DEPARTMENT OF THE INTERIOR,

UNITED STATES INDIAN SERVICE,

Albuquerque, N. M., March 5 1909.

Mr. W. H. Code, Chief Engineer,
522 Bumiller Building,
Los Angeles, Cal.

Dear Sir:

I have made a personal examination of the proposed reservoir site and storage proposition for the Navajo Indians, near Ganado, Arizona, and I herewith report on the same.

The project is to store the waters of the Rio Pueblo Colorado, a small stream that only flows a portion of the year, but which discharges considerable amounts of water in the spring when the snows melt and in the summer after the rains. The government topographical maps indicate a drainage area of about 380 square miles.

PRESENT USE OF WATER. Mr. J. L. Hubbell, who owns 640 acres of land about two miles below the proposed reservoir site, and who has acquired water rights in this stream, has built a ditch and irrigates his land. A missionary, the Rev. Mr. Bierkemper also irrigates a few acres from this ditch.

Some five miles below Ganado begins what is known as "The Cornfields", a beautiful bottom land that extends along both sides of the stream for a distance of many miles, and which is largely under cultivation. Much of the land lies very low, and at each flood is subject to overflow, and for higher lands, the indians have constructed crude ditches and manage to irrigate the land once or twice a year, and raise large crops of

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corn, sufficient for their own use, and one trader has purchased as high as 150,000# of corn in one season, and sufficient fodder for a large amount of stock. The indians are very industrious and are very anxious for a reservoir to be built.

In consultation with several of their head men, they stated that if the Government would build the reservoir and survey the ditch lines that they would build the ditches without cost to the government other than for headgates and flumes, which would be beyond their powers of construction.

RESERVOIR.

The site for the reservoir is not in the bed of the creek, but on a flat on the north side of the same. On this flat there is at present a shallow lake, that holds water almost all of the year, covering an area of about 124 acres. By building a dyke or embankment along the lower side of this flat, a considerable reservoir will be made. (See map). Water can be diverted from the creek in a ditch about 1600 feet long that will deliver the water between 17 and 18 feet above the bottom of the proposed dam, and it is possible to divert the water from the creek about ½ mile above through a short tunnel at an elevation of about 42 feet above the base of the dam.

Figures have been prepared for building the dam to three heights to store water at the 105, 110 and 116 foot contour, with the top of the bank three to four feet higher.

The diversion ditch, which will be the same for either project, will necessitate the moving of 5630 cu. yds. of material of which about 1700 may prove loose rock. The ditch will not be less than ten feet on the bottom. The cost of this, together with the

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headgates I have estimated at $1500.oo.

The lowest dam - 8 feet high - will have a length of 1830 feet, contain 6322 cu. yds. and take 633 cu. yds. of rock for slope paving. This rock is close at hand. For outlet I estimate on a 16" Coffin Valve Co. valve, and wooden stave pipe ~~for outlet~~, and a tower and foot bridge built of timber.

The total cost of this dam including ditch, I estimate at $3793.60, not including preliminary and general engineering.

I estimate that the reservoir can be filled at least twice during the year, and that the duty of the water in the reservoir, in addition to rainfall and flood waters that may be used in addition to that stored, at 2½ feet. The capacity of this reservoir will be 860 acre feet, not counting the water below the 100 foot contour, and the land that could be served would be about 687 acres, at approximately a cost of $5.37 per acre.

The second proposition is a dam 14 feet high (maximum), and 2500 feet in length. The contents will be 24347 cu. yds., and 1650 cu. yds. of stone will be needed for slope paving. Outlet gate as in other proposition. Estimated cost $9781.16. Capacity 2002 acre feet, which would serve on the above basis 1600 acres of land at a cost of about $6.11 per acre.

The highest dam, 20 feet maximum, will contain 58950 cu. yds. and need 3013 cu. yds. of rock for paving. The estimated cost is $21,646.10 ; the capacity 3889 acre feet and the area that could be served 3110 acres, at a cost of $6.99 per acre.

LAND.

