Irrigation
9010-36-A

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August 25, 1937

Mr. A. L. Wathen, Director of Irrigation,
U. S. Indian Irrigation Service,
Washington, D. C.

Subject: Inspection of Navajo Irrigation Projects.

Dear Mr. Wathen:

Reference is made to your instructions in letter of April 23rd and telegram of May 26th. I visited the Navajo country June 5th to 8th, inclusive, and again from July 7th to 22nd. I visited a large number of the projects in company with Chief Engineer Fife, Firmin Brown, Hervey Brown, and H.C. Powers.

The meeting with Sloan of the Reclamation Service and the representatives of the San Juan Valley farmers at Shiprock, scheduled for the 7th, was postponed until the 9th, during which time Mr. Firmin Brown and I visited Captain Tom Dam on the 5th. Wheatfields, Lukaichuka, Round Rock, Rock Point, Shiprock and Fruitland on the 7th and 8th. On the 8th I learned that the meeting had been postponed indefinitely so left Gallup for Washington that evening. After returning from Washington on the 6th visits were made to Natural Bridge Damsite on Black Creek, Ganado Secondary Storage Dam and Ganado Project on the 7th; to the new Demebito Dam and Tuba City on the 8th; Lower Moencopi and Cow Springs on the 9th. We attempted to go to Kayenta, but heavy storms forced our return to Gallup by way of Flagstaff. On the 12th we visited Eastern Navajo with Fife, Brown, and Sam Wood. Saw Mariana Lake, Juan's Lake, and Casamera Lakes. On the 13th went with Fife, Brown, and Powers to Sawmill, Chin Loo, Canyon DeChelly Damsite, and on to Greasewood. On the 14th we visited Lukaichuka, the new Tosoto Diversion Dam and two possible damsites in the Lukaichuka Mountains at the head of Tosoto Canyon, also the new Red Lake arch masonry dam. The 15th and 16th were spent among the Pueblos. On the 17th with Fife, Brown, and Bentley went to Kin Le Chee and Klagetoh. The 18th and 19th were spent on Southern Ute. On the 20th to 22nd discussed program with Brown in the office.

The above schedule is given to indicate the territory covered. Only the outstanding features which are of further interest will be discussed here.

F. W. 2004

Captain Tom Dam. The attached photograph shows erosion of the gravel blanket on the 3:1 upstream slope of the dam. Gravel was used in the absence of heavier rock. The blanket is about two feet thick. It seems inevitable that large rock must be used to properly protect the dam from wave action. However, the danger is not immediate and in the absence of sufficient funds temporary protection can be provided by one or more lines of woven wire fencing placed at the lower edge of each beach, either juniper or steel posts could be used, with a light galvanized wire mesh supported by a strand of guy wire at the top of the posts and turned upstream in the shape of an "L".

There is some seepage below the dam which does not appear to be serious. I suggest that there should be a routine inspection of this dam for the next couple of years, especially when the water level is at the higher elevation.

Round Rock Storage Dam. This is an earth fill dam approximately 26 feet high completed near the end of the fiscal year 1937 on the site of an older dam about 14 feet high, which was apparently built without consolidation of the materials. The old dam was used as the upstream toe of the new dam, which was sprinkled and rolled. At the time of my visit on June 7th water had been carried at an elevation about eight feet below the top, but had receded to about 10 feet. The material is apparently not well suited to the construction of this type of dam, being mostly of very fine sand. There was serious saturation of the lower toe, which had reached a point approximately five feet in height andthe ground below the dam for a considerable distance was very wet. Upon my suggestion test pipes were sunk to show the path of percolation and the line of saturation. The water level was soon thereafter drawn down for irrigation of some of the new land under this project. The upstream slope was paved with large thin slabs of rock without any gravel underneath and wave action has made a very flat beach, with a consequent displacement of much of the rip-rap. Settlement of the dam where the old dam was the highest has caused some serious cracks through the new dam, but these have been puddled and there may be no serious result. As to remedy for these defects I suggest the excavation of a shallow trench three or four feet deep along the lower toe of the dam. The blanketing of the lower toe, including the bottom of the trench and extending to within 8 or 10 feet of the top level of the dam with good gravel to a depth of at least three feet at the bottom tapered to one foot at the top, on which should be placed a heavy blanket of rock, filling the trench to a depth of six or eight feet at the bottom tapered to two feet at the upper edge of the gravel. This will serve to hold down the toe and prevent sloughing. The shallow trench will serve as a drain for the water which seeps through. The dimensions are for the maximum section and may be tapered to the both ends of the dam. In regard to the rip-rap I see no alternative but to strip it back and blanket with at least a foot of good gravel, after which the rip-rap should be replaced. It will probably be necessary to anchor the rip-rap by building headers of heavier stone well anchored into the base of the dam at intervals of say ten to 15 feet up and down the slope. I do not

