

#56001

REPRODUCED AT THE NATIONAL ARCHIVES

DEPARTMENT OF THE INTERIOR,
UNITED STATES INDIAN SERVICE,

Fort Defiance, Ariz.,
July 26th, 1904.

To the Honorable
Secretary of the Interior,
Washington, D.C.

Sir:

In accordance with Department instructions of June 18th, 1904, 6043 Ind.Div. 1904, I have visited the Fort Defiance Division of the Navajo Reservation, Arizona, for the purpose of investigating the various irrigation projects referred to in the report of Samuel E. Shoemaker, Supervisor of Constructed Ditches, dated June 14th, 1904.

Upon arriving on the ground I found that Superintendent Perry was absent -- presumably on his annual leave, -- and the agency in charge of Assistant Superintendent Paquette. I also found an irrigation engineer, Mr. H. F. Robinson, at the agency, engaged upon making surveys, plans and estimates for the improvement of irrigation on the Navajo Reservation, the Superintendent having been granted authority to employ him for this purpose for a period of three months.

While awaiting the arrival of Mr. Shoemaker, to whom word was sent to meet me at Fort Defiance, I investigated the Fort Defiance school irrigation system, the proposed plan of Mr. Robinson for the utilization of the flood water of the Canon De Shelley at Chin Lee, -- some 50 miles north west of Fort Defiance, -- and the Red Lake and Black Creek propositions.

It is, perhaps, unnecessary to remind the Department that thousands of dollars have been spent on this part of the Navajo Reservation in constructing dry ditches and reservoirs, also in building dams which subsequently washed out. It is to be hoped, therefore, that any further money appropriated for this point may show results and that the unfortunate experiences of the past may not be repeated.

I first examined the system designed for the irrigation of land immediately adjacent to the Fort Defiance, School, finding a number of ditches constructed which, with some needed repairs, would cover more land than could be furnished with water from Bonito Canyon, the only source of water supply for this school. In order to divert water from the canyon to the constructed ditch which heads at its mouth, it is necessary to do one of three things to wit.

FIRST. Construct a permanent diversion dam 8 ft. in height across the mouth of canyon.

SECOND. Drive a tunnel through the rock on north side of canyon from the head of the present ditch (leading from the

REPRODUCED AT THE NATIONAL ARCHIVES

mouth of the canyon) to a point some 500 feet higher up the creek.

THIRD. Construct a small flume from the head of the present ditch to a point in the canyon about 600 feet above the head of present ditch.

The first two plans contemplate permanent structures, which would settle for all time the matter of diverting water for irrigation on the lands adjacent to the Fort Defiance School and I shall consider the various projects in the order named.

Character of Dam Recommended for Bonito Canyon, Fort Defiance.

This canyon at its mouth has a width of approximately 180 feet between its perpendicular rock walls. In lieu of building rock filled timber dams, such as have been constructed in the past, I would excavate all earth deposits across the canyon on either side of the main channel to the rock walls, for a distance of 100 feet up and down the said canyon, carrying the excavation down to a depth corresponding to the lowest point of the channel. A number of holes could then be drilled in the sides and near the top of the rocky walls of canyon and tons of rock could be blasted down into the prepared excavated section, subsequently shaping the same to a proper cross-section by means of derricks placed on either side of the canyon. It has been demonstrated in India and elsewhere that loose rock dams carefully laid, with a long flat slope of one foot vertical to ten horizontal on the down stream side, are the most satisfactory and permanent dams which can be built on a yielding bottom such as sandy river channels.

151-
Proposition
\$5000-

The cross-section on Plate A illustrates the character of construction, which would necessitate about 4000 cubic yards of loose rock and a short tunnel through the canyon wall around one end of the dam connecting with the present head of ditch. The total cost would approximate \$5000 but it would, in my opinion, be a permanent and safe structure.

Tunnel Project for Bonito Canyon.

Another plan for rendering the irrigation supply from Bonito Creek permanent and available and the one which I should recommend as the acme of safe construction at this point is as follows:

Lower the grade of the present ditch system a couple of feet at head near mouth of canyon, which Mr. Robinson assures me can be done and still give the canal ample grade to cover the irrigable lands of the school. Beginning at the head of the present ditch with its lowered grade, cut a tunnel through the north wall of the canyon and by running the same on a light grade it would only need to be about 450 feet in length to intersect the grade of the creek channel owing to the exceptionally heavy fall of the latter. The tunnel need be no larger than absolutely necessary for men to work in, and an unlined tunnel of approximately 4'x6' dimensions, through sandstone, should not cost to exceed \$8 per lineal foot. With a proper gate at the entrance and the latter connected with the main channel by means of a box culvert under the roadway, there need be no further trouble at Fort Defiance in diverting all of the normal water supply available from Bonito Creek and a good head of its flood waters. I might state that the rains of the past few days have brought floods down this creek which could have been utilized to a large extent had the tunnel been constructed.

