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GALLUP

The work on this project consisted mostly of maintenance and operation.

During the year there has been an ample supply of clear water in the Rio Pueblo Colorado, so that it has not been necessary to divert any of the heavily silt laden flood waters into the reservoir and at the end of the irrigation season there was 2,005 acre feet. At the beginning of the irrigation season of 1921 we had 2,260 acre feet. Beginning with next year a performance chart of this reservoir will be prepared.

Superintendent Peter Paquette of Fort Defiance began the allotting of lands in this project in January and was besieged with requests from the Indians for allotments. Allottees at once commenced preparing their twenty acre plots and in a few instances building fences. By the middle of May we were delivering water to seventeen users, sixteen are under the south side ditch and one under the north side. A number of Indians who have plots under the north side ditch asked for water but we were unable to deliver water to them because the ditch

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was not in condition. It is hoped to save enough money from maintenance next year to place the north side ditch in condition to serve these and other plots under it.

For some years past high waters have been cutting into the east bank of the Rio Pueblo Colorado above the diversion dam threatening to make a channel around the dam. To prevent this three jetties of cedar brush and rock, each 35 feet long, 12 feet wide and seven feet high, were built to deflect flood waters from the east bank,

Flood. in July 1920 cut deeply into the arroyo banks at flume No. 4 and there was danger that the caissons supporting the steel truss might be taken out. Heavy dry walls were laid up around the caissons to prevent further cutting.

Between flumes 3 and 4 wind and water borne sand has given us a great deal of troubl. To remedy this a dike 400 feet long and three feet high was built to turn floods coming down the small arroyo into the river above flume No. 3.

The wooden Pratt truss supporting flume No. 5 has become so badly sagged and out of line

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that it was deemed necessary to replace it with a steel truss. The new truss is located far enough off the line of the old one that it is not necessary to interrupt delivery of water during construction. The truss is a 48 foot span deck structure supported on caissons made of 24 inch corrugated culvert pipes 12 feet long. At the end of June the construction of the truss was not entirely completed.

Flume A on the north side ditch was built. This is a No. 60 galvanized metal flume supported by a wooden truss with 20 foot span. A small arroyo not deep enough to permit the use of a culvert, but which occasionally carries considerable water crosses the north side ditch 800 feet below flume A and necessitated a water bridge. These two structures enabled us to furnish water to one 30 acre plot on the north side.

Under his agreement with the Government Mr. J. L. Hubbell cleaned the ditch from the headgate to his farm. From there on the Indian water users cleaned the ditch without pay.

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As stated above, we have this year seventeen Indian water users cultivating 220 acres; the Presbyterian School and Mission are cultivating 30 acres and Mr. Hubbell 100, making a total this year of 350 acres.

It is believed now that allotting of lands in this project has begun a considerably more satisfactory return for the money expended will be shown.

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MOENCOPI WASH

The Moencopi Wash which flows through the Western Navajo Reservation a short distance from Tuba furnishes the water, through a ditch built many years ago, to something over six hundred acres of land. About 250 acres of this is used for the School and Agency farm and the balance is used by the Navajo Indians.

Some years ago a new heading was made for this ditch about 1800 feet further up the stream than it originally headed, and substantial headgates and a good dam were constructed. Owing to the flat grade upon which it was necessary to construct this part of the ditch and because of the great amount of silt carried in the stream at all high water periods, large amounts of silt are deposited in the canal and on a number of occasions it has been necessary to go in there after floods and dig out from four to six feet of silt. In order to remedy this condition it was decided to put in a spillway about 1800 feet from the headgates, placing it several feet below the canal grade and by leaving these waste gates open part of the time it was believed that most of the silt

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at least could be sluiced out and back into the stream; this being possible because right opposite in the stream is a series of falls or cascades aggregating something over forty feet.

This receiving your approval the wasteway was constructed during the last part of February and March this year.

It was found that further work should be done in order to insure the safety of the ditch below this point, for just below the falls mentioned above, the ditch runs very close to the top of a forty foot bank composed entirely of alluvial deposit and the stream has cut back into this deposit for a considerable distance and threatens to cut further. In addition to this the water being carried in the ditch seeps out through this alluvial deposit and threatens to break back into the stream at almost any time.

A report was submitted to you about the first of June recommending the lining of this ditch for about one thousand feet with concrete and the building of a crib or jetty to keep the water of the stream from cutting further into the bank.

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While these repairs will be rather expensive, amounting to something like $5.50 per acre for the land under it, it seems to be the best method of combating the danger as it will be impractical to carry the ditch further from the bank as it will throw us into very heavy cutting and also increase the length of the ditch which would flatten the grade already flatter than good construction would warrant were it possible to give it a better grade.

If this work is approved construction will be commenced early in the next fiscal year.

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UNDERGROUND WATER DEVELOPMENT NAVAJO AND HOPI

During the year two well rigs were in operation. One in the Hopi country and the other in the extreme eastern part of the Navajo reservation. The former worked during the entire year completing fourteen wells aggregating 2,392 feet in depth. The latter rig was not operated at all until October 8th owing to inability to secure a competent driller, but about that date the driller in charge of the other rig was transferred and his helper was put in charge of the rig in the Hopi country and two new helpers secured.