F. W. 2005

believe the percolation itself will be serious if sloughing can be prevented on the downstream slope. The region of settlement and cracks should be carefully watched and pressure puddling should be resorted to if further cracks are noticed. These matters were discussed with Mr. Brown and Mr. Fife.

Lower Denebito. This is a new cantilever type concrete diversion dam where a flood washed out the embankment at one end just before completion at the close of the year. The structure at the time of my visit had been back-filled and was practically complete. It appears that additional riprap or wing protection will have to be provided on both lower wings and perhaps on the right upper wing. It is believed that under the circumstances the concrete wing walls which are founded on solid rock should have been considerably longer. I also suggested that in order to prevent damage from freezing the rectangular straight sided stilling pools at the lower toe should have holes drilled through the lower wall to prevent water from standing in them. An excellent job of concrete work was secured as evidenced by the appearance and by the fact that the outlet conduit showed no signs of failure after it was completely undermined by the washing away of the embankment.

Lower Moencopi. This project originally intended to consist of an arch dam and an intake structure has practically been rebuilt since the August flood damaged the right approach and intake. The arch still stands, but the crest has been carried nearly double the distance toward the right and a large amount of paving of the rotten rock slopes has been done to protect the structure. It appears to be in quite good condition now. This project occasioned comment because it is one of the few which for some reason havenot shown any development of land under them. I mention it because there are a few such projects which seem to have been conceived in good faith, carried out, and are now available, but have not been utilized to any considerable extent. Such are Lower Moencopi, Casamero, Juan's Lake, and Mariana Lake. Comparison of the total area under constructed works with the area actually cultivated and irrigated, would probably show entirely too much land under existing projects not in use to be a good recommendation for constructing additional projects. I mention this not because this is a condition peculiar to the Navajo Reservation, but because I believe this gap should be closed as soon as possible, especially where the need for subsistence crops is so great and where the resources of good land and water supply are comparatively limited.

Mariana Lake. This is the place where an auxiliary dam to the main storage dam was built across a narrow valley, with a narrow deep cut through shale between them. Apparently, the floods in the smaller valley have been sufficient to fill up a part of the storage with silt and the low earth dam has been overtopped for nearly its entire length without, however, causing a complete break. Apparently this dam should either be built higher or the rock cut should be enlarged, probably both. On the other hand there is very little irrigation in evidence under this project, and any great expense in making the repair would not seem justifiable.

F. W. 2006

Juan's Lake. This is a large sized lake fed from Kimenola Creek, with an auxiliary dam across the creek. The possibilities here seem great, although development has just started. However, the north end of the dam across Kimenola Wash and the spillway have settled about a foot, although water has never flowed through the spillway. This dam is a long earth dyke across a flat valley and the spillway is in earth. So far the diversion of water into Juan's Lake has taken the entire flow of Kimenola Creek, but should an extraordinary flood occur it would most certainly erode the spillway and cut a channel back into the creek, which below the dam consists of a great gorge which is cut back from the Charco Canyon. It is probable that this could be protected by paving the spillway with rock and carrying the flood channel sufficiently far below the dam so that it would not endanger it during the first flood period after which additional protective work would probably be necessary.

Cosamera. At this place a lake has been formed by construction of a long low earth embankment with a spillway through the right abutment. This spillway is in soft shale with several thin layers of sandstone. This has been badly eroded and another flood is likely to cut it back into the reservoir, thus diverting the entire stream and endangering the dam. Expensive reconstruction work will be necessary, if this project is to be protected. There is considerable good land under the reservoir, but asyet no development has taken place.