REPRODUCED AT THE NATIONAL ARCHIVES

The Water was very heavily laden with silt containing 13 1/3% by volume, but would have been valuable notwithstanding, if applied to the crops with discretion.

Including the cost of engineering and superintendence and a margin for contingencies, I should also estimate the total cost of this work at approximately \$5000. In making this estimate I do not contemplate that it would be necessary to put any concrete lining in the tunnel which pierces a red sandstone bluff; while the outside face of the rock is full of seams the tunnel would, in my opinion, be safe, especially in view of the small head of water which would flow through the same and consequent slight erosion. Plate B shows the alignment of the present main ditch and approximate location of tunnel.

Temporary Expedient of Constructing Small Box Flume.

If, in view of the small amount of irrigation water available and the considerable expense attached to building permanent works of the character above detailed, it is the desire of the Department to undertake a less expensive project, would suggest the following plan, which, however, can only be regarded in the light of temporary construction, to wit:

Beginning at the head of the present ditch (See Plate B) a small box flume 1-1/2' x 1' could be extended up the canyon on a comparatively light grade to a point where it would intercept the grade of the main channel, a distance of approximately 300 feet. Where possible it could be attached to the rocky sides of the canyon and at other stretches could be buried in the earth deposits adjoining the main channel to a depth of several feet and weighted with rock. By using lumber fairly well seasoned and properly tarred such a structure would last for several years and, in all probability, would not be greatly damaged in the interim by floods. This flume, I estimate, would not cost to exceed \$600.

If the money for construction of diversion works for the irrigation of school lands at this point comes from the school fund, would recommend the tunnel and larger expenditure. If it is to be charged to the meager irrigation fund would recommend the inexpensive box flume, since it is my belief that there are other places on the reservation where the irrigation fund can be expended in a manner which will do greater good to a larger number of needy Indians. In this connection I desire to state that the small normal supply of water furnished by Bonito Creek, should be entirely used by the school in maintaining a garden and small hay farm. If the tunnel was constructed there would be short periods during and subsequent to floods when some water could be furnished to a few small Indian farms near the school, but to attempt to spread the normal supply over other than school lands means more or less failure all along the line. I see no reason, therefore, why an improvement so essential to the success of the school, should not be made from school funds.

RED LAKE and BLACK CREEK PROJECTS.

In company with Engineer Robinson I visited the Red Lake Reservoir which is still in fair condition, but the dam in Black Creek is almost entirely washed out. This is not at all surprising

Proposition of 1st - \$5000 -
3rd - Proposition in view of 1st and 2nd - \$600 -

since a more flagrant case of anchoring a flimsy structure on shifting sand could not be imagined. What makes this case more aggravating is, that according to the soundings of Engineer Robinson and Supervisor Shoemaker bed rock is found at a depth of from two to six feet below the bed of the stream and a dam could have been anchored to this in a substantial manner. Large sums of money have been spent at this point in the endeavor to impound the flood water from the drainage area of Black Creek and Red Lake; to date there is nothing to show which justifies the expenditure. These projects were conceived and constructed by an engineer named Vincent and some improvements were made by Superintendent Butler whose work was well done and is still substantial, he having had nothing to do with the putting in of dam across Black Creek, at least I am so informed by parties on the ground.

Theoretically the Red Lake and Black Creek drainage area should furnish sufficient runoff to fill this small reservoir many times a year, but we are met with the discouraging fact that the reservoir which is today in condition to intercept and impound the water of the Red Lake drainage area has not conserved a sufficient supply during the past five or six years to permanently reclaim 50 acres of land. While the drainage area of Red lake is much smaller than that of Black Creek, better results might reasonably have been expected in the way of conservation of flood waters.

If bed rock extends across the Black Creek channel as indicated by the soundings of Mr. Robinson, a safe dam can be built at this point, but in my opinion the chief reasons for making further expenditures on this project are, first, the amount of money thus utilized would furnish work to a number of Indians who greatly need it owing to their impoverished condition brought about by the recent years of drouth. Secondly, the construction of this dam would divert more or less water into the Red Lake Reservoir and probably show some results, which, although not commensurate with the large outlay which has been made, would at least relieve the project from its present aspect of entire uselessness as an irrigation proposition.

CHIN LEE PROJECT.

Again in company with Engineer Robinson I visited the Canyon de Chelley and Chin Lee District, finding at this point that conditions were more promising for the development of a water supply than at any other portion of the reservation which has come under my observation. Canyons de Chelley and Del Muerto have a large drainage area and each year considerable water passes the mouth of the former, which, by means of proper ditches could be spread over a large tract of land in the Chin Lee Valley during a period of from two to three months each spring. According to the observations of local observers the water begins to flow from the canyon into the Chin Lee Valley about February 15th, continuing to increase until April 15th after which it recedes, disappearing entirely after May 15th, or shortly thereafter. Summer rains which generally occur in July or August again bring down flood waters, hence late irrigations could thus be frequently afforded. I observed flourishing corn crops growing in the valley even during this year of extreme drouth which owed their existence to early irrigations from the flood waters of Canyon de Chelley.

