Calif., for Contra Costa County water district. The contractor will furnish and lay pipe, construct moss screen and turn-out structures, and install stationary moss screens, gate valves, meters, slide gates, pipe vents, and air valves.
Do	5 230-kilovolt air switches for Folsom-Elverta terminal switching facilities; 12 230-kilovolt and 5 115-kilovolt air switches for Folsom switchyard; and 1 115-kilovolt air switch for Nimbus switchyard.
olorado-Big Thompson, Colo.	Installation of carrier-current equipment at Sterling substation.
lumbia Basin, Wash.	Construction of guard and firehouse headquarters building at Coulee Dam, a 1-story, 124- by 90-foot masonry structure with partial basement. Interior finishes will include plastering, acoustical treatment, and floor coverings on concrete floors.
Do	Construction of 5 wasteways of 5- to 35-cubic feet per second capacity, about 23 miles long with RI drops, culverts, farm and county road crossings, and bridges for lateral area W-3.
Do	Drilling an exploratory well in the P-9 area on Potholes East canal near Eltopia, Wash.
Do	Seven vertical-shaft motor-driven pumping units for area P-8 on Potholes East canal, as follows: one 2-cubic feet per second capacity at 16-foot head, one 2.3-cubic feet per second capacity at 18.5-foot head, one 3.3-cubic feet per second capacity at 13-foot head, one 2-cubic feet per second capacity at 10.5-foot head, one 6-cubic feet per second capacity at 29-foot head, and two 6.3-cubic feet per second capacity at 14-foot head.
Do	Three 24-cubic feet per second capacity at 50-foot head, horizontal-centrifugal type motor-driven pumping units for Eltopia Branch pumping plant.
avis Dam, Ariz.-Nev.	Installation of 10,500-kilovolt-ampere shunt capacitor and erection of additional 69-kilovolt bay and installation of 69-kilovolt oil circuit breaker and other equipment for the 16,000-kilovolt-ampere Cochise substation near Cochise, Ariz.
la, Ariz	3 indoor, 5,000-volt, 600-ampere, and 2 indoor 5,000-volt 1,200-ampere metal-clad motor-control switchgear cubicles for Wellton-Mohawk pumping plants 1, 2, and 3.
issouri River Basin, Nebr.	Construction of 2.4 miles of 685-cubic feet per second capacity Courtland canal includes 9 embankment sections which are to serve also as detention dams. Work includes 5 timber bridges, 2 drainage inlets, 2 lateral turnouts, 9 detention basin evacuation conduits, and 0.4 mile of unreinforced concrete canal lining. Work located 3 miles southeast of Superior, Nebr.
Missouri River Basin, Nebr.—Continued	Construction of 20-mile reach of Bartley Canal, varying from 13-cubic feet per second capacity, 12-foot base to 42-cubic feet per second capacity and 6-foot base. Main structures are siphons, overchutes, culverts, turnouts, and timber bridges. Located near Bartley, Nebr.
Do	Construction of a 13-mile unlined reach of Franklin earth canal of 210- to 140-cubic feet per second capacity and 12- to 14-foot bottom width, for second section of Franklin canal near Franklin and Riverton, Nebr. Main structures include 15 precast concrete pipe siphons, 78 to 60 inches in diameter; 23 precast concrete pipe cross culverts, 9 timber highway bridges; 2 wasteways, and 5 baffled apron drops.
Missouri River Basin, S. Dak.	Construction of 20,000-kilovolt-ampere Rapid City substation near Rapid City, S. Dak. Work involves furnishing and erecting steel structures and a prefabricated steel control building measuring 24 by 50 feet, and installing government-furnished electrical equipment. Electrical equipment includes one 20,000-kilovolt-ampere transformer; 115-, 25.2-, and 4.16-kilovolt bus structures, circuit breakers, and switching equipment; one 10,000-kilovolt-ampere synchronous condenser, and a 200-kilovolt-ampere distribution transformer.
Do	Construction of 15,000-kilovolt-ampere Weaver substation for the Air Force base near Rapid City, S. Dak. Work involves erecting steel structures and installing government-furnished equipment including two 115-kilovolt-switches, one 15,000-kilovolt-ampere power transformer and one 2,000-kilovolt-ampere reactor.
Do	Construction of the following 115-kilovolt transmission lines in the vicinity of Fort Randall dam: Two parallel 12-mile transmission lines from Fort Randall tap to Fort Randall switchyard, Fort Randall-O'Neil 1.7 mile-extension into Fort Randall switchyard, and Fort Randall-Winner 1.7-mile extension into Fort Randall switchyard.
Rio Grande, N. Mex.-Tex.	Construction of 1,600 feet long by 42 feet high earth-fill North Branch dam on the Picacho Arroyo, 5 miles northwest of Las Cruces, N. Mex. Requires 160,000 cubic yard embankment.
Vermejo, N. Mex	Rehabilitation of Vermejo dams involves construction of 3 small earth-fill dams for irrigation storage, including 4 concrete outlet works structures on the Vermejo River near Maxwell, N. Mex. The headworks structures include wasteway and canal outlet works for reservoir No. 2; inlet transition, concrete box drop and stilling basin for reservoir No. 7 and 8 Stubblefield: and concrete box, inlet transition, and stilling basin for reservoir No. 13.

United States Department of Interior, Oscar L. Chapman, Secretary
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THE RECLAMATION AREA

The
Reclamation ERA

December

1952

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Volume 38, No. 12

The Reclamation ERA

35 Years Ago In The Era

Your War Contribution—Bread or Meat?

Meat rather than bread should be the principal food contribution of the reclamation projects . . .

Feeds not available or needed for human consumption should be used as largely as possible in feeding live stock. By feeding straw or corn stover, especially for wintering mature stockers and breeding animals, farmers will make the best possible use of these roughages. In this way a large proportion of the straw and stover ordinarily burned or wasted can be manufactured into meat and milk. Grain sorghums, whenever they are available, should be fed to release corn for human uses. Grain, where fed, should be used as economically as possible.

Every animal should be a factory for turning into food material inedible for human beings.

(From an article prepared by the United States Department of Agriculture on page 573 of the December 1917 issue of the Reclamation Record, predecessor to the Reclamation Era.)

OUR FRONT COVER. Winter Wonderland for summer dividends. Conservation and distribution of the water stored in the snow banks and used for irrigation pays enormous material dividends to our national economy. This scene on the Boise project in Idaho photographed by Phil Merritt.

Our Back Cover is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

Design and illustrations by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

SIX LOADS TO SHOULDER

Adapted from remarks by U. S. Commissioner of Reclamation MICHAEL W. STRAUS at the Annual National Reclamation Association Convention, Long Beach, Calif., November 14, 1952.

Reclamation should be an owner-operated enterprise in which the stockholders play full and active part.

We in Reclamation have been recommending greater local and State participation in providing Reclamation development for years and have gone a long way in providing mechanics to practice it. Local and State participation is built into Reclamation by law and policy.

Under present laws and policies, no project can be built without a community's clamoring for it, approving the plan, and forming voluntarily a local water users' organization, properly set up under valid and appropriate State law, which makes a contract to repay its share of the allocated costs; and this contract must be approved by a vote of local members and confirmed by a court designated by State law.

The local interests must by law be kept informed of all developments in the investigation. After the proposal is ready for submission to the Congress, it must by law be submitted to the States and other Federal agencies involved for review. The Bureau's policy is to submit the proposal to the water users' organizations and other local agencies, as well as to the States. At the same time we issue a public proclamation and accounting, and thus, in effect, we submit the proposal to the scrutiny and approval of the world.

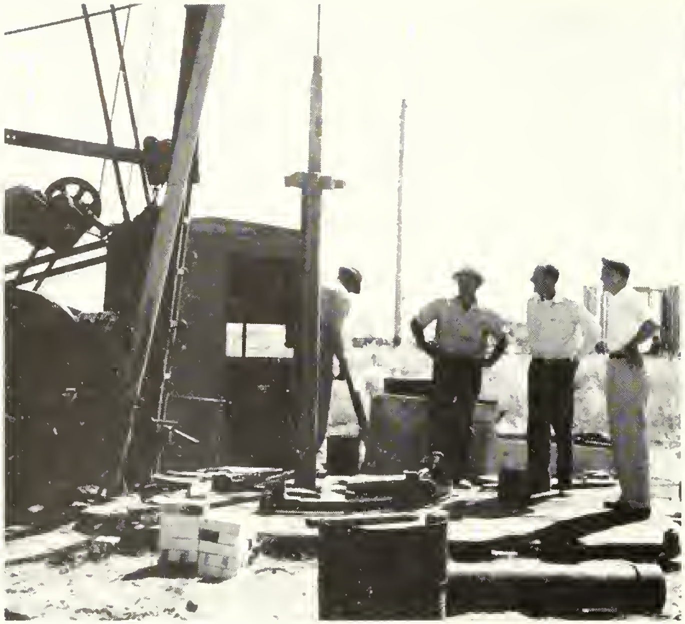
Next, the project must in most cases be authorized and in all cases financed by the elected representatives of the local people in Congress. And finally, when the project is finished, it is offered, with all the insistence of which we are capable, to the local water users for operation and maintenance.

These are the formal and required steps which safeguard and insure local participation. In practical work, the number of informal contacts and relationships is almost infinite. Settling farmers on new land; collecting construction charges; making rehabilitation and betterment arrangements; amending contracts as economic circumstances change; conforming not only with State laws, but with State plans and programs; cooperating in the many programs incidental to water-resources development; all these activities go to make up the great network of Federal-State-local-individual partnerships which is Reclamation.

Thus the local interest in Reclamation is amply protected under our present laws and policies; but there is another and stronger reason for seeking more local participation, control, and responsibility. It is simply that our job is big and broad

(Please turn to page 296)

STATE GOVERNORS TO ASSIST in dedication of Davis Dam, on the Colorado river near Kingman, Ariz., on December 10, 1952. Governors of the 11 Western States, Congressional delegations and representatives from Mexico have been invited to participate in this dedication of one of Reclamation's multiple-purpose dams with which the water resources of the Colorado River, which courses through 7 States, are being developed for beneficial use. It provides 225,000 kilowatts of low-cost power plus other benefits for Nevada, Arizona, and California, and reregulates the river for downstream irrigation use under the treaty with Mexico. *Photo by Phil Blew, Region 3 photographer.*



THEY INCORPORATED 8 farm units as the South Winchester Water Association. Driller Jack Harrison (back to camera) starts the well as officers of the S. W. W. A. look on. From left to right: President Virgil Townsend, Vice President William Bennett, and Secretary-Treasurer John Baird (attorney).

THEY DID THE WORK.—Settler Art Johnson, foreground, holding pipe, W. C. McDonnell, center, and Clarence Schwebke working on ditch in background, helping to bring their own domestic water to the Westmont Acres Water Association's part-time units near Soap Lake, Wash., on the Columbia Basin project.

Domestic Water for the Columbia Basin

by ORLAND H. TONNEMAKER

County Extension Agent, Grant County, Washington

"How and when can we get domestic water?" That is usually the first question asked by new settlers on the Columbia Basin project after they have picked out their farm units.

And here in the State of Washington, three agencies are working together to aid the new settlers in getting good wells as rapidly as possible. The United States Bureau of Reclamation with the concurrence of the Farmers Home Administration and the Washington State College Extension Service has published a Feasibility Report on which is located a source of domestic water for every farm unit in the Columbia Basin. These agencies also have a three-way mutual agreement to help the settlers plan individual wells or a group well to be shared by neighboring units.

The feasibility reports give the expected depth of all wells in the entire area, the estimated cost of the well for every farm unit, and also map out expected building sites for the homes on each farm unit, indicating the size of pipe needed to carry the water from the group wells to all the farm units.

All of this information including a definite proposed location for each well, can be read from the map for each irrigation block.

As soon as there are enough neighbors settled in the area, a meeting is held to answer the questions of how and when they will get their "running water." Explanation of the reports is properly the function of the County Extension Service, but usually it also requires the help of Mr. Wistar Burgess, local supervisor of the Farmers Home Administration and Gordon Anderson, Farmers Home Administration engineer.