Tosoto. A concrete diversion dam was recently completed here under E.C.W. Recent floods have begun to erode the channel below the dam and since the apron is very narrow it is believed that it should be extended eight or ten feet with a good cut-off wall and the lower edge provided with a dentated sill which will discharge the floods in such a manner that the material will be deposited against the cut-off wall rather than cut away.

Montezuma Creek. This project is in Utah. One concrete heading and and new main canal were constructed last year. Recent floods have cut the river channel about six inches below the grade of the canal and a diversion structure of some sort seems to be indicated. It is suggested that a line of steel rails be driven across the channel, which is approximately 200 feet wide, to form a low diversion weir. It is believed that sixty to seventy-five pound rails approximately 25-30 feet long should be driven about eight feet apart, that a cable be strung through holes near the tops of the rails to tie them together. These rails should not extend more than two to three feet above the bottom of the canal and with the accumulation of drift they will probably hold the river bed to an elevation high enough to divert a good head of water. They should be well anchored into both banks, the end rails being raised two or three feet above the elevation at the center. Large floods will sweep on by without damaging the rails and the placing of a small amount of brush with the butts resting on the cables will serve

F.W. 2007

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to complete diversion during low flows.

Fruitland. On this project considerable difficulty is experienced with silt entering the head gates and choking the canal above the sluiceway. In this connection reference is made to my letter of July 3rd, 1936, in which suggestions were made to improve this condition. The first was to improve the sluiceway by constructing a vertical wall in front of the head gates to give a skimming effect and to avoid sharp disturbance of the water as it enters the canal. The second step is the contraction of the upper portion of the canal to size which with its grade will give the necessary capacity with resultant higher velocities to prevent the deposition of silt near the head of the canal. I also believe it will be necessary eventually to line the entire section of canal from the intake to the sluiceway in order to carry the silt through the canal and sluiceway into the river. Additional work must also be done on the diversion dam both to replace material taken out of the crest by floods and to extend the dam into the right abutment.

I believe this concludes the remarks which I wish to make on improvements, but it would be unfair to conclude without referring to some of the good features of which I saw many on my trip.

Generally speaking, some excellent construction work and especially concrete work is being done where any work has been in progress. At Rock Point some excellent crops are being raised on new land under the Rock Point Project. At Fruitland some good wheat crops were raised on a small acreage at the upper end of the project. At Round Rock some very excellent subjugation was being carried on with equipment and operators secured from Sacaton. At Montezuma Creek a new headgate and canal are so located that excellent results should be secured and good crops were being raised under this project. At Red Rock an excellent masonry arch dam about 35 feet in height was constructed in a narrow gorge where 72 acre feet of water can be stored and the reservoir filled several times each season. A number of tracts of newly developed land have been put under cultivation by the Indians this year with excellent results.

I wish to express my appreciation of the courtesies shown me by Superintendent Fryer, Chief Engineer Fife, Mr. Firmin Brown, who is in charge of Irrigation, and by Mr. H.C. Powers, in charge of E.C.W. work.

I would like to call attention to the large number of irrigation possibilities on the Navajo Reservation and to correct what I believe to be a misconception of the opportunities for extending irrigation work on this reservation. There are many places where there is available land and where water can be developed even though at considerable cost, which would increase the Navajoes' opportunities for raising a large amount of additional subsistence crops.

F. W. 2008

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The following photographs are attached:

No. 1 - Navajo Central Agency, Business District.
" 2 - Navajo Central Agency, Residence District.
" 3 - Red Lake Diversion Dam.
" 4 - Tsosto Diversion Dam.
" 5 - Captain Tom Storage Dam.
" 6 - Red Rock Storage Dam.
" 7 - Fruitland Diversion Weir and Headgates.
" 8 - Priests' Dam, atop Mount Lukaichukka.
" 9 - Natural Bridge.
" 10 - Diversion Damsite on Chin Lee Wash.
" 11 - First wheat crop on Rock Point Project.
" 12 - Rock Point from which trading post and irrigation project were named.

Yours very truly,

HVC/rk
cc: Supt. Fryer.