The plan, as submitted by Engineer Robinson, contemplates a diversion weir across the canyon, some 8000 feet of canal and a

REPRODUCED AT THE NATIONAL ARCHIVES

2000. Account of
Robinson/Roberts
Rel. 46-98-1904

storage reservoir of 1047.55 acre feet capacity. The construction of the latter with the increased cross-section and other modifications which, in my opinion, would be essential for an absolutely safe structure, would entail a large outlay approximating \$20000 and owing to the small amount of water it would impound would not recommend such construction at this time. I would, however, advise the building of the canal during the present year which could be accomplished with its appurtenances at an expense of approximately \$4000, providing the sinking of test pits along the line, a work I have recommended as soon as possible, does not disclose more rock than now contemplated in Mr. Robinson's surveys and estimates. The above estimate contemplates a canal of the cross-section recommended by Mr. Robinson. A small brush and rock wing dam could be thrown across the north half of channel in a manner which would deflect the water to the south side where the headgates would be located and by establishing the grade of head one foot lower than the stream channel, it is my opinion that sufficient water could be diverted the first year to warrant its construction, leaving a more expensive diversion dam until the future and eliminating the reservoir proposition entirely for the present. It would, perhaps, be well to build a couple of sand sluicing boxes in the first mile of main canal. Plate C traced from Mr. Robinson's map shows canal alignment and lands which it would cover.

PROPOSED SCHOOL SITE IN COTTONWOOD GROVE, CHIN LEE VALLEY.

This is a most desirable location for a school site if the Department has in contemplation the rection of another school on this reservation as I am given to understand by Superintendent Perry who returned several days ago, from his Eastern trip. The fine grove of Cottonwoods in a valley otherwise comparatively devoid of trees is a pleasing contrast. The soil is rich, elevation not excessive (5300 feet above sea level) and the land would come under the contemplated canal. (See Plate C) Investigation as to the underground water supply near this grove proved satisfactory, water being found in existing wells at depths of from six to ten feet below the ground. The water is apparently good and I have sent a sample of it to Proff Forbes of the University of Ariz. at Tucson for analysis.

UNDERGROUND WATER SUPPLY OF THE CHIN LEE VALLEY.

It is my belief that there are several localities in this portion of the Navajo Reservation where, by sinking bored wells, a supply of water can be developed for irrigation by means of pumping plants similar to those recently installed in the Salt River Valley, Arizona, and on the Pima Reservation. Chin Lee Valley presents the most favorable indications for such development, water being encountered within two feet of the surface of the wide, shallow De Chelley wash or channel which traverses the valley for a distance of many miles to the north. The bed of this channel seems to be composed of sand and while such material is not so favorable for water developemnt as gravel stratas with the larger

interstices, it is my belief that a considerable quantity of water could be obtained by pumping. An effort should be made to determine definitely whether such water could be developed for irrigation purposes and to do this properly the Department should purchase a first class well drilling rig and employ an experienced driller to operate the same. The best portable rig I have observed is made by the American Well Works of Aurora, Ill., and I have written the company to forward the Department the price of said machine f.o.b. Gallup, New Mexico,

There are other portions of the reservation where test wells should be put down and in all probability many places on the Moqui and Western Navajo Reservations; a machine of this character could be used to good advantage as long as it held together. A direct connected steam centrifugal pump of about 500 gallons a minute capacity with the necessary suction and discharge pipes, would be a necessary part of the equipment, in order that each well could be tested as to its capacity after being drilled and perforated.

There is an abundance of coal for fuel on many portions of this reservation, most important essential for steam pumping plants. Unfortunately it has not to date been located nearer than 20 miles of the Chin Lee Valley, but cedar wood can be obtained within six or seven miles at an expense of about \$5 per cord and by careful prospecting it is probable that a vein of coal can be located much nearer the Chin Lee Valley than the Black Mountain region where it is now obtainable. Hay is worth over \$30 per ton near Chin Lee and grain \$2 per hundred, prices which demonstrate conclusively the advisability of making every effort to obtain a water supply at this point.

In making recommendations for the development of water for irrigation by means of pumping on these drouth stricken reservations in Arizona, I appreciate fully the expense of installation, as well as the subsequent cost of maintaining and operating such plants. It is also possible that the drilling of wells on this reservation would not reveal a sufficient underground water supply to warrant the construction of large pumping stations, but the wells would be valuable for such supply as they could furnish, if only for stock water and in view of the large sums which have been expended for the development and conservation of surface waters and the comparatively meager results that have been obtained, I believe that an effort should now be made to determine the practicability of utilizing the underground water supply.