W. O. Watson and T. H. Griffin, Bureau of Reclamation engineers, have calculated on these reports the cheapest and most feasible way to get water. Some are figured on private systems, some in groups of two or three and the rest in larger groups.

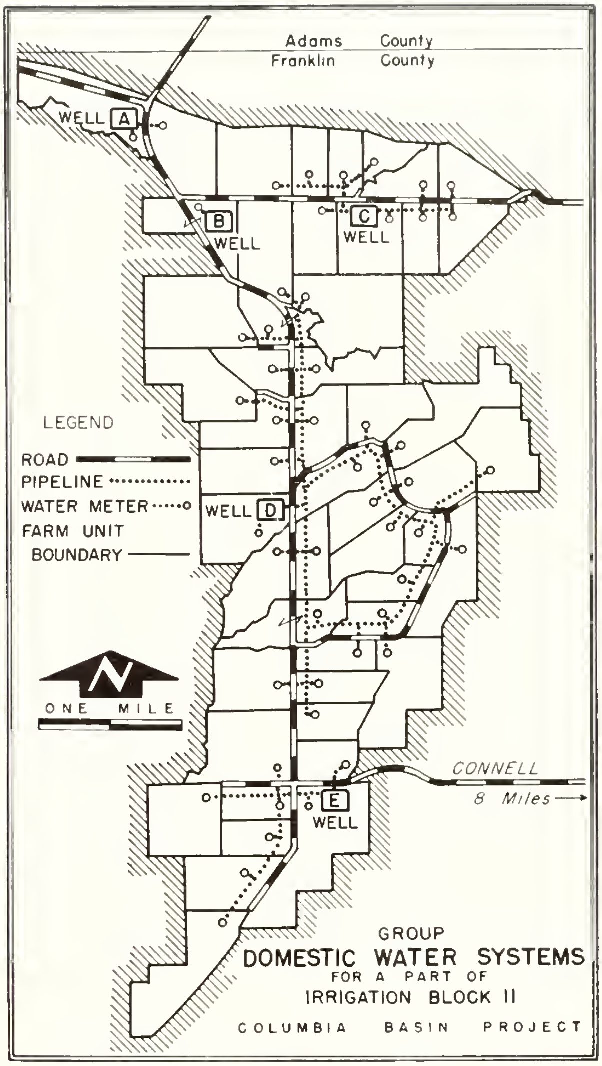
When new settlers learn in a meeting that they can get city water pressure and city water service out on their isolated farm units by grouping together with their neighbors and at the same time make a saving averaging from 10 to 80 percent of the cost of the well they say, "Why wait?"

But they still have another surprise. If they will group together they can buy an equal share in a group well for much less than a private well would cost; but if they will incorporate this group under the laws of the State of Washington, they will then be allowed to borrow 90 percent of their share of this well at 3 percent interest for a 20-year repayment period. This 90 percent loan is secured by a mortgage on the well system, thus leaving their capital and credit free to be invested in other necessary improvements.

This loan program of the Farmers Home Administration is one of the most popular ever entrusted to that agency by the Government. At this point, the group usually starts to incorporate. It takes five signers to incorporate, so usually owners of five farm units become incorporators for each group. Then the F. H. A. engineer works up a new estimate for this group for a domestic water association.

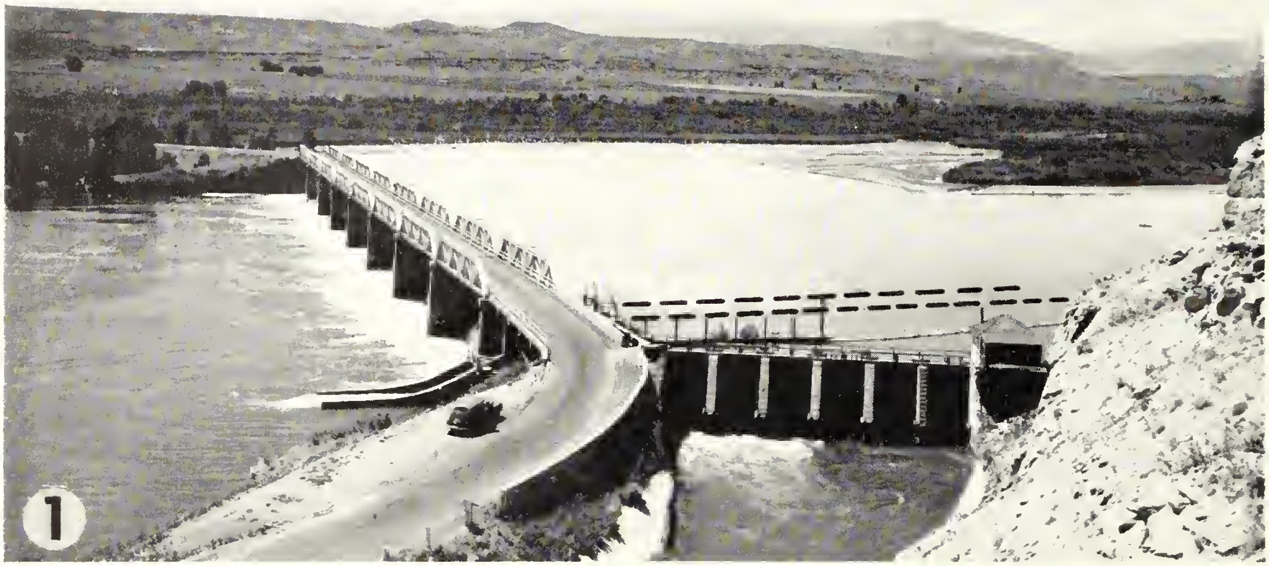
It often comes as a matter of surprise to them that they are to operate this entirely by themselves. Often the question is asked, "When are you going to hire the well drillers?" It is then they learn

(Please turn to page 297)



THEY GOT EXPERT ADVICE on the best and cheapest ways of getting "running water" to their farms. Below, front row, A. F. Enzler, Ralph Enzler, Sam Palmerton, and Glenn E. Morland. Second row, Mrs. T. H. Lowe. They since have incorporated as the Wheeler Water Association. At the back of the room, from left, Grant County Extension Agent Orland H. Tonnemaker (author of article); Ray Toll, and A. Gordon Anderson, both of Farmers Home Administration. At right, a map for irrigation block 11, showing the possibilities for locating wells and pipelines. *All photos for this article by Ellis Shorthill, Region 1 photographer.*

229749—52——2



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HEADING OFF THE SLUSH FROM THE HEADGATE.—(1) Wind River Diversion Dam and headgate of the Wyoming Canal, with dotted line indicating the location of the by-pass channel when the water back of the dam freezes solid; (2) and (3), opening a channel in the ice behind the dam to carry the slush ice through the log-way, and thereby divert it from the headgate of the canal which feeds water to the Pilot Butte Power Plant. Temperature—25 degrees below zero.

RIVERTON'S "SLUSH PLOW"

SLUSH OR FRAZZLE ICE has often threatened to "black out" the Riverton project in Wyoming.

But since the winter of 1948–49, a "slush plow" devised by Karl Powers, irrigation manager for the Midvale irrigation district, an organized water users group of the project, has not only ended this threat, but saved almost $19,000 in one season.

The Pilot Butte Power Plant, which has been in operation since 1925, depends upon a 9-mile-length of the Wyoming Canal to deliver the water for generating electricity. During the severe, subzero winter months, a granular form of ice known locally as slush ice can cut off the flow of water into the canal.

When the temperature is below 25° Fahrenheit, this slush ice appears in the swifter flowing reaches of the Wind River which do not freeze over solid. As slush ice apparently forms around minute particles of silt or sand, it is slightly heavier than surface ice and is carried along downstream by the swift currents until it reaches slower sections of the river where the surface is completely frozen. Here it follows the current underneath the ice.

When slush ice reaches the Wind River Diversion Dam, which channels water into the Wyoming Canal, its natural tendency is to follow the current to the canal headworks, pile up against the canal gates, clog the works, and cut off the flow of water to the open Wyoming Canal. Thus, a source of electricity in the Wind River area can be completely shut off.

During the first 2 years of operation slush ice almost caused the power plant to shut down. Then began the heroic efforts of the Riverton project's operating staff to live up to its motto, "The water must be delivered." Page 1 of the January 1948 issue of the Reclamation Era carries a graphic description of the hazardous job they undertook year after year. They cut a diagonal channel in the solid ice upstream from the diversion dam, leading to the spillway. Crews of 12 to 15 men worked 24 hours a day for periods of a month or more in temperatures ranging from zero to 50° below zero, trying to detour the slush ice from the canal gates to the spillway.

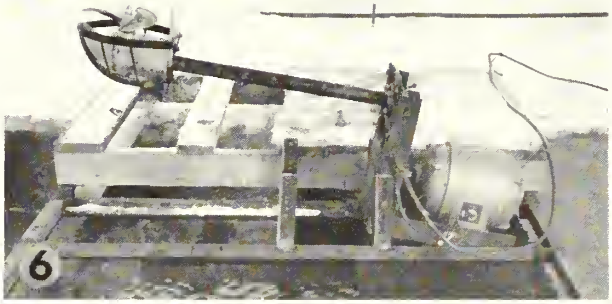
The Wind River is aptly named. Sometimes 40-mile-an-hour winds blew men into the slush-laden channel. Occasionally they would slip on the ice and take an unexpected dunking in the freezing water. But in spite of all the hazards of the job, no one drowned or lost his life, primarily because the crews were always on the alert for such contingencies.

Sometimes, even with a large crew of men on the job and with their best efforts, the channel could not be kept open. As the demand for electricity increased, the situation became even more serious, as increasing amounts of water were needed for the power plant during the winter months.

Adding to the severity of the problem is the fact that the diversion dam raises the normal water surface of the river about 18 feet, thus creating a considerable forebay of still water. Whenever slush ice blocked the canal headworks and the diversion works too, the river rose as much as 15 feet, and flooded nearby ranches.

In order to live up to their motto, "The water must be delivered," the Riverton project staff added another one, "The slush ice must be kept moving."

During the winter of 1948–49, Karl Powers began to experiment with an idea of his. He took some large outboard motors, the kind that are used for boats, slung them on an iron angle frame which spanned the open cut in the ice, wired the outboards to an electric motor, and let the propellers churn away—stirring up the slush ice, keeping it moving down the river, insuring water deliveries to Pilot Butte Power Plant, and saving a lot of back-breaking, dangerous hand labor.



THE "SLUSH PLOW" IN ACTION.—(4) The new electrically driven propellers detouring the slush ice. Note agitation of the water. (5) The new ice-moving machine, with the propeller in the water. (6) View showing propeller shaft of the "slush plow."

Powers and his crews have gradually improved on the idea. At present, the electrically-driven propellers have replaced almost all of the hand labor formerly required. During the past winter, except for 1 week when additional help was needed, the regular gate tender and one extra employee kept the channel open.

Records show that removing slush ice, prior to the use of the machines, cost as high as $22,000 in one season. During the 1951–52 winter, the work cost only $3,134, representing a possible saving of almost $19,000 in one season. At this rate, in 22 years Riverton project operators will save as much as the entire power installation cost to begin with.

The "slush plow" has been adopted as a standard operation on the project, and could undoubtedly be used to advantage on other projects. # # #

229749—52——3

DAIRY DIVIDENDS

MORE THAN $3,000 A YEAR.—That is the amount saved by pasturing registered dairy cows on the only sprinkler-irrigated farm in the Tucumcari project, in New Mexico, shown above.

How A Tucumcari Farmer Makes A Profit on his Sprinkler Irrigated Pasture

by GARFORD WILKINSON
Regional Information Officer
Amarillo, Tex., Region 5

W. H. INGRAM, THE ONLY SPRINKLER IRRIGATOR on the Bureau-built 42,000-acre project at Tucumcari, N. Mex., does not look upon himself as an individualist. For the most part, he contends that sprinkler irrigation is particularly advantageous to his land and dairy operations.