The rig in the eastern part of the Navajo reservation has had a hard time in developing water as they are far from base of all supplies and the country in which they are drilling is a very difficult one in which to develop water. The first well put down was in the vicinity of Stony Butte where water was badly needed but owing to the freak formation in that country only a small flow was encountered but the well was finished as an artesian well flowing 37 gallons an hour. The rig has been moved south of

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there where another well was put in with good success and has again been moved to the extreme southeastern part of the reservation. When the well at this point is completed it is thought that the rig will be moved to the school farm near Crown Point where it seems necessary to develop additional water and the Indian Office has been asked to authorize the drilling at this point.

In the Hopi country most of the wells put down were in the nature of discovery wells as we were trying out a new section of the country but on the whole the results were good. Although we had put down a hole at Keams Canyon a number of years ago over 1300 feet without success Mr. Womack was so confident that artesian water could be found around the Hopi Villages that we put down a test well to a greater depth than any of the other wells in that section, and at about 450 feet an artesian flow was encountered giving about 200 gallons per hour of soft water, and by far the best water in that section of the country. Encouraged by this another hole was put down ten miles north and at approximately the

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same depth a well flowing over 700 gallons of water was developed with the same quality of water.

Mr. Tomack, in general charge of all well drilling, has put in some time the last few months making intensive studies of the geology and running numerous lines of levels to check the outcrop at various points and believes that he has determined a considerable area around the Hopi Villages where it is safe to predict that artesian water will be struck at depths from 400 to 800 feet. This will be a wonderful thing for this part of the country as the quality of the water is so much better than that of the shallow wells and the development of artesian flows will make it unnecessary to erect windmills and tanks and keep up the constant maintenance necessary with the shallow wells.

The first artesian well struck in this section was about 3,300 feet from the Matron's quarters at Polacca and by a combination of funds available from Agency sources, some money in the hands of the missionaries in that country, and a small amount of assistance from this Service in the way of

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supervision and the use of an old boiler not valuable for other purposes, the water will be piped from the well to this point. It is proposed to build a reservoir that will hold about 25,000 gallons at the well into which the well will discharge at all times, a pump house built in which a steam pump will be installed, and the water will be pumped to another reservoir on a hill above the Matron's quarters which will supply water under pressure to all of the Indians living off the Mesa. There will be a loading station at this point where the Indians may drive their wagons and load water into barrels or tanks to be hauled to the top of the Mesa where some 600 Indians live.

It is proposed to put in a modern hand laundry where all of the Indians may have plenty of water for doing their laundry work of a much better quality than any forrerly used. There will also be installed public baths and the boiler above mentioned will be used as a 600 gallon circulating water heater for the purpose of heating water for the baths and the laundry. This development will be of

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inestimable value to the Indians in aiding them to advance in civilization.

During the year all wells on both the Navajo and Hopi reservations have been kept in repair, tanks and troughs repaired or replaced when necessary and this work has been excessively heavy owing to a much greater wind movement than usual during most of the year, which damaged many mills and towers.

Mr. Womack reports that it will not be practical to develop water in the new artesian belt with the present rig, as it is supposed to be only of from 300 to 400 foot capacity, and it is hoped that we can see our way clear to purchase another larger rig for this section, transferring the light rig to some other part of the reservation where shallow wells can be developed. This will scarcely be practical for the coming fiscal year as the amount of money available will not permit the running of three rigs. However, if the Office approved, it would be possible to purchase a heavier rig, laying up the light rig until another year in hopes that

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we would then have money enough to operate them both.

In a report to me from Mr. Somack he emphasizes the value of the well drilling and shows that the development has been much more valuable than it would have been to have put the money into the building of reservoirs or tanks and the improving of springs. He says:

> "As the herds have increased so fast in the last few years it is next to impossible to keep pace with the demand for water and new range as it is necessary to develop a new range with wells before the stock raising can expand. The Indians fully realize that if the money had been spent in reservoirs and surface lakes they would not have enough sheep and cattle left to commence with next year as all of the lakes and ponds have been dry for the last year and there would not have been enough water in the country, without the wells, to have kept twenty percent of the stock alive.
>
> "You will remember that the popular idea (that of people who did not know the history of the country) was to use the money to construct reservoirs and dams and also to dig out the springs, etc. The conditions now existing after a dry year when all the lakes have failed and most of the small springs have had their flow reduced to practically nothing should be a good lesson to them as to the occasional conditions in this country.
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> "The Indians have been so dependent on the wells that it would scare them to think of the well drilling being discontinued."

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It will probably be remembered that in all of the reports from this office that Mr. Wollack and myself have continually insisted upon the value of the wells and minimized the value of spring development and the construction of dams or reservoirs. There are many years when these would be of advantage, but if we had spent the available money for reservoirs or tanks that would probably have furnished ample water during the ordinary years, and which would have allowed the Indians to increase their flocks and herds to such an extent that the springs or other natural flow of water would not carry them through a dry year when the reservoirs and tanks would be empty, we would face a situation where we would be unable to supply water during the dry year and a large percentage of the stock would die. By putting the money into well development that can be depended upon even in the driest of years, the increase in stock will not be sufficiently great that the dry years supply will not take care of them, and it is believed that our standpoint has been fully justified during the present year.

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