There is sufficient lands for any of these projects within reasonable distance of the dam. This land lies at an elevation

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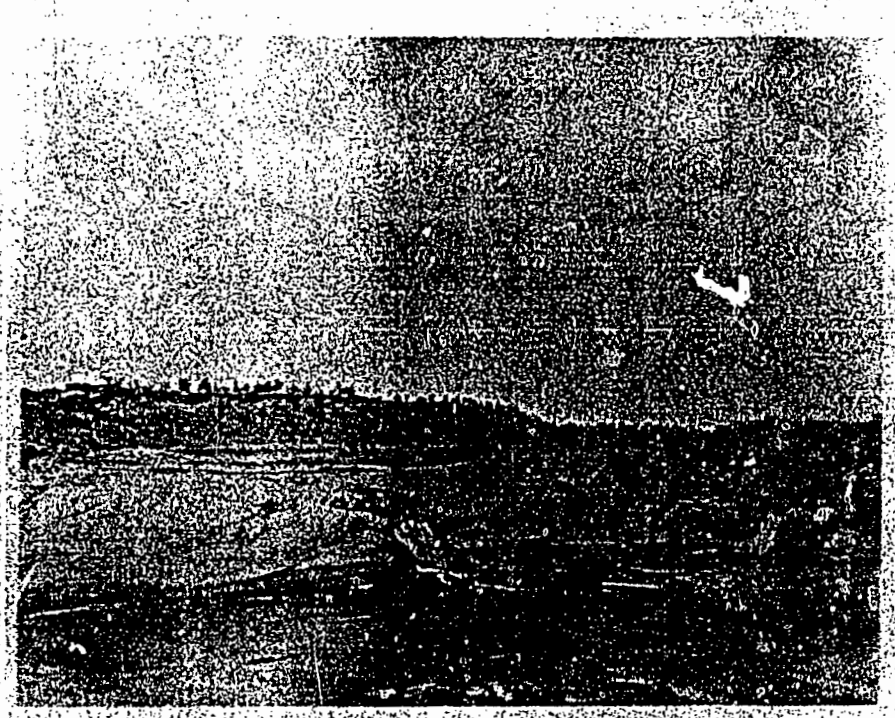

Rock Falls.

Hogback east of reservoir.
Possible site for tunnel inlet.

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of about 6100 feet above sea level and is well adapted for corn, alfalfa, wheat etc.

The reservoir is located on the north side of the creek, and irrigible land lies on that side within ½ mile of the reservoir, and continues down the stream for miles, and a ditch can readily be constructed to the land. On the south side of the stream the land for some distance is rough, and the water can best be go gotten to the land by turning it into the stream bed and diverting it some distance below.

The head of the Hubbell ditch (see photo) is about ¾ mile below. This ditch is about 2½ miles long and covers the land belonging to Mr. Hubbell. The best body of indian land lies immediately below this tract.

Mr. Hubbell is very desirous of having this reservoir built for several reasons. He has lived among these indians for over thirty years past and desires to see their condition improved, toward which end he has labored long and ernestly. He is a trader, and the improvement of the indian will, of course, help him in his business, and further, he desires to make arrangements with the Government by which his rights to the waters of this stream, which he has already secured, be merged with that of the indians in the larger reservoir, and his land be served from this reservoir. To secure this he will turn over to the government his present ditch with its headgates, flumes etc. which he has had in operation for some years, and which is of good construction and in first class condition. (See photos). Should this be accepted, a small extension of the ditch will put a considerable area under water.