It is a fact, however, that the Ingram sprinkler system forges an assembly-line reaction that is unique on the Tucumcari project. The sprinkler irrigation adds abundantly to the grass the cows eat to produce the milk that is processed in the Ingram dairy and marketed by Mr. Ingram in the wholesale and retail trade in the form of pasteurized milk, cream, butter, and ice cream.

The Tucumcari project lands range in elevation from 3,900 to 4,100 feet above sea level. There is much sunshine, characteristic of the Southwest. The air is dry, with high evaporation. Annual precipitation averages 16.42 inches. The frost-free period averages 195 days out of each year.

For the last 5 years Mr. Ingram has maintained 22 acres of permanent seeded pasture, divided into 6 plots of 3¾ acres each. He recently seeded 11 additional acres. He uses the following 11 pound mixture per acre: Orchard Grass, 5.3; Perennial Rye, 1.1; Ladino Clover, 1.1; Alsike Clover, 1.3; Alfalfa, 2.2.

The Ingram land, just east of the city of Tucumcari, is rolling and would be very costly to level for surface irrigation. Moreover, his dairy hands are fully occupied only a few hours each morning and evening. At other times each day they are available to operate the sprinkler system.

Up to this year, Mr. Ingram calculated his annual net income from his pasture program at $75 per acre. These earnings are not spectacular, but they are impressive, considering the type of soil on which the pastures were first planted and the characteristics of the area.

Mr. Ingram says he has pastured up to 65 head of dairy catle on 22 acres for 3-week periods without adversely affecting the grass. He mows the pasture, on which the cattle are rotated at regular intervals, about every 30 days and drags a harrow behind the mower to scatter the droppings. The pastures require an irrigation every 7 to 10 days.

To cite the value of his pasture program, Mr. Ingram has a cost-income chart which, unfortunately, was compiled prior to the strong advance in feed prices. His figures reflect a period of 190 days, with 36 cows at pasture, although his pasture-use season ranges from 200 to 210 days over a 5-year period. He saved $2,470 on hay alone in the recorded 190-day period, based on his estimate that his herd would have consumed 13 bales of hay daily at a cost of $13 had pasture not been available. Savings on grain amounted to $1.26 each day, or $239.40 for the full 190-day period. He estimated his pasture increased the milk output by 10 gallons a day or $5.60 per day, $1,064 for the full period. Total savings were $3,773.40.

Contrasted with the savings are the following costs of maintaining the irrigated pastures:

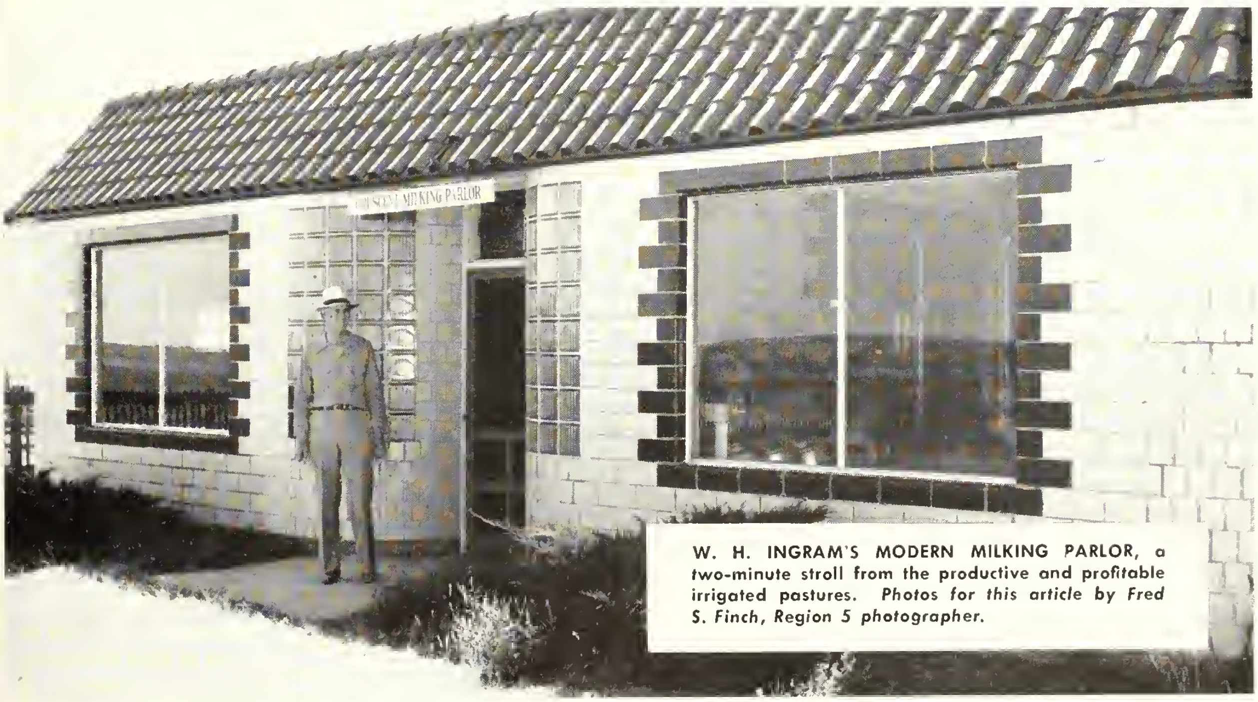
Cost of fertilizer at 600 pounds per acre—totaling 13,200 pounds	$561
Total cost of applying fertilizer, 8 days' labor	80
Mowing and harrowing, 8 days' labor	80
Electricity to pump water every 9 days	380
Cost of water at rate of 5 acre-feet for each irrigation for a total of 105 acre-feet at an average cost of $3 per acre-foot	315
Depreciation on equipment, tax, and repairs	275
Cost of applying water 3 hours daily	420
Total costs	2,111

Total estimated income as compared with the additional costs of maintaining a pasture indicates an operating profit of $1,662.40 or a per acre profit [1] of $75.50.

Although Mr. Ingram is a veteran in the dairy business, he got into it by accident. He had decided to give the pick and shovel end of Arizona's mining industry a whirl in return for going wages. But a chance acquaintance 25 years ago of the tall, raw-boned midwesterner, then in New Mexico en route to Arizona, steered him into a commercial dairy. About two decades later, while the Bureau was putting finishing touches to the Tucumcari irrigation project, Mr. Ingram set forth on his own for Tucumcari, where he established a creamery, an ice cream manufacturing plant, an outlet store for his dairy products, and began building an irrigated pasture program for his own dairy herd.

Mr. Ingram's multiple commercial enterprises, coupled with his pasture irrigation program, keeps him as busy as a bee in a bundle of blackberry blooms. He flies his own plane to dairy herd improvement meetings and conventions of creamery operators. Most of the time, however, he is irrigating, milking, churning making deliveries, or favoring friends with products of his pasture—ice cream, and milk shakes. # # #

[1] Estimated prior to the more recent sharp increase in cost of feed. Labor and all other costs unchanged.



W. H. INGRAM'S MODERN MILKING PARLOR, a two-minute stroll from the productive and profitable irrigated pastures. *Photos for this article by Fred S. Finch, Region 5 photographer.*

NORTH DAKOTA'S SOIL TRAIN

by RAY O. PETERSON,
Settlement Specialist, Bureau of Reclamation, Region 6

Know your soil—how it was formed, how to conserve, protect and use it wisely to provide the needs of human life through the plants that grow on it.

This theme was effectively presented by the North Dakota State Agricultural College last winter through a "soils special" train that made stops at 54 towns in the State.

The importance of our greatest national resource—the soil—was uniquely shown by means of a display of soil profiles, charts, pictures, demonstrations, and research data illustrating how our present soils required thousands of years to develop, the damage that can be done to them by improper use, and how they can be protected and even improved by following good soil management practices.

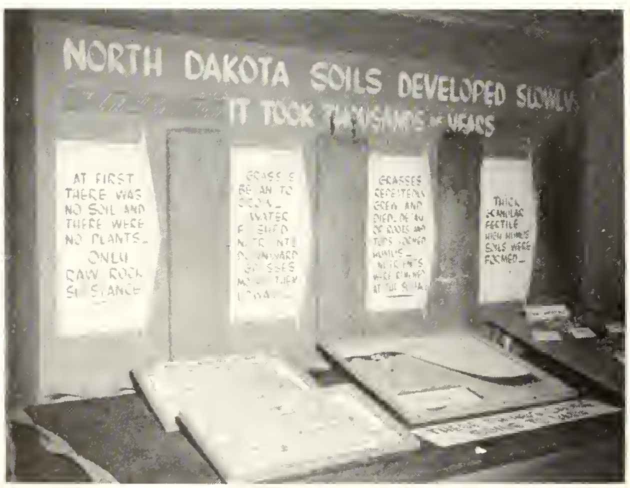
A total of 54,400 people made the guided tour through the train, a large number, considering that the farm population in the State is only 200,000 and heavy winter snow made travel in rural areas difficult.

The "soils train" which was developed by the North Dakota Agricultural College and routed in cooperation with three railroad companies, the Great Northern, the Northern Pacific, and the Soo Line, consisted of three passenger cars from which the seats had been removed. The cars were equipped with excellently prepared displays that traced the soil from its origin through its response to intelligent use. A fourth car was used to seat visitors until groups of 10 to 20 could be assembled to make the trip through the car. Each railroad company furnished one car to carry part of the exhibit and the fourth car was supplied by the company on whose line the train was being shown. The agricultural agents from the railroad companies met the visitors and explained the general features of the "soils special," organizing them into groups to be conducted through the train.

Local arrangements for showing the train and conducting the meetings were made by the county agent working with committees. The power companies and cooperatives provided the electrical hookups to light the cars. Soil Conservation Service personnel assisted in supplying material and conducting groups on the tour of the exhibit.

The first part of the exhibit was a display on the basic soil features which described the processes through which soil was changed from rock to a "thick granular, fertile, and high humus soil." By using actual soil profiles the different kinds of soils found in North Dakota were clearly

IN PLACE OF THE LOWER BERTHS—the story of the birth of the soil, in colorful, easy-to-read exhibits.



KEYS TO SUCCESSFUL FARMING—graphic illustrations of how to use even the poorer soils to best advantage.

FOR LAND'S SAKES—save the soil, was the theme of the North Dakota Agricultural College's campaign. *Drawing by Lloyd Chellman, Graphics Section.*

described. This brought out the different uses to which each kind of soil is suited, and showed that some soils can be used for grain, row crops, hay and grass while others are suitable for native pasture only.

The importance of proper soil management was emphasized by a display showing the need for commercial fertilizer, green manure crops and barnyard manure in securing maximum crop production. Research work conducted by the North Dakota Agricultural College shows that dry-land wheat yields have been increased 4.5 bushels per acre, barley 6.3 bushels and oats 7.2 bushels per acre by adding phosphate fertilizer. Wheat following corn, a legume and fertilizer yielded 50 percent more than continuous wheat.

Along with this part of the exhibit a display pointed out the value of summer fallow and other tillage practices in crop production. Experiment station results demonstrated that dry-land wheat yields could be doubled by summer fallowing and fertilizing the land. The visitors saw why the surface soil should be protected from wind and water erosion, and how the loss of topsoil reduces crop yields, and in some cases, makes the soil unfit for crop production.

The importance of livestock in good soil management was demonstrated in another section which illustrated how the soil needs forage crops in rotation and livestock are needed to utilize these feed crops on the farm. The value of proper stocking of pastures was illustrated by a miniature pasture that was overgrazed and one that was pastured wisely.

Another display provided basic information on irrigation in North Dakota. It pointed out the requirements of water and soil for successful irrigation. Profiles of soils that were suitable for irrigation and those that were not suited were displayed. The benefits of irrigation were illustrated by pictures and figures on yields of irrigated crops and pastures. A striking illustration of the value of irrigation water was a picture of the dairy cows on the Mandan Development Farm pasture on which 18 Holstein cows grazed on 7.6 acres during 1951 and produced 8,000 pounds of milk and 300 pounds of butterfat per acre.