Supervisor Shoemaker suggests a submerged concrete dam across the mouth of Canyon de Chelley to intercept the underflow and bring it to the surface. This channel is nearly 500 feet wide and in view of this fact and the probable great depth it would be necessary to excavate in order to find bed rock on which to found the dam, it would not, in my opinion, be practicable to consider such construction. The building of submerged dams throughout the West has not shown results commensurate with the outlay. The soundings conducted by Engineer Robinson across the stream channel of the Canyon de Chelley were continued to a depth of 23 feet below the surface and nothing but sand was encountered. Even such a depth is sufficient to discourage any attempt towards the construction of a submerged dam.

Ditch Supervisor Shoemaker spent a short time with me at Fort Defiance in discussing the relative merits of the various projects mentioned herein and in his report of June 14th, 1904. His long experience on the Navajo Reservation rendered his advice valuable in many matters. Mr. Shoemaker seems to be a conscientious man with a desire to do all he can to improve the condition of the Indians in the way of further water development. It is my belief, however, that he has all that one man can properly look after if he takes care of the interests of the Indians along the San Juan River. Any spare time he may have can be utilized to good advantage in looking up and reporting upon other feasible routes for small ditches from this river.

SA HA LE, WHEAT FIELDS, and COTTONWOOD CREEKS.

In company with Superintendent Perry I visited the localities above named and observed the progress that is being made along agricultural lines, finding several hundred acres in cultivation on each creek, some of the crops looking very good and others poor. The normal water supply of these creeks is too small to warrant large expenditures for irrigation, but what is greatly ^{is} a good, energetic farmer, who will see that the Indians keep such ditches as they have in a good state of repair and use the available supply to the very best advantage. He would not need to be employed over six months out of each year for this locality.

Mr. Shoemaker recommended light expenditures at Cottonwood and Wheat Fields which it would be well to make. He also advised the construction of a new canal for the Sa Ha Le Creek and stated that the present ditch built by Mr. E.C. Vincent was a "complete failure." I went over the ditch which was built by the latter and the only one I located on the creek and found that the Indians had improved it to a degree and were utilizing it for a distance of about a half mile. The remaining portion of the ditch was filled up with sediment and washed through in a number of places, but covered an excellent body of land. Before advising the expenditure of more money for a new ditch heading further up the canyon as contemplated by Mr. Shoemaker I would recommend that a survey be made of the Vincent ditch to ascertain its fall and the cost of cleaning out and repairing same. If it has a proper grade and can be rehabilitated at a modest expense, it would be well to defer the building of a new ditch until all of the land under the present one is properly cultivated. The high elevation at Sa Ha Le precludes the growing of good corn crops, but wheat, oats and alfalfa seem to do very well and the native hay is excellent.

There are many possibilities in the way of developing water by means of pumping in the small valleys traversed by the Sa Ha Le, Cottonwood and Wheat Field Creeks.

I appreciate that in all probability the irrigation fund for 1905 has been practically all apportioned ere this and that no large sum is available for work at this point.

In conclusion I would make the following recommendations, to wit;

1st. That the sum of \$6000, or as much more as it is possible to apportion to this point from the irrigation fund for 1905, be set aside for the Fort Defiance Division of the Navajo Reservation.

2nd. That, if possible, the sum of \$5000 be apportioned from school funds for the construction of a tunnel for the benefit of Fort Defiance School farm as detailed herein.

3rd. That the irrigation fund be utilized in effecting repairs on the present ditches at Wheat Fields, Cottonwood and Sa Ha Le, also in constructing ditch from Canyon de Chelley at Chin Lee in accordance with the plan of Engineer Robinson with the modifications suggested herein.

4th. As soon as funds are available a first class well drilling rig should be purchased and put into operation. A sum of \$10000 would be necessary to properly carry on such investigations.

5th. That in view of the extreme importance of having future expenditures produce maximum results at this point, the work should be carried on under the direction of a capable and experienced engineer regularly in the employ of the Department. Mr. George Butler, Superintendent of Irrigation, has spent some time at this point and owing to his familiarity with the entire reservation as well as with the mistakes that have been made in the past, I would recommend that any funds appropriated for this point be spent under his direction. If the apportionment for this year should be small he could leave the work under a capable assistant giving it necessary general supervision and carrying on work on other reservations at the same time.

I find Superintendent Perry an active, intelligent and energetic man well qualified, in my opinion, to successfully carry on the work at this point in a manner that will meet with the approval of the Department.

Very respectfully,
A. H. Code

U. S. Indian Inspector.

TWO OFFICIAL LETTERS ENCLOSED
ALSO VIEWS ON NAYAJOE RESERVATION.
M.N.C.