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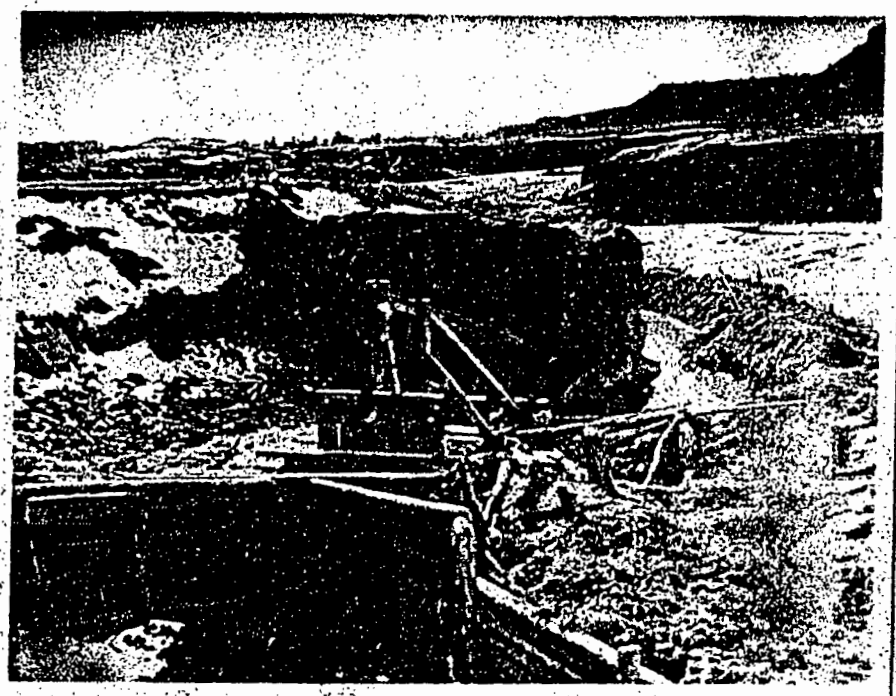
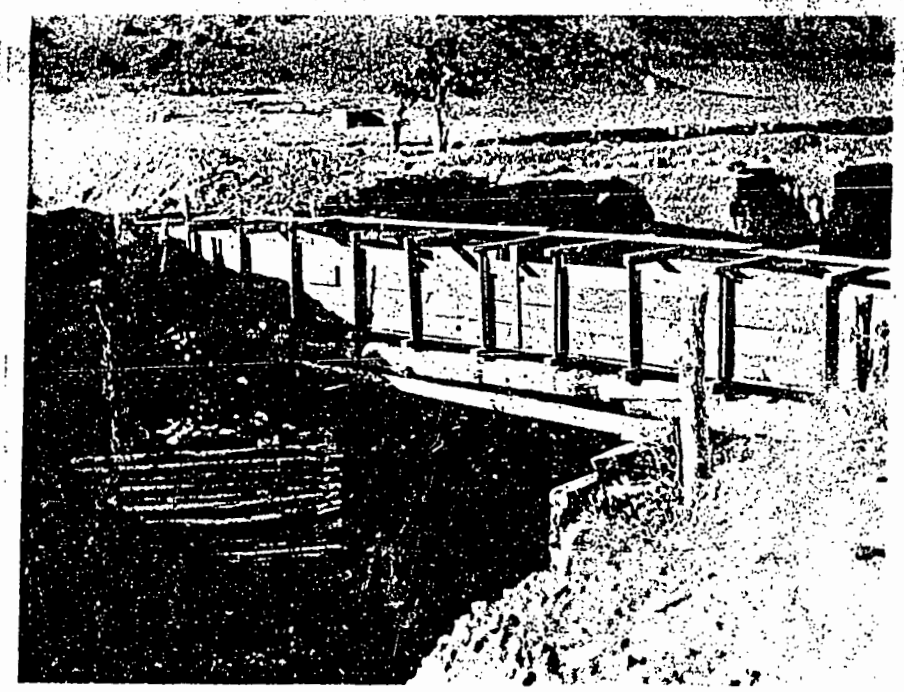


Headgate, Hubbell ditch.



Flume. Hubbell Ditch.

CV-6417-201

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He says further, to quote a letter of recent date: "Will also guarantee that the ditch will be cleaned to four miles from the reservoir by the indians themselves and kept in condition to run the water, except where flumes or headgates are dostroyed by floods. In making this agreement with you, I consider that at the present time I have to do it to get water to my place, and the keeping it in repair for two miles more will be only a very small expense to me in case the indians fail to do it. The benefits accruing to this community, would more than offset the little expense that I would have. In other words I have perfect faith that the Indians in this community will use the water, and would not want Government help except in extrordinary cases of destruction by floods of flumes and headgates." Further: On February 26, 1907, Mr. Hubbell wrote to the Commissioner of Indian Affairs regarding the reservoir and made the Department a proposition to construct the reservoir, any one of the above specified sizes, as follows: 8 foot dam, $3987.28 ; 14 foot dam, $9600.53; and 20 foot dam, $19,366.78. He now states that he is still willing to construct, and to enter into a contract to do so, giving good and sufficient bond for the performance of the work. If he should be bound down to work the indians but 8 hours a day then his price should be increased 15% as he based his offer on a longer day's work. The work to be done under the supervision and to the satisfaction of this department. He would prefer that the department put in the head gates and discharge works also, the cost to be deducted from his contract price

CONCLUSIONS.

From an engineering standpoint the proposition

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is not at all difficult, being simply an earthen dyke, slope paved on the upper side, with a feed ditch of short length, provided with headgate, and a discharge valve and pipe. From the fact that a portion of the bottom of the proposed reservoir is covered with a shallow lake that does not seep away, is good evidence that the soil is of such nature that a tight dam could be readily built.