Following each showing of the "soils special" a farmers' meeting was held and the more important recommendations on soil management for the soil conditions found in the specific area where the train was being shown were explained in detail.

Soils specialists with the college discussed the

(Please turn to page 291)

HOW TO GET THE MOST FROM THE SOIL was depicted in miniature scenes of "do's" and "don't's" for farms.

IRRIGATION AND LIVESTOCK FARMING GO TOGETHER according to this display of suitable soils for irrigation.

it CAN happen in Texas

THE FLOOD OF JUNE 15, 1935.—Looking south along Congress Avenue, Austin, Texas, with the Colorado River flooding the streets. The building in the foreground with advertising signs at each end can be seen in the photo on the following page.

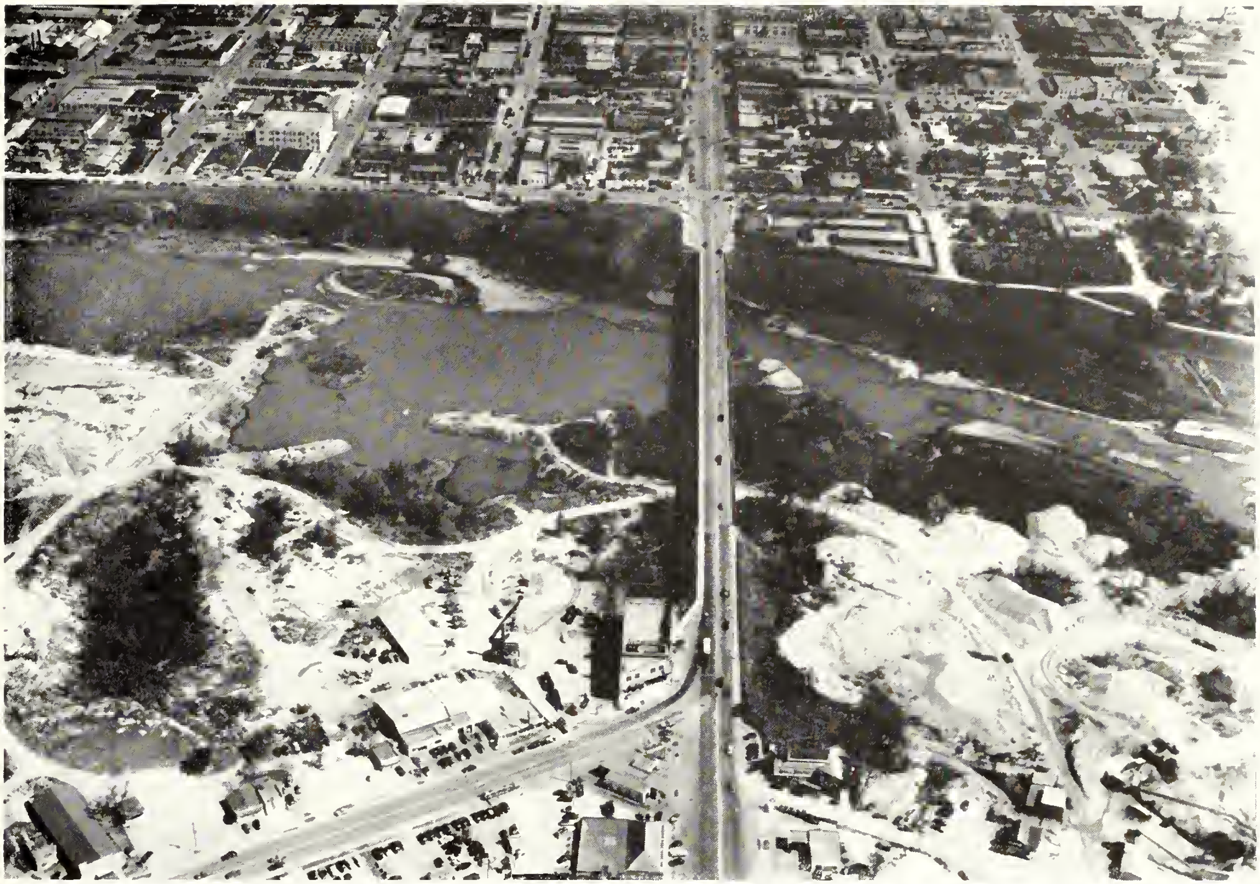
by HARRY P. BURLEIGH, Area Planning Engineer, Austin area planning office, Austin, Tex., Region 5

After years of drought—a deluge.

Within 3 days, from September 9 through 11, 1952, the central part of Texas was drenched with long awaited hydrologic manna. A storm originated in the Gulf of Mexico, southeast of Corpus Christi, traveled inland in a northwest direction, and dumped its load of H_2O over the "Hill country" formed by the Edwards Plateau. Heavy torrential rains beat upon the hard-packed surface of the area, ran down the banks of the streams, and rushed down the shell-shaped plateau on its way back to the Gulf. About 8 people lost their lives and many bridges were washed out on streams leading to the Colorado and Guadalupe Rivers which drain the area. Rainfall alone rose to 22 inches near Johnson City; the rivers swirled even higher as the flood crest gathered momentum and water from the contributing streams.

But multiple-purpose, basin-wide planning paid off.

A lesser flood (481,000 cubic feet per second crest) in 1935 caused flood damages amounting to $12,735,000, along the Colorado River and its tributaries. This year, damages were reduced to an estimated $1,181,300, due mainly to the existence of multiple-purpose structures along the Colorado River. Before the September storm, the reservoir behind Marshall Ford Dam (designed and built by the Bureau of Reclamation) and Buchanan Reservoir (created by the Lower Colorado River Authority) were empty. During the storm, the two man-made lakes held more than 1,000,000 acre feet of the floodwaters, with space left over. The United States Geological Survey has estimated that peak discharge of the Colorado River during this year's storm would have reached 600,000 cubic feet per second at Austin without Marshall Ford Reservoir and would have caused heavy damages along the river at and below Austin.



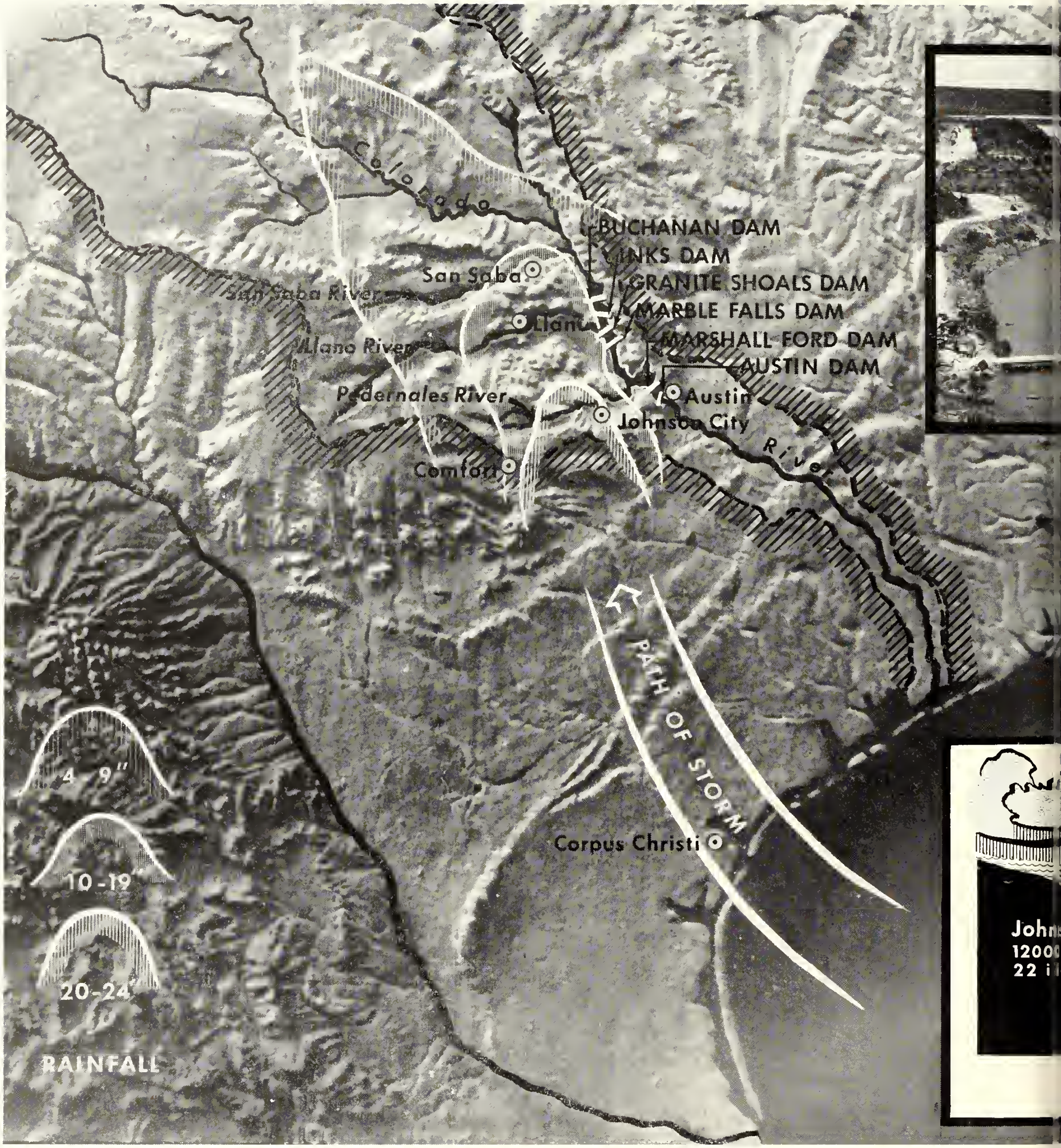
PROTECTION DURING FLOOD OF 1952.—Looking north on Congress Avenue. The "Y" intersection (foreground) barely shows above water in foreground of other picture. The white stuff isn't snow—it is sand. *Both photos by Neal Douglass, Austin, Tex.*

The peculiar geological formation of the plateau, with its sloping shelf to the Balcones Escarpment and its limestone land surface, fairly high-stream gradients, and basin slopes, makes it particularly susceptible to flood damage. Heavy rain usually produces excessive and immediate runoff.

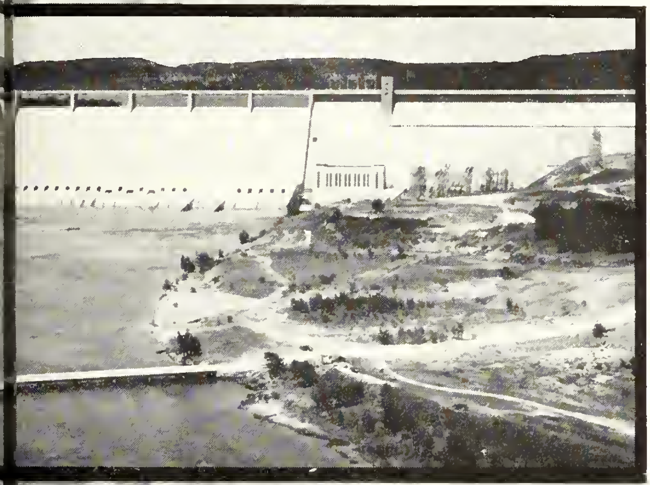
In 1869 a storm comparable to that of this year resulted in a discharge of 500,000 cubic feet per second in the Colorado River at Austin. Lesser floods, varying in peak discharge from 135,000 to 164,000 cubic feet per second have been recorded at Austin in 1900, 1913, and 1915.