Herbert V. Clotts
Assistant Director

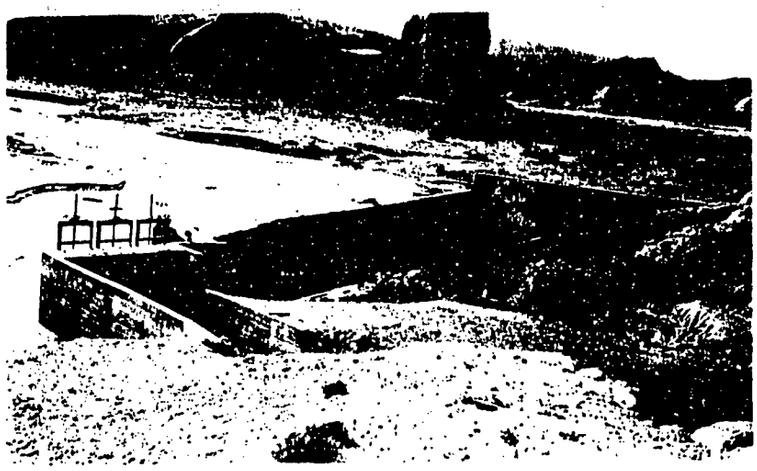
F. W. 2009

Navajo Central Agency 7/21/37
Business District

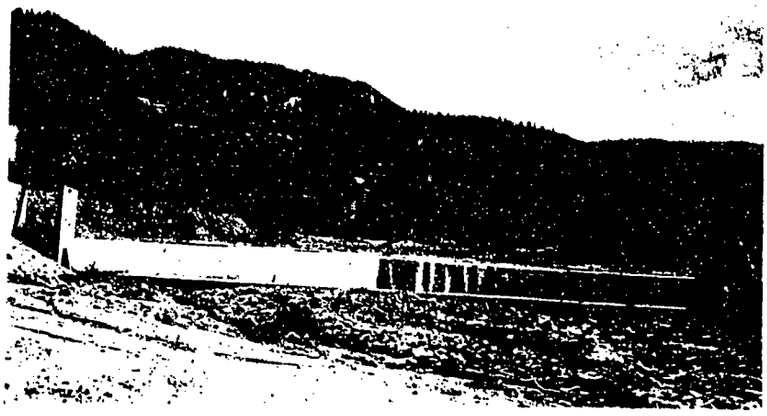
Navajo Central Agency 7/21/37
Residence District

F.W. 2010

NN001603



[illegible] Diversion Dam 8/17/37
Recently Rebuilt



Tosoto Diversion Dam 7/14/37
Built by E. C. W.

F. W. 2011

Capt. Tom Storage Dam 6/5/37
Showing erosion of gravel riprap

Red Rock Storage Dam 7/14/37
Rock Masonry 72 Ac. Ft. Capacity

F. W. 2012

Fruitlands Diversion Weir 6/8/37
and Headgates after first
season's floods

Priests Dam atop Mt. Lukachukai, 7/14/37
Note hewn log outlet made with
arch cover.

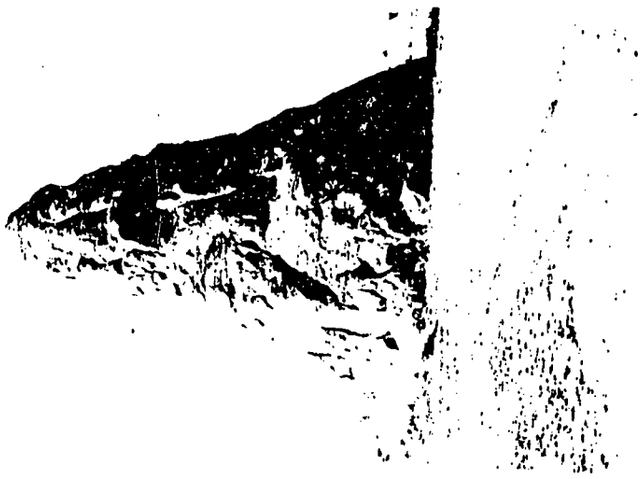
F.W. 2013

Natural Bridge near Navajo Agency 7/7/37
45' span

Diversion Dam site on Chin Lee Wash 7/13/37

F.W. 2014

First Wheat Crop on Rock Point Project. 6/7/37



"Rock Point" from which the Trading Post and Irrigation Project were named. 6/7/37

F. W. 2015