If I am not in error as to the amount of water that can be secured from the runoff, and of the duty thereof, the cost per acre is small, and I would suggest that if anything is done at this point that the 14 foot dyke be constructed, and later, if good use is made of the water and it is found that there is sufficient water to justify a larger reservoir, that the dam could then be raised. Mr. Hubbell, I believe, has in cultivation about 400 acres of land, and has a small reservoir that holds enough water for one irrigation of about 40 acres of land that he could continue to use to equalize the flow of water when there was any water coming down the stream and not flowing into the large reservoir. If the area of his farm is deducted from the area estimated above, there would still be 1200 acres served for the indians at a cost of about $8. per acre. I might say in this connection that Mr. Hubbell would use no more water from the reservoir than he does now, his advantage being that he could have it when he needed it the most, and not as now, when it was flowing in the stream.

If the indians will build their own ditches, and I am assured by their chief men that they will, and Mr. Hubbell states that he

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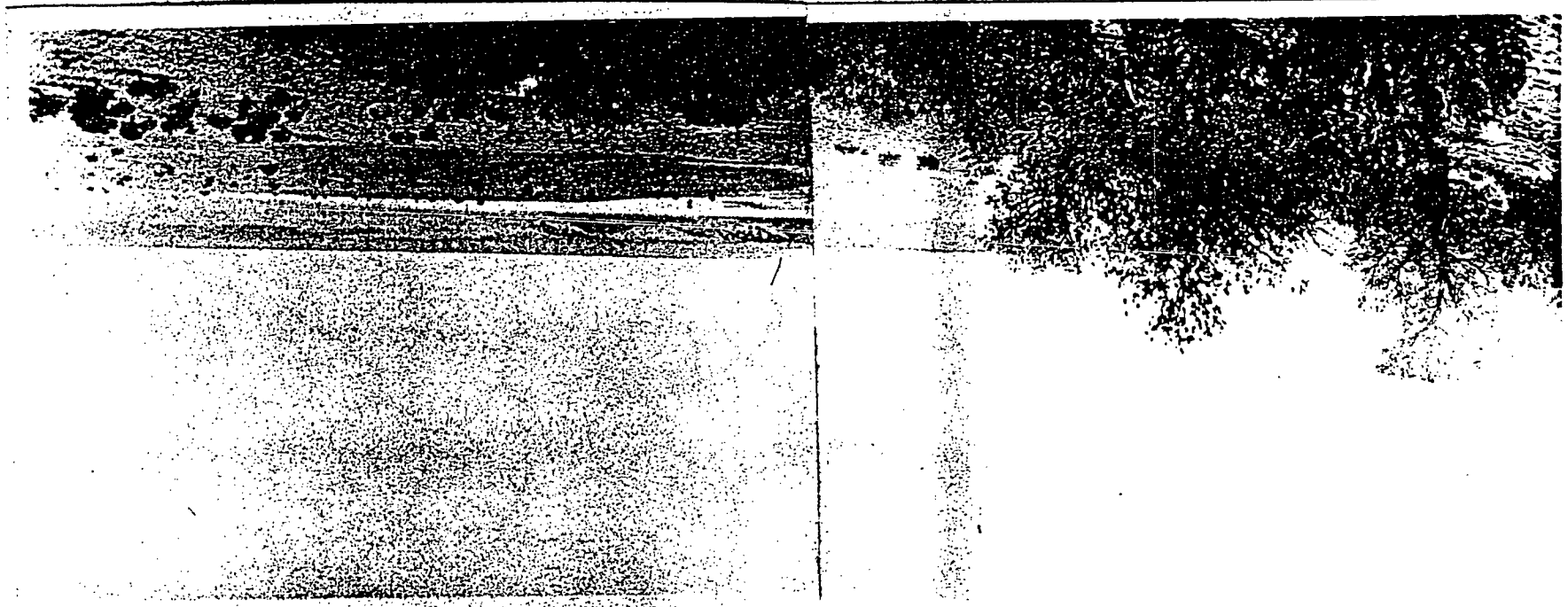
Reservoir Site - Looking S.W. from ridge.



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CV-6417-201

will be willing to guarentee that they will, it shows a great desire on their part to be assisted in securing water, and if the w that they have been doing below at The Cornfields is any indication of what they will do above, there is no doubt but what they will make good use of the water, and greatly benefit themselves.

The elevation is not too high, not quite as high as it is at Blackrock and Zuni, the land is very productive and they will have a ready market for all surplus grain that they may raise.

The conditions both physical and of the indians is superior to any place on the Navajo Reservation that I know of, excepting perhaps, along the San Juan River.

If this work is undertaken a farmer should be stationed here to help the indians in their farming and to have charge of the reservoir and the distribution of water, and to see that all of the flood water was saved.