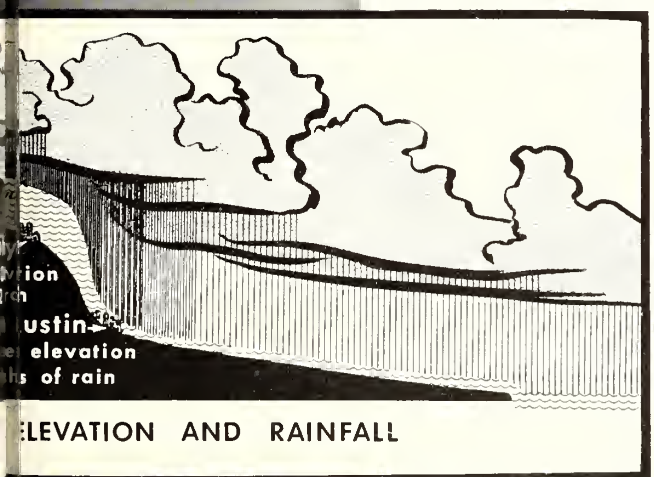
Texans, discouraged by the magnitude of recurring flood damages, and impressed by the economic potential of a controlled river regulated for beneficial use of water, had created the Lower Colorado River Authority in 1934. The authority, established as a governmental subdivision of the State, was given a broad directive to prevent future flood damage and concurrently extract from regulated flow of the river all possible beneficial use. How well the authority has succeeded in its mission to date is clearly demonstrated by the magnitude of flood damages prevented during the recent storm by lower Colorado River reservoirs, and by the dependable water supplies that have been made available from the reservoirs for municipal water supply, power production, and irrigation water supplies during the past 5 years of subnormal rainfall and stream flow.

Over the past 17 years the authority has created about 2,580,000 acre-feet of storage capacity in two basic storage reservoirs, Buchanan and Marshall Ford; allocating 780,000 acre-feet to flood control, 1,800,000 acre-feet to power and conservation storage. Four smaller reservoirs (Inks, Marble Falls, Granite Shoals, and Austin) have been created to develop additional power from the regulated waters released from Marshall Ford and Buchanan dams. These releases provide dependable water supplies for Austin, a city of 140,000 people, and for irrigation of 110,000 acres of rice along the lower reach of the river.



STORM IN SEPTEMBER swept in from Corpus Christi and dumped its load as indicated above. Torrential rains ran down the slopes towards the rivers and streams but were caught by the multiple purpose structures shown on the map. Inset at upper right is Marshall Ford Dam, designed and constructed by the Bureau of Reclamation for the Lower Colorado River Authority. The cross-section diagram at lower right gives some idea of the slope of the land and the constant menace to the capital of Texas, the city of Austin, in the path of heavy flood waters due to rapid runoff from recurring storms. *Drawing based on information supplied by the author, Harry P. Burleigh. Design by the Graphics Section, Washington, D. C. Map based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.*





With 1,045,000 acre-feet of new water in storage and available for use by municipalities, irrigators and power users; with heavy flood damages along the Colorado River being prevented; and with 1,257,000 acre-feet of storage remaining to absorb additional runoff, Texas has concluded that the multiple-purpose-project approach as applied on the Colorado River has demonstrated its value. Most Texans agree that the Lower Colorado River Authority program accomplished to date looks particularly good in view of firm water supplies that have been available over the past years of drought and low river runoff.

The need for comparable developments on other Texas rivers is becoming increasingly apparent in view of the rapidly mounting water requirements of many Texas cities, particularly in areas where the new petro-chemical industries are seeking industrial water supplies in quantities heretofore considered fantastic. Also 2,400,000 acres or about two-thirds of the present area irrigated in Texas (3,700,000 acres) is dependent upon generally declining ground-water supplies which eventually will have to be supplanted or supplemented by annually replenished surface water supplies if the 40 percent of gross crop income in the State, presently derived from irrigated agriculture, is to be maintained permanently.

The Bureau of Reclamation designed and built Marshall Ford Dam for the Lower Colorado River Authority using Federal funds provided by the Secretary of the Interior acting as Public Works Administrator. All told, 90 percent of the cost of Marshall Ford, Inks, Austin, and Buchanan dams, approximately $39 million, came from Federal funds of which over $10 million has been repaid to the Federal Treasury. And Federal contracts with the River Authority call for additional payments in the future. Bond issues were used to finance Marble Falls and Granite Shoals Dams.

Power from Lower Colorado River Authority turbines, and water supplies provided from the storage reservoirs, have been solid factors in the Texas share of past defense efforts and now represent indispensable tools in the present rapid industrialization of southern Texas. The job of the River Authority is by no means complete, and it is fashioning additional plans for further utilization of the river.

No doubt the future work of the Authority will continue to be joint ventures of Federal and local agencies. The history of the Lower Colorado River Authority shows clearly that Federal and State Governments can join forces to develop water resources and to eliminate flood hazards through multiple purpose projects. The benefits of a well conceived, locally managed river development accrue not only to the State or region but to the Nation. ###

ALTUS FARMERS SPEAK UP

Part 3—Southall and Kelley

by U. H. WARNER, Editor, the Geary Star
Geary, Oklahoma

16 CATTLE ON 6 ACRES OF IRRIGATED PASTURE, according to Bob Southall (top photo), made his Altus farm a mecca for visitors, Murrell Kelley (immediately above) raised 7 tons of alfalfa per acre. *Photos by Fred S. Finch, Region 5 photographer.*

An irrigated pasture one mile north of Humphrey attracted so much attention from county agents that hundreds of visitors went to see it last spring and summer.

The owner, Bob Southall, told us that he got ashamed of his old loose-wire corral which they walked past enroute to the pasture. Now, he has a nice, straight corral with the boards all white-washed ready for the 1953 influx of 4–H and FFA boys and agricultural experts.

Southall planted and irrigated a 12-acre pasture in 1951. He used alfalfa, brome, fescue, rye grass, dallis grass, and orchard grass in the seeding. His 16 beef animals got so far behind with their eating in a few months on the luxuriant growth on this 12-acre plot that he ran an electric fence down the middle and left them only 6 acres for grazing.

The 6 acres proved to be ample for the grazing needs of the 16 cattle. He cut some good hay crops off the other half of the field. County agents say it takes around four acres of nonirrigated pasture to feed one cow in this section of Oklahoma.

Southall irrigated 18 acres of alfalfa last summer and made five cuttings of hay. He sold it at $40 per ton for a return of $102 per acre from the 1951 crop.

The Southalls have all the modern conveniences in their spacious rural home and also own a home in Altus. Mr. Southall is a nephew of L. E. Grimes, of Geary.

Their farm is so perfect for irrigation that they can have a little variety in their watering. Southall ran his water from west to east for a while, then decided on a change. He took it across the fields from north to south the last year with equal ease.

Record Hay Production

Altus experiment station records show that Murrel Kelley produced an average of 7 tons of alfalfa per acre on 30 irrigated acres to top the record in hay production.

Kelley finished his noon meal and came into the living room of his modern new home to greet us when we called at his place on March 21. Mr. and Mrs. Kelley have a 77-acre tract which borders the town of Hester on the north side.

He told us that he raised his alfalfa to prepare the ground for row crops. Since going to row crops, he has had his best success with cotton. He turned out 37 bales on 27 acres in 1950 and harvested 70 bales from 60 acres last year. One 6-acre plot which he had to replant on June 28 came through with eight bales of cotton. Farmers in the area who did not have irrigation were lucky to take from one-fourth to one-third bale per acre to the Jackson county gins in 1951.

"I never had seen irrigation until we started in here at Hester," said Kelley, "for I was raised at Tipton in southern Oklahoma.

"I decided I wanted to have some land where I could get water for my crops whether it rained or not, so I came up here and bought this land when I heard there was going to be an irrigation district."

This concludes a series of interviews with successful irrigation farmers of the W. C. Austin project in southwestern Oklahoma, by Mr. Warner, publisher and editor of the Geary Star, and also president of the Geary Chamber of Commerce. These interviews were the result of Mr. Warner's interest in the proposed Canton irrigation project in the North Canadian River Basin in west-central Oklahoma, now under study by the Bureau of Reclamation. Under the project plan, 16,000 acres of fertile alluvial lands along the right side of the North Canadian River Valley, could be irrigated by water made available from Canton Reservoir, completed in 1948 by the Corps of Engineers, Department of the Army. Irrigation outlets works were incorporated in the dam so that the distribution facilities could be constructed when the irrigation phases of the project were authorized. ###

North Dakota's Soil Train

(Continued from page 285)

history and development of the soils of the community in which the meeting was held and stressed the management practices dictated by the nature of the soils and their environment. Information presented emphasized that North Dakota's dry climate makes too little water one of the main things that limits crop and pasture yields in most years.

Representatives of the Livestock Department of the College Extension Service discussed the pasture management practices that would give the greatest production and maintain good cover. They also pointed out the place of livestock in a good soil management program.

Agronomists presented specific recommendations on the use of fertilizers and cropping practices in promoting high yields and protecting soil against erosion.

Tillage and irrigation practices were also discussed by Extension Service personnel. Interest in irrigation in the State is increasing and many questions were asked on soil and water management and methods of applying water to the soil. Farmers were advised to be sure of an adequate supply of water before irrigation is started, to have the water analyzed to determine whether it is suitable for irrigation, and to have the soils and drainage examined to see whether irrigation could be successful.

H. L. Walster, Dean of the North Dakota College of Agriculture and director of the experiment station, summarized the story presented by the "soils special," in a bulletin which carried the following statements:

Take care of the soil—our greatest resource.

Hold it against . . . blowing winds and running waters.

Clean it by . . . crop rotation—fallowing—weed eradication

Reinforce it with . . . grass and humus.

Strengthen it with . . . plant food from manure and fertilizers, and soil-improving crops.

Guard it always against . . . erosion—depletion—and contamination. # # #

Irrigation District Saves $19,000 on Power Contract

The West Side Irrigation District of Tracy, Calif., first preference customer to contract for power after the Bureau of Reclamation and the Pacific Gas and Electric Co. executed the "wheeling agreement" for delivery of power, reports a saving of $19,501.85 or 46 percent of previous charges under private company rates.

The low-cost Reclamation power was delivered to the irrigation district by the Pacific Gas and Electric Co. over P. G. and E.'s lines under the agreement. The West Side District has a 9-year contract with the Bureau which began in June 1951.

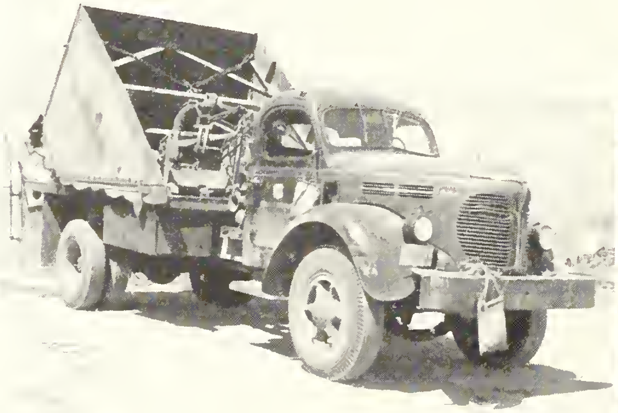
Under terms of the District's contract, P. G. and E. specifies the delivery of 1,500 kilowatts of power over its lines. During the year ending August 1952, the district received almost 5 million kilowatt hours of electricity for which it paid at a rate of 3.62 mills per kilowatt-hour. •

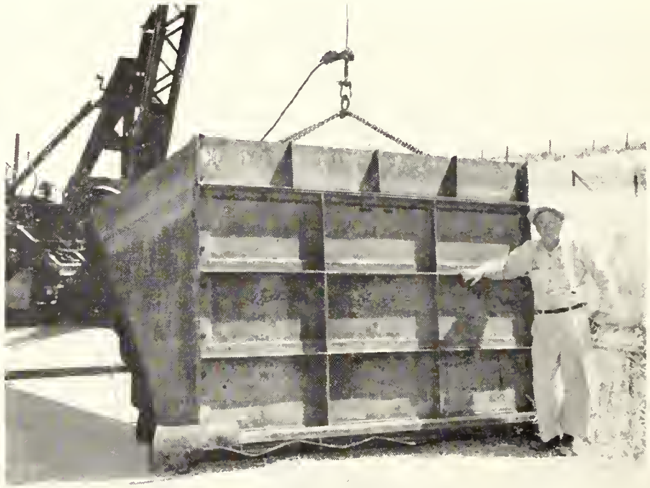
EASY TO ASSEMBLE.—A Contra Costa maintenance crew assembles the newly developed cofferdam in a short time, to meet an emergency.

CONTRA COSTA'S PORTABLE

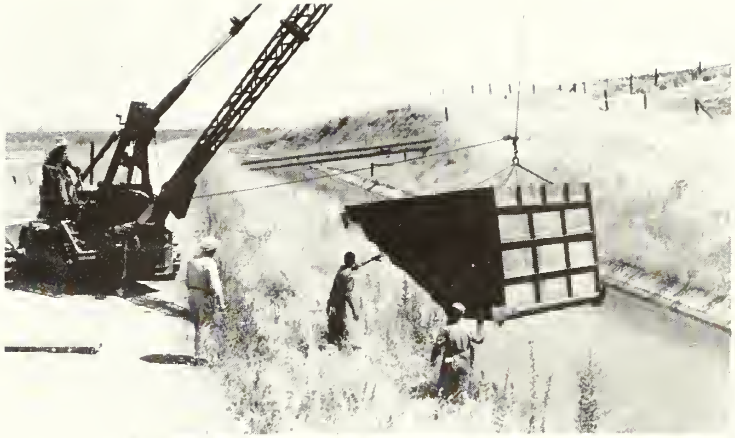
EASY TO HAUL—The assembled cofferdam fits neatly on a truck (below), for transportation to the repair spot. AT THE SCENE (at right) the cofferdam and its inventor, canal foreman A. G. McIntyre, pause briefly at the canal bank before starting to work.

by W. G. WAGGONER,
Personnel Assistant,
Sacramento, Calif., Region 2





EASY TO INSTALL—A small crane lowers the cofferdam into position in the canal (at right). READY FOR THE PUMPS (center) the cofferdam's sloping sides make a snug fit against the canal banks to keep the canal water out. READY TO GO—In a few minutes the cofferdam will be pumped dry and the repair crews can start to work.



Repairs and maintenance on the Central Valley project's Contra Costa Canal in California always have been something of a headache because of the unique operation of the waterway. Its function for domestic and industrial water delivery necessitates a year-around, 24-hour-per-day operation, so that work must be done in a full canal.

When there is repair work to be done on headgates, pipelines leading from the canal, canal lining, or leaks, a cofferdam had to be devised so that service could continue uninterrupted.

COFFERDAM

Canal Maintenance Foreman Alexander G. McIntyre tried several types but found each to be expensive and time consuming. So the Bureau of Reclamation maintenance man set out to design a cofferdam which would be suited to the operation, and save time in effecting repairs. Several things had to be considered, such as ease of loading and unloading, handling, erection, disassembly, and effectiveness.

After much study and experimentation, Mr. McIntyre finally came up with a model which filled the bill in all respects. For his ingenuity, the Contra Costa Canal foreman has received a meritorious suggestion award, and more important, maintenance work on the canal has been accomplished with a minimum of delay and without interruption of water service.

Simplicity and ease of adaptation to any situation are the keys to Mr. McIntyre's development. The cofferdam, constructed of metal, has a front section 5 by 8 feet. Side sections are built to fit the slope of the canal bank. Added versatility is achieved simply by adding sections, making possible use in a canal of any depth or cross section. If additional weight is needed to hold the cofferdam in place, timbers are placed atop the structure and sandbags are added. # # #

Good Medicine at Medicine Creek

HELP FOR THE HELPLESS and wholesome recreation are provided through the facilities of Harry Strunk Lake behind Medicine Creek Dam in Nebraska. The recreational area where the "benefit" carnivals were held in 1951 and 1952 is on the left shore.

by N. BETH WOODIN,
Kansas River District,
McCook, Nebraska

MAYBE A SPASTIC CHILD NEVER FIGURED to be a part of the indirect benefits of Medicine Creek Dam in Nebraska.

But on a hot Fourth of July this year, the Cambridge, Nebr., Lions Club sponsored a water carnival to raise money to provide medical care and educational benefits for Harlan Dreher, 13-year-old first born son of Mr. and Mrs. Albert Dreher of Cambridge. Harlan, a spastic victim since birth, lives with his mother and father, two sisters and a brother on a farm about 3 miles southwest of Medicine Creek Dam. On days when the sun is shining brightly, the sparkle of water pouring over the spillway is an awe-inspiring sight from the Dreher farm. And the dam which Harlan can see from his home is helping him to learn how to walk, talk, and live a normal life.

Medicine Lake is the reservoir formed by Medicine Creek Dam, completed by the Bureau of Reclamation in December 1949. By Act of Congress, the reservoir was renamed Harry Strunk Lake on July 9, 1952 (66 Stat. 480), in honor of Harry D. Strunk, McCook, Nebr., outstanding conservationist and president of the Republican Valley Conservation Association, who was nominated to Reclamation's Hall of Fame in the September 1949 issue of the RECLAMATION ERA.

To M. E. Heinz, pastor of the St. Paul's Lutheran Church of Cambridge, of which Harlan's parents are members, goes much of the credit for the assistance Harlan will receive. For 8 months, Reverend Heinz worked untiringly but unsuccessfully in attempts to interest State and national welfare organizations in Harlan's case. As a member of the Cambridge Lions Club, he then brought the matter to the attention of the Club members and they readily agreed to help Harlan by raising money during their annual Medicine Lake Water Carnival to send him to the Institute of Logopedics at Wichita, Kans., where he would receive physical and occupational therapy and speech correction training.

The 1952 carnival, which included boat races, water skiing, and other aquatic events, had many entries and was a thrilling spectacle to all those who braved the sweltering heat to watch it. Attendance was poor due to the fact that the Fourth turned out to be an extremely hot day, and the wheat harvest in the area was in full swing at the time. However, although the event was not as profitable as had been hoped, Harlan will not be deprived of his opportunity. The Lions Club is

CARNIVALS FOR CHARITY—M. E. Heinz (insert), pastor of the St. Paul's Lutheran Church of Cambridge, Nebr., and a member of the Cambridge Lions Club, enlisted the aid of the Lions Club in helping a crippled child toward a normal life. Below, part of the 7,000 people who attended the 1951 carnival sponsored by the Cambridge Lions Club, some of the proceeds from which were applied toward Pastor Heinz's project this year. *Photos for this article by John N. Berg, Region 7 photographer.*

using money from its treasury carried over from their successful 1951 water carnival. As a result of the attention called to this undertaking, the money supplied by the club is being augmented by donations from private individuals and by the release of several hundred dollars from the school district in which the boy resides, so that he may be sent to the Wichita Institute.

Part of the proceeds from last year's water carnival was used to purchase a resuscitator which is kept at the lake for the use of anyone having need for it. Already officers of the Club are planning a bigger and better carnival for 1953, the proceeds to go for some other worthy cause not yet determined.

The Cambridge Lions Club is to be congratulated on the unusual use they are making of Harry Strunk Lake. In addition to sponsoring events that attract sportsmen and spectators from all over Nebraska and the surrounding States, they are playing a Good Samaritan role in raising money to assist those who, like Harlan Dreher, need help.

# # #

CORRECTIONS, PLEASE. In the October issue, three errors appeared in the article entitled "Touring South Dakota's Oases" on page 233. Item 1 should have read, "the first *two* cuttings of irrigated alfalfa which ran 4.5 tons per acre." Item 2, should have read "Ten acres of mixed legume and tame grass pasture plots which remained *in excellent condition* after 24 head of cattle grazed on it through the summer, and gained 300 to 400 pounds *per acre*." Item 4, and the legend for the photograph should have read "23 tons of cabbage per acre grown on the Redfield plots," instead of 30.

Six Loads to Shoulder

(Continued from page 277)

enough to require the fullest measure of effort from everyone.

Therefore I am going to propose a six-point program for getting more local participation from our stockholders. If anyone wishes to add a few more points, I will be very glad to accept any and all collaboration—particularly when accompanied by some real performance.

I have noticed that most of the talk about local participation deals with who wants to be boss, but very little of it deals with who wants to do the work. Yet we cannot have more local control without also having more local responsibility. So under the six-point program, control is assigned squarely on the basis of tasks performed and responsibilities discharged. Control assigned on any other basis would be fictitious and mischievous, would not be tolerated, and could not endure under our democratic processes.

Point One Is Water Rights. State and local bodies can, should, and must put forth greater and more purposeful efforts in straightening out water rights, always prerequisite to authorization.

In more than one area, water-rights disputes are like a tangle of barbed wire in the path of progress. There is little the Federal Government or the Bureau of Reclamation can or should do by itself to solve this question. It is a matter in which the States and localities have asserted jurisdiction which Reclamation has always recognized.

Respect for State law has been basic in Reclamation since 1902, but we must know what State law is and to whom the water belongs. Here is a load to shoulder.

Point Two Is Rights-of-Way. No development, even with a clear water right, can be built without procurement or easement of rights-of-way for reservoirs, canals, and transmission lines when land is in private ownership. In many of our projects our local partners acquire and turn over all necessary rights-of-way, which, after all, are required solely for their benefit.

Reclamation has been trying to get localities into such work for a long time. Now we repeat: Here is a load to shoulder.

Point Three Is Project Planning. There is plenty of work for everybody in this field. State reconnaissance programs, like those of Wyoming or New Mexico, are a great contribution to everyone in the water-resource picture.

The United States Government and the Bureau of Reclamation have encouraged State and local work on these lines for years. Most Reclamation projects were perfected from such local planning initiative. There is still much work to be done.

Point Four Is Regional Development Planning. States and localities, singly or in groups, have a vital and indispensable responsibility for planning the uses to which all waters are to be put, regardless of State lines. This is true not because of any Federal versus State viewpoint, but simply because water insists on running downhill and rivers are notorious for ignoring political boundaries. So it is largely up to the States to decide where, when, and how the regional water resources of the West shall be applied to the soil, the minerals, and the industries of the West. The better that job is done, the better the Federal program can be built to fit your plans.

The States and localities must use, in the most realistic, purposeful, sincere, and constructive way, all the tools available to them—compromise, adjudication, ingenuity, and vision. They must seek not only to apportion the waters now available, but most of all, to find and develop new supplies from waters now wasting unused to the sea. In the last analysis, no one else can do this planning for them; and no criterion, no argument, no justification which does not lead to a full and successful solution of the problems can be accepted.

The States, with Federal encouragement, have been exploring this field for years—at least since the meetings in 1920 and 1921 which led to the Colorado Compact, on which various conflicting interpretations are placed today. Now we repeat: Here is a load to shoulder.

Point Five Is Project Operation. Every time that Federal Reclamation is compelled to continue operating a distribution system beyond the development period, your Government is compelled to divert, money, time, and energy which should be spent in planning and building more projects, away from that vital task.

That is why Federal Reclamation has to date 100 contracts under which 88 completed projects or project units have been turned over to water users for operation.

We Reclamation bureaucrats have been trying with considerable, but still incomplete, success to get out of the irrigation project operating business virtually since the beginning of Reclamation. But we cannot let go of a project until someone else, some local group, is able and willing to take it over—or to assume control.

POINT SIX IS STATE AND LOCAL PROJECT CONSTRUCTION. The Federal Reclamation program was established 50 years ago, and is still maintained, to build projects which for one reason or another are beyond the resources or authorities of local agencies, States or their subdivisions. Under this program, we have built such developments as Hoover and Grand Coulee Dams, which probably could have been built by no lesser agency than the Government of the whole United States. And we built other necessary developments which were needed at times when money was scarce and the demands upon local agencies were great.