Owing to lack of absolute knowlege of the amount of water that may be depended upon, I hesitate to recommend this work, but from all evidence that I have on the subject, I believe that there is ample water for the reservoir to the 110 foot contour, and I do not know of any other place on the reservation where $10,000. will put water on 1200 acres of good land, and I have yet to find any settlement of the Navajos that I believe to be as industrious in farming and agriculture as those that live in the vicinity of Ganado.

The map and figures as to areas and capacities I have taken from maps and report prepared by an engineer some years ago for Mr. Hubbell at his expense and used to lay the matter before

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the Department.

Respectfully submitted,

H. T. Robinson

Superintendent of Irrigation.

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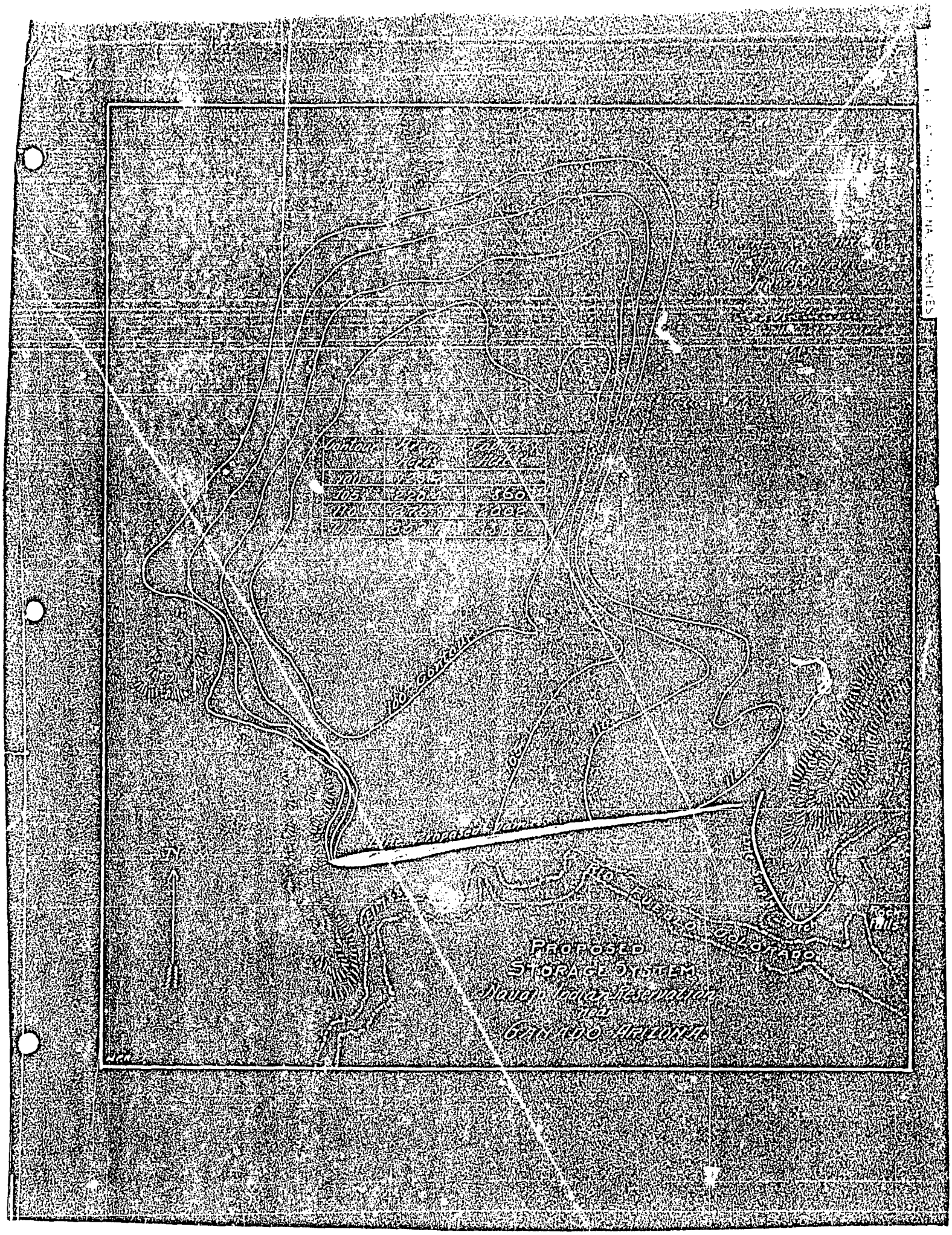

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