But Western States have grown enormously in their resources and capabilities since 1902. As a result, Utah, Washington, Montana, Wyoming, and possibly a number of other States, have felt able to set up limited water-resource development programs of their own.

To the extent that States, districts, and other agencies can build their own developments, they free the resources of the Federal agency for use where the need is greater. We ask only that State or local programs be accommodated to over-all plans for river-basin development, so that one man's project will not interfere with another man's project.

Naturally, when the Federal Bureau of Reclamation does build or operate a project, it must do so under Reclamation law. Furthermore, since the American people have made a considerable investment through our Federal Reclamation program, we of the Bureau have an obligation to see that what we have begun is finished in the way that was intended by the stockholder investors. But we by no means insist on doing anything ourselves.

For example, 8 years ago I first heard a group, including the California State Chamber of Commerce, advocating that the State take over and operate the Central Valley project. I immediately wrote California's Governor a letter which the Secretary of the Interior signed, saying that was fine [1] providing California could pay for the project and carry the comprehensive plan through to completion under the policies and laws under which the endeavor was first undertaken.

Several Secretaries of the Interior and Reclamation's Regional Director Boke have reiterated the original expression. Now I want to go further and actively ask California to go ahead and assume this responsibility, and proceed in an intelligent and thoughtful manner to buy the project it first planned to build itself anyway.

But we cannot sell off Federal projects without Congressional authority and without a buyer. A California Congressman, Clair Engle, has calculated that it would cost close to 4 billion dollars in the next 50 years to buy the existing CVP works and complete the comprehensive Central Valley plan. Then he asks whether the State could carry that load and whether it can let its water and power development wait, and answers each question in the negative. But that is a matter for California to decide.

Reclamation is in earnest about local control and responsibility. And if the 16 other Western Reclamation States are as serious as we are about local control, you will be right there with us before Congress supporting the proposal. For with CVP off our Federal budgets, there will be, by subtraction arithmetically, more of the limited National Reclamation funds available to develop your States.

Here's a real load to shoulder. # # #

[1] The Ickes-Warren letter of March 7, 1945, read: "If the State has arrived at a financial position where it is ready to reimburse the United States Treasury for expenditures already made in behalf of the people of California, and is further prepared to guarantee the additional financing necessary to complete the project within a reasonable number of years, the Department of the Interior is prepared to withdraw from the project. Before we hand back these responsibilities to the State, however, we feel that sufficient evidence should be presented to prove the willingness and ability of Californians to shoulder the burdens of this great enterprise."

Domestic Water for the Columbia Basin

(Continued from page 279)

they must hire the well drillers and carry on the operations themselves.

Operating as a group starts more smoothly with legal counsel. John Baird, a local attorney in Ephrata who helped the first group to organize, has listed the numerous things the group must actually do for themselves to secure the benefits of an incorporated water association.

The attorney prepares articles of incorporation. The members sign these in triplicate. These are then sent to the secretary of state in Olympia. After approval he returns one copy for the group and one copy for filing with the county auditor at Ephrata. Members authorize an application for loan funds, usually to the Farmers Home Administration.

The F. H. A. engineers then prepare preliminary specifications. The attorney uses these specifications to secure, through legal procedures, franchises, easements, and road or lateral crossings. The attorney helps the group fill out the numerous application forms required by the F. H. A.

The group of settlers must also obtain a deed to the well site, 100 feet square, from the owner of the land on which the well is to be placed. This land must have a title guaranty report also.

Permits must be secured from the Department of Conservation and Development of the State of Washington through application for groundwater rights. The group also usually needs legal help in securing bids for the construction of the system. In some cases the bid figures may exceed the loan funds and in this case the bids must be rejected and often the members then do a large share of their own work.

One of the important outcomes of this group activity is the community spirit developed between neighbors who are planning to make their future homes together.

Within 6 months of the delivery of the first irrigation water to the Columbia Basin, we find that 9 groups are now producing water for over 50 farm units. Another 11 groups have completed their organization and are either drilling or waiting for their loan funds.

The real significant figures are that now 62 more groups, representing 730 farm units, are in the first stages of becoming acquainted with their neighbors so they can benefit from cooperation by getting cheaper water. A course in orientation, with co-op organization and counseled operation brings drinking water to the desert. # # #

Research Scientists Invited to Participate in Saline Water Conversion Program

All organizations or individuals interested in developing methods of converting sea water and demineralizing brackish water for beneficial uses, are being invited to participate in the initial phase of the program authorized by the Eighty-second Congress through Public Law 448, by the Office of Saline Water Research Coordination, Department of the Interior, at the direction of Secretary Oscar L. Chapman.

The objective of the current program is to coordinate and stimulate research and development of economically feasible processes by which saline waters of all kinds may be made useful for municipal, industrial, irrigation and livestock uses. The first phase of the program quite necessarily consists of inventorying past theoretical and practical developments in the field; establishing contact with all persons who might have something to contribute from personal experience, demonstration or research.

A preliminary brochure is being distributed to universities, research institutions, industries, and individuals known to have active interest in this work. The brochure outlines very briefly the possible physical, chemical, and electrical processes or phenomena necessary to conversion of saline waters into fresh water, together with energy sources which might be used or developed for this purpose. Also included are some of the technical considerations and a somewhat extensive bibliography. The brochure will serve as a starting point for the collection of additional information and the evaluation of new proposals in which the Federal Government may see fit to participate.

Assistant Commissioner of Reclamation, Goodrich W. Lineweaver, designated by Secretary of the Interior Oscar L. Chapman as his representative to head this Department's saline water program, is inviting all educational institutions, foundations, industrial concerns, individuals, and government agencies, State and National, which have previously done some work in this field or have a genuine scientific or related interest in the program problems, to present any constructive suggestions they may have to offer.

Current research funds appropriated by the Congress are severely limited. However, information is available as to the manner in which applications may be made for grants or contracts with which to conduct, or primarily to assist in, research in one or more fields of activity. While it will not be possible after evaluating the proposals to provide sufficient funds for even the anticipated top priority group, every effort will be made to inform sources of private capital or privately financed foundations of meritorious proposals which cannot be financed from available congressional appropriations.

Although several hundred inquiries have been received, Davis S. Jenkins, research coordinator of the program, expresses the hope that any who have not already made their interest known will do so by writing the Department of the Interior. •

Last Concrete Poured at Hungry Horse

On October 4 the last concrete was poured in Hungry Horse Dam, 564-foot-high concrete bulwark located on the South Fork of the Flathead River in Montana. The giant multipurpose structure was completed nearly 1 year ahead of schedule and was dedicated by President Truman only 3 days before the last concrete was poured.

A total of 3,100,000 cubic yards of concrete was poured in the dam during the 4 years of high speed construction to meet the power shortage in the Northwest. Many records were set during the pouring, including more than 206,000 cubic yards per month for a 6-month period, and 9,000 cubic yards in 1 day. At the time of the dedication, on October 1, the first 71,250 kilowatt generator went on the line. Three others will be installed in the powerhouse, the second on December 1 of this year, and the third and fourth scheduled for operation in August and November 1953 respectively.

Completion of the dam to its full height this year means the entire capacity of the 3,500,000 acre-foot reservoir will be available during the 1953-1954 water storage season and the full power and flood control benefits will be realized a year earlier than planned. •

"Hap" Parker Retires After 42 Years' Service

H. A. Parker, District Manager for the million-acre Columbia Basin project in Washington State, will retire December 20, 1952, after 42 years' service with the Bureau of Reclamation. He will be succeeded by P. R. Nalder who has served as his assistant.

Mr. Parker, a native of Maine, who received his B. S. degree in civil engineering from the University of Maine in 1909, started working for Reclamation on the old Fort Peck project in Montana that same year, and worked on many Bureau projects during the ensuing years including Montana's Milk River and Lower Yellowstone projects and Wyoming's Shoshone project before coming to Ephrata, Wash., headquarters of the Columbia Basin project.

Mr. Nalder is the second oldest employee in length of service on the Columbia Basin project, having arrived in 1933 prior to the formal ground breaking for Grand Coulee Dam. A native of Washington State, Mr. Nalder received his B. S. degree in electrical engineering from Washington State College in 1933. Mr. Nalder also served on the Commissioner's staff in Washington, D. C. •

NOTES FOR CONTRACTORS

Contracts Awarded During October 1952

Specification No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3709	Eklutna, Alaska	Oct. 10	One 5,000-kilovolt-ampere transformer with three 9,000-volt lightning arresters for Palmer substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	$35,754
DS-3737	do	Oct. 24	Two 115,000-volt circuit breakers for Eklutna switchyard, schedule 1.	Brown Boveri Corp., New York, N. Y	40,432
DS-3742	Davis Dam, Ariz.-Nev	Oct. 17	Two 14,400-volt circuit breakers for Phoenix substation, schedule 1.	do	26,162
Do	do	do	Four 5,400-kilovolt-ampere reactive power capacitor equipments and six 12,470-volt lightning arresters for Phoenix substation, schedules 2 and 4.	General Electric Co., Denver, Colo	152,222
DS-3761	do	Oct. 24	One 10,500-kilovolt-ampere reactive power capacitor equipment for Cochise substation.	Line Material Co., Milwaukee, Wis	83,115
DC-3774	Columbia Basin, Wash	Oct. 10	Miscellaneous installations of pipe insulation and pipe heating circuits for Grand Coulee pumping plant.	Bennett and Todd, Coulee Dam, Wash	15,157
DC-3777	Provo River, Utah	Oct. 16	Construction of earthwork and structures for improvement of a 10-mile reach of Provo River channel, Jordanelle to Deer Creek reservoir.	Gibbons and Reed Co., Salt Lake City, Utah.	168,332
DC-3780	Columbia Basin, Wash	Oct. 2	Construction of a selected earth blanket for Potholes East canal.	Otis Williams and Co., Kennewick, Wash.	402,262
DC-3782	Tucumcari, N. Mex	Oct. 17	Construction of earthwork and structures for 4.9 miles of surface drains 3 and 6 near Tucumcari, N. Mex.	Miller and Smith, Albuquerque, N. Mex.	71,951
DC-3783	Missouri River Basin, S. Dak	Oct. 14	Construction of Paetola Dam	Adler Construction Co., Loveland, Colo.	4,246,380
DC-3784	Central Valley, Calif	Oct. 17	Construction of 4.8 miles of earthwork, pipeline, and structures for farm-delivery extensions and additional sublaterals, Ivanhoe irrigation district, Friant-Kern canal-distribution system.	Concrete Conduit Co., Lindsay, Calif	79,440
DS-3786	Missouri River Basin, S. Dak	Oct. 8	Four 2-foot 9-inch by 2-foot 9-inch high-pressure gates for outlet works at Paetola dam and dikes.	Monarch Forge & Machine Works, Portland, Oreg.	36,600
DS-3787	Central Valley, Calif	Oct. 16	Nine 11-foot 4-inch by 13-foot 5-inch bulkhead gates, one lifting frame, and one lot of bulkhead gate seats, guides, and latches for Folsom power plant.	California Steel Products Co., Richmond, Calif.	35,388
DS-3788	do	Oct. 29	2 governors, complete with pumping equipment and auxiliaries, for controlling speed of 9,400-horsepower hydraulic turbine for Nimbus power plant.	Pelton Water Wheel Co., San Francisco, Calif.	75,000
DS-3791	Boulder Canyon, Ariz.-Calif.-Nev.	do	Metal partitions, doors, railings, and structural and architectural metalwork for units A3, A4, and A9, Hoover power plant.	Macri & Hood Iron Works, Oakland, Calif.	34,446

Contracts Awarded During October 1952—Continued

Specification No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC-3796	Central Valley, Calif.	Oct. 17	Construction of radial gate checks on the Friant-Kern canal, schedule 3.	Young & Smith Construction Co., Salt Lake City, Utah.	$173,110
DC-3803	Columbia Basin, Wash	Oct. 29	Completion of river channel slope protection on the Columbia River at Grand Coulee Dam.	Pacific Bridge Co., San Francisco, Calif.	267,500
DC-3806	Central Valley, Calif	Oct. 30	Construction of 0.55 mile of Camp Creek tunnel with 7-foot diameter horseshoe shaped section, schedule 2.	G. L. Tarlton Contracting Co., St. Louis, Mo.	412,655
DC-3807	San Diego, Calif	do	Construction of steel siphon and structures for San Diego aqueduct's second pipeline, San Luis Rey River crossing.	P. & J. Artukovich, Inc. and M. Miller Co., Los Angeles, Calif.	671,380
DC-3809	Paonia, Colo	do	Construction of earthwork and structures for Fire Mountain canal extension.	A. F. Burkhard, Hotchkiss, Colo	51,501
117C-158	Columbia Basin, Wash	Oct. 17	Modification of Pasco 6.2 relief pumping plant	J. G. Ungerecht and Associates, Pasco, Wash.	11,252
117C-164	do	Oct. 8	Cut-off walls and miscellaneous construction on Main, West and East Low Canals.	Stidham Bros., Inc., Ephrata, Wash.	14,898
200C-211	Central Valley, Calif	Oct. 1	Electrical distribution system for Mowry and Columbia pumping plants.	Collins Electrical Co., Stockton, Calif.	13,243
200C-217	do	Oct. 24	Graveling road, mile 5.57 to 88.60, Delta Mendota Canal	H. Sykes, Patterson, Calif	26,270
600C-102	Missouri River Basin, Mont	Oct. 14	Fire station, shop building and 5-car storage garage at Tiber Dam Government camp.	F. L. Flynn & Co., Billings, Mont	33,805
600C-105	do	Oct. 27	Construction of caretaker and operating houses for Missouri Diversion Dam, schedule 1.	Borgan Construction Co., Billings, Mont.	36,704
602C-14	Missouri River Basin, S. Dak	Oct. 23	Riprap protection of the channel at the outlet of the service spillway, Shadehill Dam, S. Dak.	Virgil R. Jensen, Mobridge, S. Dak	12,475
703C-279	Kendrick, Wyo	Oct. 6	Check structure, Casper Canal, station 219+50 and drain inlet, Oregon Trail inlet.	F. L. Flynn & Co., Billings, Mont	22,897

Construction and Materials for Which Bids Will Be Requested by February 1953

Project	Description of work or material
Boulder Canyon, Calif	Construction of a 134-acre-foot capacity equalizing reservoir, and overflow weir-type inlet and outlet structures on Unit 8 of Coachella distribution system adjacent to Coachella canal, southwest of Indio, Calif. The outlet structure will have a slide gate for draining the reservoir.
Buffalo Rapids, Mont	Construction of additional drains for the project's first and second divisions, about 20 miles east of Miles City, Mont.
Central Valley, Calif	Sly Park Dam, part of the American River Basin development, involves construction of an earth- and rock-fill dam about 750 feet long and 175 feet high, with an outlet works conduit and ungated spillway; and construction of a saddle dam about 700 feet long and 100 feet high, on Sly Park Creek about 10 miles from Camino, Calif. Total volume for dam and saddle dam will be about 1,100,000 cubic yards.
Do	Construction of the north section of Madera distribution system's Unit 3 near Madera, Calif., comprises 13 miles of unlined or earth-lined laterals of 6- to 12-foot bottom width and 187 c. f. s. initial capacity.
Do	Construction of 64 miles of 12- to 69-inch diameter reinforced concrete pipe line, monolithic concrete moss screens, the 170 c. f. s. capacity outdoor-type pumping plant D-3, and other smaller pumping plants and highway and railroad crossings for Unit 2 of Delano-Earlimart irrigation district distribution system on Friant-Kern canal located in Tulare and Kern Counties near Delano, Calif.
Colorado-Big Thompson, Colo.	Construction of 13.8-kv. distribution and control line in the Foothills South Area near Loveland, Calif.
Columbia Basin, Wash	Construction of 85 miles of Area E-5 laterals, sublaterals, and wasteways varying from 350 to 2 c. f. s. capacities, near Warden, Wash. Work consists of 73 miles of unlined laterals and wasteways of 2- to 10-foot base width, 12 miles of 12- to 60-inch diameter precast concrete pipeline, concrete structures, and 3 small pumping plants.
Do	Vertical-shaft, motor-driven pumping units of the following capacities for Lateral Area P-9 on Potholes East canal: One 2 c. f. s. at 16-foot head, one 2.3 c. f. s. at 18.5-foot head, one 3.3 c. f. s. at 13-foot head, one 2 c. f. s. at 10.5-foot head, one 6 c. f. s. at 29-foot head, and two 6.3 c. f. s. at 14-foot head. Also required are 3 horizontal centrifugal-type, motor-driven pumping units, each 24 c. f. s. at 50-foot head, for Eltopia Branch pumping plant.
Do	Construction of a small concrete block building and erecting a 60-foot wood-pole antenna for radio communications, near Othello, Wash.
Do	Drilling water supply wells for ditchriders' sites, 1 each in lateral areas W6A and W7 and Babcock pumping plant, all near Quincy, Wash., and 1 in the E4 Area in the vicinity of Moses Lake, Wash.
Columbia Basin, Wash.—Continued	Construction 2 three-bedroom and 1 two-bedroom permanent-type wood frame houses, 3 double garages, 1 pump house, and streets and utilities for ditchriders housing, lateral Area P-8 near Eltopia, Wash.
Do	Furnishing and planting lawn shrubs and trees and furnishing and installing materials and equipment for lawn sprinkler systems at Royal and Eltopia operation and maintenance headquarters.
Do	Painting equipment in Grand Coulee right switchyard and interior painting of metalwork and equipment in Grand Coulee pumping plant. Installation of 20,500 feet of rubber joint strip in both right and left powerhouse.
Do	One 230-kv. disconnecting switch for Grand Coulee 230/287-kv. switchyard.
Davis Dam, Ariz.-Nev	Additions to Cochise substation involves installation of 10,500-kvar. shunt capacitor; erection of 69-kv. bay; and installation of 69-kv. circuit breaker and other equipment. Additions to Phoenix substation involves installation of two 21,600-kvar. shunt capacitors and two 14,400-volt' 2,000-ampere, circuit breakers and other electrical equipment.
Do	Erecting steel structures and mounting 161-kv. buses and switches for Buckeye substation near Buckeye, Ariz.
Davis Dam and Parker Dam Power, Ariz.-Nev.-Calif.	Construction of 10 dwellings and 30 one-car garages at Parker Dam Government camp at Parker Dam, Calif.
Gila, Ariz	Construction of 22 miles of unreinforced concrete-lined laterals and sublaterals of 45 to 15 c. f. s. capacities for Unit 4 of Mohawk distribution system near Wellton, Ariz. Concrete structures include turnouts, checks, drops, siphons, culverts, and lateral turnouts. About 17,000 cubic yards of excavation for laterals is required.
Do	Construction of 2.4 miles of 220 c. f. s. capacity Dome canal and 2.6 miles of 100 c. f. s. capacity lateral D-1.4E, near Dome, Ariz. Structures on Dome canal will include river siphon, road siphon, radial gate check, 3 bridges, 2 constant-head orifice turnouts with capacities of 100 and 60 c. f. s., and 8 slope-type turnouts of 15 c. f. s. capacities. The open distribution system will serve about 12,000 acres.
Do	Two 1,100-hp., 257 r. p. m., unity power factor, 4,160-volt, vertical-shaft motors with direct-connected exciters for Wellton-Mohawk pumping plant No. 1; two 3,000-hp., 277 r. p. m., 0.8 leading power factor, 4,160-volt, vertical-shaft motors with direct-connected exciters for Wellton-Mohawk pumping plant No. 2; and one 1,850-hp., 277 r. p. m., unity power factor, 4,160-volt, vertical-shaft motor with direct-connected exciter for Wellton-Mohawk pumping plant No. 3.

Construction and Materials for Which Bids Will Be Requested by February 1953—Continued

Project	Description of work or material
Kendrick, Wyo.	Constructing 6,000 feet of extension to open lateral 256 and concrete structures, and constructing a wasteway structure in Natrona County 4 miles southwest of Casper, Wyo.
Middle Rio Grande, N. Mex.	Improvement of about 7 miles of low-flow channel of the Rio Grande near Bernardo, N. Mex., includes clearing of floodway and excavation of pilot channel.
Missouri River Basin, Mont.	Crow Creek 100 c. f. s. pumping plant to be constructed about 4 miles southwest of Toston, Mont., on the Missouri River. will lift water from the river an average of 176 feet through a 1,000-foot long, 52-inch inside diameter steel pipe discharge line to Toston tunnel for gravity flow to Toston and Lombard canals. The indoor-type plant is to have a reinforced concrete substructure and a steel superstructure 23 by 60 by 25 feet. The contract is to include installing three 33.3 c. f. s. pumps driven by 900-hp. motors and an 8-ton single I-beam manually operated crane.
Do	Construction of 0.4 mile of a 4,160-volt distribution line to the Crow Creek pumping plant about 4 miles south of Toston, Mont.
Do	Three 32- by 20-foot radial gates and hoists for Tiber Dam.
Do	Two 7- by 12-foot slide gates for Tiber Dam.
Do	A 60-ton traveling crane for Little Porcupine power plant at Missouri diversion dam, 4 miles south of Toston, Mont.
Missouri River Basin, Nebr.	Construction of Bartley diversion dam, a concrete overflow weir 1,100 feet long and 3 feet high above river bed, on the Republican River near Indianola, Nebr., will require steel sheet piling cutoffs, a sluiceway, and canal headworks.
Do	The second section of Franklin canal near Franklin and Riverton, Nebr., requires construction of a 13-mile unlined reach of Franklin earth canal of 210 to 140 c. f. s. capacity and 14 to 12 foot bottom width.
Missouri River Basin, N. Dak.	Raising about 1 mile of the Buchanan road and constructing a timber bridge in the Jamestown reservoir area near Jamestown, N. Dak.
Missouri River Basin, S. Dak.	Second stage construction of the Huron, Sioux Falls, Watertown, and Mount Vernon substations will consists of placing concrete footings and installation of power transformers, autotransformers, and related switches and oil circuit breakers to convert 69-kv. operation to 115-kv.
Do	Second stage construction of the Armour, Beresford, Flandreau, Tyndall, and Woonsocket substations will consist of placing concrete footings and installation of power transformers, autotransformers ranging up to 20,000-kv.-a., and related switches, regulators, and oil circuit breakers.
Do	One air-cooled 10,000- kv.-a., 4,160-volt synchronous condenser for Rapid City substation.
Do	Construction of 115- kv., H-frame, wood-pole transmission lines in the vicinity of Fort Randall Dam as follows: Two parallel 12-mile lines from Fort Randall tap to Fort Randall switchyard; 1.7 mile Fort Randall-O'Neil line extension into Fort Randall switchyard; and 1.7 mile Fort Randall-Winner line extension into Fort Randall switchyard.
Newlands, Nev.	Lining 0.4 mile of U-line canal and 0.1 mile reach of S–3 lateral, near Fallon, Nev., involves furnishing and applying 72 tons of hot asphalt over subbase prepared by others.
Palisades, Idaho	A 6-ton draft tube bulkhead gantry crane for Palisades power plant.
Riverton, Wyo.	Conversion of Pilot Butte power plant to semiautomatic operation.
Tucumcari, N. Mex.	Construction of drain 3–C, about 1 mile long and 4 to 9 feet deep, including 2 culvert road-crossing structures, near Tucumcari.
Vermejo, N. Mex.	Vermejo project rehabilitation under this contract involves construction of earth-fill dams and dikes for the enlargement of three reservoirs and construction of four concrete outlet structures near the Vermejo River about 5 miles northwest of Maxwell, N. Mex.
Yakima, Wash.	Furnishing and erecting a small prefabricated warehouse building and constructing a road near Chandler power plant 9 miles from Prosser, Wash.

United States Department of Interior, Oscar L. Chapman, Secretary
BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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